**Literacy Studies:** Perspectives from Cognitive Neurosciences, Linguistics, Psychology and Education

Elinor Saiegh-Haddad
R. Malatesha Joshi *Editors*

# Handbook of Arabic Literacy

## Insights and Perspectives

Springer

Handbook of Arabic Literacy

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While language defines humanity, literacy defines civilization. Understandably, illiteracy or difficulties in acquiring literacy skills have become a major concern of our technological society. A conservative estimate of the prevalence of literacy problems would put the figure at more than a billion people in the world. Because of the seriousness of the problem, research in literacy acquisition and its breakdown is pursued with enormous vigor and persistence by experts from diverse backgrounds such as cognitive psychology, neuroscience, linguistics and education. This, of course, has resulted in a plethora of data, and consequently it has become difficult to integrate this abundance of information into a coherent body because of the artificial barriers that exist among different professional specialties. The purpose of this series is to bring together the available research studies into a coherent body of knowledge. Publications in this series are of interest to educators, clinicians and research scientists in the above-mentioned specialties. Some of the titles suitable for the Series are: fMRI, brain imaging techniques and reading skills, orthography and literacy; and research based techniques for improving decoding, vocabulary, spelling, and comprehension skills.

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Elinor Saiegh-Haddad • R. Malatesha Joshi
Editors

# Handbook of Arabic Literacy

## Insights and Perspectives

Volume 9

Springer

*Editors*
Elinor Saiegh-Haddad
Bar-Ilan University
Ramat Gan
Israel

R. Malatesha Joshi
Texas A&M University
College of Education
College Station
Texas
USA

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# Foreword

Language defines humankind; writing defines civilization (Daniels 1996). Modern civilization was then redefined by the printing press and paper. And today, writing technology is again transforming our world as the electronic media turn the world on paper (Olson 1994) into a paperless world. Yet the key to the world of print, whether on a computer screen, paper, clay or stone remains unchanged; the near-instantaneous access to the meanings locked in the symbol strings of the written text. Around half of humanity, however, does not hold this key. The illiterate and semi-literate are excluded. In most parts of Asia and Africa, illiteracy and poverty go hand in hand. Curiously, in the Arabic-speaking world, literacy levels are uniformly and alarmingly low in wealthy and impoverished societies alike. Even highly educated and skilled readers of Arabic read their native Arabic more slowly than they read non-native languages such as English, Hindi or Arabic's Semitic cousin Hebrew which shares the same highly synthetic poly-morphemic structure as Arabic. Why is literacy learning so difficult in Arabic?

In addressing this quandary, the present volume offers no quick-fix remedies, but it does offer a first-generation infrastructure of scientific theory and research that can inform decision-making by policy-formulators, educators and practitioners confronting the literacy challenge in Arabic on a daily basis. Saiegh-Haddad and Joshi have rendered an outstanding service to the field in this ground-breaking volume which brings together a panoply of leading scholars from the Middle East, North America, and Europe, representing a wealth of disciplinary perspectives. The depth and breadth of the scholarship will no doubt earn this handbook benchmark status for future work in this field.

Arabic is the fourth most common language in the world, and the Arabic script is the second most widely used segmental (phonemic) script after Roman. The scholarship embodied in this volume will not only inform practitioners and researchers of the Arabic language and literacy but any theory aspiring beyond language-specific status. For too long, the language and literacy research agenda has been a captive of Anglo-American concerns, overwhelmingly dominated by English. Today, the world is finally waking up to the fact that most of the world's languages are not English-like. This Anglo-centrism is ever more poignant in the literacy domain given that English orthography is an outlier even among European alphabets (Share

2008). Most of the world's literacy learners are learning to read in languages and writing systems that are neither alphabetic (i.e., full and equal status is given to consonant and vowel signs) nor European. It therefore behooves researchers to keep informed of literacy studies across a range of languages and writing systems and avoid the scientific solipsism of the past in which literacy studies in languages other than English were regarded as mere exotic *curiosa*. This volume will become a landmark not merely because it is a world first, but because it offers *all* literacy scholars a wider angle lens on their own work.

September, 2013 David L. Share
Haifa University, Israel

# Preface

It is customary in promoting a book to talk about an existing lacuna in the field to which the book belongs. This may or may not in fact be the case, but this tradition does indeed match the reality in the field of Arabic linguistic studies as far as this volume is concerned. Studies of Arabic literacy are meagre and they remain marginal in Arabic linguistics, in spite of the undisputed importance of this topic in understanding the language at the crossroads of psycholinguistics and language acquisition, educational linguistics, sociolinguistics and cultural studies. The multifaceted nature of this topic is reflected in the content of this volume of essays which report the findings of new research, or bring together the major insights of existing work to map aspects of Arabic literacy studies for use as a platform for future research. The net result is a volume of great reach, depth and interest. It describes, explains and offers empirical and quantitative conclusions which can help interested scholars reflect, comparatively, on literacy in Arabic and other languages from theoretically-informed perspectives.

In recent years, Arabic literacy has emerged as an issue of great educational importance in the Arabic speaking world. PIRLS results during the past few years have consistently placed participating Arab countries at the bottom of international achievement levels. Arab policy-makers and pedagogy experts have been exercised by this and are on the look-out for ways to understand the problem and to devise solutions. Arabic language teaching reforms in Arab countries during the last decade are an expression of this endeavour (I know this to be the case from my long experience in this field). Although the essays in this volume are not offered as a solution to this problem, they nevertheless provide a basis from which an understanding of it can be developed. This understanding is bound to be complex and may speak in different inflections, depending on disciplinary perspective.

This is an excellent volume and the first of its kind. It will be the first port of call for those who wish to learn about Arabic literacy. The editors and contributors are to be congratulated on this achievement.

April 2013

King's College
Cambridge University
U.K.

Yasir Suleiman

# Introduction

Among the various reasons for literacy problems that have been postulated, Vellutino et al. (2003) cite instruction and environment as being the two most fundamental factors. Instructional factors include the lack of a suitable literacy environment in schools, ineffective instructional methods, and the teachers' lack of knowledge about language and structure (Cunningham et al. 2004; Joshi et al. 2009; McCutchen et al. 2002; Moats and Foorman 2003; Piasta et al. 2009). Environmental reasons include poor oral language development (Piasta and Wagner 2010), number of books available at home, parental attitudes, and parental models (Chiu and McBride-Chang 2006).

In addition to these factors, orthography may also influence literacy acquisition. In a seminal study, Seymour et al. (2003), examined word reading of children in grades 1 and 2 in 13 European orthographies and found that children who were learning to read in transparent orthographies such as Finnish, German, and Spanish read words faster and more accurately than children who were learning to read in opaque orthographies such as English and French. However, the majority of the studies conducted on literacy acquisition have been conducted on children speaking English, which, according to Share (2008), is an 'outlier' orthography.

There are very few studies on literacy acquisition among speakers of Arabic, even though it is the fourth most spoken language in the world. Further, Arabic orthography depicts interesting linguistic and orthographic features and hence offers an excellent testing ground for various competing theories of language and reading acquisition. These features include diglossia, double-script, vowelization/vocalization, root-based morphological structure and morpho-syntactic marking, to mention a few.

The chapters included in this book address linguistic, orthographic, cognitive, as well as environmental and socio-cultural factors in literacy development in Arabic. Besides being the first edited book of empirical research into language and literacy development in Arabic, it provides a representation of recent approaches to the study of Arabic literacy as well as a demonstration of the theoretical models, methods, and tools that have been recently employed in addressing literacy-related questions in Arabic. The handbook brings together a range of perspectives on the topic of literacy acquisition in Arabic and offers a discussion of the theoretical frameworks as well as the practical implications of the questions investigated. Rather than provide definitive answers to questions regarding processing, instruction or intervention, the aim of the handbook is to offer a synthesis of contemporary research insights and perspectives on the study of Arabic literacy in the hope of generating more research interest in a hitherto neglected area of investigation. Here, we would like to thank the contributors as well as the anonymous reviewers for their invaluable contribution to this project.

Because an understanding of literacy development in any language requires first and foremost an accurate and explicit understanding of the linguistic and orthographic structure of that language, the handbook opens with an introductory descriptive chapter, co-authored by Saiegh-Haddad and Henkin-Roitfarb, that provides an outline of the structure of Arabic language and orthography with specific focus on aspects of Arabic linguistic structure that have direct implications for literacy development. The chapter provides a linguistic description of Arabic, yet care was taken to ensure that its content is accessible to readers with no background in Linguistics or knowledge of the Arabic language.

The remaining chapters in this collection are clustered into five thematic parts. Part two focuses on morphological structure and orthographic complexity and features psycholinguistic research into the representation and processing of Arabic words—how information moves from the page into the lexicon of the readers—and it includes four chapters. Chapter 2, by Boudelaa, addresses the nature of the Arabic lexicon and uses evidence from spoken and written word recognition in order to probe whether the Arabic mental lexicon is morpheme-based or stem-based. In Chap. 3, Funder-Hansen addresses word recognition in root-based Arabic and uses the unique features of Arabic script and Semitic morphology to propose a language-specific model of reading. Chapter 4 also addresses orthographic features in word reading in Arabic. The authors, Eviatar and Ibrahim, synthesize the insights they have gained from a series of recent examinations of word reading in Arabic and discuss the factors that they believe contribute to difficulty in developing this ability.

Part three focuses on reading and spelling development and disorders in Arabic. In Chap. 5, Mohamed, Landerl and Elbert report an epidemiological survey of specific reading and spelling disorders in Arabic speaking children in Egypt. This study reveals a less than expected dissociation between reading and spelling in vowelized Arabic compared to other shallow orthographies, as well as a high incidence of specific reading and spelling disorders in Arabic speaking children in Egypt. In Chap. 6, Friedmann and Haddad-Hanna discuss evidence demonstrating various types of developmental dyslexias in Arabic and present new research directions that utilize orthographic features of Arabic in understanding reading breakdown. In Chap. 7, Ravid, Naoum and Nasser report a study of narrative text production in Arabic in an attempt to shed light on the developing language basis of literacy. Abu Ahmad, Ibrahim and Share report a longitudinal study from kindergarten to grade 2 of the cognitive predictors of early reading ability in Arabic in Chap. 8. Using modularity as a framework, they show that while early word recognition depends primarily on phonological abilities, reading comprehension still relies heavily on decoding as well as higher-order linguistic and cognitive abilities.

Part four, which contains five chapters, addresses various aspects of Arabic diglossia. In Chap. 9, Myhill reports comparative data on literacy rates in a number of countries and shows that basic literacy rates in Arabic-speaking countries are far lower than would be expected based upon their relative wealth. Using comparative evidence, he argues that much of the explanation for this lies in their usage of a standard language which is based upon an earlier version of the language which no one speaks anymore, and that the best policy for addressing this problem in initial literacy instruction would appear to be to use a strategy parallel to that adopted for languages such as Chinese, Japanese, and Sinhala in which early literacy is based on written phonological representations of the different spoken dialects. In the wake of this latter proposal, in Chap. 10, Saiegh-Haddad and Spolsky discuss some of the problems, ideological and others, in basing initial literacy in a diglossic context on the spoken vernacular. Then, the authors describe a pioneering attempt to address these problems in literacy development in Arabic. Chapter 11, authored by Laks and Berman, describes a novel approach to studying the linguistic manifestation of diglossia by analysing the linguistic structure of oral and written narrative text productions in spoken and standard Arabic, respectively, by Jordanian native speakers.This examination qualifies the linguistic distance between spoken Arabic and standard Arabic as reflected in the actual use of the two language varieties in oral and written text production. In Chap. 12, Rosenhouse examines another reflection of diglossia in the language used in textbooks in Israeli Arabic-speaking schools. The study analyses the language used in the textbooks and its proximity/distance from the language of speakers in an attempt to gain insight into the consistency, or lack thereof, in the linguistic elements that are covered in these textbooks, as well as of the suitability of the texts to the young learners and their effectiveness in promoting language acquisition.  Chapter 13, authored by Khamis-Dakwar and Makhoul describes the rationale and research evidence behind the construction of a novel language assessment tool—ADAT (Arabic Diglossic knowledge and Awareness Test) that aims at measuring diglossic knowledge development in typically developing native Arabic-speaking children.

Part five addresses socio-cultural aspects of literacy development in Arabic. Chapter 14, authored by Tibi and McLeod, reports a study of the acquisition of emergent literacy in the Emirate of Abu Dhabi in the United Arab Emirates. In particular, it examines the language and literacy acquisition consequences of a newly implemented bilingual educational plan in the country—the "New School Model", which entails bilingual education (Arabic & English) from kindergarten through the years of compulsory schooling. Chapter 15, authored by Korat, Aram, Hassunha-Arafat, Hag-YehiyaIraki, and Saiegh-Haddad, is a study of the quality of storybook reading and joint word writing by Arabic speaking mothers with their young children. The study tested the influence of these activities, as well as socio-economic status and home literacy environment, on children's literacy attainment and provided insights into the design of family intervention programs so as to maximize children's literacy growth within the Arabic-speaking family.

Part six includes three chapters that address literacy development in special populations. These populations include bilingual English-Arabic speakers in the U.S.A., Arabic foreign language learners in Israel, and Braille reading of Arabic native speaking blind individuals. Chapter 16, authored by Farran, Bingham and

**Table 1** Index to the symbols used in the transcription of Arabic vowels

| Sound symbol | Sound description | Arabic grapheme and name |
|---|---|---|
| */a/* | short low vowel | فتحة: ◌َ |
| */a:/* | long low vowel | الف ا |
| */u/* | short high back vowel | ضمة: ◌ُ |
| */u:/* | long high back vowel | واو: و |
| */i/* | short high front vowel | كسر:ة ◌ِ |
| */i:/* | long high front vowel | ياء ي |

Matthews, reports a study of the role of environmental variables (parent education, beliefs, and home language use and literacy practices) in language and literacy outcomes among English-Arabic bilingual children in the US, and reveals a strong relationship between parent home language use and the development of various language and literacy skills in Arabic in this population. Chapter 17 describes two studies of the acquisition of grapho-phonemic representations among native Hebrew speakers learning Arabic as a foreign language. Based on quantitative and qualitative analyses of spelling errors among eighth graders during the second year of exposure to the written form of Arabic, and an examination of the developmental trajectory of grapho-phonemic knowledge among eighth, ninth, and tenth graders, Russak and Fragman demonstrate slow progress in spelling accuracy in this population and suggest that the phonological distance between Arabic and Hebrew may be one important cause. The last chapter in this collection, Chap. 18, authored by Jarjoura and Karni is unique in testing Braille reading in blind and sighted Arabic native speakers. The study reports the findings from Braille reading tasks of vowelized and unvowelized words and texts in Arabic. It shows, *inter alia*, that Arabic Braille readers, children and adults, are pervasively slower compared to English Braille readers. On the basis of these results, as well as the analysis of errors, the authors argue that specific characteristics of Arabic, including diglossia and vowelization may be responsible for the observed slowness in Braille reading.

## Transcription Conventions

All chapters included in this collection follow uniform phonemic transcription and indexing conventions. The transcription of Arabic words follows a broad phonemic transcription system, unless in cases where a phonetic transcription was required. The phonetic symbols used are a combined modified version of the IPA (International Phonetic Alphabet) and the APA system used by American linguists. An index to the phonetic symbols used in representing Arabic sounds is provided in the tables below (Tables 1 and 2). Slant lines are used to enclose phonemes presented in an italicized font (e.g., /*b*/, /*m*/). No slant lines are used to enclose the transcrip-

**Table 2** Arabic consonants and corresponding Arabic letters

| | | Stop | Fricative | Affricate | Liquid | Nasal | Glide |
|---|---|---|---|---|---|---|---|
| Labial | | /b/ ب | | | | /m/ م | /w/ و |
| Labiodental | | | /f/ ف | | | | |
| Dental | plain | /t/ ت<br>/d/ د | /s/ س<br>/z/ ز | | /l/ ل | | |
| | emphatic | /ṭ/ط<br>/ḍ/ض | /ṣ/ ص | | | | |
| Interdental | plain | | /θ/ ث<br>/ð/ ذ | | | | |
| | emphatic | | /ð̣/ ظ | | | | |
| Alveolar | | | /š/ش<br>/j/ ج | (/ž/) ج | /r/ ر | /n/ ن | |
| Palatal | | | | | | | /y/ ي |
| Velar | | /k/ ك | /x/ خ<br>/ɣ/ غ | | | | |
| Uvular | | /q/ ق | | | | | |
| Pharyngeal | | | /ħ/ ح<br>/ʕ/ ع | | | | |
| Glottal | | /ʔ/ ء | /h/ ه | | | | |

tion of full words, however (e.g., *walad*). Square brackets [ ] are used for phonetic transcription and quotes are used for English glossing (e.g., *walad* 'boy'); where necessary, the actual Arabic word is also provided. A hyphen—is used to mark morpheme boundaries (e.g., *l-walad* 'the boy'; *bi-bayt-i* 'in my house') and dots are used to mark syllable boundaries (e.g., *mak.ta.bu.na:* 'our desk'). Where internal morphological structure is relevant, capital letters are used for root consonants (e.g., KTB) and capital C for the consonant slots of word patterns (e.g., CaCaCa). Capital letters are also used to represent the letters of written words, (e.g., KTB, KATB, MKTUB).

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# Contributors

**Hanadi Abu Ahmad** Learning Disabilities Department, University of Haifa, Israel

**Dorit Aram** Tel Aviv University, Tel Aviv, Israel

**Ruth A. Berman** Department of Linguistics, Tel Aviv University, Ramat Aviv, Israel

**Gary E. Bingham** The College of Education, Georgia State University, Atlanta, Georgia, USA

**Sami Boudelaa** Department of Linguistics, United Arab Emirates University, Al Ain, United Arab Emirates

Neuroscience of Language Laboratory, NYU Abu Dhabi, Abu Dhabi, United Arab Emirates

**Thomas Elbert** Department of Psychology, University of Konstanz, Konstanz, Germany

**Zohar Eviatar** Psychology Department, University of Haifa, Haifa, Israel

**Lama K. Farran** The College of Education, Georgia State University, Atlanta, Georgia, USA

**Alon Fragman** Ben Gurion University, Be'er Sheva, Israel

**Naama Friedmann** Language and Brain Lab, School of Education and Sagol School of Neuroscience, Tel Aviv University, Tel Aviv, Israel

**Gunna Funder Hansen** (Dep.) Svendborg Langeland, HF & VUC FYN (Adult Education Centre Fyn), Svendborg, Denmark

**Manar Haddad-Hanna** Tel Aviv University, Tel Aviv, Israel

**Himat Hag-Yehiya Iraki** School of Education, Bar-Ilan University, Ramat Gan, Israel

**Safieh Hassunha-Arafat** School of Education, Bar-Ilan University, Ramat Gan, Israel

**Roni Henkin-Roitfarb** Ben-Gurion University of the Negev, Beersheba, Israel

**Raphiq Ibrahim** Learning Disabilities Department, University of Haifa, Israel

The Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, University of Haifa, Haifa, Isrerel

**Waleed Jarjoura** The Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, University of Haifa, Haifa, Israel

The "Convent of Nazareth" school for the blind, Nazareth, Israel

**Avi Karni** The Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, University of Haifa, Haifa, Israel

The Sagol Department of Neurobiology, University of Haifa, Haifa, Israel

**Reem Khamis-Dakwar** Department of Communication Sciences and Disorders, Adelphi University, Garden City, NY, USA

**Ofra Korat** School of Education, Bar-Ilan University, Ramat Gan, Israel

**Lior Laks** Department of English Linguistics and Literature, Bar-Ilan University, Ramat Gan, Israel

**Karin Landerl** Department of Psychology, University of Graz, Graz, Austria

**Baha Makhoul** Haifa University, Haifa, Israel

The Centre for Educational Technology (CET), Tel-Aviv, Israel

**Mona W. Matthews** The College of Education, Georgia State University, Atlanta, Georgia, USA

**Lorraine McLeod** UAE University, Al Ain, United Arab Emirates

**Wessam Mohamed** Department of Educational Psychology, Faculty of Education, Fayoum University, Faiyum, Egypt

**John Myhill** Deptartment of English Language and Literature, University of Haifa, Haifa, Israel

**Dina Naoum** The Department of Communications Disorders, Tel Aviv University, Tel Aviv, Israel

**Suheir Nasser** The Department of Communications Disorders, Tel Aviv University, Tel Aviv, Israel

**Dorit Ravid** School of Education and the Department of Communications Disorders, Tel Aviv University,, Tel Aviv, Israel

**Judith Rosenhouse** Swantech Ltd., Haifa, Israel

**Susie Russak** Beit Berl Academic College, Kfar Saba, Israel

**Elinor Saiegh-Haddad** Department of English Linguistics and Literature, Bar-Ilan University, Israel

Department of English Linguistics and Literature, Bar-Ilan University, Ramat Gan, Israel

**David L. Share** Learning Disabilities Department, University of Haifa, Israel

The Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, University of Haifa, Haifa, Isr彼rel

**Bernard Spolsky** Bar-Ilan University, Ramat Gan, Israel

**Sana Tibi** Queen's University, Kingston, ON, Canada

# About the Authors

**Elinor Saiegh-Haddad** is a professor of Linguistics in the English Department of Bar-Ilan University, Israel and a consultant for the National Authority for Testing and Evaluation of the Israel Ministry of Education (RAMA) as well as the Centre for Educational Technology (CET). Her main research areas include the acquisition of reading and writing in bilingual children, and in Arabic diglossia, and the relationship between oral language skills and the acquisition of literacy. Prof. Saiegh-Haddad has published numerous articles on literacy acquisition in children and co-edited (with Esther Geva) a special issue of Reading and writing on the simultaneous acquisition of reading in two languages. She has also been active in curriculum reform and development in Israel in the field of literacy (Arabic as L1 and English as FL) at both the elementary and pre-school levels.

**R. Malatesha Joshi Ph.D.** is Professor of Reading/Language Arts Education, ESL and Educational Psychology at Texas A&M University, where he teaches and conducts research in literacy development and literacy problems among monolinguals and bilinguals. Dr. Joshi is the founding editor of *Reading and Writing: An Interdisciplinary Journal*, rated one of the top journals in education and educational research. A monograph series titled *Literacy Studies: Perspectives from Cognitive Neurosciences, Linguistics, Psychology and Education* is also under his editorship.

# Part I
# The Arabic Language

# Chapter 1
# The Structure of Arabic Language and Orthography

**Elinor Saiegh-Haddad and Roni Henkin-Roitfarb**

**Abstract** This chapter was designed to promote our understanding of the triangulation, in Arabic, of language, orthography and reading. We focus on topics in the structure of the Arabic language and orthography that pertain to literacy research and practice. It is agreed that the development of basic reading skills is influenced by linguistic (mainly phonological and morpho-syntactic) and orthographic variation among languages. Therefore, the chapter devotes particular attention to these aspects of the linguistic structure of Arabic and to the way this structure is represented in the Arabic orthography. Further, in light of the importance of oral language processing skills in the acquisition of reading, the chapter also discusses Arabic diglossia: it describes the linguistic distance between Colloquial or Spoken Arabic and Standard or Literary Arabic, the primacy of Standard Arabic linguistic structures in the written form of the language, and the effect of this on several linguistic processes in literacy acquisition.

**Keywords** Arabic · Diacritics · Diglossia · Language · Morphology · Orthography · Phonology · Reading · Spelling · Syntax

## 1.1 Introduction

Arabic is the native language of approximately 300 million people worldwide and is an official language in 27 states. Also, as the language of the *Quran* it is the religious and liturgical language of all Muslims everywhere. Significantly, some local spoken variety of this language is spontaneously acquired by all native speakers as their mother tongue. This variety is known as *Spoken* (or *Colloquial*) *Arabic*, a collective term that refers to the whole range of Arabic vernaculars in numerous local dialects. These are generally classified into two regional clusters: *Eastern*

E. Saiegh-Haddad (✉)
Bar-Ilan University, Israel
e-mail: saieghe@mail.biu.ac.il

R. Henkin-Roitfarb
Ben-Gurion University of the Negev, Beersheba, Israel
e-mail: henkin@bgu.ac.il

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and *Western* dialects. Eastern Arabic is spoken throughout the Fertile Crescent, in the Arabic-speaking regions of Asia, in Egypt, in the Sudan, and in partially Arabized parts of East Africa. Western Arabic is spoken in the region referred to as the *Maghreb*, including Morocco, Algeria, Tunisia, Mauritania and Libya. The regional distinction between Eastern and Western Arabic coincides with contrasting linguistic differences of phonological, morphological, phonotactic, and lexical nature, pertaining most saliently to the inflection of the imperfect verb, syllable structure, and many items of lexicon.

In contrast with the dialects, the literary varieties of Arabic, namely *Classical Arabic*, *Literary Arabic* and their modern descendant, known as (*Modern*) *Standard Arabic* (MSA), have no native speakers.[1] These literary varieties constitute the primary language of literacy,[2] namely the language children are taught to read and write at school and the only variety considered, until recently, proper for writing Arabic. As such, it is the only variety with a standardized written form. Although Spoken Arabic may be phonetically represented using the Arabic alphabet (notwithstanding some spoken sounds that have no corresponding letters) there is no consensus regarding the appropriate orthographic representation of Spoken Arabic, or even as to whether it is legitimate (culturally and ideologically) to put this non-prestigious form of the language into writing.[3]

## 1.2 The Structure of Arabic

### *1.2.1 Phonology: Consonants, Vowels, Diphthongs*

The rich consonantal inventory of Modern Standard Arabic comprises 28 phonemes (two of which are actually semi-vocalic, see below). Four coronals, */s t d ð/*, represented by the letters س ت د ذ respectively, whose primary articulation involves the tongue blade and the dental-alveolar location, have phonemic counterparts characterized phonetically by a velarized co-articulation known in traditional Arabic grammar as إطْباق *ʔiṭba:q* 'covering, lidding'. Articulation of these sounds

[1] These terms have historically referred to different language varieties—*Classical Arabic* referred to the language of pre-Islamic poets; *Literary Arabic* referred to the prose language of medieval Islam, while (*Modern) Standard Arabic* refers to the modern use of this language, a descendant of the former two older forms (Bateson 2003, p. 75). The distinction, however, is not strictly adhered to.

[2] Writing in some of the colloquial prestige dialects has been noted since the fifteenth century, but most prominently since the nineteenth century in the Cairene dialect for several genres of literary prose, poetry, and drama. This 'culture of the colloquial' has been challenged and evoked some opposition and debate in Egypt (Davies 2006).

[3] Historically, Colloquial Arabic is argued by scholars to have descended from "some form of inter-tribal speech in use during the period of the [Islamic] conquests containing a greater or lesser admixture of ClA [Classical Arabic], and owe their variations to the indigenous influences" (Bateson 2003, p. 94). The popular belief that Colloquial Arabic is a direct deterioration of Classical Arabic, believed to have been the spoken language of the pre-Islamic era until spoiled by foreign substrata in the newly conquered territories, has been refuted in the light of evidence that Classical Arabic was never generally spoken (ibid).

involves raising the tongue body toward the back of the soft palate (Davis 2009, p. 636),[4] so that it "seems to fill the cavity above like a lid" (Bakalla 2007, p. 459). Additional co-articulations characterize these four phonemes, including constriction of the top of the pharynx (Al-Ani 2008, p. 599; Bakalla 2007, p. 460; Broselow 2008, p. 611; Holes 2004, p. 57). They are subsequently labeled 'pharyngealized', 'velarized', or 'emphatic', and are conventionally transcribed with a diacritic underdot */ṣ ṭ ḍ ð̣/*. In the Arabic alphabet these phonemes are represented by the letters ص ط ض ظ respectively.[5]

These velarized emphatics share with other back consonants (velar غ/*ɣ*/ and خ/*x*/; and uvular ق /*q*/) the feature of تَفْخيم *tafxi:m* 'thickening, magnifying, emphasizing' (Bakalla 2009, p. 421) caused by the tongue raising (in the primary articulation of the latter but as a secondary co-articulation in the former). In modern dialects, all these مُسْتَعْلِيَة *mustaʕliya* 'raised' consonants (velarized and velar), also ر /*r*/ in many cases (Holes 2004, p. 58), tend to trigger a phonological assimilation process known as 'velarization spread' or 'emphasis spread'. This process results in the lowering and backing of neighboring vowels and in the velarization of surrounding consonants within the word, and sometimes even across a word boundary, until blocked by a high or front environment. Velarization spread may proceed forward, as in *ṣa:d* [*ṣạ:ḍ*] 'to hunt', where the emphatic $C_1$ /*ṣ*/ partially assimilates the non-emphatic $C_2$ /*d*/ with respect to velarization, turning it into a *[ḍ]* allophone. Alternatively, velarization spread may proceed backward, as in *wasaṭ* [*wạṣạṭ*] 'middle', where the emphatic /*ṭ*/ velarizes the preceding non-emphatic /*s*/, turning it into allophonic *[ṣ]*. The vowels in both cases become velarized as a result of this process. The two directions of spread have been claimed to stand in asymmetrical relation: regressive spread, like regressive assimilation in general, is more frequent and 'stronger'—it is more categorical (i.e. non-gradient) and less subject to blocking by consonants and high vowels (Davis 2009, p. 637).[6]

'Marginal' (Al-Ani 2008, p. 600) or 'secondary' emphatics, primarily */l m b/* in the vicinity of back vowels, may also trigger backing effects in many dialects. Notably, phonemic value has been claimed for secondary emphatics, such as /*ṛ ṃ ḷ*/ in Negev Arabic, e.g., *na:ṛ* 'fire', *ʔaṃṃ* 'mother', *xa:ḷ* 'maternal uncle', respectively. But minimal pairs cannot be established since the secondary emphatics are limited to a low vocalic environment (Davis 2009, p. 637) and are thus conditioned allophones (phonetic variants of phonemes) in contrast with the true or primary emphatic phonemes which are by definition non-conditioned. Moreover, for example, in the Negev Arabic pair *xaḷḷ-i:*(*h*)[7] 'my vinegar' vs. *xall-i:h* 'leave him' (Shawarbah 2012, p. 55), velarization in the former affects the entire lexeme [*χạḷḷ*], and a pair cannot be minimal if it differs

[4] According to other descriptions, the back of the tongue is raised towards the velum, i.e. the extreme back of the palate (Bakalla 2007, p. 459; Shawarbah 2012, p. 54).

[5] In many modern dialects, including Negev Arabic, *ḍ* and *ð̣* have merged and are pronounced as an interdental emphatic, like the historical/*ð̣*/.

[6] But Al-Ani (2008, p. 600) claims the opposite: "The progressive spreading is the most common, whereas regressive spreading is very rare".

[7] The 1st person sg. possessive and accusative suffixes in Negev Arabic, stressed *-i:* 'my' and *-ni:* 'me' respectively, may end in an *h*-like off-glide, so that *ʔibni:h* 'my son' is indistinguishable from the imperative *ʔibni:h* 'build it' (Blanc 1970, p. 131; Henkin 2010, p. 14).

in more than one segment. The same is true for the oft-cited 'minimal pair' *walla:h* 'he appointed him' vs. *wa*ḷḷ*a:h* 'by God' (see for example, Al-Ani 2008, p. 600). Since the latter word is emphatic throughout [*ẉạḷḷạ:ḥ]*, the pair is far from minimal. Notably, the velarized consonant develarizes in a front environment, as in *l-illa:h* 'to God', which shows it to be a conditioned allophone. In any case, it is agreed among Arabists that the phonological scope of emphasis and rules of velarization spread are highly dialect-specific: "dialects may differ in the domain of emphasis spread, the direction of emphasis spread, the set of consonants that trigger emphasis spread, and the set of segments that block emphasis spread" (Broselow 2008, p. 610 citing Watson 2002, pp. 273–275). Moreover, the phonological scope of emphasis emanating from both 'primary emphatics', i.e. the four conventionally recognized emphatics of Classical Arabic, and 'secondary emphatics', such as /*ḷ ṃ ḅ*/, is a suprasegmental phenomenon pertaining to both phonetics and phonotactics. Notably, it tends to influence the phonetic realization of consonants and vowels in MSA which, in the absence of an accepted MSA norm, will reflect the speaker's native dialect (Holes 2004, p. 58). Most importantly for our study, this spreading phenomenon results in a large set of velarized allophones. Some of these allophonic variants coincide with Arabic phonemes that have orthographic representation in the Arabic alphabet, including (ظ ط ض ص). This, as we will explain later, becomes an important issue in spelling Arabic and a source of orthographic opacity.

Two of the 28 conventional 'consonants', namely the glides /*w*/ and /*y*/, are in fact better considered semi-vowels (or semi-consonants): like consonants and unlike vowels, the glides may open a syllable (Holes 2004, p. 57); but in other respects, including the articulatory, acoustic and even orthographic (see Sect. 1.3: Orthography), they act like a prolongation of the corresponding vowels */u/* and */i/* respectively: the letter و represents both the semi-consonantal glide /*w*/ and the long vowel /*u:*/; correspondingly, the letter ي represents simultaneously the semi-consonantal glide /*y*/ *a*nd the long vowel */i:/*.

Notwithstanding the large consonantal inventory of Standard Arabic, its vocalic inventory is small, consisting of just 6 vowel phonemes. The three short vowels are low /*a*/, high front */i/*, and high back /*u*/, corresponding to their respective long equivalents: /*a:*/*,* /*i:*/*,* and /*u:*/ (Broselow 2008, p. 609), as in *walad* 'boy', *bint* 'girl', *ʔumm* 'mother'; *na:s* 'people', *di:n* 'religion', *du:r* 'houses', respectively. In fact, some linguists (cf. Holes 2004, p. 57) recognize even fewer vocalic phonemes—just three (short) vowels, and an element of length applicable to both vowels and consonants: a geminated or lengthened consonant such as *ll* by this approach is prosodically equivalent to a long vowel, such as */a:/*. But it must be remembered that the distributional properties of lengthened vowels and geminated consonants are very different: a geminated *ll* may 'split' to two distinct, non-adjacent ones *l*V*l*. Thus, the root *DLL* gives both *dall* 'to guide' (with a geminated *ll*) and *dali:l* 'proof' (where the two root consonants $C_2$-*l* and $C_3$-*l* are separated by a vowel /*i:/)*. In contrast, a long vowel such as */a:/* cannot 'split' to two non-adjacent short ones, in a sequence such as *a*C*a*.

Ancient Arabic dialects, specifically eastern ones, appear to have had a fourth long vowel, the result of إمالة *ʔima:la* 'inclination, deflection', namely raising and fronting from an original /*a:*/ towards /*e:*/ or even /*i:*/ (Levin 2007; Versteegh 2001, p. 42; Wright 1975 I, p. 10). Medial (word internal) ʔ*ima:la* of several types has been recognized in modern dialects. Minimal pairs in some sub-dialects of Negev Arabic include *jd***æ:***d* 'new' (plural) / *jd***a:***d* 'forefathers', *b***æ:***liy* 'worn out' (participle) / *b***a:***li* 'my mind' (Henkin 2010, p. 53). Two secondary phonemes in many dialects are /*e:*/ and /*o:*/, resulting from diphthong contraction (see below): *mawt*⇒*mo:t* 'death'; *sayf*⇒*se:f* 'sword'.

The term 'diphthong', known in Arabic as صَوْت مُرَكَّب *ṣawt murakkab* 'compound sound', is applied in Semitic linguistics to a combination of a vowel and a glide, rather than to a sequence of two adjacent vowels forming the peak of a syllable, as in other languages. In traditional Arabic grammar just two falling diphthongs are recognized: *aw* and *ay* (al-Ani 2008, p. 599; Iványi 2006, p. 640). Widespread contraction or monophthongization of these in the dialects, especially in front phonetic environments, has given rise to two additional long vowels of Spoken Arabic, *e:* and *o:*. Both are at least partially phonemic, as witnessed by minimal pairs such as *de:r* 'monastery' vs. *di:r* 'put' (imperative); *do:r* 'turn, role' vs. *du:r* 'houses'. However, not all native speakers perceive the difference between /*e:*/ and /*i:*/, or between /*o:*/ and /*u:*/, even in dialects where some phonemic status has been established (cp. Blanc 1970, p. 118 for Negev Arabic).

### *1.2.2 Phonotactics: Root Structure, Syllable Structure, Stress*

All 28 Arabic consonants may function as root radicals. However, there are some constraints on the distribution of some consonants, mainly on the co-occurrence of root consonants that are identical, homorganic or otherwise similar. For example, $C_2$ and $C_3$ may be identical, as in *RDD*, whence *radd* 'to return'; but $C_1$ and $C_2$ cannot be identical. A comprehensive table, devised by Greenberg (Frisch 2008, p. 625), presents the co-occurrence of all consonant groups with each other on a gradient of similarity and co-occurrence, and a principle of similarity and preference in inverse correlation. Moreover, Frisch (2008, p. 628) proposes a functional base for the principle of dissimilation, namely that similarity poses a cognitive load and is therefore undesirable: "forms without repetition are easier to produce, perceive, and hold in short-term memory". Some basic principles are as follows (Broselow 2008, p. 610):

> Generally, roots are unlikely to contain adjacent labial consonants (/*b f m*/). Adjacent coronals are avoided if they also share similar manners of articulation; thus, roots with adjacent coronal sonorants, coronal stops, or coronal fricatives are rare, and even combinations of a coronal stop and a coronal fricative are unlikely. In the posterior regions, combinations of velar and uvular consonants are avoided, as are combinations of guttural consonants.[8]

All syllables in Modern Standard Arabic begin with a single consonant (C) or glide, serving as the syllable onset and necessarily followed by a vowel (V), as the syllable nucleus or peak. The minimal syllable is thus CV, as in the preposition *li* 'to'. This is known as an open syllable, because it ends in a vowel, which is characterized by relative openness of the vocal tract. It is monomoraic, i.e. it contains one

[8] Holes (2004, p. 99) precludes homorganic non-identical root radicals in general. Exceptions include the sonorants, which can co-occur with any other consonant in any position.

mora,[9] and is thus light. Each additional mora, be it vowel length or an additional consonant, adds heaviness. A bimoraic syllable, consisting of CV: or CVC, is thus ‘heavy’ (Broselow 2008, p. 612; Jesry 2009, p. 388; Kager 2009, p. 344).[10] It may be open (CV: as *ma:* ‘what’) or closed (CVC, as *man* ‘who’). Syllables with 3–4 moras, considered ‘extra heavy’, or ‘super heavy’ in this system, are limited to pausal status. One sub-class of this category is a syllable containing both a long vowel and a closing consonant (CV:C), e.g., *ba:b* ‘door’—this structure may occur word-internally in special cases, such as *ʕa:m.ma* ‘public’ (fm.) (Holes 2004, p. 61); another is a syllable that is ‘doubly’ closed with two consonants: CVCC, e.g., *kalb* ‘dog’ or even CV:CC, e.g., *ma:rr* ‘passer by’—this last type, however, is limited to geminate consonants (Broselow 2008, p. 610 ff.; Jesry 2009, p. 388).

Importantly, Arabic syllable boundaries vary with morphological processes such as declension that the words might undergo. Since syllabification in junctural (connected) prose operates across the boundaries of words in sequence, we find Standard Arabic pausal (basic) forms resyllabified in non-pausal connected or context status, e.g., pausal *jadd* ‘grandfather’ vs. context *jaddun* (*jad.dun*); pausal *maktab* (*mak.tab)* ‘office’ vs. *maktabu š-šurṭa* (*mak.ta.buš.šur.ṭa)* ‘the police office’ in a construct phrase. The Standard Arabic sequence *min* ‘from’ and *l-bayt* ‘the house’ potentially forms a 3-consonant cluster (*nlb*). Since Arabic does not permit 3-consonant clusters in principle, an anaptyctic (helping vowel) is inserted to break the cluster, forming *min-al-bayt* (*mi.nal.bayt)* ‘from the house’.

It is noteworthy that Arabic vernaculars may vary in their syllable structure and their phonotactic constraints. For instance, Palestinian Arabic allows many 2-consonant clusters in syllable-initial positions (e.g., *tra:b* ‘soil’ or *kla:b* ‘dogs’) or across morpheme-boundaries in some grammatical forms (e.g., definite nouns *l-be:t* ‘the house’). Yet, syllable final clusters are not as prevalent. The sonority principle of final anaptyxis is $C_1VC_2C_3 \Rightarrow C_1VC_2VC_3$ if Sonority $C_2 <$ Sonority $C_3$ (Zemánek 2006a, p. 86). In other words, a rise in sonority within a final $C_2C_3$ cluster will call for anaptyxis, so *qabl* ‘before’ (sonority rises from $C_2$*b* to $C_3$*l*)⇒*qabil.* Notably, the sonority hierarchy for final clusters is directly contrary to the sonority hierarchy for initial clusters, where anaptyxis is called for in the case of falling sonority. Thus, perfectly acceptable word-initial clusters of a $C_1$ stop or fricative and a $C_2$ sonorant of higher sonority, such as *dr, bl, tn, fl, sm* in ***dr**u:s* ‘lessons’, ***bl**a:d* ‘country’, ***tn**e:n* ‘two’, ***fl**a:n* ‘so-and-so’, ***sm**i:n* ‘fat’, will need anaptyxis in word final position, as in *ba.**dir*** ‘full moon’, *qa.**bil*** ‘before’, *ma.**tin*** ‘corpus’, *ṭi.**fil*** ‘child’, *ʔi.**sim*** ‘name’, respectively. Word-final clustering is more generally acceptable in the case of dropping sonority: *ʔaka**lt*** ‘I/you ate’, *ka**lb*** ‘dog’, *ħa**md*** ‘praise’, though again, dialects vary with respect to clustering in such cases.

Arabic stress is non-phonemic (Holes 2004, p. 62) or non-distinctive (Kager 2009, p. 344), and is predictable (though dialect-dependent), given the weight

[9] A mora is a prosodic weight unit for classifying syllable structure. It counts all units excluding the onset consonant.

[10] Holes (2004, p. 62 ff.) considers bimoraic syllables ‘light’ too; ‘heavy’ syllables in this system contain 3–4 moras. Al-Ani (2008, p. 601) similarly considers CVC a light syllable. A little further on in the article, however, Al-Ani (2008, p. 602) posits an in-between category of ‘medium’ or bimoraic syllables, such as *kam* ‘how many’ and *ma:* ‘what’.

and number of syllables in the word.[11] In Standard Arabic, a word (in pausal status only) can contain just one extra-heavy syllable (of four elements or more)—that syllable is necessarily final, and receives stress, e.g., *ki.**ta:b*** 'book', *ka.**tabt*** 'I/you wrote'. In the absence of extra-heavy syllables, stress falls on the rightmost non-final heavy syllable (Kager 2009, p. 349): *mu.dar.ri.**su:.**na* 'teachers'; *yas.ta.**ṭi:.**ʕu* 'he is able'; *kas.**sar**.tu.hu* 'I broke it', ***mak**.tab* or ***mak.**ta.bun* 'office'. Otherwise, stress falls on the first syllable, e.g., ***ba.**ra.ka* 'blessing', ***ka**.ta.bu:* 'they wrote'.[12] Stress variation in Modern Standard Arabic is due, at least in part, to the fact that, as in the issue of syllable structure, here too speakers are influenced by their native dialects, which vary considerably in their stress rules. The Standard Arabic stress scheme just outlined is very similar to that of Eastern Arabic dialects (Kager 2009, p. 350).

### 1.2.3 Morphology: Root, Pattern[13]

Arabic, like other Semitic languages, is characterized by a predominantly non-linear or non-concatenative morphological structure (Larcher 2006; McCarthy 1981), the hallmark of which is a جَذْر *jaðr* 'root' and a derivational or inflectional pattern ميزان صَرْفيّ *mi:za:n ṣarfiyy*.

In Semitic languages, morphological derivation and inflection typically involve two bound morphemes: a triliteral (and sometimes quadriliteral) root (e.g., $_{C1}$*K*-$_{C2}$*T*-$_{C3}$*B*) and a word pattern or template (Broselow 2008, p. 610; Holes 2004, p. 99), such as $C_1$*a*:$C_2$*i*$C_3$ e.g., *ka:tib* 'writer' (active participle) or *ma*$C_1C_2$*u:*$C_3$, e.g., *maktu:b* 'written' (passive participle). The root is an unpronounceable bound morpheme, "a skeleton of consonants" (Bentin and Frost 1995, p. 273) that provides the core meaning, or the semantic family. The pattern is a non-pronounceable bound morpheme too—a fixed prosodic template with slots for the root consonants. The insertion of the root consonants within the word pattern produces a unique lexical item with a unique meaning and a well-defined grammatical category directly discernible by the specific word pattern. It is noteworthy that while patterns are

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[11] Holes ibid presents rare cases where phonemic status may be attributed to stress. This is due to neutralization of word final gemination, which results in minimal pairs such as dialectal ***sA**kat 'he was silent' vs. sa**kAt**+t⇒sa**kAt**.* 'I was/you were silent'. But he notes that such cases are "marginal and artificial".

[12] More elaborate stress rules (Holes 2004, p. 62 ff.) account for cases like *yas.**ta**.mi.ʕu* 'he listens', *muš.ki**.la**.tu.ka* 'your problem' and, particularly, when all the non-final syllables are light, e.g., *ma.li.ka.tu.hu* 'his queen'. In this case there is no general agreement as to whether the stress fell on the first syllable in Classical Arabic ***ma**.li.ka.tu.hu* (Kager 2009, p. 349), or was limited to the last three syllables (Broselow 2008, p. 613), namely *ma.li.**ka**.tu.hu*, the Arab grammarians having totally ignored the issue of stress in their writings.

[13] In the following two sections we discuss mainly Modern Standard Arabic. In demonstrating the forms, however, we choose variants that are as close as possible to those of Spoken Arabic. We thus prefer pausal forms that omit final short vowels in the same way as dialectal variants, e.g., *katab* (and not *kataba)* 'to write', Impf. *yaktub* (rather than *yaktubu),* unless the omitted vowels are the issue discussed, or when historical morpho-phonological processes are being shown, e.g., *ramaya⇒rama*: 'to throw'.

primarily vocalic templates (vowel patterns), some patterns involve gemination of root consonants or vowel length, and others are augmented with certain consonants, such as */ʔ s t n/.* In the case of verbs, these augmented patterns are called أَفْعالمَزيدَة *ʔafʕa:l mazi:da* ‘augmented verbs’, namely all Arabic verb patterns except for pattern I, referred to as فِعْل مُجَرَّد *fiʕl mujarrad* ‘bare verb’, because it consists only of the root consonants and vocalic pattern. Importantly, the additional consonants of the augmented verbs, as well as the long vowels of word patterns, are an indispensable part of the orthographic representation of words, even in unvoweled Arabic script (see Sect. 1.3: Orthography).

The root-pattern morphological structure is common to almost all Arabic content words and some function words, such as *qabl* ‘before’; their semantic identity is largely determined by the consonantal root. Interestingly, even loan words, such as *talfizyo:n* ‘television’ and *talifo:n* ‘telephone’, are treated by speakers as having an internal root-pattern structure; via a derivational process known as ‘root extraction’, new quadriliteral roots *TLFZ* and *TLFN* are derived and combine with the quadriliteral pattern $C_1aC_2C_3aC_4$ to form the verbs *talfaz* ‘to televise’ and *talfan* ‘to phone’. Root consonants usually preserve their phonemic identity when combining with word patterns to form Arabic lexemes. Yet, because of velarization spread (the phonological assimilation process described earlier) some root consonants may become emphatic. This phonetic change is not represented, however, in the orthographic structure of Arabic words and this may lead to orthographic opacity (see Sect. 1.3: Orthography).

All consonants, including glides, can function as root-radicals. A root containing a glide, however, is considered مُعْتَلّ *muʕtall* ‘weak’,[14] being prone to morpho-phonological changes. These contrast with the ‘strong’ or ‘sound’ roots called صَحيح *ṣaħi:ħ* ‘correct’ whose radicals remain phonologically stable (Akesson 2009, p. 121; Holes 2004, p. 110 ff.; Versteegh 2001, p. 85 ff.; Versteegh 2007b, p. 309). In a $C_1$-glide root, known as مِثال *miθa:l* ‘assimilated’, e.g., *WJD* ‘find’, the glide may be elided in the Impf. **yawjidu ⇒yajidu* ‘he finds’; a $C_2$-glide root, known as أَجْوَف *ʔajwaf* ‘hollow’, e.g., *QWL*, undergoes several changes, e.g., **qawaltu ⇒qultu* ‘I said’, Impf. **ʔaqwulu ⇒ʔaquwlu ⇒ʔaqu:lu* ‘I say’; **qawalat ⇒qa:lat* ‘she said’; a $C_3$-glide root, known as ناقِص *na:qiṣ* ‘defective’, such as *RMY,* is also prone to morpho-phonological changes, e.g., **ramaya ⇒rama:* ‘to throw’, Impf. **yarmiyu ⇒yarmiy ⇒yarmi:* ‘he throws’ (Akesson 2009, pp. 121–122; Chekayri 2007, p. 164 ff.).[15]

Most traditional Arabic dictionaries are alphabetically ordered by consonantal roots and they specify in each entry the specific meaning that results from the

[14] Some scholars include hamzated verbs, i.e. verbs containing *hamza* (see Sect. 1.3: Orthography), in the category of weak verbs (e.g., Voigt 2009, p. 700 ff.).

[15] The grammarians set up phonotactic rules according to a scale of relative lightness and strength of the phonemes that corresponds to sonority (Holes 2004, p. 113): vowels are lightest and strongest, consonants heaviest and weakest; within the vowels, the hierarchy is *a>i>u*. In contact, the lighter-stronger phoneme overrules and only sequences of rising lightness are permitted. So the triphthong *iyu* in **yarmiyu* above will contract to *iy ⇒i:*, as also in **qa:ḍiyu ⇒qa:ḍi:* ‘judge’ (Versteegh 2001, p. 86 ff.; Voigt 2009, p. 699). The homogeneous triphthongs **awa,*aya* are simplified by elision of the glide, as we saw in **qawala ⇒qa:la* and **ramaya ⇒rama*: above.

combination of the root with the pattern. Regular renditions of a word meaning from its root and pattern, known in Arabic grammatical terminology as قِياسيّ *qiya:siyy* ‘analogous’ or ‘regular’, need not be listed as these may be computationally constructed. In contrast, dictionaries attempt to list all meanings, known in traditional terminology as سَماعيّ *sama:ʕiyy* ‘heard’, i.e. based on hearing (Versteegh 2001, p. 85) or learned by ear. In the latter case, a word’s meaning might not be a straightforward combinatorial function of the root meaning and the function of the word-pattern. This is because roots may be affiliated with more than one semantic family; some of these families may be remarkably distinct. Also, roots may undergo semantic broadening and adopt new areas of meaning while other areas might become obsolete. Finally, word patterns are not perfectly regular nor are they systematic.

It is possible to categorize word patterns in Arabic into two classes: *verbal patterns* and *nominal patterns*. Verbal patterns combine with roots to derive verbs, whereas nominal patterns combine with roots to derive nouns. There are 15 distinct triliteral verbal patterns (measures or forms, Hebrew *binyanim*) in Arabic, 10 of which are still productive (Holes 2004, p. 100 ff.; Larcher 2009, p. 640 ff.), though not necessarily in all dialects: I *faʕal*, II *faʕʕal*, III *fa:ʕal*, IV *ʔafʕal*, V *tafaʕʕal*, VI *tafa:ʕal*, VII *ʔinfaʕal*, VIII *ʔiftaʕal*, IX *ʔifʕall*, X *ʔistafʕal;* the remainder are rare and non-productive.[16] Quadriliterals have two distinct patterns *faʕlal and tafaʕlal*, $C_1aC_2C_3aC_4$ and $taC_1aC_2C_3aC_4$, respectively. Each verbal pattern in Arabic is associated with a set of morpho-syntactic inflectional patterns used in the conjugation of the verb for tense, person, number, gender, and mood.

Nominal patterns form a very large set. For example, Wright’s grammar of Classical Arabic lists 44 nominal patterns derived from the first verbal pattern only. Holes (2004, p. 106) notes eleven among them as the most common in modern use. He also lists 13 additional patterns used in deriving nouns from augmented verbs. Boudelaa and Marslen-Wilson (2010, p. 483) report the occurrence of 2,324 different word patterns in current use in MSA; ‘broken plural’ patterns alone (see 1.2.4: Morpho-syntax) exceed 36 (Versteegh 2001, p. 84).

If patterns were perfectly systematic and predictable, “the lexicographer would only need to list the roots, and the speaker could combine them at will with the desired pattern to express, e.g., ‘the place where such and such takes place’, ‘a professional practitioner of such and such’, ‘one who pretends to be such and such’, etc.” (Bateson 2003, pp. 1–2), but in fact, there is no such uniformity. Even though patterns are conceived to have clearly defined functions, they are not perfectly systematic. So, from the verb *jalas* Impf. *yajlis* ‘to sit’ we find *majlis* ‘place or time of a meeting’ in the $maC_1C_2iC_3$ pattern for place and time of an action distinct from *majlas,* a verbal substantive of the type known as مَصْدَر ميميّ *maṣdar mi:miyy* ‘*M*-verbal noun’. But in other cases, the verbal noun is identical to the noun designating place or time, or to the passive participle in the case of the derived verbal patterns (Wright 1975 I, pp. 124–129), e.g., *mujtamaʕ* ‘gathering place’ and also

[16] The numbering of these forms is a western innovation. Arabic terminology knows them just by name (Versteegh 2001, p. 87).

'gathered people, society'. This contributes to morphological opacity—difficulty in recovering the meaning of a word from its root-pattern morphological structure.

Another factor contributing to morphological opacity in Arabic is the fact that "many patterns are the result of a series of derivational steps, some of which are semantically systematic, while others seem arbitrary" (Bateson 2003, p. 2). So *qawmiyya* 'nationalism' is derived in stages from *qawm* 'race, people, nation' + attributive suffix -*iyy* => *qawmiyy* 'national' + feminine suffix -*a* for an abstract noun (ibid, p. 20).[17]

### 1.2.4 Morpho-syntax: Parts of Speech, Inflection, Declension, Clitics

Arabic words have been traditionally classified into three classes إسْم *ʔism* 'noun' (including substantive and adjective), فِعْل *fiʕl* 'verb', and حَرْف *ħarf* 'particle' (including adverbs as well as prepositions and conjunctions). Both nouns and verbs inflect for gender (مُذَكَّر *muðakkar* 'masculine', مُؤَنَّث *muʔannaθ* 'feminine') and for number (مُفْرَد *mufrad* 'singular', مُثَنّى *muθanna:* 'dual', and جَمْع *jamʕ* 'plural'), although the morphemes marking these categories differ.

There are two pluralization mechanisms for nominal forms: سالِم *sa:lim* 'sound' or 'sane' concatenated plural on the one hand and so-called مُكَسَّر *mukassar* 'broken' or تَكْسير *taksi:r* 'breaking' non-concatenated plural on the other hand (Wright 1975 I, p. 191 ff.). The sound plural masculine suffixes, in general use for participles in the augmented verbal patterns (II -X), some animate nouns and adjectives (Versteegh 2001, p. 83) are *u:n(a)* **or** *i:n(a)* depending on case (see below), and the feminine suffix, also common in loans, is *-a:t;* so, for example, *muʕallim-u:na* 'teachers', in the oblique cases (accusative and genitive) *muʕallim-i:na*; fm. *muʕallim-a:t*. The broken plural patterns are numerous and diverse, e.g., *ʔaqla:m* 'pens' from *qalam*; *kila:b* 'dogs' from *kalb*; *kutub* 'books' from *kita:b*; *mulu:k* 'kings' from *malik; maka:tib* 'offices' from *maktab*. Dual nouns are suffixed with *-a:ni* or *-ayni* depending on case. In the head noun of a construct phrase and before possessive suffixes, the final syllable of the sound plural (and also the dual forms) is omitted, thus *muʔallim-u:-hum* 'their teachers'; *walada: l-ja:r* 'the neighbor's two sons'.

Verbs inflect for person (as well as number and gender)—مُتَكَلِّم *mutakallim* 'speaker', مُخاطَب *muxa:ṭab* 'addressee', and غائِب *ɣa:ʔib* 'absentee' (Wright 1975 I, p. 52). They may be structurally classified into two conjugations: the suffix conjugation combines perfective aspect with past tense, e.g., *katab-tu* 'I wrote, I have written' (the completed action is set in the past); the prefix conjugation combines

[17] The attributive suffix named نِسْبَة *nisba* 'relationship, attribution', is transcribed in the linguistic literature and dictionaries as *-i:, -iy, or -iyy*. We prefer the latter, reflecting most faithfully the morpho-phonological gemination occurring in MSA and seen in vocalized Arabic orthography. Gemination of this morpheme is absent from many dialects and this affects stress patterns in the spoken varieties.

imperfective aspect with non-past (present and future); secondary differentiations are encoded in particles, modal endings, and auxiliary verbs, e.g., *sa-ʔ-aktub* 'I will write' (the incomplete action of writing is explicitly set in the future by the particle *sa-*); *ṣirtu ʔ-aktub* 'I have begun to write, I began writing' (the incomplete action of writing is non-past, ongoing; its initiation is denoted by the auxiliary verb *ṣa:r* 'to become, begin', itself set in the perfective past).

Common to both nouns and verbs in Standard Arabic are عَلامات الإعْراب *ʕala:ma:t al-ʔiʕra:b* '*ʔiʕra:b*-endings'. These vocalic word endings denote the syntactic categories of case and mood respectively. Nouns in non-pausal position take one of three case-endings: the nominative -*u*(*n*) which, being a high vowel, is called مَرْفوع *marfu:ʕ* 'raised', the accusative-adverbial -*a*(*n*) called مَنْصوب *manṣu:b* 'erected', and the genitive *-i(n)* which is مَجْرور *majru:r* 'pulled along' by a preceding preposition or construct-head of the إضافَة *ʔiḍa:fa* 'construct'. The imperfective verb resembles the noun in taking the former two endings—to denote the indicative and subjunctive moods respectively—and is thus called مُضارِع *muḍa:riʕ* 'similar (to the active participle)'; the third mood, the jussive, is denoted by a zero-ending, whence the term مَجْزوم *majzu:m* 'apocopated' (Wright 1975 I, p. 60). The imperative أمْر *ʔamr* 'command' is considered a distinct mood in Arabic grammatical tradition; the classical 'energetic' form, known as تَأْكيد *taʔki:d* 'corroboration', is likewise listed as a mood in some modern reference works (e.g., Wright 1975 I, p. 51) or at least a modal category (Larcher 2009, p. 640).

The noun is determined by the article (*a)l*- 'the', by possessive suffixes, e.g., *ʔumm-i:* 'my mother', or by a following noun in construct (genitive) status, e.g., *ʔumm-u l-walad-i* 'the boy's mother'. Indetermination in Standard Arabic is marked by تَنْوين *tanwi:n* 'nunation', e.g., *ja:r-un* 'a neighbor'. Nouns are primarily triptotes, declining for all three cases; but there is a group of diptotes admitting just partial declension and hence known as غَيْر مُنْصَرِف *ɣayr munṣarif* 'non-declined (for *tanwi:n*)' or غَيْر قابِل للتَصْريف *ɣayr qa:bil l-it-taṣri:f* 'not allowing declination'. In the indefinite state they admit just -*u* or -*a* (not *tanwi:n)*, but behave regularly in definite status. This partial lack of declension is attributed by the grammarians to a deviation from default unmarked Arabic substantive basic forms (msc., sg., indefinite) in at least two of nine criteria of deviations, such as تَأْنيث *taʔni:θ* 'being feminine', وَصْفِيّة *waʕfiyya* 'being an adjective', عُجْمة *ʕujma* 'being a foreign word', تَرْكيب *tarki:b* 'being a compound', عَلَمِيّة *ʕalamiyya* 'being a proper noun', وَزْن الفِعْل *wazn al-fiʕl* 'a verbal pattern' (Versteegh 2001, p. 82; Wright 1975 I, p. 234 ff., especially p. 245). For example, the personal name *Yazi:d* 'loses' its capacity for triptosis by the two criteria of 'verbality' + 'proper noun'; *ʔakbar* 'bigger'– adjective + verbal form; *ħamra:ʔ* 'red'– adjective + feminine.

The adjective, named صِفَة *ṣifa* 'attribute', is a sub-class of the noun, characterized by admitting elative (comparative, superlative) forms, e.g., *kabi:r* 'big' vs. *ʔakbar* 'bigger, biggest'. Every adjective may be employed as a substantive and stand alone, e.g., *kari:m* 'a noble or generous man' (Bateson 2003, p. 44; Beeston 1970, p. 34, 67; Fischer 2006a, p. 18).

Arabic does not have a separate lexical category of adverbs. Adverbial functions are fulfilled by noun phrases and prepositional phrases, such as *ʔams* 'yesterday';

*bi-l-ʔamsi* ‘on the eve’ (Beeston 1970, p. 89), and most pervasively the accusative-adverbial case ending *-a(n),* as in *jidd-an* ‘very’, *layl-an* ‘at night’, *al-yawm-a* ‘today’.[18]

The morphological structure of Arabic also comprises a predominant system of clitics. These are morphemes that are grammatically independent, but phonologically dependent on another word or phrase. They are pronounced (and in Arabic also written) like affixes but function at the phrase level much like the English contracted forms -’ll in ‘he’ll’, or -’ve in ‘I’ve’. In Arabic, clitics may attach to the word as unstressed prefixes (proclitic) or suffixes (enclitic) and can co-occur within the same word, resulting in one-word phrases and clauses, as in بِبَيْتِهِ *bi-bayt-i-hi* ‘in his house’ or وَسَيَأْخُذُهُ *wa-sa-yaʔxuðu-hu* ‘and he will take him’. Pronominal clitics are suffixed to verbs (as direct objects), to nouns (as possessives), and to prepositions; clitics that are prefixed to the content lexeme include several prepositions, conjunctions, and other particles, such as the article (*a)l*-, the asservative (emphasizing) *la*-, and future marker *sa*-.

### *1.2.5 Syntax*

Typologically, inflected languages do not need strict word order because syntactic functions are encoded morphologically (e.g., in case endings) and are thus independent of word order. Yet, “although Arabic is an inflected language, it does have a relatively rigid word order which allows for stylistic deviations” (Bateson 2003, p. 45). Moreover, word order is highly significant in the syntactic conception of the Arab grammarians. They traditionally classified Arabic clauses/sentences into two types (Fischer 2006b, p. 398; Versteegh 2001, pp. 79–81): one is the verbal clause (جُمْلَة فِعْلِيَّة *jumla fiʕliyya*) which opens with a verb and proceeds in a default sequence of Verb-Subject-Object-Adverbial(s), e.g., *kataba r-rija:lu l-maktu:ba l-yawma,* literally ‘wrote the men the letter today’; the other, classified in the Arabic grammatical tradition as a nominal clause (جُمْلَة إِسْمِيَّة *jumla ʔismiyya)*, may naturally have no verb at all and constitute a Subject-Complement-Adverbial(s) sequence, e.g., *ʔar-rija:lu huna: l-yawma* ‘the men (are) here today’; more interestingly, however, a nominal sentence may also begin with a noun followed by a verb in a Subject-Verb-Object-Adverbial(s) sequence, e.g., *ʔar-rija:lu katabu: l-maktu:ba l-yawma* ‘the men wrote the letter today’. The apparent paradox, in western eyes, of a nominal sentence containing a verb, is very rational for the Arab grammarians. The

[18] In the Greek and Latin grammatical tradition the term ‘declension’ is exclusive to nouns. As mentioned earlier, however, Arab grammarians see the imperfect verb as مُضارِع *muḍa:riʕ* ‘similar’ to the participle, and have focused their attention on the parallelism between verbal and nominal endings. They subsume both under the term إعْراب *ʔiʕra:b*, treated under syntax (نَحْو *naħw)*, rather than morphology (صَرْف~تَصْريف *ṣarf ~taṣri:f)*, which deals with inflections of person, number, etc. (Versteegh 2001, p. 74). In this tradition “the endings/*-u, -a*, -0/ of the imperfect verb are case endings” (Versteegh 2001, p. 85). We shall accordingly use the term ‘declension’ for verbal modal endings too, as is common in the writings of modern Arabists (e.g., Larcher 2009, p. 639; Versteegh 2001, pp. 76–79).

verb in a verbal clause profiles the action which initiates it. As such, it is not fully governed by the following subject and therefore is not in full agreement with it: in *kataba* (msc.sg.) *r-rija:lu* (msc.pl.) there is agreement in gender but not in number; the action is declared, as it were, semi-independently of the following subject, which is downgraded to almost an afterthought. In the nominal clause, however, the clause-initial subject is actually a topic in a left-dislocation syntagm. So *ʔar-rija:lu katabu:* is actually ‘the men—they wrote’, where ‘the men’ is a dislocated topic and the rest, a verbal sentence, is the comment. Verbal agreement is full in this structure (*katabu:* pl.), but is perceived to be to the covert subject pronoun ‘they’ rather than to the dislocated topic ‘the men’. The syntactic behavior reflects a major semantic opposition, as formulated by Wright (1975 II, p. 251–252):

> The difference between verbal and nominal sentences, to which the native grammarians attach no small importance, is properly this, that the former relates an act or event, the latter gives a description of a person or thing.

## 1.3 Orthography

Arabic is written from right to left in a cursive script. All 28 letters of the alphabet represent consonants, except for aleph which, however, may act as a ‘bearer’, metaphorically كُرْسيّ *kursiyy* ‘chair’ of an additional sign. This is the *hamza*, representing the 28th consonant, a glottal stop (Holes 2004, p. 89).

The Arabic script is believed to have originated in the earlier Nabatean script (Bateson 2003, p. 54 ff.). The Nabatean script, itself descended from the Aramaic alphabet, was used first to write the Nabatean dialect of Aramaic, and subsequently for writing Arabic. As Arabic had more consonants than Aramaic, the script was modified to represent the extra Arabic consonants. The ligatures, which were adopted from the early Canaanite alphabets to form cursive script, also resulted in the loss of some phonological distinctions. Therefore, some originally distinct Aramaic letters became indistinguishable in shape, so that in the early writings 15 distinct letter-shapes had to represent 28 sounds.

In order to disambiguate pairs or triplets of letters that were identical in their basic shape (رَسْم *rasm*) and represented multiple sounds, e.g., modern س/ش, ع/غ, د/ذ, ر/ز, ص/ض, ط/ظ, a system of consonant pointing was developed, named إعْجام (*ʔiʕja:m*) ‘foreignizing’, which consisted in the use of distinguishing dots. Each ambiguous grapheme was allocated a distinct number of dots for each of its sounds, one (ن), two (ت), or three (ث); placement of the dots, above(ن خ) or below (ب ج) the letter was also distinctive. It was not until the eighth century AD that this pointing system was standardized and stabilized as an inherent component of the Arabic alphabet, with the dots eventually considered part of the letter.

The writing system reflects some dialectal differences between the western *ħija:ziy* dialect of early seventh century Mecca, which dictated the Quranic orthography, and the prestigious eastern dialects of Najd, on which subsequent standardized pronunciation was based a century later (Beeston 1970, p. 26 ff.). Discrepancies between the western and eastern dialects were resolved by diverse means in the script, which could not be altered for its religious sanctity. This had significant repercussions for the resulting orthography. A particularly prominent example is the glottal stop, which had by that time disappeared from the Meccan dialect to be replaced by a glide or long vowel depending on its phonetic environment. This situation is reflected in the consonantal script. So, for example, the word *suʔa:l* 'question' was pronounced *suwa:l* in the Meccan dialect, and written سوال. In the consequent standardization process, the *hamza*, still very much alive in the eastern dialects on which the grammarians of Lower Iraq based their codification decisions, was restored over the consonantal body, and is now written سُؤال with the letter و *W* now acting as the bearer of the *hamza* (Goldenberg 2013, p. 39). Another example of this discrepancy in orthographic convention is the so called أَلِف مَقْصورَة *ʔalif maqṣu:ra* 'shortened aleph'. It often represents a historical Meccan final diphthong /*ay*/, written in the consonantal script with the letter ي *Y* (Beeston 1970, p. 27; Holes 2004, p. 91). In the eastern dialects, however, this diphthong contracted to a long /*a:*/, pronounced [*a*] today, as in the verb *baka:* 'to cry' or the preposition *ʔila:* 'to'. These are written بَكى and إلى respectively, namely with the final ى Y grapheme, but without its diacritic dots.[19]

The adapted Nabatean alphabet did not represent vowels. The Arabic alphabet is thus considered a consonantal alphabet, or an *abjad* (Daniels 1992). An *abjad* is a type of writing system where each symbol always or usually stands for a consonant, leaving the reader to supply the appropriate vowels. This system was nicely suited to the Arabic root and word pattern morphological structure, where the most basic semantic meaning is carried by the consonantal root and where vowel information may be recovered from the vocalic word pattern. Each of the 28 letters of the Arabic alphabet (except aleph) represents a consonant. Three of these letters, ا و ي are called حُروف العِلّة *ħuru:f al-ʕilla* 'letters of defectiveness'. They act as *matres lectionis* 'mothers of reading' and are used to represent the three Standard Arabic long vowels: high front /*i:*/, high back */u:/*, and low */a:/*, respectively. These three letters are also called حُروف اللّين والمَدّ *ħuru:f al-li:n wal-madd* 'letters of softness and elongation' because according to traditional views they indicate elongation of the preceding short vowel sound represented orthographically via a vowel mark (Versteegh 2007b, p. 309). This traditional characterization of the role of ا و ي appears to fit nicely with recent characterizations of the Arabic writing system as a mora-based system (Ratcliffe 2001). According to this view, Arabic letters represent CV moras within syllables. Any additional segment besides the mora, be it vowel length as in a CV: syllable, or another consonant (including a glide) as in a

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[19] *ʔalif maqʂu:ra* is glossed by Wright (1975 I, p. 11) as the aleph "that can be abbreviated", in contrast with *ʔalif mamdu:da* 'lengthened aleph', which never shortens. In non-final context the consonantal/*y*/ may re-appear, e.g بَكَيْتَ *bakayta* 'you cried' and إلَيْكَ *ʔilayka* 'to you', respectively. Another variant of the shortened aleph is actually spelled with an aleph in cases such as the verb غَزا *ɣaza:* 'to raid' from the root *ƔZW*.

CVC syllable, requires an additional letter, as in ما *ma:* ‘what’ and من *man* ‘who’, respectively.

The modern Arabic script is thus characterized by two sets of diacritics: the first is graphemic and consists of the dots of *ʔiʕja:m* which, as we saw above, are compulsory and are used for phonetic distinction of letter consonants. The second is phonemic and does not include any dots but rather, other superscripted marks representing the short vowels of Arabic and other features of vocalization. It is known as تَشْكيل *taški:l* ‘forming’. The short vowel marks of *taški:l* are called حَرَكات *ħaraka:t* ‘motions’,[20] and include:

1. *fatħa* فتْحَة ‘opening (of the lips)’ for a short /*a*/—a small diagonal accent mark placed above a letter;
2. *kasra* كَسْرَة ‘breaking, drawing apart (of the lips)’, for a short /*i*/—a similar diagonal mark below a letter;
3. *ḍamma* ضمَّة ‘pressing together (of the lips)’ for a short /*u*/—a small و *W* placed above a letter;
4. *taški:l* also includes *suku:n* سُكون ‘silence’, which is a circle-shaped diacritic placed above a letter, indicating that the consonant below is vowelless and closes a syllable; this latter information is important for orthographic segmentation and phonological decoding of the Arabic orthography, especially for beginners, given the predominance of the CV syllable in the phonological structure of Arabic words (Saiegh-Haddad 2007). Besides the four marks described above, *taški:l* also includes شَدَّة *šadda*, a small ش Š without its dots (Goldenberg 2013, p. 39) placed above the letter indicating consonant doubling (or lengthening).

The *taški:l* diacritics also include the following less frequent signs:

1. مَدّة *madda* ‘elongation’, a tilde-like diacritic over an aleph آ, accordingly ألِف مَمْدودَة *ʔalif mamdu:da* ‘lengthened aleph’. The most common context is when a syllable-initial *hamza* (always written above or below an aleph) is to be followed by an aleph (with or without a *hamza*, i.e. vocalic or consonantal)—the two consecutive alephs are replaced by one elongated aleph, e.g., آكِلونَ *ʔa:kilu:na* ‘eating’ (pl. participle) instead of أاكِلونَ (Wright 1975 I, p. 25).[21]
2. هَمْزَة وَصْل *hamzat waṣl* ‘connecting *hamza*’ or وَصْلَة waṣla ‘connector’ (Wright 1975 I, p. 19 ff.) which indicates that a *hamza*, predominantly that of the determiner (*ʔa)l-,* is not pronounced in juncture, e.g., *w-* + *(ʔa)l-walad*=>*wal-walad* ‘and the boy’ although its bearer, the aleph, is written, as in وَٱلْوَلَد.
3. ألِف خَنْجَرِيَّة *ʔalif xanjariyya* ‘dagger aleph’ or ‘superscript aleph’, a short vertical stroke on top of a consonant indicating a long */a:/* where aleph is normally not written. This diacritic, familiar from some high-frequency words like هذا *ha:ða:* ‘this’, is seldom indicated.

[20] The term *ħaraka:t* refers properly to “the phonemes that are known in the Western tradition as ‘short vowels’…” (Versteegh 2007a, p. 232), but often includes the graphemes too.

[21] The *madda* is less frequently written over an aleph designating a long*/a:/* before a *hamza*, e.g., *ja:ʔ* ‘he came’ is usually written جاء, properly جآء (Wright 1975 I, p. 24).

A distinct sub-category of *taški:l* is عَلامات الإعْراب *ʕala:ma:t al-ʔiʕra:b* ‘*ʔiʕra:b*-endings’. These have the morpho-syntactic function of indicating mood and case (see Sect. 1.2.4: Morpho-syntax). The modal endings of verbs and the case endings of definite nouns consist of the three Arabic short vowels, and are represented in the Arabic orthography using the same phonemic symbols of *fatħa, kasra, and ḍamma*. The case endings of indefinite nouns in non-pausal status are called تَنْوين *tanwi:n* ‘nunation’. Phonologically and orthographically distinct from other diacritical marks, they consist of the three vowel signs doubled to indicate that the vowel sound is followed by the consonant /*n*/: وَلَدٌ *walad**un*** ‘a boy (nominative)’; وَلَدًا *walad**an*** ‘a boy (accusative)’; وَلَدٍ *walad**in*** ‘a boy (genitive)’.

The fact that the Arabic writing system is corroborated by an optional system of *taški:l* to mark vocalization results in two scripts: مَشْكول *mašku:l*, a fully vocalized (vowelized or voweled) and an unvocalized script. The bulk of Arabic script is unvocalized. Indeed, *taški:l* is commonly used only in religious texts, in children’s literature, and sporadically in ordinary texts when an ambiguity of pronunciation might arise, as its main purpose is to provide a phonetic aid, by showing the correct pronunciation.

It is noteworthy that Arabic also employs a partially vocalized script, where the phonemic diacritics, mainly *fatħa, kasra, ḍamma, suku:n* and *šadda*, necessary for word recognition (or lexical access) are marked word internally, but not the morpho-syntactic *ʔiʕra:b*-endings. This script is used in special purpose texts, such as those intended for native speakers when beginning to read. The main intent of partial vocalizing is to mark the phonological information required for word recognition rather than for accurate declension according to the rules of Standard Arabic.[22]

In the cursive Arabic script all but six letters may ligate (attach) forward, to a following letter. The six exceptions are known as حُروف الرَّفْس *ħuru:f ar-rafs* ‘kicking letters’ (و ز ر ذ د ا). All letters can ligate back to a preceding letter (unless that happens to be a kicking letter). This state of affairs results in a maximum of four allographic forms per letter, as determined by two factors: its position in the word—initial, medial, or final, and whether or not it ligates forward. The combination of position and ligation creates the four letter forms: a) a form for word-initial letters and word-medial letters preceded by a kicking letter; b) a form for word-medial letters ligating both ways; c) a form for final letters that ligate to the preceding letter, and d) a form for final letters preceded by a kicking letter. It is noteworthy that while a few of the Arabic letters actually have four distinct forms (e.g., غـ ـغـ ـغ غ all representing the consonant /*ɣ*/ or هـ ـهـ ـه ه all representing the consonant /*h*/), most letters have only two distinct forms with the other two differentiated just by the ligature (e.g., خـ ـخـ ـخ خ representing the consonant /*x*/, or كـ ـكـ ـك ك representing the consonant /*k*/).

[22] The introduction of vowel marks into the Arabic orthography was initiated by the medieval grammarian *ʔabu: l-ʔaswad ad-duʔali:*, using red dots in different arrangements and positions. This system was changed in the late eighth century by *ʔal-fara:hi:di:* into a system similar to what we see today. *ʔal-fara:hi:di:* found the task of writing Arabic tedious when using two different colors, one for letters and another, red, for vocalization. Also, the *ʔiʕja:m* (consonant dots) had been introduced by then. This meant that without a color distinction the two systems could become confused. As a result, *ʔal-fara:hi:di:* introduced the use of superscripted letters to mark vocalization, thus distinguishing visually between the two systems, vocalization and consonant diacritics.

Like most scripts, Standard Arabic script is conservative in many respects. For example, it leaves many instances of historical phonological assimilation unmarked, most prominently the assimilation of the consonant *l*- of the determiner *(a)l*- to following 'sun letters' حُروف شَمْسِيَّة *ħuru:f š*amsiyya (ت ث د ذ ر ز س ش ص ض ط ظ ن). This group of letters representing coronal consonants takes this label because the word شَمْس *šams* 'sun' begins with such a letter, in contrast to the word قَمَر *qamar* 'moon', which represents all the other, non-assimilating consonants (Wright 1975 I, p. 15).

## 1.4 Diglossia

Arabic is a prototypical case of the concept *diglossia*, which emerged in sociolinguistic theory to describe a situation in which in a given society there is more than one language variety in complementary functional use. In his famous 1959 article, Ferguson defines diglossia as follows:

> DIGLOSSIA is a relatively stable language situation in which, in addition to the primary dialects of the language (which may include a standard or regional standards), there is a very divergent, highly codified (often grammatically more complex) superposed variety, the vehicle of a large and respected body of written literature, either of an earlier period or in another speech community, which is learned largely by formal education and is used for most written and formal spoken purposes but is not used by any section of the community for ordinary conversation. (p. 336).

According to Ferguson, a diglossic context is characterized by a stable co-existence of two linguistically-related language varieties: a *High,* primarily written, variety and a *Low* spoken variety. These are used for distinct sets of complementary functions and in different spheres of social interaction. The spoken variety, which is the original mother tongue, is almost always held in low esteem and its spheres of use involve informal, interpersonal communication. The literary variety is held in high esteem and is used for written communication and formal spoken communication. Such rigid functional complementarity, it is argued, gives way only to slight and insignificant overlap (Maamouri 1998); in a diglossic context, no section of the community uses the High variety for ordinary conversation. This is arguably "the most important factor in a diglossic situation and one that makes for relative stability" (Keller 1982, p. 90).

Though Ferguson proposes a dichotomy between the spoken and written varieties, he himself recognizes that this is just an abstraction. The much more complex linguistic situation in Arabic diglossia has subsequently been described in terms of levels, or even a continuum, with speakers shifting between as many as four (Meiseles 1980) or five (Badawi 1973) varieties, ranging between colloquial/vernacular and literary/standard forms. It is argued that there are "gradual transitions" (Blanc 1960) between the various varieties, and "theoretically an infinite number of levels" (Bassiouney 2009, p. 15). A code switching approach has also been proposed (Boussofara-Omar 2006, p. 634). We shall continue to use the well-established term 'diglossia' and its derivatives, understanding it in this modern conceptual framework as a continuum along which shifting, switching, and mixing occur constantly.

In diglossic Arabic, children start out speaking a local variety of Spoken Arabic, the one used in their immediate environment: at home and in the neighborhood. Once they enter school, they are formally and extensively exposed to Modern Standard Arabic as the language of reading and writing while Spoken Arabic remains the language of informal speech. Academic school-related speech is conducted in a semi standard variety, known as 'Educated Spoken Arabic' (Badawi 1973), except in Arabic lessons, where Standard Arabic is more dominant, or at least aspired to (Amara 1995). Outside the school milieu, there is a similarly stable co-existence of the two major varieties, each functioning for distinct spheres of social communication: Spoken Arabic is used by all native speakers—young and old, educated and uneducated—for informal and intimate verbal interaction in the home, at work, in the community. Standard Arabic, alternating with Educated Spoken Arabic, is at least expected to be used for formal oral interactions, such as delivering a speech or a lecture, and for writing. Thus, while Spoken Arabic is undoubtedly the primary spoken language, native speakers of Arabic, including young children, are actively and constantly engaged with Standard Arabic as well; they pray, do their homework, and study for their exams in Standard Arabic, and they also watch certain TV programs and dubbed series in this variety. Thus, besides proficiency in using Spoken Arabic, linguistic proficiency in Arabic involves, from an early age, concurrent proficiency in using Standard Arabic.

Moreover, the 'vertical' diglossic scale ranging from High to Low is supplemented by a 'horizontal', interdialectal scale with some prestigious dialects, mainly those of urban centers, serving as a kind of regional, or even national, *dialectal standard* (Holes 2004, p. 49 ff.). Such a prestigious, basically 'urbanite' regional standard may adopt some local 'ruralite' elements, particularly following mass immigrations to the urban center, and become a mixed 'dialectal koiné' (Miller 2006, p. 595) which, in turn, exercises koineizing and leveling effects on the entire region. Prominent regional standards include the contemporary dialects of Damascus, Beirut, Jerusalem, Casablanca and, probably the most prominent of all—the Cairene dialect, with a particularly strong koineizing effect, even outside Egypt (Versteegh 2001, p. 138 ff.). In inter-dialectal communication, speakers of local, 'marginal' dialects may tend to level their dialectal variety and accommodate to the regional dialectal standard, or to the Cairene dialect, to which they are exposed more and more today via the media, movies, and other means.[23]

Despite a rather stable diglossic context, two important developments in recent years are particularly relevant to children, casting doubt on classical definitions of diglossia and supporting the modern continuum conception. One is the introduction of satellite TV, and in particular children's TV channels, which dub children's programs in a Standard-like variety in order to make them available to children from different Spoken Arabic backgrounds. This has meant that Arabic native speaking

[23] Terminology varies here, as in other issues. Bassiouney (2009), for example, avoids the term 'standard' in the context of dialects, i.e. on the horizontal scale. She devotes a chapter (1.2.1, p. 18 ff.) to the difference between 'standard' and 'prestige' in the context of dialects, reserving the term 'standard' for Standard (i.e. modern Literary) Arabic.

children are more exposed, and at a rather early age, to Standard Arabic linguistic structures. The second is the introduction of social media and electronic texting and the widespread availability of these facilities to Arabic speaking children and youth. Electronic messages within this population in many Arabic speaking countries are written in Spoken Arabic (Abu Elhija 2012; Al-Khatib and Sabbah 2008; Haggan 2007; Mostari 2009; Palfreyman and Al-Khalil 2007).

In a diglossic community more than elsewhere, speakers' attitudes to their language and dialect are particularly important, because of the significance of the diglossic duality to everyday life, and the choice inherent in every communicative act. The Arabic language, as is well known, is held in the deepest esteem in the Arab world. This begs the question 'What is the Arabic language?' While writing this paper we were surprised to find ourselves disagreeing (happily, that did not happen too often concerning other issues) on the meaning of the term اللُّغَة العَرَبِيَّة *ʔal-luɣa l- ʕ*arabiyya 'the Arabic language' for its speakers. For Elinor, based on her north Palestinian native dialect and several authorities on Arabic sociolinguistics, it is an umbrella term and an abstraction that refers to the full range of spoken varieties as well as to Standard Arabic (Maamouri 1998; Suleiman 2006, p. 173), contrasting with *ʔal-luɣa l-fuṣħa: / l-faṣi:ħa* 'the most eloquent/ eloquent language' for specific reference to the literary varieties, namely Classical, Literary and Standard Arabic. In this approach, Arabic speakers consider themselves monolingual native speakers of *ʔal-luɣa l- ʕarabiyya* 'the Arabic language', regardless of the specific vernacular they may speak. For Roni, however, based on her experience with Negev Arabic and other authorities on Arabic (Bateson 2003, p. 75; Fischer 2006b, p. 397; Holes 2004), the term *(ʔal-luɣa) l- ʕarabiyya* refers just to the pure Classical language, or a literary variety that aspires to that. Children learn it at school, but a speaker of the local Negev dialect would not say to another *ʔana baħkiy maʕak b-al-luɣa l-ʕarabiyya* 'I am speaking Arabic to you' but rather *ʔana baħkiy maʕak ʕaṛabiy.*

### *1.4.1 Differences between Classical and Modern Standard Arabic*

Modern Standard Arabic is a direct descendant of Classical-Literary Arabic and the linguistic structure that we have outlined in the previous section basically applies to both. However, as a modern means for interdialectal communication, Modern Standard Arabic has undergone, and is necessarily still undergoing, several changes. Among these, Bateson (2003) includes: (a) linguistic simplification and reduction of various Classical-Literary Arabic linguistic realizations; (b) a vast shift in the lexicon stemming from technical terminology and borrowing from other languages; (c) stylistic-syntactic variations due to translations from European languages and extensive societal bilingualism; and (d) a strong shift in the realization of Classical-Literary Arabic phonology, with changes in the phonetic realization of consonants and vowels and in the extent of velarization and allophonic variation due to the influence of spoken dialects (for a detailed discussion and examples, see Bateson 2003, pp. 84–92). Given these differences, some scholars use the simple adjective (*ʔal-luɣa) l-faṣi:ħa* ‘the eloquent (language)’ to refer to Modern Standard Arabic, keeping it distinct from the superlative (*ʔal-luɣa) l-fuṣħ*a: ‘the most eloquent (language)’, namely Classical-Literary Arabic.

### *1.4.2 Differences between Literary and Spoken Varieties of Arabic*

There is intimate linguistic relatedness between Classical-Literary Arabic and its contemporary descendent Modern Standard Arabic, and both differ from Spoken Arabic in all linguistic domains. According to Bateson (2003) these include the processes that have occurred in the New Arabic type, to which all the contemporary dialects belong:

*Phonologically*, some consonants (as many as four or five) have been lost; final short vowels have been deleted; long unstressed vowels have been shortened and falling diphthongs have contracted to long vowels; new extra-heavy syllable types have developed including more clusters than were permitted in the old type, and various sorts of stress patterns have emerged.

*Morphologically,* the primary difference lies in the general reduction in inflectional categories. This includes the loss of final short vowels indicating case and mood, accompanied by the general use of the genitive-accusative forms of duals and sound masculine plurals. The dual, originally realized in the nominal, pronominal and verbal systems, has survived only partially in the noun system.

*Syntactically*, Colloquial Arabic has a more complex system of parts of speech than Classical Arabic, including an autonomous system of adverbs. This is in part due to the morphological changes delineated above, especially the loss of certain inflectional categories, which placed a heavier burden on word order.

*Lexically*, Colloquial Arabic is more open to loanwords than Classical Arabic. The primary source language varies from one place to another.

### *1.4.3 Representation of Standard and Spoken Arabic in Orthography*

Arabic orthography is primarily a representation of Classical-Literary-Standard Arabic. It maps Standard Arabic phonology, morphology, syntax, and lexicon. This means that linguistic features of Spoken Arabic, including sounds, words, and syntactic constructions, may not have a conventional form of representation in spelling. It is noteworthy that given the linguistic relatedness and partial overlap between Spoken and Standard Arabic, some Standard Arabic linguistic constructions are also available in some Spoken Arabic dialects, albeit with certain variation. These will naturally have a standard orthographic representation. Moreover, distinctive spoken structures may be phonetically represented. Yet, they do not have a conventional orthographic form.

Arabic orthography maps Standard Arabic consonants and long vowels in a rather regular fashion, with a one-to-one relationship between graphemes and phonemes. This results in a regular and transparent abjad (primarily consonantry) with a one-to-one mapping between the letters of written words and their phonological representation.[24] Morphological representation of this abjad is likewise transparent, with a rather regular mapping of the consonantal root morpheme letters and all other consonantal material, as well as the long vowels of word patterns (however, see Sect. 1.2.3: Morphology).

Despite a rather high degree of feedforward consistency in the relation between orthography and phonology when proceeding from the former to the latter (as in reading), Arabic features a few instances of feedback inconsistency, or opacity, especially in the process of moving from phonology to orthography (as in spelling). The first is the *hamza*, representing the glottal stop. This character ء, originally a small ع (Goldenberg 2013, p. 39), has a variety of different phonologically-conditioned orthographic forms and 'bearers' (see Sect. 1.3: Orthography), depending on preceding and following vowels and their alleged relative 'strength'. Another factor pertains to the absence of أَلِف خَنْجَرِيَّة *ʔalif xanjariyya* 'dagger aleph' (see Sect. 1.3: Orthography) from modern Arabic texts. This means that some words will be pronounced with a long vowel that is not represented in spelling. It is noteworthy, however, that 'dagger aleph' is very rare and limited to high frequency words, such as 'إِلٰه' *ʔila:h* 'god' and هٰذا *ha:ða:* 'this'. This explains the tendency to leave it unmarked in modern Arabic texts. A third source of opacity is the optionally marked consonantal gemination (or doubling, or lengthening) which is represented using the superscript sign *šadda.* According to traditional views the *šadda* must not be omitted because consonantal doubling is phonemic, sometimes morphemic, in Arabic. Yet, most modern everyday writing omits the *šadda* together with the other *taški:l* diacritics. In the absence of the *šadda*, word recognition may be hampered, especially among beginners, yet consonant gemination may still be recovered from the morphological and morpho-orthographic representation of the word, as well as from lexical and contextual cues.

The widespread phonological assimilation process of velarization spread in Arabic is another source of orthographic opacity. In this process non-velarized consonants become velarized through vicinity to a velarized phoneme (see Sect. 1.2.1: Phonology). As such, because primary velarization is phonemic in Arabic, the phonetic realization of these secondarily velarized consonants might coincide with the phonemic representation of other letters in the Arabic alphabet. Consequently some letters become homographic, leading to difficulty in the orthographic encoding of sounds, or spelling. For instance, in connected speech, the first letter ت T in the word تَقَدَّم *taqaddam* 'advance' will tend to be realized with the emphatic sound *[ṭ]* and may therefore be spelled incorrectly with the letter ط which represents this emphatic. The source of this mistake is the uvular /*q*/ which triggers a partial regressive assimilation process of velarization spread, namely a backing effect in the vicinity of low vowels making spelling of these letters more difficult (Saiegh-Haddad 2013).

[24] Note that the phonetic realization of consonants, as allophonic variants of phonemes, is not graphemically marked. This is salient in the case of widespread phonological assimilation processes, such as velarization spread (see Sect. 1.2.1: Phonology).

Two morpho-phonological features are noteworthy here as additional factors contributing to orthographic opacity. One is تاء مَرْبوطة *ta:ʔ marbu:ṭa* ‘bound T’; another is ألِف الفارقة *ʔalif al-fa:riqa* ‘separating aleph’. *ta:ʔ marbu:ṭa* is not an independent letter of the Arabic alphabet. Rather, it is a variant of the letter T ت. The basic variant is called *ta:ʔ maftu:ħa* ‘opened T’, as the grapheme is open at the top. The ‘bound’ variant, ‘closed’ at the top, is in fact the letter H (word final shapes) ه ـه, a matre lectionis with diacritics ة ـة to differentiate it from the consonantal H and to mark it as a morphological entity, namely the basic feminine suffix of nouns and adjectives. When a word ending with *ta:ʔ marbu:ṭa* is suffixed with a personal pronoun, the consonant /*t*/ is restored in both speech and in writing as *ta:ʔ maftu:ħa* ‘opened T’; when vocalized for the case ending, or opening a construct *ʔiḍa:fa*, the consonant /*t*/ is restored in speech only. It is argued that the feminine suffix used to be /*t*/ in all circumstances, then was realized as *[h]* in pausal status, and finally was muted to [*a*]; the letter representing it comes from the middle stage, H for [*h*] combined with the two dots of the letter ت T. Because *ta:ʔ marbu:ṭa* usually sounds like /*a*/ in pausal status and as /t/ in junctural speech as well as in suffixed and construct status, it may be confused with the *fatħ*a in the former and with the letter ت in the latter. This may constitute a source of difficulty in early spelling, especially in the case of *ta:ʔ marbu:ṭa,* because while spelling in Arabic does not typically encode short vowel marks, omitting *ta:ʔ marbu:ṭa* is considered a spelling error.

In Standard Arabic, perfective verbs in the third person plural, such as *katabu:* ‘they wrote’ and imperfective verbs in the subjunctive and jussive moods, e.g., *lan yaktubu:* ‘they will not write’ and *lam yaktubu:* ‘they did not write’, respectively, end with a suffix called واو الجَماعَة *wa:w al-jama:ʕa* ‘plural W’. In spelling, this suffix consists not only of the letter و W, as expected, but also of the letter aleph ا. This aleph is called ألِف الفارقة *ʔalif al-fa:riqa* or ألِفَ الفاصِلة *ʔalif al-fa:ṣila* ‘separating aleph’ or ألِف الوقايَة *ʔalif al-wiqa:ya* ‘aleph of protection’, having served in the past to distinguish this suffix from the conjunction و W ‘and’ (Holes 2004, p. 92; Wright 1975 I, p. 11) at a time when words were not separated by spaces. As this aleph is silent, it may be missed in spelling or, conversely, wrongly vocalized in reading.

Vocalized Arabic is highly transparent for reading, since all of the phonological information required for accurate pronunciation is marked, and is regular. Excluded are secondarily velarized consonants and vowels. In contrast, unvocalized Arabic is rather opaque. This is because the phonological information represented through *taški:l*—mainly the system of vowel marks—is missing from this script. It is noteworthy here that the terms ‘orthographic regularity’ and ‘orthographic opacity’ refer to fundamentally different underlying phenomena in Arabic and in English. In English, orthographic opacity does not stem from the absence of the graphemes that represent phonological information, but rather from the ambiguity or lack of systematicity in the mappings between graphemes and phonemes. Such orthographic opacity necessitates reliance in reading and spelling on large grain-size units (Ziegler and Goswami 2005), primarily lexical. The Arabic unvocalized orthography, in contrast, represents the morphological structure rather regularly, with full representation of root consonants, as well as the consonants and long vowels of word-patterns. Given that the great majority of Arabic words are complex and have an internal root-pattern morphological structure, the sub-lexical morphemic grain-size unit appears to be a functional linguistic unit in reading and spelling in Arabic (Frost 2006; Saiegh-Haddad 2013; Ravid 2012).

Given the systematic representation of morphemes in the Arabic unvocalized orthography, fully vocalized Arabic may be paradoxically more opaque than unvocalized Arabic, especially for spelling. This opacity is not related to orthographically regular vowel marks. Rather, it pertains to the case endings, in particular *tanwi:n*, which is not necessary for lexical access and which is associated with a number of orthographic-phonological complexities, such as the nasal sound /*n*/ that it represents, as well as its effect on the phonological quality of *ta:ʔ marbu:ṭa*. Similarly, other *ʔiʕra:b*-endings which take the form of short vowels may be mistaken for the mothers of reading (ا و ي) especially among children and beginners who fail to make accurate auditory discrimination between short and long vowels and who cannot use higher order linguistic skills to compensate for difficulties in phonological representation and awareness.

We have argued above that fully vocalized Arabic is highly transparent with graphemes (letters and diacritics) representing phonemes regularly. We have also argued that unvocalized Arabic is also highly consistent with morphemes fully and regularly represented. This claim is true, however, only if the mapping systems that we consider are Standard Arabic, on the one hand, and its orthographic representation, the Arabic orthography, on the other. Yet, from a psycholinguistic point of view, the Arabic orthography might not be said to be transparent for two reasons. First, at a higher linguistic level, it does not map the language structures (syntax, lexicon, etc.) that native Arabic speakers naturally use and master. Further, at a lower-order level, the symbolic system in the case of Arabic maps phonological units that may be unfamiliar to readers (Saiegh-Haddad 2003, 2004, 2005, 2007, 2011, 2012; Saiegh-Haddad et al. 2011). This implies that the mapping from spelling to sound, while it may be considered linguistically regular at some abstract level, may be regarded as psycholinguistically opaque.

In this chapter, we have attempted a general description of the Arabic language and orthography, with particular focus on phonological and morpho-syntactic properties, as well as on the mappings from language to orthography. This focus on phonology, morpho-syntax, and orthography was guided by our intent to provide the reader with those aspects of the Arabic language and orthography that may have a direct relevance to reading research and practice in Arabic. While it does not claim to be a comprehensive account of this extremely complex topic, we believe it provides the reader with the necessary 'springboard' for the rest of the book.

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# Part II
# Arabic Lexical Representation and Processing

# Chapter 2
# Is the Arabic Mental Lexicon Morpheme-Based or Stem-Based? Implications for Spoken and Written Word Recognition

**Sami Boudelaa**

**Abstract** There are two contending views of Arabic morphology. The first is a morpheme-based approach which holds that Arabic surface forms consist of a root and a word pattern. The second is a stem-based approach which dispenses with roots and word patterns and views the Arabic lexicon as being built around processes that take the stem as a basic unit. The two views have implications for the way Arabic words are accessed and stored in the mental lexicon, for the patterns of deficits seen following brain injury, and for the way in which language processing is neurally instantiated in the brain. In this chapter, the different predictions of the two views are evaluated, and an *obligatory morphological decomposition* (OMD) model is suggested and compared to a dual route account and a connectionist account. The OMD is found to be superior and it is concluded that the Arabic, and indeed the Semitic lexicon, are organized in terms of morphemes which govern spoken and written word recognition processes.

**Keywords** Arabic morphology · Stem-based lexical acces · Spoken and written word recognition · Root-based lexical access

## 2.1 Introduction

Our long-term knowledge of language requires us to store information about the words of our language—what they sound like (phonology), what they mean (semantics), and how they are combined to construct utterances (syntax). This array of information is made available to us when we hear or see words. When native

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S. Boudelaa (✉)
Department of Linguistics, United Arab Emirates University,
15551 Al Ain, United Arab Emirates
e-mail: s.boudelaa@uaeu.ac.ae

Neuroscience of Language Laboratory, NYU Abu Dhabi, Abu Dhabi, United Arab Emirates

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speakers of English, for example, hear the word *walk*, they will recognize it as a phonological form they have encountered before, and will recover both its meaning and its syntactic characteristics (as a verb or a noun), where *walk* as a noun behaves differently from *walk* as a verb. But many English surface forms—and even more so in other languages—are more complex than the simple form *walk*, as in the inflectional variants *walks, walking, walked*. The question therefore arises about the kind of representation used and accessed when such complex forms are read. Does each of these complex forms have its own stored representation, or are they analyzed into their stems (e.g., *walk*) and their respective suffixes (e.g., ~s, ~ing and ~ed)? Similar questions arise with regard to the representation of complex derivational forms, such as *walker* or *walkable*, as well as the issue of whether semantic factors play a role in the choice of decomposed or full-form representations.

These questions become particularly relevant when considering languages like Arabic where at least two views contend to account for how complex forms are represented in the lexicon and processed on-line. The first is the traditional *root and pattern* view, originating with the medieval Arabic lexicographers, taken on board with some important modifications by structuralist linguists (Cantineau, 1950a, b; Cohen 1961; Cohen 1951), and ultimately formalized in terms of autosegmental phonology (McCarthy 1979, 1981, 1982). The second is the *stem-based or word-based view*, motivated by certain theoretical hurdles faced by the root and pattern model on the one hand, and on the other by the pressure felt by theorists to account for Semitic morphology using the same set of universal constraints or rules applied across the world languages (Benmamoun 1998, 2003; Gafos 2003; Heath 1987, 1997, 2003; Ratcliffe 1998, 2004).

### *2.1.1 The Root and Pattern Model*

There are at least three distinct versions of the root and pattern model which differ either in terms of the number of morphemic units they posit and/or in terms of the way surface word forms are thought to be built. According to the oldest version of the model which we owe to the medieval Arab grammarians, the workings of the morphological system hinge on two morphemes: a consonantal root which conveys a broad semantic meaning, and a vocalic word pattern which conveys non-referential aspects of meaning such as *perfective*, or *active*. These two units are interleaved to build a deverbal noun stem (called *maṣdar*).[1] However, the derivation of all the other surface forms does not involve root and pattern combination, but proceeds on the bases of the *maṣdar* using different morpho-phonological procedures such as prefixation, infixation, and vowel deletion or insertion. To illustrate, the root QTL ‘kill’ for example is initially combined with the pattern *faʕl* (CaCC) to form the stem *QaTL* ‘killing’. However, to build the *place noun maQTaL*, the root QTL is not

[1] Note that this is the view of the grammarians of Basra, which is different from the view held by those of Kufa, who viewed the perfective verb form as the starting point in the derivational chain.

mapped onto the pattern maCCaC; instead the perfective verb *QaTaL* ‘he killed’ is derived from the stem *QaTL* ‘killing’ by vowel stem modification. The imperfective form *yaQTuL* is then derived from the perfective *QaTaL*, and is in turn used to derive the form *maQTaL* (Bohas and Guillaume 1984). Thus, the relationship between the root QTL and a complex form like *maQTaL* is remote and mediated by three surface forms. In contrast to this, the second version of the root and pattern view, put forward by structuralistlinguists such as Cantineau (1950a, b) and Cohen (1951), and advocated more recently by lexicographers like Hilaal (1990), conceives of every surface form as a combination of a root and a word pattern, and of the lexicon as a repository of roots and patterns with a set of rules to associate them. On this view, the difference between *QaTL* and *maQTaL* is that the root QTL is mapped onto the pattern CaCC in the first, but onto maCCaC in the second.

The third instantiation of the root and pattern model is developed within the framework of autosegmental phonology (McCarthy 1979, 1981, 1982). Here Arabic morphology is thought to operate with three morphemes: a consonantal root still believed to convey the core semantic meaning, a vocalic melody conveying morpho-syntactic meaning such as active-passive, and a CV-Skeleton that contributes morpho-syntactic information as well as determining the phonological structure of the surface form. According to this model, a form like *KaTaM* ‘remained silent’ is comprised of the root KTM, the vocalic melody *a*, and the CV-Skeleton CVCVC. A more complex form like *maKTaB* ‘office’ is analyzed into a locative prefix ma~, a consonantal root KTB, a vocalic melody *a*, and a CV-Skeleton CVCCVCVC. So much like the structuralist approach, McCarthy’s model entails that the root, the vocalic melody and the CV-Skeleton are combined to derive every surface form, although in later developments of his theory some word formation processes like broken plural and diminutive formation do not operate on roots, CV-Skeletons, and vocalic melodies, but on prosodically defined portion of the input (McCarthy and Prince 1990).

Despite the differences between the three versions of the root and pattern model, there is an interesting unity underlying their apparent diversity. Specifically, they all assign a morphemic status to the root and the pattern, whether the latter is viewed as a unitary construct, as in the Arab grammarians’ and the structuralists’ approaches, or as a composite construct consisting of a vocalic melody and a CV-Skeleton as in McCarthy’s approach.The morphemic status of roots and patterns hinges on two kinds of argument. The first is distributional, based on the observation that consonantal roots and word patterns appear in many words with overlapping meanings. For example, the root KTB surfaces in 31 forms all of which, save one form *KaTi:Bah* ‘squadron’, revolve around the general meaning of *writing* inherent in this root, while the word pattern maCCaC appears in hundreds of surface forms, most of which are place nouns (e.g., *maDXaL* ‘inlet’, *maKTaB* ‘office’, *maSBaH̄* ‘swimming pool’. A second type of argument derives from the patterning of certain co-occurrence restrictions, which apply to the consonants of the root but not to affixal consonants. For example, the first and second consonant of the root are generally neither identical nor homorganic such that roots like *SSM or *BMS are very rare (Frisch and Adnan Zawaydeh 2001). The same constraint applies, if less stringently, to first and third consonants with very few roots like *KBK or *MTM. The second and third consonant can be identical (e.g. MDD), but not homorganic (e.g., *MDT). Since these co-occurrence restrictions can be stated in terms of the root consonants, while intervening vowels and affixal consonants are ignored, this argues for a level of representation at which the consonantal root functions as an independent entity (Greenberg 1950; McCarthy 1981).

The morphemic status assigned to roots and patterns sets this class of models in sharp contrast with the more recent stem-based approach. We will not be juggling with the three versions of the root and pattern approach in the remaining part of this paper. Instead we will use the term *root and pattern model* to encompass only the structuralist version (Cantineau 1950a, b; Cohen 1961; Cohen 1951) and McCarthy's version (McCarthy 1979, 1981, 1982). We do this for a number of reasons: first because these two versions suffer from similar problems relating to the derivation of certain forms such as the broken plurals, diminutive nouns, or place nouns, which have either directly (McCarthy's version) or indirectly (structuralist version) motivated the emergence of stem-based or word-based accounts. Second, the most significant difference between the structuralists' view and McCarthy's view relates to McCarthy's fractionation of the word pattern into a CV-Skeleton and vocalic melody. However, in previous psycholinguistic research we have found only partial evidence for the parsing of the word pattern into further components (Boudelaa and Marslen-Wilson 2004). Therefore, we take the two versions to be cognitively equivalent. Third, both versions provide similar predictions regarding the cognitive relevance of the root and the pattern and these can be clearly pitted against those derived from a stem-based or word-based approach.

### *2.1.2 The Stem-Based/Word-Based Model*

Like the root and pattern approach, the stem-based model is not a homogenous approach, but has a number of different versions. For instance, Heath (1987, 1997, 2003) draws a distinction between lexical representations, morphological derivation, and lexical processing and argues, on the basis of observations such as the above, that as far as lexical representation and morphological derivation are concerned, the consonantal root is best "consigned to oblivion" (Heath 2003, p. 115). There is no principled way, according to Heath (2003), to segregate consonants and vowels and assign them to different levels of representation. This is because the word patterns, or ablaut templates as he refers to them, cannot be said to contribute any grammatical information in many cases. Stems such as *XuBZ* 'bread', *KaLB* 'dog' and *SiLM* 'peace' abound in the language, yet their respective word patterns CuCC, CaCC and CiCC do not convey any grammatical information. On this view the stem is taken to be the singular form for nouns (e.g., *KaLB* 'dog', *QaMaR* 'moon', *Ba:B* 'door') and the imperfective form for verbs (e.g., *KTuB, XRuJ*). Where lexical processing is concerned however, Heath acknowledges that *"root-like strings are extracted from input representations […] but these extracted consonantal sequences do not correspond exactly to the traditionally recognized roots, particularly where vowels and* *semi-vowels are concerned"* (Heath 2003, p. 126–128). Accordingly he speculates that an input like *KaWwiN* 'bring into being, causative' is initially decomposed into the causative word pattern CaCCıC and the root KWN; subsequently this root is identifiedas the stem *KuN* 'be, imperfective', based on the fact that medial geminated /w/ in causative is usually the result of mapping a vowel /*u*/ onto a CC slot (Heath 2003, p. 128).

Other stem-based accounts dispense with roots and patterns altogether (Benmamoun 1998, 2003; Ratcliffe 1998, 2004). For instance, Ratcliffe (2004) suggests a sonority-based mechanism serving to strip off affixes and recover the stem, and although he is not explicit about the tripartite distinction between derivation, lexical representation and processing, his analysis carries unmistakable overtones that the stem is the pivotal element governing all three domains. Similarly, Benmamoun (1998, 2003) defines the primitive of Arabic word formation processes -and by extension of Arabic word processing- as the imperfective stem. He argues that a form like *muʕaLLim* 'teacher' is built not by mapping the root ʕLM onto the pattern muCaCCiC as the root and pattern theory would argue, but by appending the prefix *mu~* to the imperfective stem ʕaLLim.[2]

The emphasis on the stem as *the* unit of morphological representation and processing allies these accounts with the Generalized Template Theory (GTT), which suggests that constraints dictating minimal and maximal prosodic word length guide word formation in Semitic languages (McCarthy and Prince 1990; Ussishkin 2000, 2005). On this account word formation processes operate on existing words to derive new words and this is achieved by allowing word formation rules to adjust the structure of existing stems as necessary to produce the desired output. For instance, the Hebrew form *GiDeL* 'he raised' is thought to be derived by over writing the vowels *-a-a-* of the lexically stored stem *GaDaL* 'he grew *up*' without the root GDL ever being accessed as an independent element (Ussishkin 2005). Thus words with the CaCeC pattern are the primitive of morphological processing and representation in Hebrew, and presumably, those with the CaCaC pattern would serve as such a primitive for Arabic (Ussishkin 2005).

The foregoing paragraphs underline the heterogeneity of the stem-based approach. Not only are different stems posited by different theorists, but some of these theorists roundly reject the root and pattern as relevant morphological units (Benmamoun 2003; Ratcliffe 2004; Ussishkin 2005), while others concede a role for the root or a root-like unit in language processing (Heath 2003). In order to be able to adjudicate between the stem-based account and the root and pattern account, we will focus on the imperfective stem-based version as developed by Benmamoun (1998, 2003). There are three reasons for this: first, the imperfective stem version provides a unified treatment of morphological derivation arguing that both verbs and nouns can be built from the appropriate imperfective stem. Second, this account emphatically rules out any functions for the root or the pattern, and so stands in sharp contrast with the classic root-pattern model. Third, it shares with other

[2] The syllabic structure of the imperfective stem varies for different verb forms (or word patterns). So the imperfective stem for the first patterns is CCVC (e.g., *ya-DRuS* 'he studies'), but CVCCVC in the second pattern (e.g., *yu-DaRrıS* 'he teaches').

instantiations of the stem-based account the goal of aligning Semitic languages with the rest of the world languages. Consequently, if the imperfective-stem account is strained by psycholinguistic data, this will to a large extent apply to other instantiations of the stem view.

### *2.1.3 Empirical Questions*

Against this linguistic backdrop, the question we ask here, using experimental psycholinguistic and cognitive neuroscience techniques, concerns the nature of the lexical representation used and accessed by native Arabic speakers as they read or hear Arabic words. Is a form like *maSBaĦ* 'swimming pool' processed as a prefix ma~ and an imperfective stem SBaĦ, or as a word pattern maCCaC and a root SBH? To evaluate the predictions of these two approaches we bring to bear data from behavioral experiments, pathological data from aphasic patients, and recent imaging data using event related potentials. Because most of the available behavioral data are based on the *priming* task, we start by giving a brief description of this technique and its rationale.

**What is Priming?**

In a typical priming experiment, words are presented in pairs. The first member of the pair is called the *prime*, the second the *target*, and participants are usually instructed to make a lexical decision about the target (i.e., decide whether it is a word of the language or not). The relationship between the prime and target can be varied depending on the goals of the study. Prime and target may, for example, share morphological elements (e.g., *happiness/DARKNESS*), orthographic (e.g., *mile/MILL*) and/or phonological properties (e.g. *quay/KEY*), or simply be semantically related (e.g., *pledge/OATH*). Priming is said to occur when the timed response to the target (e.g., *DARKNESS*) is affected—either speeded up or slowed down—as a consequence of having previously encountered a related prime (e.g., *happiness*), relative to responses following an unrelated prime (e.g., *faithful*). The most common interpretation of priming is that the mental representations of the prime and target are interconnected or overlap in such a way that activating the representation of a prime word either activates the representation of the target word (Forster 1999; Neely 1991), or activates the representations of lexical or morphemic competitors.

In research investigating whether the mental lexicon is organized in terms of the phonetic word or the morpheme, two versions of the priming technique—cross-modal and masked priming—have been used extensively.

*Cross-modal priming*: here the prime and target are distinct perceptual events, with a visual target presented immediately at the offset of an auditory prime (Marslen-Wilson et al. 1994). Since the prime and target are in different sensory modalities, priming is thought to occur at the more abstract level of the lexical entry, since it is here that prime and target overlap, rather than at lower, more modality-specific

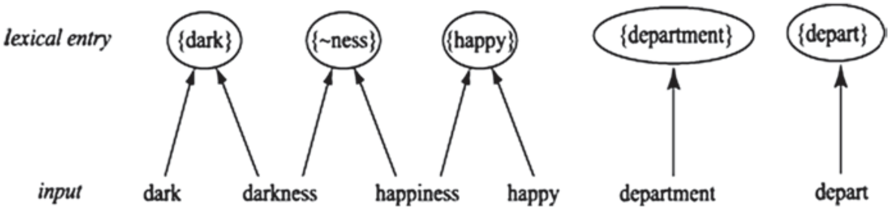


**Fig. 2.1** Illustration of how input forms sharing a morpheme map onto the same underlying representations, both for cases of a free stem as in *darkness/dark* and *happiness/happy* and a bound suffix as in *darkness/happiness*. Forms sharing a stem but no semantics map onto different representations. (Adapted from Marslen-Wilson and Zhou 1999)

levels of representation. Cross-modal morphological priming in Indo-European languages like English has been found to be contingent on the prime and target sharing either a stem and a transparent semantic link (e.g., *darkness/DARK*) or a productive affix (e.g., *happiness/DARKNESS*). Words that are related purely on historical linguistic grounds (e.g., *department/DEPART*) fail to prime (Marslen-Wilson et al. 1994). This result is theoretically captured by hypothesizing that priming between pairs like *happiness/DARKNESS* and *government/GOVERN* reflects repeated access to the same underlying lexical entry, while absence of priming among pairs of words like *department/DEPART* reflects access to different and unrelated entries, as illustrated in Fig. 2.1[3] (Marslen-Wilson and Zhou 1999).

On this view of priming, words sharing only form (e.g., *electrode/ELECT; tinsel/TIN*) do not show facilitatory priming effects, but instead compete with each other, leading to slower responses relative to the baseline. The prime *electrode*, for example, does not contain the morpheme {elect}, so hearing it as a prime will activate its own lexical entry. This will generate interference with the subsequent recognition of the target *ELECT* (Gaskell and Marslen-Wilson 2002). For pairs that are only semantically related (e.g., *pledge/OATH; curve/BEND*), cross-modal priming seems to be an elusive phenomenon (Gaskell and Marslen-Wilson 2002; Marslen-Wilson et al. 1996). It is only observed when the prime is unambiguous, and even so it decays quickly, suggesting that sharing facilitatory links between distinct lexical entries is not as effective a mechanism for priming as accessing the same shared entry.

*Masked priming*: in this version of the priming paradigm both the prime and the target are visually presented. However, participants are typically not aware that a prime is present at all, since it is presented very briefly (50 ms), and is sandwiched between a forward pattern mask (often a series of hash marks) and a backward mask, the target itself. Recent masked priming research suggests that morphologi-

[3] There are other ways of theorizing about these issues where, for example, an intermediate level of representation called the *lemma level* is thought to mediate the mapping between the input and the lexical entry (Schreuder and Baayen 1995; Taft 1994). We have evaluated these alternative views and their relevance to Arabic allomorphic variation elsewhere (Boudelaa and Marslen-Wilson 2004). Our interest here is not in comparing the contending cognitive views of morphology, but in using one of them as a starting point for predictions about how Arabic morphology may affect on-line processing.

cal decomposability alone determines priming in this task. For example, the word *corner*, which is morphologically simple but which is potentially parsable into corn + ~er, is found to facilitate the processing of the stem *CORN*, even though the two words are not in fact either morphologically or semantically related (Rastle et al. 2000). This suggests that in languages like English, masked priming does not tap into processes occurring at central levels of representation, but into early processes of word segmentation that apply to any potentially morphologically decomposable input regardless of meaning.

Cross-modal and masked priming can be seen as complementary techniques that track on-line processing at different stages, with cross-modal priming tapping into stored long-term representations, and masked priming providing a window into the early stages of lexical processing when visual input is segmented into morphemes. Should one take this view as a starting point for thinking about how the Arabic mental lexicon is organized, then a number of questions arise. First, do we see priming between Arabic words that just share a root (e.g., *maKTaB/KiTa:B* 'office'/'book')? Do words sharing a word pattern (e.g., *FaRraQ/KaSsaR* 'scatter'/'smash') also show priming? Is root priming modulated by the transparency of the semantic relationship between prime and target such that transparent pairs (e.g., *maKTaB/KiTa:B* 'office'/'book') prime, but opaque ones (e.g., *KaTi:Bah/KiTa:B* 'squadron'/'book') do not? Are the effects of priming likely to vary depending on whether we use masked or unmasked primes? As discussed below, stem-based and root-based approaches make different predictions here.

### *2.1.4 Priming Evidence for Roots and Word Patterns*

*Cross-modal priming with roots*: the following illustrates a cross-modal investigation of the potential effects of the root morpheme in Arabic by using a within-word design (Table 2.1).

If Arabic roots are stored at a central level of representation and play a role similar to that played by stems in Indo-European languages, then hearing the prime word *maDXaL* 'inlet' should have two immediate processing consequences. It should activate the morpheme DXL, and at the same time inhibit other morphemes which are similar to it only in a form like DXN 'smoke', or DJL 'dupe'. The prior activation of DXL should facilitate the response to the target *DuXu:L* 'entering' when it is subsequently displayed. But what happens when the root has different interpretations across prime and target, as illustrated by *muDa:XaLah/DuXu:L* 'participation'/ 'entering' in Condition 2? Does the morpheme DXL in the prime map onto the same underlying representation as the morpheme DXL in the target in spite of their different meanings? Or are there two different entries, one for DXL meaning *participate*, and one for DXL meaning *enter*?

Having a separate entry for every meaning variation of a root, although potentially costly in terms of cognitive storage, may nonetheless lead to priming via facilitatory links between the two morphemes. A more parsimonious alternative would be to

**Table 2.1** Sample stimuli used to probe for root effects in cross-modal priming. +/−R indicates whether the prime/target pair share a root or not, +/−S whether they share semantics. Unrelated refers to the baseline condition. (For further details see Boudelaa and Marslen-Wilson 2000)

| | Prime | Target |
|---|---|---|
| 1. +R+S: Sharing a root, semantically related | مدخل<br>[maDXaL]<br>inlet | دخول<br>[DuXu:L]<br>entering |
| 2. +R−S: Sharing a root, not semantically related | مداخلة<br>[muDa:XaLah]<br>participation | دخول<br>[DuXu:L]<br>entering |
| 3. −R+S: Not sharing a root, semantically related | إيلاج<br>[ʔi:La:J]<br>insertion | دخول<br>[DuXu:L]<br>entering |
| 4. Unrelated | قهوة<br>[QaHWah]<br>coffee | دخول<br>[DuXu:L]<br>entering |

posit a unique entry to all the words featuring the same root and to associate that entry with all the shades of meaning variations that the root can have. On this scenario, hearing *muDa:XaLah* 'participation' should, as in condition 1, activate the root DXL, and inhibit phonologically similar roots. This activation of the root by the priming word should lead to subsequent facilitation of the target *DuXu:L* 'entering'.

In condition 3, where the prime *ʔi:La:J* 'insertion' and target *DuXu:L* share meaning but feature different roots, significantly weaker priming is expected. Activation of the entry for the root WLJ 'enter' can only affect the entry for DXL through interlexical links, and these do not support priming as effectively as when the same linguistic entity (such as the root) is shared between prime and target (Gaskell and Marslen-Wilson 2002; Marslen-Wilson et al. 1996).

This set of predictions contrasts sharply with the predictions made by a stem-based approach where the root is thought to play little or no role in morphological processes, and the lexical entry is the imperfective stem, or the full surface form itself (Benmamoun 1998, 2003). It is not clear, on a cognitive interpretation of such an analysis, how forms sharing a root can be psycholinguistically linked to each other except on the basis of possible semantic relationships, either between their full forms or between the imperfective stems underlying primes and targets. This predicts no difference in priming between Conditions 1 and 3. In both cases there should be facilitatory activation between lexical representations of the prime and the target because of their semantic similarities, but in neither case should the strength of these effects be affected by morphological structure. Priming between words sharing a root and a transparent semantic relationship (+R+S) should be of the same magnitude as priming between pairs that are only semantically related (−R+S). For Condition 2, since the meaning of the full-form *muDa:XaLah* is not related to the meaning of the target *DuXu:L*—and similarly for their imperfective stems—there is no cognitive basis for any facilitatory priming effects, although interference may be generated given the phonological similarity between them.

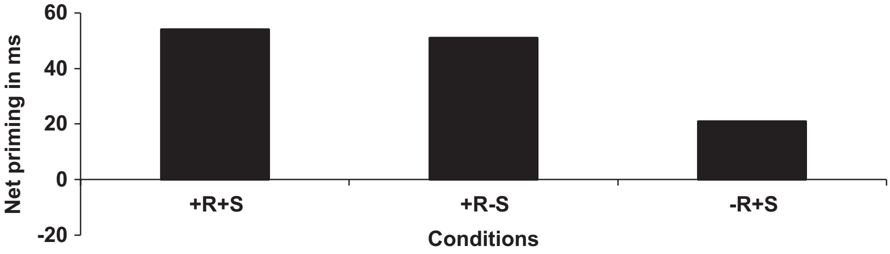


**Fig. 2.2** Cross-modal priming effects for words sharing a root with and without semantics (+R+S an +R−S), and words sharing semantics without sharing a root (−R+S)

The results, displayed in Fig. 2.2, show strong priming effects between words sharing a root. This effect is not modulated by semantic transparency. The target *DuXu:L* 'entering' is primed equally well by the semantically related *maDXaL* 'inlet', and the semantically opaque *muDa:XaLah* 'participation' (Boudelaa and Marslen-Wilson 2000), suggesting that surface forms featuring the same root map onto the same underlying lexical representation corresponding to the root morpheme. Similar results have been found in Hebrew, again using a cross-modal priming task and varying morphological and semantic relatedness (Frost et al. 2000). This finding, of overt root priming effects in the absence of a transparent semantic relationship between prime and target, seems to be specific to Semitic languages. In the Indo-European languages tested to date (e.g., English, French, Polish, Dutch), except German (Smolka et al. 2009), overt morphological priming is contingent on the transparency of the semantic relationship between prime and target, such that *casually* primes *casual*, but *casualty* does not (Marslen-Wilson et al. 1994). This cross-linguistic difference may reflect the specific structural role of Semitic morphology, especially on a root and word-pattern account, compared to a language like English, where morphological operations do not play the same fundamental role in generating the surface word-forms of the language (Boudelaa and Marslen-Wilson 2005; Marslen-Wilson 2001).

Priming effects in Condition 3, for words that are only semantically related (R+S), are much weaker and more variable. This is consistent with the view that morphological priming and semantic priming are subserved by different mechanisms: repeated access of the same underlying lexical entity in the case of morphological facilitation, and facilitatory links between different lexical entries in the case of semantic priming.

This pattern of results, which has been replicated in various forms of overt priming (including cross-modal, and auditory-auditory in Standard as well as Dialectal Arabic, where no formal teaching of roots and patterns is ever received), follows directly from a root-based account of lexical representation and processing in Semitic languages like Arabic or Hebrew. It is clearly inconsistent with a strong stem-based view on which the root morpheme would play no role in processing (Benmamoun 1998, 2003) and the only relevant unit of linguistic analysis would be the imperfective verb stem. The regularities provided by the root morpheme are picked up by the language learner and used as an organizing principle of lexical space.

**Table 2.2** Example of stimuli used to probe for word pattern effects in cross-modal priming. +WP+M stands for pairs sharing the form of the word pattern and its meaning, while +WP−M refers to pairs sharing the form of the word pattern but not its meaning. (Boudelaa and Marslen-Wilson 2000)

| | Prime | Target |
|---|---|---|
| 1. +WP+M | تجارة<br>[TiJa:Rah]<br>trade | طباعة<br>[ṭiBa:ʕah]<br>art of typography |
| 2. +WP−M | حكاية<br>[Ħ iKa:Yah]<br>story | طباعة<br>[ṭiBa:ʕah]<br>art of typography |
| 3. Phonology | مطاع<br>[muṭa:ʕ]<br>obeyed | طباعة<br>[ṭiBa:ʕah]<br>art of typography |
| 4. Unrelated | حفرة<br>[ĦuFRah]<br>hole | طباعة<br>[ṭiBa:ʕah]<br>art of typography |

*Cross-modal priming with word patterns*: similar sets of issues and contrasts arise when we turn to the second class of morphemes distinguished on a root-based approach—namely the word pattern morpheme. To probe for priming effects among words sharing a word pattern, Boudelaa and Marslen-Wilson (2000) adopted the same factorial approach as with the roots described above. The same target word was paired with four priming words as illustrated in Table 2.2.

If lexical processing in Arabic requires access to the root morpheme, as the priming data suggest, then the other component of the surface form, the word pattern, must also be accessed at some point during processing. Accordingly, upon hearing an Arabic prime word such as *TiJa:Rah* ‘trade’, a number of processing operations are triggered. These involve not only the activation of the root TJR ‘trade’, and the suppression of its cohort competitors on the one hand, but also the activation of the word pattern CiCa:Cah ‘profession noun, singular’ (and possibly the suppression of its cohort competitors as well) on the other. Since residual activation of the root morpheme generates priming, so should residual activation of the pattern. Therefore priming is expected in Condition 1 (+WP+M) among words sharing the phonological structure and the morpho-syntactic meaning of the word pattern as a consequence of the same underlying unit being accessed in prime and target.

By contrast, in Condition 2, the prime and the target share the phonological structure of the word pattern but not its morpho-syntactic meaning (+WP−M). The pattern CiCa:Cah has a ‘profession noun’ reading in the target *ṭiBa:ʕah* ‘ art of typography’, but a ‘deverbal noun’ reading in the prime Ħ*iKa:Yah* ‘story’. If word pattern priming depends on the prime and target sharing the same morpheme, then there should be no facilitation for these pairs since their word patterns are homophonic. Alternatively, if priming through shared word patterns is much more a function of shared phonological similarity, independent of its possible linguistic interpretation, then there would be no reason not to see priming for these pairs. In Condition

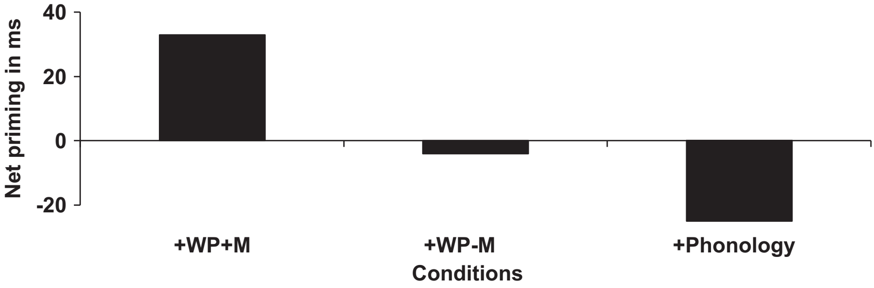


**Fig. 2.3** Net cross-modal priming effects for words sharing a word pattern (+WP), where their morphemic identity (+/−M), and words sharing phonology only (+Phonology)

3, word pairs sharing phonology like *muṭa:ʕ/ṭiBa:ʕah* 'obeyed'/ 'art of typography' should show signs of competition rather than priming.

On a stem-based approach, word patterns are not thought to be relevant linguistic units at all. So even if we relax our assumption to the point of accepting that *ṭiBa:ʕah* 'art of typography' and *TiJa:Rah* 'trade' are derived by modification of the imperfective stems *ṭ*Baʕ and Ta:JiR[4] respectively, no relationship can be established between these two items since they have different semantics and they relate to different stems. Therefore there is no basis for facilitatory priming between such items, which should behave like the phonologically related words in Condition 3 and show interference irrespective of whether they share the same morpho-syntactic interpretation of the pattern or not.

Figure 2.3 plots the net priming in the +WP+M, the +WP−M, and the + Phonology conditions. Priming between words sharing a word pattern is strongly significant, but only if the word pattern in prime and target is the same underlying morpheme, as in Condition 1 (Boudelaa and Marslen-Wilson 2000). In Condition 2, where the word patterns in prime and target are phonologically but not morphologically identical, we see no priming. This seems to be compelling evidence that the effect seen here is based on the abstract linguistic relationship between prime and target, and not on overlap in terms of their phonological or orthographic properties. Consistent with this, there is no priming in the + Phonology condition, and even some signs of interference. Taken together these results cast further doubts on the stem-based approach to Arabic in particular and Semitic in general, and provide support for the view that word pattern priming is driven by repeated activation of shared morphemes at a central level.

It is interesting to note that reliable overt word pattern priming was also found in Hebrew among verbs sharing the same word pattern (Frost et al. 2000). In Arabic, word pattern priming was found not only for verbs but also for nouns provided that the nominal word pattern occurs in the context of a productive root. Overall however, overt cross-modal priming in the two major Semitic languages, Arabic and Hebrew, provides compelling evidence for roots and word patterns as lexical units governing the process of spoken word recognition.

[4] The full orthographic forms comprising the imperfective stems *ṭ*Baʕ and Ta:JiR are respectively *yaṭBaʕu* 'he prints', and *yuTa:JiRu* 'he trades'.

**Table 2.3** Example of stimuli used to probe for word pattern and root effects in masked priming

| | Prime | Target |
|---|---|---|
| 1. +WP | شروع<br>[Š uRu:ʕ]<br>starting | دخول<br>[DuXu:L]<br>entering |
| 2. +R+S | مدخل<br>[maDXaL]<br>inlet | دخول<br>[DuXu:L]<br>entering |
| 3. +R−S | مداخلة<br>[muDa:XaLah]<br>conference | دخول<br>[DuXu:L]<br>entering |
| 4. −R + S | إيلاج<br>[ʔi:La:J]<br>insertion | دخول<br>[DuXu:L]<br>entering |
| 5. +Orthography | دخان<br>[DuXa:n]<br>smoke | دخول<br>[DuXu:L]<br>entering |
| 6. Unrelated | قهوة<br>[QaHWah]<br>coffee | دخول<br>[DuXu:L]<br>entering |

*WP* word pattern, *R* root, *S* Semantics

*Masked priming with roots and word patterns*: a growing body of visual word recognition research on Indo-European languages suggests that masked priming reflects early processes of segmentation into stems and suffixes, rather than the properties of central lexical representations (Longtin et al. 2003; Marslen-Wilson et al. 2008). This segmentation process applies automatically and blindly, so words like *corner*, which have no actual internal morphological structure, are nonetheless initially decomposed into a stem {corn} and a suffix ~er, generating masked priming to the pseudo-stem *corn*. On a root-based approach where every Arabic surface form is morphologically structured, consisting of a root and a word pattern, priming by roots and word patterns should again be found, and should not be modulated by the semantic transparency of the relationship between prime and target. We tested this prediction using the design illustrated in Table 2.3.

In Condition 1, the target *DuXu:L* 'entering' is paired with the prime *ŠuRu:ʕ* 'starting', with which it shares the nominal word pattern CuCu:C. On the traditional root and pattern approach, both *DuXu:L* and ***Š****uRu:ʕ* are morphologically structured and should be subject to the early decomposition process picked up in masked priming. This will activate the component morphemes of these words at the level of access representation and should provide a basis for priming based on repeated access to the same component CuCu:C at this level. In Conditions 2 and 3, priming is also expected based on the activation of the same morpho-orthographic component shared by the prime and target. Priming in these two conditions should be of the same magnitude although the prime and target are +R+S in Condition 2, but +R−S in Condition 3. This is because semantics does not affect the early decomposition process on which masked priming seems to be based. For the same

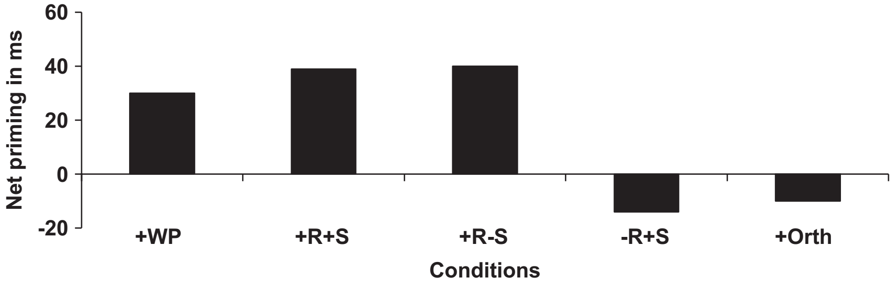


**Fig. 2.4** Masked priming effects for words sharing a word pattern (+WP), words sharing a root and semantics (+R+S), a root but no sema;ntics (+R−S), semantics but not a root (−R+S), and words sharing orthography (+Orth) at an SOA of 48 ms

reason no priming is expected in Condition 4 (−R+S), where prime and target are semantically but not morphologically related. In Condition 5, the prime and target overlap orthographically, which should lead to inhibition at the level of processing tapped onto by masked priming.

On a stem-based approach, the morphological structure provided by roots and patterns presumably has no role to play. The overlap in form between words sharing a root and words sharing a pattern should, if anything, give rise to competition between forms sharing such units at the level of access representations. This predicts that two of the three morphological conditions (+WP, +R−S) should pattern with the orthographic conditions (+Orthography), possibly showing inhibitory effects. The third morphological condition (+R+S) should pattern with the semantic condition (−R+S), although purely semantic priming is generally either weak or non-existent in masked priming at SOA's of 60 ms or less.

Figure 2.4 shows the masked priming outcome for the first five conditions relative to the Unrelated condition (Boudelaa and Marslen-Wilson 2005).

As predicted by the decompositional root and pattern model, there is a strong and statistically significant masked priming effect for both word patterns and roots (Boudelaa and Marslen-Wilson 2005). Words overlapping only in form (Condition 5: Orthography) fail to prime at all, even though they share more letters on average than words related just by a word pattern. This suggests that masked priming in Arabic hinges on the activation of potential morphemic units at the access level rather than on simple orthographic overlap between prime and target. And again there is no difference in magnitude of priming between the +R+S condition and the +R−S on the one hand and no priming in the purely semantic condition −R+S on the other. This is consistent with the claim that masked priming primarily reflects early segmentation processes—although it should not be forgotten that in Arabic, unlike English and related languages, we see no semantic interaction with morphological effects in overt priming either. Similar masked priming effects for word patterns and roots have also been reported in Hebrew (Frost et al. 1997). It is difficult to see how a stem-based approach can be modified to accommodate these findings.

### Neuropsychological Evidence

Neuropsychological research focuses on the study of damaged brain systems in order to understand normal cognitive functions. The rationale underlying research in this area is that if a specific cognitive problem can be found after an injury to a specific area of the brain, it is likely that this part of the brain in some way supports the cognitive function in question. Although the inference from patterns of breakdown to normal function is notoriously difficult and depends on the theory of normal cognition (Bullinaria and Chater 1995; Caramazza 1986; Shallice 1988), looking at the way in which the cognitive function breaks down in patients with brain damage may nonetheless be informative about the organization of the normal system. Competing morpheme-based and stem-based views of Arabic morphology seem to make different predictions about the patterns of dysfunction likely to be observed in Arabic following brain damage. Because it assigns a cognitive status to roots and patterns, the morphemic approach predicts that damage to brain areas supporting language understanding and production may affect these morphemes differentially and selectively. By contrast, on a stem-based approach neither the root nor the word pattern is referenced by cognitive processes, since the stem is the basic unit for such processes, and should be implicated in any lexically-related deficit following damage to the brain.

The Semitic neuropsychological literature offers two reports addressing the issue of whether roots and patterns can be selectively impaired. Prunet et al. (2000) assess the extent to which metathesis errors (where the ordering of elements is compromised) target root consonants as opposed to word pattern consonants. They examined the speech of an Arabic aphasic patient, ZT, suffering from stroke damage to left hemisphere territories known to be important for normal language function. When prompted to read a word like *maMLaKah* 'kingdom' from the root MLK, ZT would produce the non-word **maLMaKah* or **maKMaLah* where the order of the root consonants is swapped around, but he would almost never produce something like **KaMLamah* where a root consonant swaps positions with a word pattern consonant. A second report focused on the selective impairment of the word pattern vowels of a Hebrew speaking patient, Dudu (Barkai 1980). This patient exhibited severe problems in producing the vowels of the word pattern while his uses of the consonants of the root were preserved. For example in response to a form like *GaZaZ* 'cut', Dudu would produce the nonce form **GiZeZ*, where the order and identity of the root consonants are intact, while the vocalic pattern [a-a] is realized as [i-e].

Taken together, the cases of ZT and Dudu suggest that unless the root and the word pattern have a special cognitive status, as embodied in the morphemic approach, it would be hard to explain how errors can selectively target root consonants in ZT's case, and the vowels of the word pattern in Dudu's case (Barkai 1980; Prunet et al. 2000). Like the priming evidence reviewed earlier, the neuropsychological evidence is at variance with the stem-based approach.

**Neuro-Imaging Evidence**

Neuro-imaging techniques fall into two broad classes: haemodynamic methods, such as PET and fMRI, and electro-physiological methods such as EEG and MEG). Haemodynamic methods are predicated on the close coupling between changes in the level of activity of a neuronal population and changes in its blood supply (Raichle 1987), while electro-physiological methods take advantage of the fact that some classes of neurons act like electrical dipoles which create an electromagnetic field that can be detected and recorded from outside the head (Wood 1987). Neuro-imaging provides a means to separate and identify different cognitive operations in terms of their neuro-physiological correlates. It assumes that if two experimental conditions generate qualitatively distinct patterns of neural activity, they are more likely than not to engage functionally distinct cognitive operations (Rugg 1999).

Within this framework, Boudelaa et al. (2010) conducted an Event Related Potential (ERP) experiment to look at how the brain responds to Arabic words differing either by a consonant belonging to the root, or a vowel belonging to the word pattern. We used the Mismatch Negativity (MMN) technique which relies on electroencephalography (EEG) to measure the brain's electrical activity and make inferences about regional cortical activities (Näätänen and Alho 1997; Pulvermüller and Shtyrov 2003).

Participants were presented with two pairs of auditory stimuli while watching a silent movie. The first pair formed the root condition and was made up of the two words *ʕaRi:S/ʕaRi:F* 'bride'/ 'corporal', which feature the same word pattern CαCi:C, but different roots ʕRS and ʕRF. The second pair represented the word pattern condition and consisted of the words *ʕaRi:S/ʕaRu:S* 'bride'/ 'bridegroom'. These are made up of the same root ʕRS, but use the different word patterns CαCi:C and CαCu:C respectively. In both cases the word *ʕaRi:S* was used as standard and presented 85 % of the time, while the words *ʕaRi:F* and *ʕaRu:S* served as deviants in the root and pattern conditions respectively, being presented only 15 % of the time. Performance on these word-word pairs was compared to performance on closely matched non-word-non-word pairs which differed either by a consonant (e.g., *NiRi:S/*NiRi:F), or a vowel (e.g., *NiRi:S/*NiRu:S).

On a morpheme-based approach, words differing by a root consonant should elicit a different brain response than words differing by a word pattern vowel, because the diverging segment belongs to functionally distinct morphemes. The stem-based approach, in contrast, seems to predict no difference between the root and the word pattern conditions. A word like *ʕaRi:F*, represented either as a full form or in terms of an imperfective stem, is as different from *ʕaRi:S* as it is from *ʕaRu:S*.

The results are in keeping with the predictions of a morpheme-based approach, showing that at 160 ms after the deviation point, the word deviant *ʕaRi:F* 'corporal' elicits a larger MMN than its matched non-word deviant at fronto-central recording sites. There is no significant lateralization. This pattern of activation is typical of responses to content words which exhibit no inter-hemispheric differences. In the word pattern condition there was a significantly larger MMN response evoked by the word deviant ʕaRu:*S* relative to the matched non-word deviant *NiRu:S. This effect was seen in left inferior temporal regions at 250 ms after the word recognition point. These inferior temporal regions are typically associated with the processing of grammatical morphemes in earlier studies (Caplan 1992; Chapman 1999; Mohr et al. 1994; Pulvermüller 1999; Pulvermüller et al.1995). These results provide a demonstration of a neural dissociation in the processing of roots and word patterns in a Semitic language: roots, like content words in Indo-European languages, are subserved by neural assemblies equally distributed over both hemispheres, while word patterns are similar to function words, lateralizing strongly to the left. It is not clear how stem-based or full-form approaches can provide a basis for explaining these contrasts.

### *2.1.5 Implications*

The across-the-board morphemic effects described above have far reaching implications for how Arabic words are recognized from script and speech. Not only do they strongly suggest that access representations are organized in terms of roots and patterns, they also indicate that modality-free central representations of lexical form and meaning are structured in terms of the same units. Furthermore, the same units seem to govern both the early decomposition processes and the central processes of access to meaning from speech and script with the stem itself playing no role in the lexical access process *per se* (see Berent et al. 2007; Vaknin and Shimron 2011 for a different opinion). So, what kind of cognitive architecture do we need to model this? In what follows we sketch out a tentative account of morphological effects in spoken and written Arabic word recognition.We then compare this suggestion to the dual route model of Frost et al. (1997), and to the distributed connectionist account of Plaut and Gonnerman (2000); two models designed to account for similar phenomena in Hebrew.

#### The Obligatory Morphological Decomposition Account

The above data strongly suggest that lexical processing in Arabic evolves around roots and word patterns, and that the extraction of these units during spoken language comprehension and reading is subserved by an obligatory decomposition mechanism as schematically depicted in Fig. 2.5.

This idea is similar to Taft's (2004) and can be instantiated as an interactive activation network with localist representations corresponding to roots and word patterns. According to this view, all content words in Arabic undergo a process of *obligatory morphological decomposition* (OMD) whereby their roots and word patterns are accessed as *lexical entries*. A lexical entry will feature the morpho-syntactic, phonological, semantic and functional information associated with the component morphemes of a given word. As long as the input word has an identifiable morphological structure it will undergo decomposition whether its meaning is

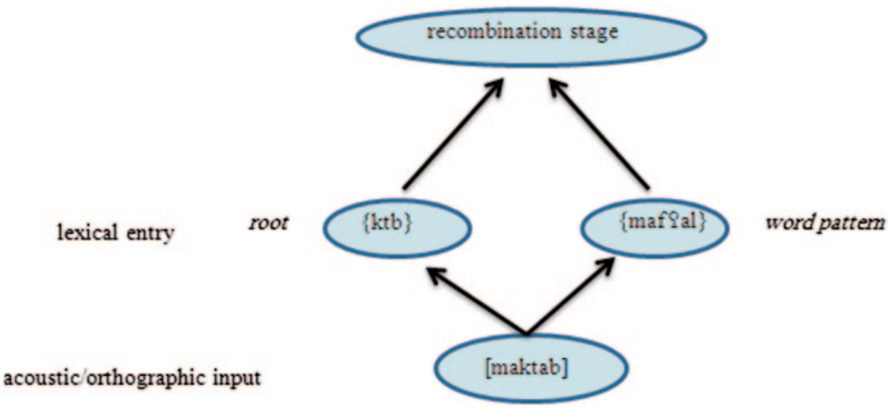


**Fig. 2.5** Schematic representation of the Obligatory Decomposition view of Arabic spoken and written word recognition

combinatorial or not. This obligatory decomposition naturally accounts for the fact that transparent forms like *Ka:TiB* 'writer' and non-transparent forms like *KaTi:Bah* 'squadron' generate comparable amounts of priming in overt (i.e., cross-modal) and covert (i.e., masked) priming.

Why would a non-transparent form like *KaTi:Bah* be decomposed when its meaning is not combinatorial? The answer to this lies in the distributional properties of the language. Most of the Arabic words sharing a root have significant overlaps in meaning. As mentioned earlier, the root KTB for instance is encountered in 31 distinct derived forms in Modern Standard Arabic, all of which, save one — namely *KaTi:Bah*- evolve around the general meaning of 'writing' (Boudelaa and Marslen-Wilson 2010). The overall consistency of the mapping between the form of a root—in this case KTB-and its semantic interpretation—'writing'-provides a valuable island of reliability in the otherwise arbitrary task of learning to relate a given spoken or written form to its meaning. This promotes the development of a parsing strategy to extract the linguistic component that helps attenuate the severity of the arbitrariness of the form-to-meaning mapping; and this unit happens to be the morpheme in Arabic.

The initial obligatory decomposition applied to non-transparent *KaTi:Bah*-like forms needs to be subsequently followed by a *recombination stage* so that their idiosyncratic interpretation can be established. So the claim here is not so much that there are no full form representations in the Arabic mental lexicon, but that such representations are available only for opaque forms, and that most importantly the storage of such forms does not circumvent obligatory decomposition. So, unlike the dual route view of Frost et al. (1997) described below, the OMD posits a single parsing route to the lexicon and a post-access recombination stage in the case of opaque forms. An interesting consequence of this is that surface form frequency effects are expected to affect processing at the recombination stage, whereas root frequency and word pattern frequency effects should affect the earlier stages of the lexical access process itself. This prediction is being tested by the present author in a lexical decision EEG experiment where variables such as surface frequency, root frequency and word patterns frequency, among others, are correlated with the Event Related Potential on a millisecond by millisecond basis.

## Frost et al.'s Dual Route Model

In Frost et al.'s (1997) model, lexical units (words) and sub-lexical units (morphemes) are both represented. Processing of Hebrew printed stimuli consists of a lexical retrieval process in which lexical units are located at the word level and a morphological parsing process in which morphemic units are extracted and located at the sub-lexical level. One of the critical features of this model is that the morphological level of representation encodes only the orthographic form -and by extension to the auditory domain only the phonology- of the root. This allows the model to account for priming among words sharing a root but an opaque semantics (e.g.,*KaTi:Bah*/ *KiTa:B* 'squadron'/ 'book').

What is not clear however is whether the morphological representation of the word pattern encodes only the phonology/orthography of this unit or whether it also encodes aspects of its morpho-syntactic meaning. If the morphological representation of a word pattern like CuCu:C or CiCa:Cah is assumed to encode only the phonological -and orthographic- attributes of this unit, by analogy to the morphological representation of the root, then the model would predict facilitation among primes and targets that share the phonological structure of a word pattern but not its morpho-syntactic meaning such as *TiJa:Rah*/QiL*a:Dah* 'trade'/ 'necklace', where the pattern CiCa:Cah has a profession noun interpretation only in the prime.This is not the case however; significant priming in nouns[5] at least is observed only when the word pattern occurs in the context of a productive root and when the prime-pattern and target-pattern have the same phonological structure and the same morpho-syntactic interpretation as in *TiJa:Rah/ṭ*iBa:ʕah 'trade'/ 'art of topography' where the pattern encodes the meaning of *profession noun* in both the prime and the target (Boudelaa and Marslen-Wilson 2011).

A similar problem for the dual route model is raised by the Hebrew cross-modal priming data which suggests that +R+S prime-target pairs show evidence of stronger priming than matched +R−S pairs (Frost et al. 2000). This suggests that semantics modulates root priming in overt tasks in Hebrew and consequently that the morphological level of representation of the root cannot be claimed to represent only the form of this unit. In addition to this, the dual route model is not clear about

[5] The situation with word patterns in verbs is a bit different, with priming occurring regardless of the interpretation of the pattern (Boudelaa and Marslen-Wilson 2012). This is arguably because there are much fewer patterns in the verb morphology domain and so deviation from the correct morpho-syntactic interpretation of the pattern can be tolerated. In contrast, the nominal word pattern space is densely populated with more than 400 nominal patterns, which precludes deviation from the specific morpho-syntactic of the pattern at hand and consequently prevents priming among patterns that do not have the same meaning.

the time taken to recognize a word via the lexical route or the sub-lexical route. Do the two routes race with each other? What variables affect the race? Or is the race between the lexical and the sub-lexical routes fixed such that processing via the two pathways is instantiated simultaneously and systematically delivers an output?

## Plaut and Gonnerman's (2000) Connectionist Network Model

Plaut and Gonnerman (2000) used a simple feed-forward network, where orthographic input is mapped onto semantic output via a set of hidden units, to demonstrate that non-semantic morphological effects are not incompatible with a distributed connectionist account. Like many other connectionist accounts (e.g., Rueckl et al. 1997; Joanisse and Seidenberg 1999; Seidenberg and Gonnerman 2000), Plaut and Gonnerman's model assumes morphology to be a characterization of the learned mapping between the surface form of words, that is their orthography or phonology, and their meanings. Since morphologically related words necessarily share form, and this is mapped onto largely overlapping aspects of meaning, the internal representation of a connectionist network should pick up on this quasi-regular mapping and treat morphological structure in a combinatorial way. Priming between morphologically related but semantically unrelated words was simulated using a set of morphologically related words varying in semantic transparency. These were embedded either in a morphologically rich or a morphologically poor language corresponding respectively to English and Hebrew. Morphological priming was found to increase with the degree of semantic overlap in both languages; and morphological priming occurred between words that share morphology without semantics in the morphologically rich language (Hebrew) but not in the morphologically impoverished language (English).

When lexical knowledge is represented distributedly, words that share parts of their spelling (e.g., *muMTıʕ* 'enjoyable', *MuTʕ*ah 'pleasure'), and map that spelling onto similar meanings 'enjoyment/pleasure', have similar effects on some of the weights; therefore exposure to one word improves performance on the other. By contrast, words that share their spelling but map onto differential meanings (e.g. *MaTa:ʕ* 'commodities', *MuTʕ*ah 'pleasure') push the weights in competing directions, and exposure to one word does not benefit processing of another. Consequently the fact that the network exhibits priming among morphologically related semantically opaque forms is in itself a success, and a clear demonstration that the way opaque items are represented and processed depends on the overall linguistic environment to which the network is exposed. If most derivative forms featuring a particular root have similar semantic interpretations and only few of them deviate from the general semantics of the root, the semantically transparent items will ally themselves to exert a coherent influence on the opaque ones such that every member of the morphological family is represented more or less componentially. Plaut & Gonnerman's model is however at odds with the data summarized above.These data do not reveal a graded morphological effect as a function of semantic transparency. Instead, what we see is comparable amounts of root facilitation among semantically transparent pairs and semantically opaque ones.

## 2.2 Conclusion

We have evaluated the predictions of two views of Arabic morphology, a morpheme-based approach and a stem-based approach in the light of the available data from cognitive psychology, neuro psychology, and cognitive neuro-science. The data from these three areas of research converge to support the view that Arabic surface forms are cognitively represented on a morphemic basis, with entities such as roots and word patterns playing a crucial role in processes of lexical access and in the structure of lexical representation (Saiegh-Haddad 2013). The stem-based approach does not seem able to accommodate this kind of data, and is further strained by much other behavioral data, such as slips of the tongue (Berg and Abd-Al-Jawad 1996), and novel word acceptability judgments (Frisch and Adnan Zawaydeh 2001). Even on a purely formal linguistic level, this model arguably suffers from significant in adequacies (Prunet 2004; Tucker 2009). On a more general level, the stem-based approach fails to strike the right balance between the aim of accounting for Semitic languages using the same set of formal apparatus used with other languages, and the aim of capturing the specificity of each individual language.

The OMD sketched above is a root and pattern based account and provides a good fit to the existing data. It provides a better fit to the data than the dual route model (Frost et al. 1997), and the distributed connectionist model (Plaut and Gonnerman 2000). Future development of the OMD will need to be informed more significantly by neural consideration in order to build a neuro-cognitively viable account of speech and reading comprehension in Arabic in particular and Semitic in general.

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# Chapter 3
# Word Recognition in Arabic: Approaching a Language-Specific Reading Model

**Gunna Funder Hansen**

**Abstract** This chapter makes an attempt to explain reading processes and specifically word recognition with specific reference to Arabic. A short historical outline of word recognition theory is presented and critical theoretical aspects are examined in order to question the universality of the dominating theories about how word recognition processes proceed at the cognitive level during reading. Then, a connectionist word recognition model giving letter recognition particular consideration is outlined, and from this theoretical perspective a language specific description of word recognition in Arabic is proposed, with consideration given to the specific features of both Arabic script and Semitic morphology, using our knowledge of reading in English as a comparative framework.

**Keywords** Letter recognition · Cognitive processing · Connectionism · Literacy · Word recognition · Reading theory · Writing system.

## 3.1 Introduction

Reading is a highly complex process involving a range of different cognitive resources. Reading processes are often divided into two separate components: word recognition and reading comprehension. Every reader brings his or her experiences and history into play when extracting meaning from print, and expectations regarding the text play a major role in the reading process. However, word recognition is the *motor* of the process. If readers are not sufficiently familiar with the writing system—the script and the coding principles it employs—they will not get very far. Furthermore, *automatic* word recognition has proven to be essential. Readers need to be able to recognise words instantly, without giving it conscious thought, in order to obtain a fair reading speed and liberate sufficient attention towards more general text comprehension processes.

To date, word recognition processes have mainly been described and explained from a Western point of view, and only recently has the universality of established reading

G. F. Hansen (✉)
(Dep.) Svendborg Langeland, HF & VUC FYN (Adult Education Centre Fyn),
Viebæltet 5, 5700 Svendborg, Denmark
e-mail: gfh@vucfyn.dk

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theories been questioned (Frost 2006; Share 2008). In this chapter, a connectionist word recognition model is introduced and developed in order to explain how Arabic script and morphology is rooted in the word recognition mechanism of the reader of Arabic, and how these language-specific features affect the reading process.

### *3.1.1 Traditional Views of Word Recognition*

For many years, the theoretical discussion of word recognition focused on the extent to which readers rely on phonological vs. lexical "routes" to a "mental lexicon". Psychologists argued that significant differences in subjects' reading speed when decoding regular and irregular (English) words respectively, imply that the two types of words are processed differently (Henderson 1984). This did not exactly match the traditional view of word decoding, according to which a rule-based recoding or "translation" from grapheme to phoneme was applicable to any kind of input. The findings were explained by a "dual route model": besides the phonological decoding of letters into sounds which leads to recognition of the word and its meaning, there had to be an alternative, a more direct route to the lexicon, by which words are recognised as lexical entities. Irregular words had to be recognised through this lexical route, as rule-based letter-to-sound correspondences do not apply; pseudo-words would be recognised only through rule-based phonological decoding, as they are not recognisable lexical units, while regular words could be recognised through both routes (Henderson 1982, 1984).

The dual route model was supported by experimental research revealing that irregular words are read faster than pseudo-words—supposedly because irregular words are decoded directly, without involving the phonological level of processing—and that regular words are read faster than irregular words—supposedly because regular words are decoded through both routes at the same time—though the difference is very small for high-frequency words but very significant for low-frequency words—supposedly because all words are predominantly decoded through the direct, lexical route when readers have encountered them a sufficient number of times (Rayner and Pollatsek 1989). Moreover, neurological research revealed isolated phonological dyslexia in brain damaged subjects who could not decode pseudo-words—apparently because only the phonological route to the lexicon had been damaged. Likewise, other patients were found to display "surface dyslexia", which means that they were able to read both regular words and pseudo-words, while they could not read irregular words and homophones correctly—apparently because only the lexical route to the lexicon had been damaged (Rayner and Pollatsek 1989; Coltheart and Coltheart 1997; Miceli et al. 1997; Rapp et al. 1997).

In relation to reading in Arabic, the baseline of the bulk of research exploring differences in the reading process in different languages has been the *orthographic depth hypothesis* (ODH) (Feldman and Turvey 1983; Frost et al. 1987; Katz and Frost 1992). This hypothesis builds on differences in grapheme-to-phoneme correspondence in different alphabetic orthographies: *shallow orthographies* have simple and consistent one-to-one correspondences between graphemes and phonemes, while *deep orthographies*, despite their reliance on the alphabetic principle, have more complex connections between letters and the corresponding sounds. In a continuum between shallow and deep, Serbo-Croatian orthography is shallow, as each letter represents only one phoneme, and each phoneme is only represented by one letter. English orthography, on the other hand, is rather complex because of the phonological differences between words with similar letter constellations (e.g., *heal-health*) and similar pronunciation for words with different letter constellations (e.g., *peel-deal*). According to the ODH, reading shallow orthographies calls upon phonological decoding, while reading deep orthographies calls upon lexical, or direct, word recognition. In this sense, the ODH and back heavily relies on the traditional dual route word recognition model.

While studies exploring the ODH were initially concerned with Serbo-Croatian and English, which represent shallow and deep orthographies respectively (e.g., Katz and Feldman 1981; Feldman and Turvey 1983; Turvey et al. 1984), some researchers began to include non-European languages and other writing systems.[1] Much of the interest focused on Hebrew and Japanese, each of which in its own way could contribute new and interesting dimensions to the field: Hebrew (like Arabic) can be written in two different alphabetic orthographies—one (vowelled) highly shallow and one (unvowelled) very deep because of the lack of phonological information when short vowels are omitted. Japanese, on the other hand, uses three different writing systems: one logographic (kanji) and two syllabic (hiragana & katagana). While much of this research was primarily focused on supporting or rejecting the traditional dual route word recognition model (Coltheart 1984; Morton and Sasanuma 1984; Sasanuma 1984; Turvey et al. 1984; Katz and Frost 1992), it had an important side effect as well: researchers began to question the general conception of orthographic processing (examples considering the extent of phonological processing in reading Chinese are: Henderson 1982; Hung et al. 1994; Jackson et al. 1994; Hanley and Huang 1997). In 1994, Geva & Willows raised this very important issue in the following paragraph:

> [Recent research] highlight[s] the importance of examining carefully in different writing systems what is meant by orthographic knowledge, and the contribution of underlying cognitive and linguistic factors to its development in different orthographic systems. It is clear that theoretical claims regarding the universal role of orthographic and phonological processing in reading and spelling, based on learning to read and spell in English and other Roman-based alphabets, need to be examined carefully. (Geva and Willows 1994, p. 365)

In recent years, the dual route model and the empirical research supporting the model have been under heavy critique, with new theories of word recognition gaining ground. Among such methodological points of criticism is the extensive use of tests employing pseudo-word reading (in order to ensure phonological decoding, subjects are presented with "words" that do not exist in the mental lexicon) and lexical decision tasks (in order to ensure lexical decoding, subjects are asked to indicate, for instance, which of two different but phonetically identical strings

[1] This tendency is expressed in a variant of the ODH called the *script dependence hypothesis* (e.g., in Gholamain and Geva 1999; Geva and Siegel 2000).

of letters is a valid word). Moreover, it has been questioned whether it is in fact possible to view phonological and lexical processes as totally separate from each other and from other cognitive processes activated during reading (e.g., Seidenberg 1992; Berninger 1994; Geva and Willows 1994; Vellutino et al. 1995). Finally, the neurological support for the dual route model has also been questioned; isolated surface dyslexia or phonological dyslexia is most often acquired through brain damage while developmental dyslexics find both phonological and lexical decoding difficult, and according to some critics, this entirely undermines the credibility of the dual route model (e.g., Foorman 1995, p. 397).

When it comes to reading in Arabic in particular, the dual route model seems to be a narrow framework indeed. The limited amount of phonological resources provided in unvowelled Arabic text makes the phonological route appear less than efficient. However, direct lexical recognition does not seem to sufficiently explain how unvowelled Arabic words are recognised. As will be explained below, it rather seems as if other kinds of linguistic resources are much more in play, even at the isolated word recognition level.

Today, many reading researchers are advocating more flexible word recognition models in which phonological and orthographic processes are more integrated (Plaut 2004), just as other kinds of linguistic competencies (Rhode and Palut 2003).

Connectionism (see textbox below) has been used as a theoretical framework for such a model. In the connectionist word recognition system (Fig. 3.1), all relevant knowledge is stored as weights within the so-called connections. There is no "mental lexicon" in which we look up words, and thus there is no lexical route to word recognition. Rather, orthographic, phonological and semantic codes are connected within a complete process. Seidenberg, one of the prominent connectionists dealing with word recognition, describes the difference as follows:

> According to this theory, codes are not accessed, they are computed; semantic activation accrues over time, and there can be partial activation from both orthographic and phonological sources. So, for example, whereas in the standard dual-route model, 'phonological mediation' required deriving the complete phonological code for a word and using it to search lexical memory, in the present framework there can be partial activation of phonology from orthography, or of meaning from phonology. Thus, the meaning of a word is built up by means of activation from both routes, […] rather than accessed by means of whatever route wins the race. (Seidenberg 1992, p. 105)

So, word recognition is still a matter of processing phonological and lexical material, but rather than running through separate routes to a mental lexicon, the information is gathered in a melting pot, where it—together with other kinds of text relevant resources—creates meaning. Becoming a proficient reader is a matter of gradually adjusting the connections' weights through experience with frequency and consistency in the relations between lexical and phonological units. Grapheme-to-phoneme correspondences are still essential; not as isolated rules however, but rather as characteristic spelling patterns which are gradually recognised when they have been encountered several times.

This process explains both the effect of word frequency—high-frequency words are recognised faster than low-frequency words (Monsell et al. 1989), the effect of word regularity—words with regular spelling and pronunciation are recognised

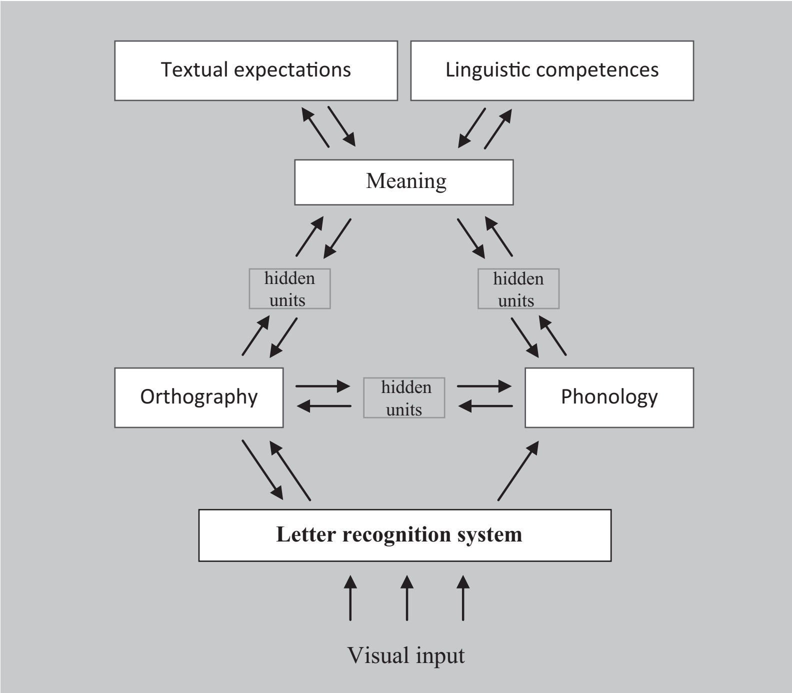


**Fig. 3.1** Word recognition system (The model is inspired by the original connectionist word recognition model by Seidenberg and McClelland (1989))

faster than irregular words (Metsala et al. 1998)—and the interplay between these two phenomena, the effect of neighbour-frequency (Grainger 1992)—the fact that word-frequency for neighbours, that is words with shared letter combinations, influences word recognition speed: if a word and its neighbours are regular (e.g., gave, save and shave) the "neighbour-frequency effect" is positive, and a frequent word increases the speed for recognition of less frequent neighbours. For irregular neighbours (e.g., have) however, the effect can be negative. This is the case for low-frequency words in particular, as the effect of highly frequent neighbours slows down their recognition, while frequency effect in highly experienced readers eliminates the negative effect on high-frequency words (Massaro et al. 1979; Seidenberg and McClelland 1989; Grainger 1992; Johnson 1992). In computer simulations of a connectionist word recognition model, Seidenberg and McClelland (1989) were able to register "frequency-effects", "neighbour-effects" and "neighbour-frequency effects" which were very similar to results from living subjects.[2]

[2] Additionally, the connectionist reading model represented in Fig. 3.2 accounts for reading aloud as a phenomenon that might involve all elements in the word recognition process without necessarily involving meaning (in opposition to prior reading models in which this aspect was either ignored or illustrated less convincingly, e.g., in Rayner and Pollatsek 1989, p. 92 & 461–473).

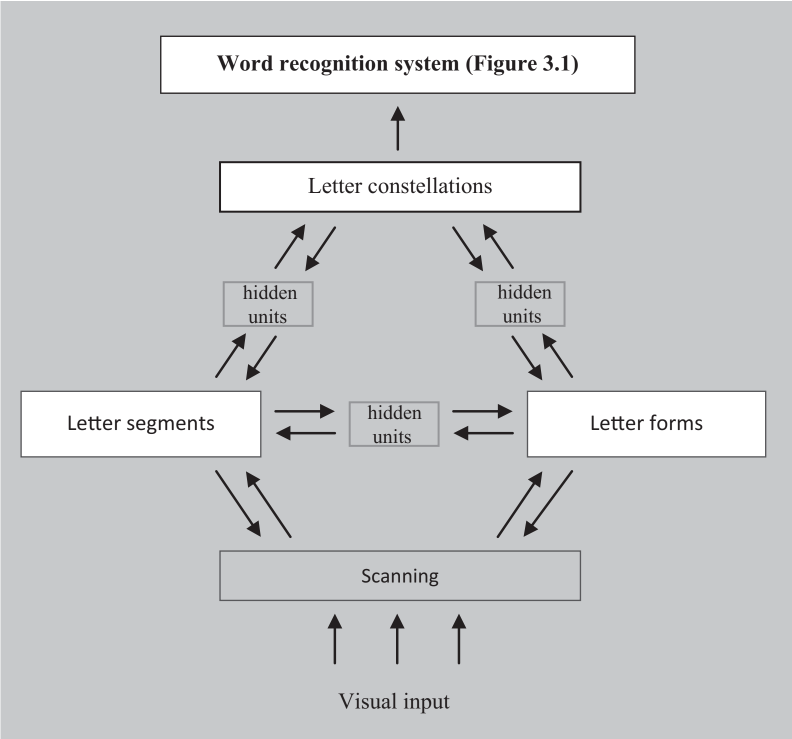


**Fig. 3.2** Letter recognition system

Another equally interesting and compelling aspect of the presented connectionist theory is that it explains the complexity of the reading process and handles the processing of different resources in a more integrated way than the traditional interactive reading models. It perfectly embraces the essence of schema theory, as all sorts of knowledge affect the process, while at the same time it includes the smallest components of phonemes and graphemes—even letter segments (see Fig. 3.2). So despite the fact that proficient readers recognise words rapidly without relying on phonological decoding, and despite such readers' ability to make use of the holistic form of single words in the word recognition process, this does not mean that words are recognised as wholes. In addition, despite the fact that context influences decoding, this does not mean that reading is based on continuous, context-reliant testing of hypotheses. On the contrary, readers visually process every single letter—but not isolated from its surroundings:

> Even while the individual letters of the text are the basic perceptual data of reading, they are not perceived one by one, independently of each other. Instead, their efficient and productive perception depends additionally on ready knowledge of words—their spellings, meanings, and pronunciations—and on consideration of the context in which they occur. In the mind of the skillful reader, each such type of knowledge is represented by constellations of

> elementary units, connected in specific, learned relation to each other: simple patterns are represented by interrelated clusters of units, more complex patterns of clusters of clusters of units, and so on such that the whole of any percept or idea is defined, at core, by the particular relations that hold among its parts. (Adams 1990, pp. 14–15)

Hence, meaning is constructed through connections of segments at several levels: letters are representations of interconnected letter segments, just like words are representations of interconnected letter combinations. Similarly, the pronunciation of a word corresponds with a composite of phonemes just like its meaning is related to interconnected elements of meaning (Adams 1990, p. 15). Thus, word recognition (and reading comprehension) is a multidimensional puzzle of experience-based elements of knowledge which are put into play and connected to each other.

At the same time, the theory embraces both *bottom-up* and *top-down* approaches in a way different from the traditional interactive models. For instance, if a network is fed with letter components and is taught to classify words, pseudo-words and letters, then it learns to identify letters in words better than letters in pseudo-words. So, the model functions *bottom-up* (is fed with the smallest units) but demonstrates a clear top-down-effect (applies its knowledge of words) (Norris 1990). The reason for this is that information flows back in the network in order to calibrate the weights of connections during the process of "learning". This explains several phenomena in the word recognition process which have been known for a long time but have never been accounted for as integrated parts of the traditional reading models, e.g., context-effect (see review in Tabossi 1991). Previously, it had not been possible to determine if context influences word recognition or whether it is not activated until later as part of a full-sentence comprehension process. Similarly, it had not previously been clear whether ambiguous words instantly activate several meanings or only one.

In the connectionist reading model, context-effect is constant as all information affects the weights of the network. In traditional terminology one could say that context is continuously incorporated into the schema and becomes part of the reader's expectations regarding the text (Seidenberg 1990, p. 59; Whitney and Warning 1991). Also, the question of whether one or more meanings are activated during the reading of ambiguous words is eliminated (see review in Seidenberg 1992, pp. 490–496 and Simpson 1984), since we are no longer dealing with a mental lexicon. Within this framework, semantic values of words are flexible fusions between several kinds of information stored in the connections of the network (Seidenberg 1992, p. 58).

*The Connectionist Letter Recognition System* Established connectionist theories of word recognition do not consider the question of possible sub-processes such as initial letter detection (Richman and Simon 1989), since script is simply considered to be an integrated part of the orthography. However, connectionist word recognition theory implies that letter recognition relies on a mental network of inter-feature relations which is established through experience. From this perspective, the role of context could be emphasised. Letters are recognised more easily when they are presented as part of a word (McClelland and Rumelhart 1981), and mixed fonts are more difficult to process than regular fonts (Sanocki 1987).

In fact, connectionist approaches to word recognition seem to represent a rather effective model at the letter recognition level in order to explain the level of flexibility and diversity of our ability to recognise different fonts. The role of letters within words seems to be an effective analogy to the role of letter segments within letters. According to this analogy, activation of one letter component is not an isolated process. Rather, it is part of a contextual stimulation of letter components which "go together"—according to prior experience with letter forms stored in the network.

Just as word recognition is not a one-way process, the idea of a hierarchical process in letter recognition is, within this framework, replaced by the network's ability to feed back as well as forward. Similarly, from a connectionist point of view, letter recognition is a completely integrated part of the word recognition process: letter components are process units within the letter recognition network, just as letters are components in the word recognition network. However, while letters can be recognised without word recognition (a letter can be presented in isolation), word recognition cannot occur without letter recognition. Hence, letter recognition and word recognition can be perceived as two different stages of a modulated process in which the two stages are both independent and intertwined. They do different things, but they are dependent on each other in a continuous interplay with information flowing in both directions. In this way, letter recognition feeds the word recognition process which again affects and supports the letter recognition process. And just as experience with both whole words' graphic shapes and with specific letter forms is utilised in the word recognition process, experience with general letter forms and letter component constellations is used in the letter detection process.

This description does not necessarily contradict traditional letter recognition theories that consider feature detection to be crucial (as opposed to template-matching theories which are essentially static). According to the feature-detection theories, we are able to decipher different fonts because standard letter segments are perceived in terms of their relative positions in relation to other segments and the overall letter shape. Most research within this framework is concerned with Roman upper-case letters. The segments of these are categorised in terms of line orientation and position of arcs, and it is argued that we recognise the graphic entities of letters through an analysis of such components (Rayner and Pollatsek 1989), so that we distinguish e.g., E from F or L on the basis of the number of horizontal lines. Regarding lower-case letters, they are believed to be initially recognised as a general form (Tinker 1965; Bouma 1971; Massaro et al. 1980), described by Bouma as "the smallest enclosing polygon without indentations" (Bouma 1971), followed by a process including letters' sub-components. This process implies not only recognition but also rejection based on the principle of exclusion. It is not entirely impossible to incorporate such process descriptions into the connectionist letter recognition system. However, within the connectionist framework, rather than a strictly hierarchical process, we could imagine letter perception as a computation of letter components creating associations with other matching components according to our experience with letters already stored in the network.

### *3.1.2 Letter and Word Recognition in Arabic*

Considering the letter recognition system in Fig. 3.2, it should be obvious that it does a very different job in the Arabic script than in the Roman alphabet. In the latter, letter segments are primarily strokes and circles, and we distinguish between letters by scanning for and recognising how these segments are positioned in relation to each other. Letter forms are relatively diverse, even though some are basically similar but mirrored (e.g., bd, pq, ZN, WM, JL). Directionality as well as position of strokes is crucial (e.g., opqbd). Thus, when acquiring the Roman alphabet, we gradually build the letter recognition system by establishing scanning strategies searching for exactly these features. Furthermore, when reading in a specific language, we acquire experience with frequent letter constellations, thus building graphotactic constraints; we learn that some letters go well together while some letters do not, and this helps us speed up the letter recognition process.

Recognising Arabic letters demands other scanning strategies. When reading Arabic script, the letter segments we are searching for are primarily curls and dots. Compared to the Roman alphabet, Arabic letter forms are more similar—many letters are only distinguishable by the number and placement of the dots (e.g., بـ تـ ثـ يـ نـ). When it comes to letter constellations, the question of whether or not a letter is connected to the following one is probably an important means for distinguishing between similar letters (e.g., ـا ـلـ). Comparisons between the Arabic, Hebrew and Roman alphabets indicate that while Hebrew letters are harder to distinguish than Roman alphabet letters, Arabic letters are even harder. In a comparative study of subjects' identification of Roman and Hebrew letters, Shimron and Navon (1981) describe how according to objective measures of "distinctiveness" (how critical the relevant letter segment is for recognition of the letter) and "uniqueness" (how rarely the relevant letter segment occurs in other letters), Hebrew letters are more alike than Roman alphabet letters. In addition, in experiments they found that manipulations of letter segments affect recognition of Hebrew letters more than Roman alphabet letters (Shimron and Navon 1980, 1981). Geva and Siegel (2000) found that English-Hebrew bilingual children make more visual letter recognition errors in Hebrew than in English. In line with this argument, it seems that decoding both Arabic and Hebrew demands more visuo-spatial awareness or visual attention than decoding English (Share and Levin 1999; Abu-Rabia 2001; Shatil and Share 2003; Ibrahim et al. 2007).

Thus, the graphic similarity of Arabic letters indicates that letter recognition in Arabic is relatively demanding, and in fact a range of different studies indicate that the graphic characteristics of Arabic script are somewhat problematic with regard to readers' ability to distinguish between letters. In one study it was found that Arabic-speakers reading Arabic pseudo-words produced alarmingly high frequencies of decoding errors, and that the readers (in this case university students) were in fact somewhat uncertain about the exact grapheme-to-phoneme correspondence among some letters that are graphically very similar. Such errors could, at least in some cases, be a result of transfer of dialectal phonology, but they still hold the potential to affect reading comprehension during the reading of real texts (Hansen 2010). Moreover, Ibrahim et al. (2002) found that Arabic- Hebrew bilingual subjects were slower in processing Arabic (L1) letters than Hebrew (L2) letters. They concluded that the results were due to the graphic complexity of Arabic script. This is supported by Eviatar et al. (2004) and Ibrahim and Eviatar (2009). In any case, it should be obvious that the letter recognition process takes quite a different course when reading Arabic compared to reading languages using the Roman alphabet.

Moving on to the word recognition system (Fig. 3.1), we do know a few things about word recognition in Arabic. First of all, we know that the reading of unvowelled Semitic orthographies—compared to European orthographies—demands longer fixations and is more time-consuming (Pollatsek et al. 1981; Roman and Pavard 1987; Shimron and Sivan 1994). This is probably due to several factors. One factor could be the more dense level of information within words in the form of articles, prepositions and pronouns which are internalised as affixes as well as clause subjects which are implicit in verbal conjugations. It is likely that the mental decomposition of these different kinds of morphemes demands more cognitive capacity.

More importantly, we know that the reading process takes different courses for vowelled and unvowelled texts. With reference to the ODH, the decoding of unvowelled script is predominantly orthographic while in vowelled script phonological information is more or less complete, and this prompts a more phonological process of decoding which seems to be faster, at least for low-frequency words (Navon and Shimron 1981; Shimron and Navon 1982; Bentin et al. 1984; Koriat 1984, 1985; Bentin and Frost 1987; Frost 1994; Frost et al. 1987; Frost and Bentin 1992b; Geva et al. 1993; Geva and Wade-Woolley 1998; Geva and Siegel 2000). Multiple studies concerned with the reading of European languages[3] show that phonological decoding is slower than orthographic, or lexical, decoding (Katz and Frost 1992). From a dual route perspective this is explained by the "direct" access to lexicon which does not involve an "extra" level of phonological processing. This is somewhat surprising, since the decoding of vowelled text involves more graphic input to be processed (the diacritics).[4]

Similarly, when it comes to context, the results of research concerned with the reading of Semitic languages collide with traditional reading theory. Not only does context play a much more dominant role in the decoding of both Arabic and Hebrew than in European languages, but highly proficient readers of Arabic also seem to benefit more from contextual information than less proficient readers (Roman et al. 1985; Shimron and Sivan 1994; Abu-Rabia and Siegel 1995; Abu-Rabia 1997, 1998, 2001; Shimron 1999). This contrasts with Stanovich's interactive-compensatory theory which is empirically well documented and broadly accepted in reading theory in general (Stanovich 1980, 1986; Just and Carpenter 1987; Rayner and Pollatsek 1989; Adams 1990; Stanovich 2000). According to this theory, only less

[3] [1]Throughout the chapter, "European languages" is used to refer roughly to "Indo-European languages written in Latin script".

[4] A study of foreign language learners' reading of Arabic reveals that, for beginning and intermediate learners, vowelled text is in fact less rapidly processed than unvowelled text (Hansen 2010). This indicates that vowelisation is in fact a cognitively demanding factor during the reading process. However, in highly proficient L2 learners and native speakers, the resource of information that vowels provide overrules the issue of graphic complexity.

proficient readers need to rely on context in order to compensate for their less efficient decoding skills (Stanovich 1980).

This mismatch between reading theory based on European languages and reading research involving Semitic languages can be explained by the higher level of redundancy in the European scripts. In English, it is definitely possible to decode script even if vowels are omitted:

txt s stll mr r lss lgble whn vwls hv bn rmvd (example from Adams 1990).

Or—even more to the point:

•n th• S•m•t•c l•n••g•s w• m•r• •r l•ss kn•w th• n•mb•r •nd th• p•s•t••ns •f th• v•w•ls w• n••d t• •ppl• •nd th•s m•k•s th••se scr•pts s•m•wh•t m•r• •cc•ss•ble.

The above examples illustrate that vowel information added to the consonants in the Roman alphabet is to some degree redundant. On the other hand, we would expect that even with some practice of reading English without vowels, we would still be able to obtain more reading speed when vowels are added. In that sense, it is not surprising that vowels support word recognition in Semitic languages as well. Furthermore, the fact that context plays a more dominant role in the unvowelled Semitic orthographies can be explained by this "missing redundancy": only less proficient readers in English need to rely on context because the phonological information necessary for decoding is often available. This is not entirely the case in the Semitic languages where a large proportion of words, due to the lack of vowels, are homographs, and this makes decoding heavily context-dependent. For instance, it is often necessary to gain an overview of the entire sentence in order to determine the form of an initial verb. In vowelled Semitic texts sufficient phonological redundancy is available, so that context becomes an additional resource that skilled readers do not need, but it can be used as a back-up source of information if decoding skills are inadequate. Thus, the consequence of Semitic script most often being unvowelled is that context plays a quite different and more important role than in the European languages. When reading in languages that use the Roman script, less skilled readers can rely on context as a compensatory resource, while highly proficient readers do not need to do so. When reading in Semitic languages, highly proficient readers are highly proficient *because* they rely on context.

Even though millions of native speakers of Semitic languages are able to decode unvowelled Semitic orthographies in an uncomplicated, fluent process, it seems clear that it is of great importance for the reading process that readers—because of the lack of phonological information compared to the case in Roman-written orthographies—have fewer resources at their disposal during reading. And it seems there is reason to assume that as a result, readers of these languages make use of other kinds of resources than those utilised in the European languages, and that the decoding process demands more cognitive capacity. When comprehension improves with vowelisation—independently of decoding speed and word recognition accuracy (Shimron and Sivan 1994; Shimron 1999; Abu-Rabia 1999, 2001)—it is at least an indication that reading without vowels is so cognitively demanding that it absorbs capacity which—when vowels are present—is more readily available for comprehension processes.

When discussing how these research results should be interpreted in order to understand word recognition in Semitic languages, it should be noted that most research publications concerned with this issue take the dual route model as their point of departure. This has influenced both research designs and the way the data were interpreted. For instance, findings based on lexical decision tasks are interpreted narrowly within the framework of a linear decoding process (e.g., when data show that vowelisation does not improve lexical decision latencies for homographs, and that homographic primes seem to activate more meanings, it is reasoned that lexical decision takes place before the exact vowel pattern is applied and thus before readers have decided on which word among the different possibilities they are dealing with) (Bentin et al. 1984; Frost 1991; Frost and Bentin 1992a; Frost and Kampf 1993). Based on such assumptions, expanded reading models for unvowelled Semitic orthographies have been launched, including an extra level of processing on the route towards the mental lexicon. This "extra lexicon" is supposed to consist of valid consonant strings (roots) (e.g. Boudelaa and Marslen-Wilson 2011), and since lexical decision does not necessarily involve phonological processing, it is hypothesised that all entries could be solely orthographic. Or, in other words, it is believed that a word's full phonological representation is a result of—rather than a means to—word recognition (Frost et al. 1987; Frost and Bentin 1992a; Katz and Frost 1992). The reader encounters an ambiguous word, detracts the root and then considers which vowel pattern it makes sense to match it with according to the context; and—if context is either ambiguous or unavailable—he weights the options according to a frequency-determined hierarchy of possible words. On many occasions, this frequency-based hierarchical procedure would of course by its very nature lead the reader directly to the correct meaning.

However, other data documenting pre-lexical phonological processing (e.g., Bentin and Ibrahim 1996; Gronau and Frost 1997; Frost and Yogev 2001) contradict this word recognition model, and perfectly match the proposed reading model in Fig. 3.1. In this model, all available research on how the different resources (context, word frequency, and vowels if available) are activated can be easily incorporated. In accordance with connectionism, this model contends a continuous interplay between orthographic and phonological processes—within which all kinds of relevant resources established by the reader through previous exposure to text are activated. This allows for the interpretation that the system of roots and patterns influences the reading process—not only as part of broad linguistic competence (at the top of the model) but also at the level of word recognition where the morphological structure probably plays a crucial role as a compensatory source of information in the case of missing vowels. This does not necessarily function as a splitting of roots and patterns into independent morphemes (despite the fact that this seems to be the case), but as a result of frequency. The limited number of possible patterns leaves the reader with a limited number of possible word structures stored in the hidden units ready to guide the decoding process.

Based on these issues it is possible to come one step closer in the determination of how information processing in word recognition in Semitic languages differs from equivalent processing in the European languages. In general, it seems that phonological processing is less significant during the reading of unvowelled script. While phonological processes are crucial in word recognition in English, just as phonological awareness is "inescapably required" (Adams 1990, p. 305) in order to achieve good reading skills, this is only to a lesser extent the case in Semitic languages, where orthographic and morphological processes play a more prominent role in establishing good reading skills than they do in European languages. According to the ODH this is due to the limited amount of phonological information provided by the orthography in question, and as a result the reader has to rely on other available resources. This explains why—in contrast to European languages—correct reading aloud and reading comprehension do not correlate in Arabic and Hebrew (Abu-Rabia 2001; Saiegh-Haddad 2003a). While phonological processing is, of course, a prerequisite for reading aloud, reading comprehension does not necessarily require an identification of words' exact phonological identities, since word recognition to a large extent makes use of other kinds of resources. Furthermore, Arabic diglossia might contribute to this matter. When written and spoken language are so far apart, the possibilities of phonological association processes are reduced and this seems to contribute to a word recognition processing which to a large extent relies on other resources than phonology (Saiegh-Haddad 2005; Saiegh-Haddad and Geva 2008).

If these issues are viewed within the illustration in Fig. 3.2, it is possible to argue that during the reading of Semitic languages the information flow is—to a larger extent than in European languages—more distinctly guided towards the left of the model, both at the word recognition level and at the top level, where context is more significantly utilized. A possible articulated output (reading aloud) could be illustrated as an external connection from the "phonology" box towards the speech organs, but a substantial part of the information flow evades this part of the model, which explains the weak connection between comprehension and reading aloud mentioned earlier.

If we examine more closely the role of morphology which is not explicit in the model but is internalised in the hidden units, in particular between orthography and phonology, we should suspect that the processes operating at this location within the model are indeed language specific, since the reader's experience with linguistic structures is stored in the hidden units (as described above). In European languages, high-frequency and low-frequency letter constellations are essential in this context, because of the 'neighbour-frequency-effect' as mentioned in the review above, or as Adams (1990) puts it:

> The nature of the stimulation passed along from a donating to a receiving letter depends on the frequency with which the two letters have occurred together in the reader's lifetime of reading experience. Letters that have often been seen with the donating letter will receive positive excitation; the more often they have been seen together, the stronger this positive excitation will be. Conversely letters that have rarely been seen with the donating letter will receive negative excitation, or inhibition, that is proportionate to the rareness of their co-occurrence. (Adams 1990, p. 109)

These processes implicitly entail that we have a perceptual tendency to split long words into syllables automatically. If, for instance, the first letter of an English word is a 'd', it is more probable that it is followed by a 'r' than by a 'n', thus 'dr' represent a well-known letter constellation while 'dn' would be less expected. And while less frequent letter constellations often occur in the connection of two syllables, as

This eamxlpe sohws taht wehn you raed fmailair wrods, it is not taht imtorpant taht all leterts are in the rihgt palce. If olny the frist and the lsat lerttes are in the rhigt pitosions, it mghit look srantge, but we wlil sitll be albe to raed it.

**Fig. 3.3** An example demonstrating that linear letter analysis is not necessary for word recognition (at least not when words are fairly frequent)

in "midnight", readers would—based on experience—be inclined to split the word at this very spot, if they fail to deal with the word as a whole (Adams 1990, p. 116). This is, of course, very expedient when each syllable represents independent units of meaning and the strategy therefore represents yet another resource in the reading process. In other words, neighbour-frequency effect is a result of storage of syllabic and morphological information in the hidden units, where both orthographic and phonological elements play their part and result in different degrees of ortho- and phonotactic incentives or constraints.

In addition to this linear processing, readers rely on a more holistic visual perception of each word. As exemplified in Fig. 3.3, we are able to retrieve word recognition fairly quickly based on word length and a few letters in their correct positions, despite the fact that the text triggers notable feedback of several uncommon or even unacceptable letter constellations.

Hence, automatic word recognition, which is essential for good reading skills, relies very much on the perception of single words as wholes. However, linear letter analysis is still activated (Adams 1990, p. 111). Seidenberg & McClelland have shown that at least monosyllabic words are processed through a "triple-letter-analysis" in which words are treated as a series of trigrams. For instance, the word "drum" is processed as [ dr], [dru], [rum], [um ]. This continuous processing serves as an "auxiliary engine" which supports the process by confirming the reader's perception of the holistic input, settles the question in matters of doubt and "cobbles the pieces together" when needed during the process. All this put together enables the reader to achieve fluency and increase reading speed.

Semitic languages are a totally different matter, as the phonological information is more scarce and the morphological structure is different: since short vowels are not present, the reader does not have the same possibility to establish a reaction to well-known and unaccustomed letter constellations, and thus it is not possible to establish positive or negative feedback based on combinations like 'dr' and 'dn'. First of all, 'dr' could represent either /*dar*/, /*dur*/, /*dir*/ or /*dr*/. Second, the orthographic recognisability depends very much on the third consonant of the relevant root. Furthermore, letters which are part of a word's pattern hold fixed positions within the word, and there are no restrictions upon which consonant such a pattern-letter can be combined with. In addition, when it comes to holistic word processing, the information available is similarly scarce, as the restricted number of patterns results in a graphically more uniform vocabulary. In short, Semitic words do not look as diverse as European words. Large groups of words are only distinguishable by the three consonants that make up the root, and thus there is no basis for the establishment of the above-mentioned positive and negative types of feedback based on letter constellations.

Instead, the tight morphological structure in Semitic languages provides other kinds of resources: prefixes, infixes, suffixes, and word length give feedback on which patterns are applicable; in fact, a prefix will sometimes reduce the number of possible pattern combinations to very few or even a single one. And when the pattern is identified, the vowels are, too. In other words, recognition of a pattern is essential when a letter constellation like 'dr' is to be decoded, as it determines whether the reader is dealing with */dar/*, */dur/*, */dir/* or */dr/*. Moreover, recognition of the root might be crucial as well, since this recognition will reduce the number of applicable patterns.

Another example of the different kinds of morphological structures stored in the hidden units in European and Semitic languages respectively is that in European languages we are readily able to distinguish between pseudo-words (which are word-like), e.g., "kvir" or "flas" and non-words (which are not word-like), e.g., "ikvr" or "lfas". Pseudo-words consist of well-known letter constellations and represent an acceptable phonological structure, and linear letter analysis gives positive feedback though they have no semantic value. Non-words, on the other hand, give negative feedback because the unfamiliar letter constellations do not accord with the grapho- and phonotactic constraints that have been established within the word recognition system. In Semitic languages the difference between pseudo-words and non-words does not depend on letter constellations but on valid or invalid patterns. If the pattern is valid, the "word" is perceived as word-like, and the difference between words and pseudo-words thus depends solely on whether or not the three root consonants construct a valid word in combination with the given pattern. Construction of a non-word would demand a non-existent pattern.[5] Likewise, it would be impossible to construct a Semitic version of the example in Fig. 3.3 (which demonstrates our ability to read English—at least high-frequency words—even if only the first and last letters are in the right positions). A corresponding manipulation of Semitic words would have a totally different result. According to Friedmann and Gvion (2001, 2005), errors in letter position in Hebrew most probably result in an existing word, and the same holds true for Arabic: with three root consonants and e.g., an infix, it is generally possible to create a range of valid words, since interchange of root consonants often results in another valid root, just like a pattern-letter in another position sometimes results in another valid pattern. Thus, as Velan and Frost (2011) put it, the "linguistic environment" does not allow for "noisy letter position coding" because in Semitic languages "words (…) have an internal structure with a well-defined set of conditioned probabilities that rigidly determine few open slots for the consonants of the root only" (Velan and Frost 2011, p. 153), and

[5] Note that in both European and Semitic languages there are in fact words—especially loanwords—which are valid despite the fact that they do not accord with established grapho- and phonotactic constraints, e.g., in Arabic 'ديمقراطية' ("democracy") and in English "phthalates".

“any transpositions that involve root letters would interfere with lexical access” (Velan and Frost 2011, p. 143).

In other words, the morphological structure of Semitic languages must lead us to conclude that during reading in these languages, processes like triple-letter analysis and neighbour-frequency effect are not essential elements as is the case in the European languages. On the other hand, the presented review and the differences between morphological structures in European and Semitic languages should lead us to assume that roots and patterns receive some level of separate attention in the word recognition process in Arabic and Hebrew, whereby knowledge of possible patterns plays a substantial role in word recognition (see Boudelaa, Chap. 2). According to Frost and colleagues (Frost et al. 1997, 2005; Deutsch et al. 2003; Deutsch et al. 2000, 2005; Velan et al. 2005; Velan and Frost 2007, 2011), word recognition in Semitic languages is essentially based on root extraction, and Velan and Frost (2011) highlight the extraction of root morphemes as a “primary phase” in the word recognition process of Semitic words, that generates a morphologically based code (Velan and Frost 2011). Based on connectionist theory it could be suggested that there is no “primary phase” reserved for root extraction, and that word patterns play an equally important role. Just as the readers’ experience-based knowledge of roots is in play, we can imagine some kind of “pattern-frequency effect” stored in the hidden units of the word recognition system where it is used to obtain rapid word recognition. An argument to support this hypothesis would be that the selection of available resources provided by the writing system is rather scarce, and recognition of valid word patterns seems to be the essential source of vowel information, at least during the reading of low-frequency words.

## 3.2 Conclusion

The purpose of this analysis has been to put forward a collective overview of what we know about how word recognition processes function in Arabic compared to similar processes in English and other European languages which have traditionally been the basis for reading research in general.

As a theoretical framework for this analysis, the common connectionist word recognition model was adjusted in order to accommodate the need to regard letter recognition as a separate process. This part of the analysis has not so far been much elaborated—research in this field is very scarce and as a result, we have come no closer than a rather general, comparative description of Arabic letters being more difficult to decipher and distinguish than letters in the Roman alphabet. The reason for this is most likely found in the cursive writing and the rather similar letter forms that characterise Arabic script.

When it comes to the “next level” of word recognition—the integration of phonological and orthographic information in the decoding process—research concerned with Hebrew provides a valuable resource. Assuming that the similarities in the morphological structures of Arabic and Hebrew entail that decoding processes in these two languages, beyond the letter recognition stage, are equally similar, the combined research dealing with reading in these two languages offers a range of guidelines for assuming that reading in Semitic languages does in fact progress rather differently from that in European languages. The fact that short vowels are normally omitted in Semitic writing makes decoding more reliant on other kinds of information than phonology. In relation to the orthographic depth hypothesis, decoding is predominantly orthographic, and the vast number of homographs makes the reader heavily dependent on context in the quest for the meaning of words, and within this context-dependent searching for meaningful output, word-frequency seems to be a guideline for prioritising the possible meanings.

Furthermore, several psycholinguistic studies seem to indicate that the root-pattern morphology in Arabic and Hebrew is embedded rather deeply in the linguistic cognitive system of native speakers of these languages, and knowledge of roots and patterns and their possible combinations might play a significant role as pieces in a word-constructive puzzle within the decoding process, thus acting as yet another resource (see Boudelaa, Chap. 2).

Adding a few more analytically-based comparative considerations based on differences between the European and the Semitic writing systems brings us a step further. The linear features of word recognition processes in European languages such as triple-letter analysis, neighbour-frequency effects and splitting of words into syllables do not make much sense in Arabic, just as grapho- and phonotactical constraints established in connection to such processes cannot exist in the Arabic word recognition network in the way they do in the word decoding system of skilled readers of European languages. Rather, readers of Arabic establish other kinds of decoding resources, and in this respect some kind of a pattern-frequency effect build into the network of the skilled reader of Arabic is a probable outcome of knowledge of word patterns being a crucial source of vowel information.

However, despite the fact that such substitutions for the lacking phonological information are thus available, reading in Arabic generally seems to be a more complex matter than reading in European languages. The script issue mentioned above might be part of the explanation, but furthermore, Arabic words are often more dense in information than words in European languages generally are, since more morphological entities are often included as parts of words, which then are to be crystallised as separate entities during decoding. Though not scientifically proved, this aspect could be of importance.

In addition to these issues linked to normative aspects concerning the Arabic writing system, sociolinguistic aspects may be relevant in explaining why Arabic readers tend to process text material less accurately and at a slower pace than readers processing texts in European languages. Besides socioeconomic difficulties and tradition-bound teaching methods limiting the educational standards in vast parts of the Arab world, the diglossic situation in Arabic is probably relevant in this respect. It has been argued that the written language variety in Arabic is a second language to children entering school (e.g., Ibrahim and Aharon-Peretz 2005), and research has shown a direct effect of the linguistic distance between written and spoken Arabic on basic reading skills development (Saiegh-Haddad 2003b, 2004, 2007;

Saiegh-Haddad et al. 2011). Such matters have proved to be highly controversial, but in any case it should be obvious that when a child is only taught how to read in a language that he or she does not master as spoken language, it is not a perfect start to a literacy career.

To take a broader view of this topic, a conclusion could be that Arabic language policies need to address the issues discussed in this chapter, however controversial and sensitive they may be. The different cognitive complexities confronted in the reading process in Arabic and invoked by the nature of the script, the writing system, the distance between the written language and the spoken varieties and the way reading is taught—and not least the combination of these issues—could very well be among the most important obstacles to human development in the Arab world. Tradition, religion and aesthetics are of course important values, but in relation to Arabic written language they might have been overemphasised for too long.

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# Chapter 4
# Why is it Hard to Read Arabic?

**Zohar Eviatar and Raphiq Ibrahim**

**Abstract** Previous research has shown that reading in Arabic is a slower process than reading in other languages, even among skilled native Arabic speakers. In addition, the process of reading acquisition by beginning readers is slower than in other languages. We present three possible sources of these phenomena from both a psycholinguistic and a neuropsychological perspective. We examine the effects of diglossia (the fact that children learn to read a language in which they are not fluent), and the visual characteristics of Arabic orthography on reading acquisition, and suggest that the particular combination of grapheme-phoneme relations and visual characteristics of Arabic orthography result in a specific reading strategy among skilled readers that involves the cerebral hemispheres differently in Arabic than in Hebrew or English.

**Keywords** Arabic · Cognitive system · Cognitive processing · Diacritics · Diglossia · Unvoweled script · Voweled script · Word reading

## 4.1 Introduction

Previous research has shown that both reading single words and reading acquisition in Arabic is slower than in other languages, even among skilled native Arabic speakers (Azzam 1984; Eviatar and Ibrahim 2004; Abu-Rabia 2001). In addition, the process of reading acquisition by beginning readers seems to be more challenging than in other languages (Saiegh-Haddad 2003). This chapter explores three possible sources for these phenomena, from both a psycholinguistic and a neuropsychological perspective. We examine the effects of diglossia (one manifestation of which is the fact that children learn to read a language in which they are not orally fluent) (for a detailed discussion see Saiegh-Haddad and Henkin-Roitfarb, in this volume), and the visual characteristics of Arabic orthography on reading

Z. Eviatar (✉)
Psychology Department, University of Haifa, 31905 Haifa, Israel
e-mail: zohare@research.haifa.ac.il

R. Ibrahim
Department of Learning Disabilities, University of Haifa, 31905 Haifa, Israel

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acquisition, and suggest that the particular combination of grapheme-phoneme relations and visual characteristics of Arabic orthography result in a specific reading strategy among skilled readers that involves the cerebral hemispheres differently in Arabic than in Hebrew or English.

### *4.1.1 Diglossia*

Arabic has two forms: the *spoken* form (*ʔa:mmiyya*—the spoken vernacular, one of a set of colloquial dialects that share certain syntactic and morphological features and lexicon and differ in others) is used by speakers of the language in a specified geographic area for daily verbal communication, and is the native language of virtually all Arabic speakers. The *literary* form (*fusħa*) is the language in which all speakers of Arabic, from all over the world, read and write. This form of Arabic is universally used in the Arab world for formal communication and is known as "Modern Standard Arabic" (hereafter, StA). Spoken Arabic (hereafter, SpA) is a colloquial dialect and has no formal written form. Everyday life requires a mixing of SpA and StA. This can be seen on television, where characters in shows speak SpA, but announcers speak StA. On news programs, interviewees often mix the two forms of Arabic, whereas interviewers speak StA exclusively. Recently, the advent of the internet and of texting on cellular phones has resulted in a grass-roots development of a written form of *ʔa:mmiya*(SpA) using Latin letters and numbers, known as 'Arabizi' (a combination of 'Arabic' and 'Inglizi' (English) (Bashraheel 2009). To our knowledge, this phenomenon is only beginning to be studied.

The differences between *ʔa:mmiyya* and *fusħa* served as part of the background to the introduction of the term 'diglossia' by Ferguson in 1959, and have generated a long debate over the distinction between diglossia and bilingualism(e.g., Eid 1990). Several psycholinguistic studies have addressed this issue directly. Ibrahim (Ibrahim and Aharon-Peretz 2005; Ibrahim 2009) examined the relationship between the two forms of Arabic in adults, by comparing auditory semantic priming and repetition effects on lexical decisions within the native language (L1 (SpA)) with the effects obtained when the primes were either in StA or in Hebrew (the participant's second language (L2)) and the targets were in Spoken Arabic, and vice-versa. These studies showed that facilitation patterns were more similar between StA and Hebrew than between either of these languages and SpA. Ibrahim suggested that despite the intensive every day use and psychological proximity of SpA and StA, they are represented in two different lexica in the cognitive system of the native Arabic speaker. However, the statistical differences indicate a closer relationship between the two forms of Arabic than between Hebrew and SpA (Ibrahim 2006).

Eviatar and Ibrahim (2000)examined this question in children, by exploring the effects of the relationship between a bilingual's languages and the emergence of metalinguistic skills in childhood. The following hypothesis was addressed: given that bilingual children reveal heightened metalinguistic abilities as a result of acquiring two linguistic systems rather than one, do preliterate and newly literate Arab children evince this effect, before they have been exposed to any other language? The study tested samples of monolinguals (Hebrew), bilinguals (Hebrew and Russian), and Arabic-speaking kindergarten and 1st grade children. The Arabic speakers' first acquired language was Spoken Arabic and they were exposed to StA via story book reading, television, and formal instruction in literacy-related activities in kindergarten and 1st grade. The Russian-Hebrew bilingual children came from immigrant families to Israel from the former USSR. They are growing up in Russian-speaking homes, but attend Hebrew-speaking schools. The Russian-Hebrew bilinguals showed the classic pattern resulting from exposure to two languages: higher performance levels in metalinguistic tests, and lower performance levels in the vocabulary measure as compared to monolinguals. The Arab children's performance levels were similar to those of the bilingual children for the most part, and suggested that exposure to StA in early childhood promotes metalinguistic skills to the same degree observed among bilingual children exposed to two different languages. This implies that Arabic-speaking children raised with SpA and StA behave linguistically and metalinguistically like bilinguals.

## Effects of Diglossia On Readings

Diglossia is a complex phenomenon that can have several effects on the acquisition of reading (see Saiegh-Haddad and Henkin-Roitfarb, in this collection). One effect has been demonstrated by Saiegh-Haddad (2003, 2004), where kindergarten children showed particular difficulty when asked to access StA as against SpA phonological structures in metalinguistic awareness tasks. This difficulty has been demonstrated in explicit as well as implicit phonological awareness tasks (Saiegh-Haddad et al. 2011). Further, formalized as the *Linguistic Affiliation Constraint*, this effect has been shown to have a cross-dialectal validity and to persist across the early elementary grades (Saiegh-Haddad 2007). Saiegh-Haddad has also shown that the recoding of letters representing StA phonemes was correlated with awareness of these phonemes and that letter recoding speed is the best predictor of pseudo-word decoding fluency in the 1st grade. These results were interpreted as indicating that Arabic-speaking children fail to construct accurate phonological and lexical representations for StA words. In convergence with these findings, recent results from our lab (Asaad 2011) reveal that even adult speakers of Arabic are slower in accessing the names of letters representing phonemes that do not exist in their specific spoken dialect. In this study, children and university students were given two versions of the RAN (Rapid Automatized Naming–in which they must name a series of letters as quickly as they can). In one version, the letters represented sounds that occurred in the participants' dialect and in the other, the letters represented sounds that did not occur in their dialect. It was found that although naming time decreased as children grew older and had more experience with StA, letters representing phonemes that only occured in StA were always named more slowly, at all ages (Fig. 4.1).

It is well known that metalinguistic ability, specifically, phonological awareness, is positively related to the acquisition of reading (e.g., Share et al. 1984). As

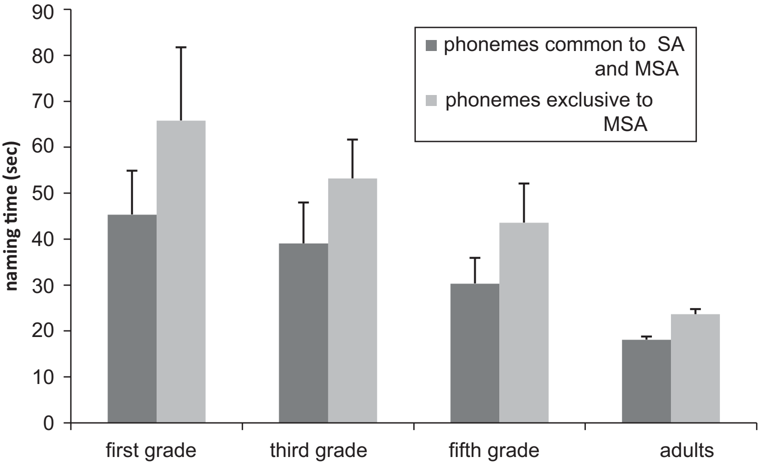


**Fig. 4.1** Response times on the RAN. Error bars are standard errors. SA = the stimuli were letters representing sounds common to both the dialect spoken by the participants (Spoken Arabic) and Modern Standard Arabic; MSA = the stimuli were letters representing sounds that are not part of the dialect spoken by the participants

described above, we have previously shown that children exposed to both forms of Arabic function as bilinguals, as they show higher levels of phonological awareness than age matched monolingual Hebrew-speakers. This would predict that they should show an advantage in reading acquisition. However, the opposite finding has been reported. In addition, we measured the relationship between phonological abilities and various reading measures in the 1st grade in children learning to read either Hebrew or Arabic as L1(Ibrahim et al. 2007). The children were given a series of tests of phonological awareness, a vocabulary test, and grade level texts to read. The correlations between the metalinguistic measures and text reading speed and accuracy are shown in Table 4.1.

It can be seen that out of 8 possible correlations, 7 are significant among the monolingual group, and 6 are significant for the Russian-Hebrew bilingual group. Both of these groups are learning to read Hebrew. For the Arabic-speaking children who are learning to read Arabic, only 3 of the correlations are significant. This implies that there is a weaker relationship beween phonological abilities and reading in Arabic than in Hebrew. Table 4.1 also shows that the children reading Arabic read more slowly and make more errors than the children reading Hebrew. Thus, although the Arab children evince higher levels of phonological awareness-than monolingual Hebrew-speakers, this phonological awareness advantage does not translate into an advantage in reading acquisition. What could be the reason for this? StA has an alphabetic orthography, like English and Hebrew, and in both these languages, phonological awareness is a very good predictor of success in reading acquisition. One possible answer might be related to the effect of the diglossia—the two groups who were reading Hebrew were fluent in Hebrew, while Arab children were learning to read a language in which they are not fluent. This may weaken the

**Table 4.1** Correlations between measures of phonological ability and vocabulary and mean text reading time (RT) and errors (ERR) in 1st grade children. The monolinguals and Russian-Hebrew bilinguals are learning to read Hebrew. The Arabic speakers are learning to read Arabic. Negative correlations reflect the relationship between high scores on the phonological and vocabulary tests, and faster reading rates and fewer errors in text reading. Only significant correlations are shown ($p<0.05$)

| | Hebrew monolinguals $N=20$ | | Russian-Hebrew bilinguals $N=19$ | | Arabic readers $N=20$ | |
|---|---|---|---|---|---|---|
| Text reading | *RT* | *ERR* | *RT* | *ERR* | *RT* | *ERR* |
| *Phonological tests* | | | | | | |
| Initial phoneme | −0.46 | ns | −0.51 | −0.47 | ns | ns |
| Final phoneme | −0.59 | −0.48 | −0.48 | Ns | ns | ns |
| Deletion | −0.80 | −0.82 | −0.56 | −0.61 | −0.46 | −0.55 |
| Vocabulary | −0.55 | −0.52 | ns | ns | −0.54 | ns |
| *Mean* | 127 s | 5.6 | 112 s | 3.1 | 190 s | 8.6 |
| *SD* | 69.2 | 6.4 | 55.7 | 4.1 | 74.1 | 5.0 |

relationship between phonological awareness, word decoding, and reading acquisition (Saiegh-Haddad 2005; Saiegh-Haddad et al. 2011).However, it has been shown that skilled adult readers of Arabic also read more slowly than skilled adult readers of other languages (Azzam 1993). Therefore, diglossia cannot be the only reason for this pattern. What could be blocking the facilititative effect of phonological awareness? We hypothesized that the visual complexity of Arabic orthography may be this factor, an aspect to which we now turn.

### *4.1.2 Arabic Orthography*

For a comprehensive presentation of the Arabic language and alphabet, see Chapter 1 of this volume by Saiegh-Haddad and Henkin-Roitfarb. We will focus on two separate aspects of Arabic orthography, which may or may not be related. The first aspect is orthographic depth. This concept has to do with the relationship between letters and the sounds they represent (Katz and Frost 1992). Orthographies in which this relationship is straight-forward (such as Spanish) are considered ’shallow’, whereas orthographies in which it is not (such as English), are considered ‘deep’. The second aspect of the orthographic system that can affect reading processes is the visual complexity of the letters themselves. Recently, a study by Rao et al. (2011) examined the effects of both orthographic depth and visual complexity in Urdu and Hindi. They measured speed and accuracy of reading single words in Urdu (in which the deep orthography is based upon a modification of Perso-Arabic script), and in Hindi (which uses a shallower, and less visually complex orthography), in Urdu-Hindi adult bilinguals. They reported that despite the fact that Urdu was the participant’s native language and the language in which most of their schooling took place, responses to Urdu were consistently slower and more error prone than for Hindi. The authors suggested that this is due not only to the differences in orthographic depth in the two languages, but also because Urdu is visually more complex than Hindi.

In Arabic all verbs and most nouns are written primarily as roots that are differently affixed and voweled to form the words of the lexicon (Prunet et al. 2000). This root-pattern morphological structure has psychological reality (see Boudelaa , in this collection). Most written texts do not mark short vowels. When vowels are included in the text (in poetry, children's books and liturgical texts), they are signified by diacritical marks above or below the letters within words. Inclusion of these diacritical marks completely specifies the phonological form of the orthographic string, making it completely transparent in terms of orthography/phonology relations. Thus, voweled Arabic words are orthographically shallow, in the sense that all of the phonological information necessary for identification is represented. Unvoweled Arabic texts are orthographically deep, because information about vowels must be inferred from the morphological, the contextual and the lexical cues present in the text.

An additional source of complexity arises from the role of dots in Arabic orthography. Dots comprise an integral part of many letters, and there are many sets of letters that have a similar or even identical structure, and are distinguished only on the basis of the existence, location and number of dots (e.g. the Arabic letters representing /t/ /*n*/, /θ/ and /*b*/ are represented by the following graphemes: ت, ن, ث, ب; the graphemes representing/r/ and/z/ are represented by the graphemes ر and ز)

In addition, 23 of the 29 letters in the alphabet have four shapes each (word initial, medial, final, and when they follow a non-connecting letter, for example, the phoneme/*h*/ is represented by the graphemes: (ه ـهـ ـه هـ), and six letters have two shapes each, final and separate. Thus, the grapheme phoneme relations are quite complex in Arabic, with similar graphemes representing quite different phonemes, and different graphemes representing the same phoneme.

Another characteristic of the Arabic orthography is that the majority of letters must be connected to their neighbors mostly from both sides (right and left), except for six letters (اـدـذـرـزـو). The unique aspect of these six letters is the fact that they can only be connected from their left side. Thus, most words in the language are comprised of completely connected letters, or contain at least some connected letters, with letter strings composed of separate letters being very infrequent (for a detailed discussion of the linguistic and orthographic features above, see Saiegh-Haddad and Henkin-Roitfarb, in this collection).

We hypothesized that the visual complexity of Arabic orthography may interfere with the acquisition of automatic grapheme-phoneme relations, and in the automatization of reading.

## The Effects of Orthographic Complexity on Letter and Diacritic Vowel Identification

Orthographic complexity has been shown to affect letter and vowel perception and identification in both beginning and skilled readers. In three studies with skilled readers, we showed that the identification and manipulation of Arabic letters is slower than that of both Hebrew and Latin letters. In the first study (Ibrahim et al. 2002), we asked 10th grade students who were native Arabic-speakers and were studying in Arabic to complete the Trails Test with Hebrew and with Arabic letters. Arab schools begin teaching Hebrew as a foreign language in 2nd grade, and English in 3rd grade, such that these students are multilingual. We used oral and visual variants of the trail making test (Reitan 1971) in Arabic and Hebrew. Both versions have two levels of complexity: the oral version of Level A requires the declamation of numbers (up to 20) and letters, in order. The visual version requires connecting numbers *or* letters, which are randomly positioned on a page, in the right order. Level B in the two modalities requires alternation between letters and numbers. The oral version of Level B involves declamation of the alternation (A 1, B, 2, etc.). The visual version requires alternation on the page, which has both letters and numbers. Performance time was the dependent variable. At the low level of complexity (Level A) there were no differences between performance in Hebrew and in Arabic in either the oral or the visual versions. In the more complex version (Level B), language (Hebrew or Arabic) did not affect speed in the oral version, but in the visual version, the test in Arabic was performed significantly more slowly than the test in Hebrew. Thus, among these skilled readers, when the task required more attention, the recognition of written letters in Arabic took longer than in Hebrew.

In the second study we showed Arabic, Hebrew, and English speaking university students consonant-vowel-consonant (CVC) nonsense trigrams in their native language, and asked them to name the letters making up the trigram (Eviatar and Ibrahim 2004). We titrated the time that the stimuli were shown individually for each participant, in order to achieve an error rate of 50 %. The top panel of Fig. 4.2 shows the mean exposure duration necessary for each language group to make 50 % errors. It can be seen that English-speakers only reach this error rate when the stimuli are presented extremely quickly, Hebrew-speakers make errors when the stimuli are exposed for almost twice as long, and Arabic-speakers already make 50 % errors in letter identification with much longer exposure durations.

In the third study with university students, we used an even simpler task (Eviatar et al. 2004). We presented pairs of letters in Hebrew and in Arabic, and asked the participants to decide if the two letters were physically identical or not. The Arab students were bilinguals, and could read both Arabic and Hebrew;the Hebrew-speakers could not read Arabic. The response times and error rates from this study are shown in the bottom panels of Fig. 4.2. It can be seen that for both groups—those who know how to read Arabic, and those who do not—responses to pairs of letters from the Arabic alphabet are slower than to pairs of letters from the Hebrew alphabet.

In our next study (Abdulhadi et al. 2011), we used an even simpler task. We hypothesized that voweled text may result in perceptual overload, making simple detection of letters and vowels more difficult. In this study we asked children in 3rd and 6th grade, who were identified by their teachers as good readers, to detect a vowel diacritic in a three-letter stimulus in Hebrew and in Arabic. In both languages, the target was the diacritic for the vowel ‘a’, which is a small horizontal line that appears above the letter in Arabic and below the letter in Hebrew. The stimuli were of the type illustrated in Table 4.2, such that children saw both words,

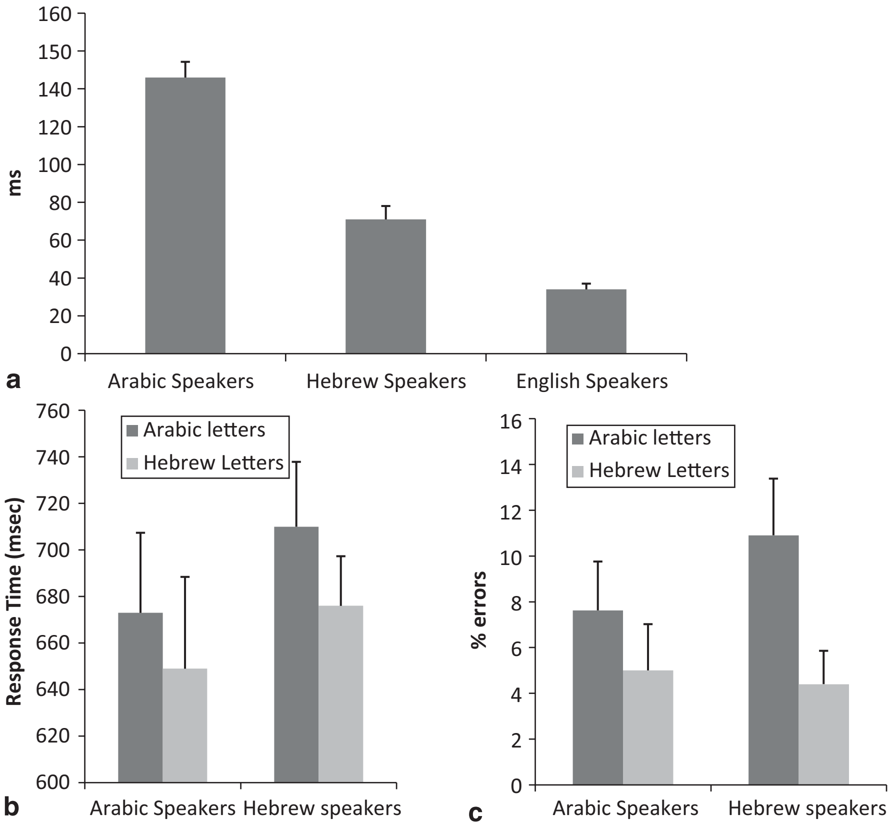


**Fig. 4.2** Letter processing in adult skilled Arabic readers. *Panel a*: mean exposure duration to achieve a 50 % error rate in letter identification of nonsense trigrams in native readers of Arabic, Hebrew, and English. *Panels b and c*: response times and error rates for a letter matching task in Arabic and Hebrew using a physical identity criterion. Error bars are standard errors

nonsense trigrams, and non-letter stimuli. In Arabic we categorized the stimuli as *simple*, if they were comprised of letters that do not connect, *connected*, if they were comprised of connecting letters that do not utilize dots, and *complex*, when they were comprised of connecting letters that include dots.

The results of this experiment are illustrated in Fig. 4.3. There are three important findings here: the first is that again, and as shown in the top panel, detection of a diacritic vowel target was faster in Hebrew (their L2) than in Arabic. We believe that this pattern results from the fact that the Hebrew stimuli are visually less complex than the Arabic stimuli. The remaining findings are new, and we will now examine each one separately.

Second, the children did not show a word superiority effect in either response latency or sensitivity. The word superiority effect is the consistent finding that among literate participants, letters are detected faster and more accurately in the context of real words than in pseudo-words (Cattell 1886).The usual explanation for this effect is that real words are recognized quickly via their global features, such that

**Table 4.2** Stimuli in the target detection task

| Arabic stimuli: Lexicality levels | Orthography groups | ◌َ Target present | Target absent |
|---|---|---|---|
| Real words | 1) Simple | دُرَرٌ | إرْمِ◌ |
| | 2) Connected | مَطرٌ | مُعْدٍ |
| | 3) Complex | نَتَجَ | خُبزٌ |
| Pseudo-words | 4) Simple | وَرَحٌ | ودْمٌ |
| | 5) Connected | عَسْمٌ | لُكدٌ |
| | 6) Complex | بَشيَ | فُخِض |
| Non-letters | 7) Simple | [illegible] | [illegible] |
| | 8) Connected | [illegible] | [illegible] |
| | 9) Complex | [illegible] | [illegible] |
| *Hebrew stimuli* | | ◌َ *Target present* | *Target absent* |
| Real words | | שִׂיחַ | עֶרֶב |
| Pseudo-words | | צַדַב | דֶרֶר |
| Non-letters | | [illegible] | [illegible] |

their constituents (the letters) can be inferred quickly, whereas non-words, being novel stimuli, require sequential letter-by-letter processing. The fact that even the 6th graders did not detect the vowel diacritic faster or more accurately in the context of a real word than in the context of a nonsense word, suggests that the readers were not using a global word-form strategy. If words, non-words, and non-letter stimuli are processed similarly, this may indicate a low level of automatization of the reading process.

The third interesting finding from this experiment somewhat mitigates the conclusion in the previous paragraph. This is that among the responses to Arabic stimuli, we found a difference between words and non-words on the one hand, and non-letter stimuli on the other hand. That is, when the stimuli were composed of real letters, the fastest and most accurate responses were obtained on the connected stimuli. We believe that this reflects a frequency effect—recall that the majority of words in Arabic are comprised mostly of completely connected letters, such that words comprised of three unconnected letters are very rare. The finding that the children can detect the fatha more accurately and more quickly when the stimuli are comprised of connected rather than unconnected letters suggests that we may be tapping a perceptual strategy that is specific to text, and is affected by their previous experience with texts, even though it is not sufficiently developed to distinguish between words and non-words.

### *4.1.3 Strategies of Reading*

The results reported above suggest that 3rd and 6th graders used a different perceptual strategy when the stimuli were more word-like (e.g., comprised of connected letters) than when they were less word-like (e.g., comprised of separate letters). Thus, it

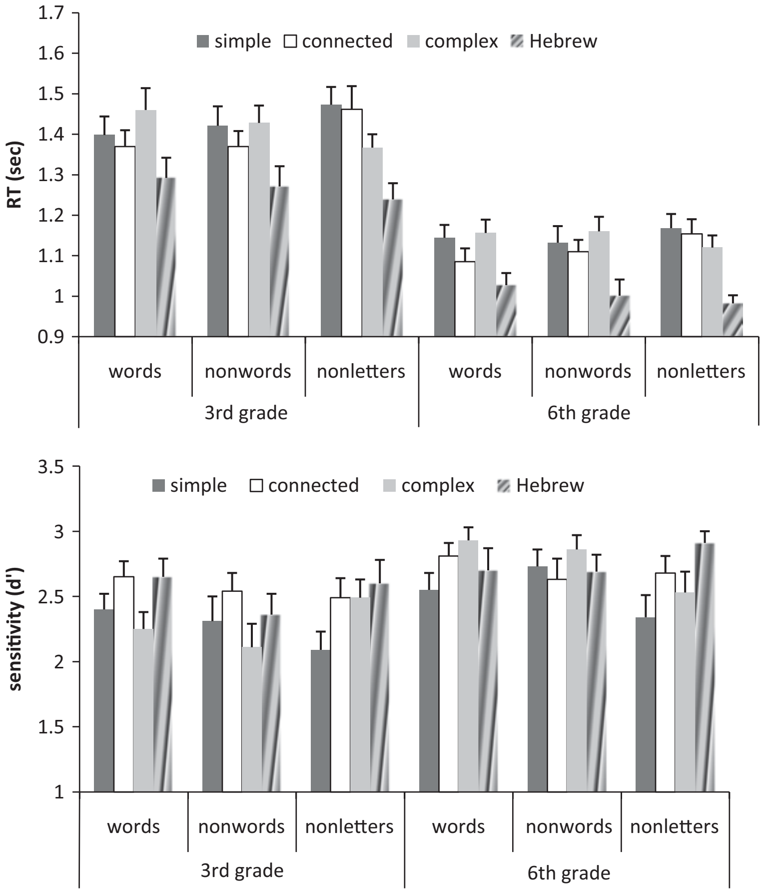


**Fig. 4.3** Response times and sensitivity scores for 3rd and 6th grade good readers in Arabic, to detect a vowel diacritic. Sensitivity scores (d') index the difference between 'hits' (correctly identifying the target) and 'false alarms', (errors in which the participants indicated the target was present when it actually was not). All of the sensitivity scores are significantly different from 0, indicating that the participants were not responding at chance level. Error bars are standard errors

may be that there is some automaticity of the cognitive processes that underlie reading, although the degree of this automaticity may not be strong enough to result in a word superiority effect in the vowel detection task. Additional support for the hypothesis that there is some degree of automaticity in reading comes from two *Stroop* experiments conducted by Asaad (2011). In these experiments, 1st, 3rd, and 5th graders performed the regular *Stroop* test, in which we compared the time taken to name the ink color of words that named other colors (as in the word 'red' written in blue ink, where the correct answer is 'blue') versus the time taken to name the ink color of words that depict color-neutral objects (as in the word 'rod' written in blue ink). The difference between these conditions is called the '*Stroop* effect' and is interpreted as an index of the automatic aspect of reading. In the second experiment,

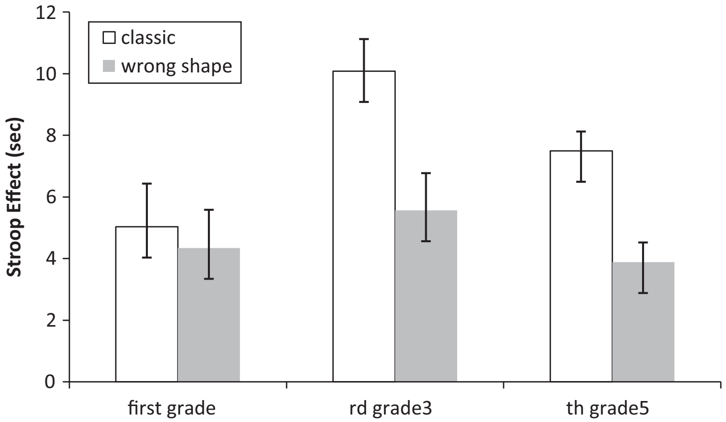


**Fig. 4.4** Stroop effects in children with differing levels of skill in reading, with the regular Stroop stimuli and with words written with the right letters in the right sequence, but in the wrong shape. Error bars are standard errors

the same participants performed the *Stroop* test, but the color words were now written in the wrong shapes. Recall that in Arabic, letter shapes change according to their place in the word. In this 'wrong-shape' *Stroop*, the color words were written with the correct letters in the correct sequence, but they were in the wrong shape. The difference in the *Stroop* effects can be seen in Fig. 4.4. It can be seen that in 1st grade, both types of *Stroop* stimuli result in the same degree of *Stroop* interference. This suggests that the children were reading both the correctly written and the incorrectly written words in a letter-by-letter sequential manner. In 3rd and 5th grades, the regular *Stroop* effect is much larger, and the 'wrong-shape' *Stroop* effect is smaller—actually, the same degree as shown by the 1st graders, suggesting that older children were reading the strange words in a sequential letter-by-letter manner, because they do not conform to the orthographic rules of Arabic. However, when words are written correctly, the older children evince a large *Stroop* effect, which is interpreted as indexing the automaticity of reading. This is because although the task requires the children to ignore the meaning of the color word (recall that the task is to name the color of the ink), they cannot, and this interferes with the naming of the ink color.

These results support the hypothesis that at least by 3rd grade, children are using a more holistic, or global strategy to read in Arabic, because words written with wrong shaped letters interfere with this strategy (this interference results in less automaticity and a smaller *Stroop* effect). These complex findings show that even though the detection and identification of letters is slower in Arabic than in Hebrew or English, the process of reading includes automatic components, as it does among skilled readers in other languages (e.g., Ellis et al. 2009).Thus, reading in Arabic shows both common and unique features as compared to English and Hebrew. We continued to explore these features by examining neuropsychological measures of reading; specifically, we examined the relative involvement of the cerebral hemispheres in letter and word identification.

### 4.1.4 Hemispheric Specialization for Reading in Arabic

There is a general consensus that both cerebral hemispheres are involved in the process of reading (e.g., Beeman and Chiarello 1998; Peleg and Eviatar 2008).The relative contribution of each hemisphere to the process seems to be a function of individual differences (e.g., Kinsbourne 1998) that are related to handedness and other factors and to the characteristics of the language being read (Eviatar and Ibrahim 2007; Eviatar 1999). One way to assess hemispheric function is to use the Divided Visual Field (DVF) paradigm. This experimental paradigm takes advantage of the way in which the eyes are hooked up to the primary visual cortex, such that stimuli presented to the right of visual fixation are available only to the left hemisphere (LH) at the first stages of processing, and stimuli presented to the left of visual fixation are initially available only to the right hemisphere (RH). This contra-lateral organization has been verified by electrophysiological and imaging data (Coulson et al. 2005; Khateb et al. 2001). Lateralized presentation of linguistic stimuli usually results in performance asymmetries, such that participants respond faster and more accurately to stimuli presented in the right visual field (RVF), directly to the LH, than to stimuli presented in the left visual field (LVF), directly to the RH. This performance asymmetry is taken to reflect hemispheric functioning. Variations in the performance asymmetry are then interpreted as variations in hemispheric functions for different types of stimuli and for different groups of participants.

We used the DVF paradigm to examine letter identification and lexical decision tasks in Arabic, and compared them to the performance of native speakers of Hebrew. In addition, in some of the tasks, given the multilingualism of Arab participants, we examined the patterns of performance asymmetry in native Arabic readers in Arabic and Hebrew. This allowed us to attempt to disentangle which of the behavior patterns are due to the language experience of the participants, and which are due to the requirements of the orthography. We detail our findings below with both letter identification tasks and lexical decision tasks.

#### Letter Identification

Previous research has shown that both hemispheres are able to match letters in English, both by shape or by name (Eviatar and Zaidel 1992,1994). In the letter matching paradigm in English, pairs of letters are presented in the peripheral visual fields, and the participants make same/different judgements using different criteria: the physical criterion requires that the letters be visually identical; the nominal criterion requires that the letters have the same name, or signify the same phoneme. In the previous section we presented the data from an experiment where Arabic-Hebrew bilinguals and Hebrew-speakers who do not know Arabic performed the matching task when the stimuli were presented in the center of the visual field (Eviatar et al. 2004). Figure 4.5 presents the findings from the lateralized conditions of this matching task (recall that participants were to match the letters by physical identity). The response time data in the top panel reveal the effect of knowing how

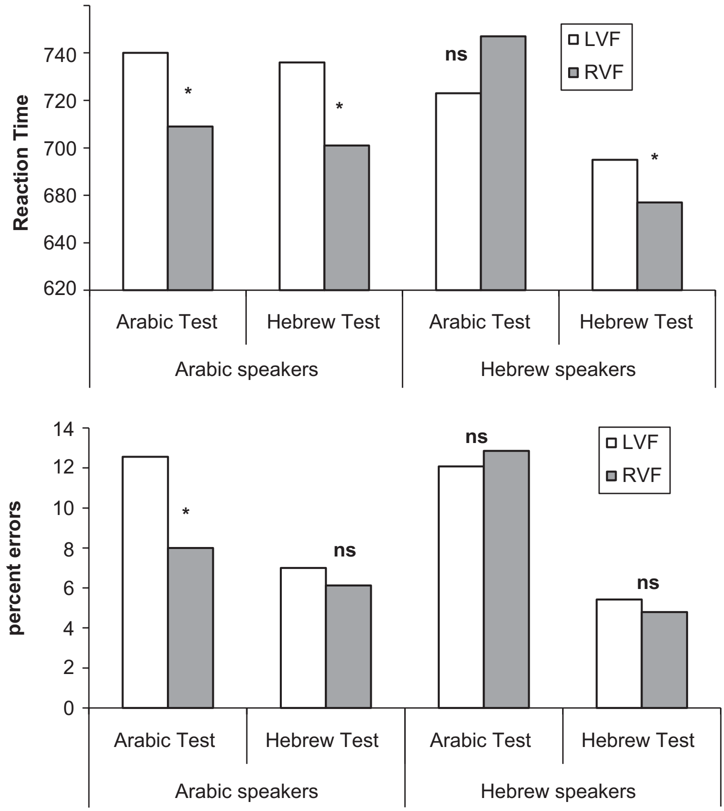


**Fig. 4.5** Response time and error rates on a lateralized letter matching task by Arabic-Hebrew bilinguals and Hebrew-speakers who do not know Arabic. * indicates a significant difference between responses in the two visual fields

to read the language.Recall that both Arabic-speakers and Hebrew-speakers can read Hebrew, and the figure shows that both groups perform faster when the pairs of letters are presented in the RVF rather than in the LVF, reflecting greater LH efficiency in doing the task. The Arabic-speakers can also read Arabic, and they show this pattern for Arabic as well. Thus, if the subjects can read the language, we see a performance asymmetry that reflects LH specialization. The Hebrew-speakers cannot read Arabic, so that for them, the task is an abstract shape matching task. They show no advantage of one hemisphere over the other.

The most dramatic results are seen in the analysis of errors.The cell means are presented in the lower panelof Fig. 4.5. It can be seen that both hemispheres of Arabic-speakers and Hebrew-speakers are equally quite accurate in the same-different judgement on Hebrew letters. These results converge with the previous findings in English mentioned above, which showed that this task is within the capability of both hemispheres (Eviatar and Zaidel 1992, 1994). It can also be seen that both hemispheres of Hebrew-speakers make many more errors on the Arabic stimuli, reflecting the difficulty of the task for them. The interesting findings are in the laterality pattern of the Arabic-speakers. The LH (indexed by responses to stimuli in the RVF) is as accurate with the Arabic stimuli as with the Hebrew stimuli. However, the RH (indexed by responses to stimuli in the LVF) shows an error rate that is equal to that of the Hebrew-speakers, who do not read Arabic.

We interpret these findings as suggesting that the RH of literate Arabic-speakers was performing the task in a non-linguistic manner. The RH of the Arabic native speakers, which is capable of using a linguistic strategy for matching pairs of Hebrew letters, is incapable of using the same strategy to match Arabic letters (Eviatar et al. 2004). What could be the reason for this?

We hypothesize that the specific structure of Arabic letters interacts with hemispheric abilities and results in a RH deficiency in letter identification. Specifically, we invoke the relative insensitivity of the RH to the local aspect of hierarchical stimuli (e.g., Robertson 1995). This is the general finding that the RH tends to be more sensitive to the global aspects of visual stimuli, and the LH tends to be more sensitive to the local aspects of visual stimuli (Ivry and Robertson 1998). As such, if the two Arabic letters for the sound /b/ and the sound /*t*/ share the same basic shape but differ only in the fact that the former has one dot below it while the latter has two dots above it, is it possible that the RH fails to distinguish beween them? To test this hypothesis (Eviatar et al. 2004, Experiment 2), we created Navon-type hierarchical stimuli (Navon 1977), with two kinds of letter pairs; a pair that differ in their basic shape (م and ت), and a pair that are identical in their basic shape, but differ in the number and placement of dots (ت and ب). These are illustrated in the top panel of Fig. 4.6. The congruent stimuli are comprised of small versions of the letter that are arranged in a global pattern of the same letter. The incongruent stimuli are comprised of small versions of one letter arranged in a global pattern of another letter. There were two kinds of incongruent stimuli; one type used two very different letters, and the other type used two very similar letters. We asked the participants to identify the letter in the global level in one block, and in the local level in the other block. Differences in response time between the congruent and incongruent stimuli represent the amount of interference from one level of the hierarchical stimuli to another. Thus, when participants are asked to identify the large, global stimulus, slower responses for the incongruent condition than for the congruent condition reflect interference from the local to the global level. In the same manner, when particpants are asked to identify the small, local letter, slower responses to the incongruent stimuli than to the congruent stimuli represent interference from the global level. The lower panels of Fig. 4.6 summarize the results.

Figure 4.6 shows that when participants were asked to identify the large (global) letter, both hemispheres show some interference from the local level when the incongruent condition contains two very different letters (م and ت). This interference is larger (the graph on the left) in the RVF (where the stimuli are initially processed by the LH), and converges with other reports of higher sensitivity to the local aspect of letters in the LH than in the RH (e.g. Van Kleeck 1989; Fink et al. 1997). However, when the incongruent condition was comprised of two very similar letters (ت and ب), neither hemisphere showed interference. Thus, incongruent stimuli were

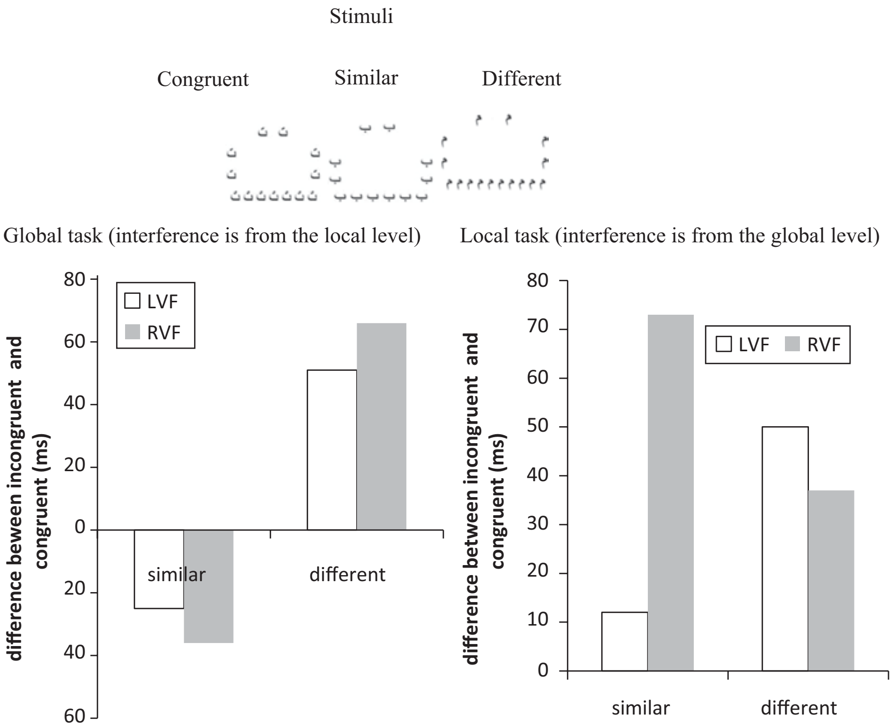


**Fig. 4.6** Sensitivity of the two hemispheres to visual similarity between letters

processed as quickly as congruent stimuli by both hemispheres in the global task when the letters were very similar.Thus, it looks as if in this condition, the participants did not notice that there were two different letters making up the incongruent stimulus. When the participants were asked to identify the small (local) letter (the graph on the right), we see a different pattern. When the incongruent condition is made up of different-looking letters, again we see interference from the global letter in both hemispheres, such that identification of the local elements of incongruent stimuli takes longer than identification of the local elements of the congruent stimuli. This interference is stronger in the LVF than in the RVF, replicating previous findings suggesting that the RH is more sensitive to the global aspect of these stimuli than the LH (e.g. Van Kleeck 1989; Fink et al. 1997). The dramatic finding is in the local condition, when the stimuli were comprised of similar letters—in the RVF (where the stimuli are processed initially by the LH ) there is interference in the incongruent condition. That is, the fact that the letter on the global level was different from the letter on the local level resulted in a slower response. However, in the LVF (where stimuli are initially processed by the RH), there was no difference between the congruent and the incongruent conditions. This suggests that when the stimuli are initially presented to the RH, ب and ت do not interfere with each other—they are percieved as the same letter.

## Word Identification

In order to explore word recognition in the cerebral hemispheres, we performed two lateralized lexical decision tasks in Arabic(Eviatar and Ibrahim, 2007). In both experiments, adult readers were exposed to 3–5 letter stimuli, half of which were real words in Arabic, and half of which were nonsense words. The task was to decide if the stimulus was a word or not. In these experiments we were interested in the effects of morphological complexity in different languages on hemispheric involvement in reading. These results have been published (Eviatar and Ibrahim 2007;Ibrahim and Eviatar 2009). Recently, we reanalyzed the Arabic data of the Arabic native speakers, examining the responses to words and non-words, irrespective of morphological structure (Ibrahim and Eviatar 2012). There were two experiments that differed in the following manner—in the *bilateral* experiment, two words were shown on each trial, and a central arrow informed the participants which of the stimuli was the target for their lexical decision. This enables the measurement of response time and accuracy in each visual field (indexing the involvement of the contralateral hemisphere), while a distractor is being simultaneously presented to the other hemisphere. In the *unilateral* experiment, a different group of Arabic native speakers were presented with only one stimulus on each trial. Thus, in this experiment, it should have been easier for interhemispheric communication to occur—because the other hemisphere was not presented with a distractor. This allows us to index the degree to which performance in one visual field is a true reflection of *independent* hemispheric abilities (i.e.,of the LH in the RVF and of the RH in the LVF). If there is a difference between performance in the visual field between the unilateral and the bilateral experiments, this suggests that in the unilateral condition, performance reflects the combined abilities of the two hemispheres—that is, that hemispheric integration occurred. If performance in the two experiments is equal, this suggests hemispheric *independence*. The results of the two experiments are illustrated in Fig. 4.7. The top panel shows the response times of correct responses for words and non-words. The bottom panel shows the sensitivity(d') scores in the two experiments. This measure indexes the ability of participants to distinguish between words and non-words, by taking into account both correct responses (responding 'word' when the stimulus was indeed a word) and false alarms (responding 'word' when the stimulus was a non-word).

These results imply that the RH, on its own, cannot distinguish between words and non-words in Arabic. This interpretation is supported by the finding that for latency of correct responses to words, RT is much longer in the bilateral condition than in the unilateral experiment in the LVF (when the stimuli were presented directly to the RH). This supports the hypothesis that when the LH was not busy processing the stimulus presented to it (in the unilateral experiment, where only one stimulus was shown per trial), interhemispheric interaction occurred that resulted in faster responses in the LVF. That is, the LH helped the RH perform the lexical decision faster when it was not busy than when it was busy processing the distractor (in the bilateral experiment). It can be seen that this difference does not occur for RVF responses, suggesting that what happens in the RH is irrelevant for LH processing.

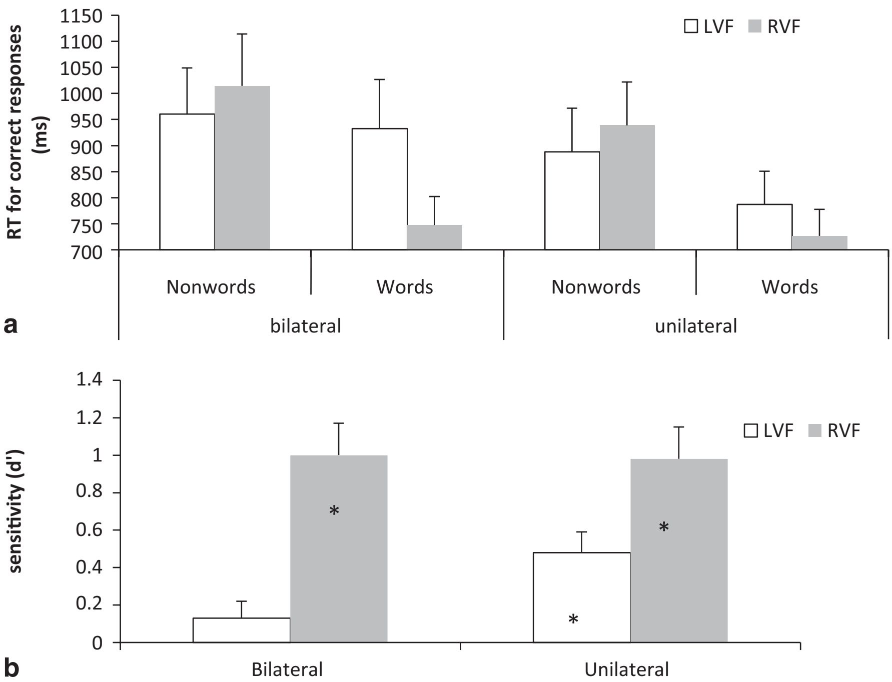


**Fig. 4.7** :*Panel a*: response times of skilled Arabic readers in two lateralized lexical decision experiments. In the bilateral condition two stimuli were presented on each trial with a central arrow indicating which one was the target. In the unilateral condition only one stimulus was presented on each trial. Error bars are standard errors. *Panel b*: sensitivity scores * indicate that d' is significantly different from 0, such that participants were not responding at chance level

That is, the LH can perform the lexical decision task independently, whereas the RH cannot.

On the basis of these findings we have suggested that the RH is less involved in letter and word identification in Arabic than it is in Hebrew and English (Ibrahim and Eviatar, 2012). Given that we know that the RH is highly involved in the early stages of reading in adults in both Hebrew and English (e.g., Beeman and Chiarello 1998; Eviatar 1999), this hypothesis might suggest a neural source for the slowness of reading acquisition in Arabic as compared to other alphabetic languages. The early stages of reading or word identification are characterized by the serial processing of letters, the computing of their phonological value, and the combination of these parts into the whole word (Aghababian and Nazir, 2000). As children become more skilled readers, they develop a faster, parallel manner of identifying words, based on global shapes as well as on the identity of their constituent letters (e.g., Stanovich and West 1989; Taouk and Coltheart 2004). This ability has been shown to be related to the development of a specific region in the fusiform gyrus in the left hemisphere, which was termed 'the visual word form area' by McCandliss et al. (2003). Imaging studies show that activation in this area is affected by orthographic structure, by word frequency, and by lexical status: the region is activated more by real words than by nonsense words (e.g., Vinckier et al. 2007). It may be the case that the development of this specialization in Arabic takes longer than it does in other, more visually simple languages.

## 4.2 Conclusion

We have shown that the combination of diglossia and the visual characteristics of Arabic orthography result in slower or lessened automation of various basic reading processes. We have suggested that the specific combination of visual characteristics and the limited capabilities of the right hemisphere lessen its ability to participate in initial word identification processes as well as in skilled reading. These findings provide a tentative answer to our question:“why is it hard to read Arabic?” There seem to be two separate sources for this difficulty. The first is that children are learning to read in a language in which they are not fluent. The second is that the orthography that they are learning has specific visual characteristics whichrestrict the contribution of the RH to reading acquisition, as it does in other languages.

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# Part III
# Arabic Reading and Spelling Development and Disorders

# Chapter 5
# An Epidemiological Survey of Specific Reading and Spelling Disabilities in Arabic Speaking Children in Egypt

**Wessam Mohamed, Karin Landerl and Thomas Elbert**

**Abstract** While the relationship between reading and spelling disabilities has been reported for many European orthographies, very few studies have been conducted on other types of orthographies. The current chapter studies the relationship between reading and spelling deficits in Arabic based on an epidemiological survey of these deficits in Arabic-speaking children in Egypt. We screened a sample of 1106 Arabic-speaking third graders for their reading and spelling abilities. The prevalence rate for combined deficits in reading as well as spelling was high (12.6 %), but very low for isolated deficits in reading (0.9 %) or spelling (1.1 %). Importantly, we observed less dissociation of reading and spelling in vowelized Arabic compared to shallow orthographies such as German. This finding has implications for word processing in Arabic and it highlights the need for further studies of both typical and atypical development of literacy skills in Arabic-speaking children.

**Keywords** Arabic · Dyslexia · Reading · Spelling-dissociation · Incidence-fluency · One-minute test · Bilingualism

## 5.1 Introduction

No orthography appears to be immune to literacy disorders. Whereas the majority of children master their literacy skills effortlessly, in all orthographies, some children show impairments in converting sounds to their corresponding written units (Boets et al. 2006; Hoien et al. 1995), a central symptom of dyslexia. Dyslexia has been

W. Mohamed (✉)
Department of Educational Psychology, Faculty of Education,
Fayoum University, Faiyum, Egypt
e-mail: wam02@fayoum.edu.eg

K. Landerl
Department of Psychology, University of Graz, Graz, Austria
e-mail: karin.landerl@uni-graz.at

T. Elbert
Department of Psychology, University of Konstanz, Konstanz, Germany
e-mail: Thomas.elbert@uni-konstanz.de

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characterized by an unexpected difficulty in reading despite adequate opportunities, intellectual ability, and motivation (Jiménez et al. 2009; Shaywitz and Shaywitz 2001).

### *5.1.1 Are Reading and Spelling Two Sides of the Same Coin?*

According to ICD-10, (World Health Organization 2000), spelling difficulties are frequently associated with a specific reading disability and they often persist into adolescence even after some progress in reading has been made. This is likely due to the fact that the two components of literacy, reading and spelling, are closely linked yet not identical. Empirical evidence shows that the correlation between word reading and spelling in English ranges between 0.77 and 0.86 (Ehri 1997). Such high correlations indicate that very similar processes are measured in these tasks even when different materials for reading and spelling are used. This is true among younger (first to sixth graders) as well as college students (Ehri 1997). This suggests that a single orthographic lexicon is probably used for reading and spelling processes (Leppänen et al. 2006; Lerkkanen et al. 2004) . Furthermore, both reading and spelling require in part the same phonological and visual skills.

Although the association between reading and spelling development is strong, there exist a considerable number of children with striking dissociations. This has been documented by the ICD-10 diagnosis of a specific spelling disability for individuals with intact reading skills. Moreover, observations of dissociations in both directions (good reading/poor spelling and poor reading/good spelling) have been reported in French (Fayol et al. 2009) and in German (Moll and Landerl 2009; Wimmer and Mayringer 2002). In English, empirical evidence suggesting separate mechanisms for spelling and reading was provided by Bryant and Bradely as early as 1980. According to their studies, both dyslexic and non-dyslexic beginning readers read more words accurately than they were able to spell. However, some children were able to spell some words but unable to read them with a prevalence rate of 3 and 13 % for dyslexic and non-dyslexic children, respectively. In a similar study, Gough et al. (1992) found that non-dyslexic beginning readers were sometimes able to spell words they were unable to read (on average 10 %). Also, they were able to read words on one occasion but not on another (10 %) and, sometimes, they spelled words inaccurately on one occasion, but not on another (11 %). Neuropsychological case studies of patients after brain damage describe clear alexia without agraphia (for review, see Coslett 2000) as well as clear agraphia without alexia (e.g., Beauvois and Derouesne 1981).

In alphabetic orthographies, reading is commonly thought to precede spelling during development (Leppänen et al. 2006). This is probably due to a certain amount of asymmetry between the consistency of grapheme-to-phoneme and phoneme-to-grapheme conversion in most alphabetic writing systems. In languages like Spanish, German, Dutch, or Greek, there is, mostly, one way to pronounce one grapheme but there is sometimes more than one graphemic representation for a phoneme (Abu-Rabia and Taha 2004). Also, reading requires recognition of orthographic representations only, while spelling requires full retrieval of the correct letter sequence from orthographic memory (Moll and Landerl 2009).

### *5.1.2 Reading and Spelling in Arabic*

The Arabic writing system is primarily consonantal with short vowels (as well as other phonological material) represented by optional diacritics. All diacritics mapping phonemic material are regularly mapped onto the phonemes they represent. (For a detailed description of Arabic language and orthography, see Saiegh-Haddad & Henkin-Roitfarb, in this collection.) Only when these diacritics are marked (vowelized or vocalized script) can the Arabic orthography be described as *orthographically transparent* (Elbeheri and Everatt 2007; Saiegh-Haddad 2005). Evidence shows that vowelization functions as a significant facilitator of reading accuracy and reading comprehension in beginning and more advanced Arabic learners (Abu-Rabia 1997, 2001, 2002; Abu-Rabia et al. 2003; Taouk and Coltheart 2004).

Paradoxically, the diacritical system in Arabic, although useful in decreasing phonological ambiguity, might constitute a source of difficulty for the beginning reader while mastering Arabic word-decoding skills necessary for the development of the phonological (non-lexical) route. This could be attributed to the complexity of the vowelization system which requires use of visuo-spatial processing (Meyler and Breznitz 1998). When texts are not vowelized, as is the case in most modern written and printed literary texts, the reader has to depend on context and/or morphology and syntax in order to identify words (Abu-Rabia 1998).

Arabic is also considered a typical case of *diglossia* (Ferguson 1959; Hudson 2002). This phenomenon refers to the use of two varieties of the same language in the same speech community, one for *High* and another for *Low* functions. In Arabic, as a typical case of diglossia, the spoken and the written languages are substantially different in terms of vocabulary, phonology, syntax, and grammar. (For more on diglossia and its implications for literacy acquisition, see in this collection, Laks & Berman, for linguistic distance, Myhill for a cross-linguistic perspective, Khamis-Dakwar & Makhoul for assessment, and Saiegh-Haddad & Spolsky for educational problems and prospects.) This linguistic distance implies that Arabic native speaking children learn to read a language with which they have relatively little familiarity (Abu-Rabia 2000; Saiegh-Haddad 2003, 2004, 2005, 2007, 2011, 2012; Saiegh-Haddad et al. 2011).

Reading development in Arabic can have interesting theoretical and practical implications because reading acquisition starts with the use of a shallow vowelized orthography and very soon, around the fourth or fifth grade, transitions into reading in an unvowelized deep orthography. Research has shown that, in the early stages, children rely on a grapheme-to-phoneme conversion mechanism rather than on whole-word recognition. The former process can only be used when Arabic script is presented vowelized (Taouk and Coltheart 2004) and it facilitates early decoding by reducing phonological ambiguity (Share and Levin 1999). In turn, this accelerates an earlier transition from the phonological-recoding phase to the orthographic phase (Share 1995). On the other hand, the diacritical system itself requires learning and thus it might constitute a source of difficulty for the beginning reader while mastering Arabic word decoding. In addition, the Arabic orthography is characterized by letter similarity, groups of letters that share a basic shape but vary by the number and location of dots, and by allography, use of different letter shapes according to position within the word (see Saiegh-Haddad & Hekin-Roitfarb, in this collection). These orthographic features have been argued to slow the process of reading in Arabic. (For more on orthographic and other linguistic aspects of Arabic word processing, see in this collection, Eviatar & Ibrahim: Chap. 4, Boudelaa: Chap. 2, and Hansen: Chap. 3.) Given letter similarity and allography, reading problems in Arabic might arise in the phonological-recoding phase (Abu-Rabia and Taha 2004; Azzam 1993) especially among poor readers (Abu-Rabia 1995). Another factor that might affect basic phonological recoding processes in Arabic is Arabic diglossia and specifically the phonological distance between Spoken Arabic and Standard written Arabic (Saiegh-Haddad 2003, 2004, 2005, 2007, 2012).

In a study of the development of reading and spelling processes in Arabic- speaking children in grades 1 through 6, Azzam (1993) analyzed the profiles of the children's reading and spelling errors. The results showed that, in Arabic, a logographic visual phase (Frith 1985) is first adopted for reading. Importantly, alphabetic and orthographic strategies were found to develop first in spelling and later in reading. For Azzam (1993), to acquire basic literacy in Arabic, the use of an alphabetic strategy may be enough for accurate reading, while accurate spelling requires at least the use of orthographic strategies if not full grammatical/semantic skills. Taking this into consideration, it might be predicted that the interdependence between reading and spelling diminishes in later stages of literacy acquisition in Arabic for two reasons. First, dissociations between reading and spelling in Arabic are pronounced during the transition from the logographic to the alphabetic phase (Abu-Rabia and Taha 2004). For instance, beginning learners, especially first graders, were shown to have a clear lack of knowledge of Grapheme-Phoneme Correspondence (GPC) rules due to many factors such as allograhic variants, diglossia phonemes and probably most importantly teaching methods. This result was also extended to second graders where children showed sequencing errors while reading (Azzam 1993). Second, alphabetic strategies are required for accurate reading, while orthographic strategies are required for accurate spelling. Thus, there is a difference in the strategies required for fluent reading and spelling (Azzam 1993).

## 5.2 Isolated Deficits in Reading or Spelling

Dyslexia is reported to be the most common type of learning disability and is estimated to affect 80% of all individuals identified as learning disabled (Shaywitz and Shaywitz 2001). In English-speaking countries, the prevalence of dyslexia is estimated to range between 5 and 17 % of school-aged children, with as many as 40 % of the entire population of the United States, for instance, reading below grade level (Shaywitz and Shaywitz 2001). At first sight, reading and spelling disabilities appear to associate. Generally, good readers (GR) are good spellers (GS) while poor readers (PR) are poor spellers (PS). However, two observations conflict with such a simple view, and show that reading and spelling can dissociate (Fayol et al. 2009). As early as 1980, Frith described a group of 12-year-old English speakers who unexpectedly spelled poorer than they could read. Comparing their spelling errors to that of GR-GS and PR-PS showed that those GR-PS spelled phonetically, but could not recall the exact letters of specific words (Frith 1980). These observations have been confirmed and extended to include other children and adults who have a good grasp of GPC and are able to spell phonetically, but have difficulties remembering word-specific information (e.g., Holmes and Castles 2001). In contrast to the former dissociation, a second dissociation (PR-GS) has been rarely reported. For example, Lovett (1987) described a group of 10-year-old English-speaking Canadian children who were good spellers, but poor (mainly slow, not inaccurate) readers. This type of dissociation was reported not only for English but also, and even more so, for shallow orthographies with regular grapheme–phoneme relationships such as German. In these orthographies, it has been shown that the main problem of dyslexic children concerns fluency not accuracy (Wimmer and Mayringer 2002). Accordingly, it was suggested that speed rather than accuracy may be the most appropriate diagnostic measure in these orthographies (Moll and Landerl 2009). Evidence for this dissociation was proposed by Wimmer and Mayringer (2002) who examined the dissociation in two samples of German-speaking third and fourth graders. They identified 4.3 and 6.4 % of children with a single reading fluency deficit (poor readers/good spellers) and 7.9 and 6.8 % of children with a single spelling deficit (good readers/poor spellers), respectively. In a recent study, Moll and Landerl (2009) replicated these findings in a representative sample of 2029 German-speaking elementary school children. Results showed equally high prevalence rates for isolated deficits in reading (7 %) or spelling (6 %). Moreover, in a sample of 1453 French-speaking fifth graders, Fayol et al. (2009) observed equal prevalence ratios (4 %) of isolated reading and spelling deficits. Interestingly, using a fluency index rather than an accuracy index sheds light on this dissociation. The results of the research discussed above show that in the case of slight phonological deficits that are associated with fast processing, children can still read accurately and rapidly using incomplete orthographic representations which are mostly sufficient to distinguish between words, but not able to attend to the orthographic forms of words and memorize incomplete representations that impair their spelling performance (Fayol et al. 2009; Moll and Landerl 2009; Wimmer and Mayringer 2002). In contrast with this deficit, the isolated reading deficit may be attributed to the efficiency of their phonological abilities and the slowness of their processing which combine and enable them to store precise orthographic representations. Therefore, poor readers-good spellers are able to read pseudo-homophones[1] suggesting a re-

[1] Pseudo-homophones are pseudo-words that are phonetically identical to an existing word; for example, groan/grone and crane/crain.

liance on intact orthographic representations in word reading (Moll and Landerl 2009), which support both their accurate reading and spelling performance, but not their fluency (Fayol et al. 2009). Thus, a rapid naming deficit in this group suggests problems in fast visual-verbal access (Moll and Landerl 2009).

While the incidence of dyslexia and the relationship between reading and spelling skills among school students have been investigated in European orthographies, little empirical research has been reported for Arabic speakers. To our knowledge, a single attempt (by Farrag et al. 1988) has been made to estimate the prevalence of specific reading disability in Egyptian second and third graders; incidence ranged from 1 to 8 %, depending on the selection criterion applied. Eight percent of the children were labeled as backward readers,[2] while 3 % of the children whose IQ was 90 or above received the diagnosis of specific reading disorder. Three years later, children with specific reading disorder were reassessed and only 1 % read three years developmentally behind their expected grade level.

To date, only a handful of studies have compared the assessment of reading problems using measures of reading fluency rather than traditional measures of reading skills as word decoding accuracy (Meisinger et al. 2010). Hence, the present study aims to investigate the relationship between fluent word reading and spelling in an epidemiological sample of 1106 Arabic-speaking third grade children in Egypt.

### *5.2.1 The Current Study*

The current study aimed to probe the prevalence rates of specific reading and spelling deficits in a large and representative sample of 1106 Arabic-speaking children in grade 3. This approach further enabled the investigation of associations and dissociations between reading and spelling skills. Specifically, we aimed to identify children who show a normal development in their general cognitive abilities (measured by a non-verbal IQ test), but are severely impaired in reading fluency and/or spelling. To label a child as severely impaired in reading and/or spelling, we applied a cut-off score of 2 years behind grade level in literacy measures. This was possible as we had investigated the level of reading and spelling in first graders at the same schools in an earlier study (Mohamed et al. 2010).[3] This 2-year criterion helped in the identification of children whose IQ is within the normal limits, but who show delay assessed not just by their below grade-level performance (below 16th percentile). To illustrate, the 16th percentile was used as a cut-off score to label a child as having a reading delay, while a child who scored below the norm of first graders was to be labeled as severely impaired or developmentally delayed in reading. Having these two cut-off scores enabled us to compare our results with the only study reported for Arabic, which used the same developmental delay criteria for their

[2] Backward readers were labeled when a reader's IQ was below 90.

[3] In a previous study, the authors validated literacy measures on Arabic-speaking children from first through third grade. In the current study we use means of first graders as a cut-off score to determine third graders who perform 2 years behind their grade level in reading and spelling.

sample of fifth and sixth graders (Farrag et al. 1988). To calculate the prevalence rates of dissociations between reading and spelling, we applied the same criteria used in previous studies (Moll and Landerl 2009; Wimmer and Mayringer 2002). Again, this enabled us to compare our results to previous findings.

## *5.2.2 Method*

### 5.2.2.1 Participants

A representative sample of 1106 third-grade elementary school children were screened for their reading and spelling abilities as well as for their general level of cognitive functioning. It is assumed that, in about three years of formal tuition, even children with poor literacy background and development would have had a good chance to develop reasonable non-lexical and lexical procedures for their reading and spelling (Moll and Landerl 2009). Moreover, the third grade is crucial in the Egyptian educational system for the assessment of academic achievement including literacy skills.[4] Mean age of the participants was 8.2 years with an *SD* of 0.57. Children were randomly selected from different school types with particular consideration given to their relative distribution in the country. Hence, the sample included 26 public schools (368 boys, 340 girls), six private schools (142 boys, 116 girls), three Language schools[5] (34 boys, 23 girls), and one Experimental school (38 boys, 45 girls). Schools were selected to represent the different districts in Beni-Suef, a city in the North Upper Egypt Region marked by a comparatively high birth-rate.

Children were assessed 3 months after the beginning of the academic year. Children who did not attend kindergarten were excluded from the study. Only children with an IQ of 85 or above and without any evidence for neurological, sensory, or motor impairment were included in this study. Parental consent forms were sent home and the verbal consent of children was obtained.

We operationalized specific reading or spelling disabilities based on the criteria of Jiménez et al. (2009) as follows: (a) low performance on literacy measures, (b) poor academic performance in literacy skills based a teacher's rating report, and (c) an IQ within the normal range, in order to exclude students with broader intellectual deficits. A cut-off score of *2-years-behind grade level*, which indicates a marked developmental delay, was used to label children who are severely impaired in reading and/or spelling.

[4] In the Egyptian educational system, "grading" policy is used according to which students are moved to higher grades even if they did not score well enough especially in the first and second grade. A student cannot be graded unless s/he achieves a certain cut-off score in the third grade.

[5] Both Language and Experimental schools offer a type of schooling whereby children are intensively presented to a second language other than Arabic, their mother tongue from kindergarten. In these schools, it is mainly the English language that is used as the language of instruction in most of the classroom subjects, except for History. While the fees in Language schools are fully afforded by parents of the children, fees of the Experimental schools are mostly sponsored by the government.

#### 5.2.2.2 Tasks

*One Minute Reading Test.* The 1 min reading test has been proven to be an efficient and practical way to assess reading performance, especially in orthographically transparent languages (Willburger and Landerl 2009). The Arabic script serves as a transparent orthography when presented in a vowelized form. Therefore, we used a 1 min reading test which was designed to provide an assessment of the accuracy as well as the fluency of reading. The test provides a score for correct words read aloud in only 1 min and was modeled after the Ein-MinutenLeseflüssigkeitstest designed by Willburger and Landerl (2009). Two sheets were presented to the child including either words or pseudo-words. Each sheet contained 136 items to be read aloud, which were presented in eight columns with slightly increasing difficulty with respect to word frequency and length. Practice items were given to the participants before reading the test items. Both sheets were presented in fully vowelized Arabic including verb inflections, but case-marking nunation[6] was disregarded in this test. A test-retest method (with a 1 month interval) with 109 children showed reliability coefficients of 0.95 and 0.73 for word and pseudo-word lists, respectively. Criterion-related validation was also used to demonstrate the validity of the test. This was accomplished by comparing test scores with the teacher's subjective ratings of the students' performance in reading and spelling on a three-point scale of good, average and poor. In a random sub-sample of 83 students, test performance was found to highly agree with the teacher's categorization of readers as good, average, and poor. An ANOVA showed a significant group effect for the word reading test, $F\ (2, 81) = 5.80$, $p < 0.01$, and the pseudo-word reading test, $F\ (2, 81) = 5.43$, $p < 0.01$, respectively. Post hoc comparisons (Scheffé-Test) showed that poor readers, as estimated by teachers' ratings, received the lowest scores on word and pseudo-word lists, respectively, (mean = 2.6 and 1.2) as compared to average readers (mean = 9.6 and 4.5) who in turn received significantly lower scores than good readers (mean = 23.2 and 12.6; all $p$-values < 0.01). Moreover, the scores that teachers gave to the children on a scholastic Arabic language achievement test was positively correlated with the scores of the children on our one-minute reading test, $r = 0.35$ and 0.34, $p < 0.01$ for word and pseudo-word reading, respectively (see Mohamed et al. 2010, for further details).

*Spelling Test.* The test was designed based on the *Salzburger Lese- und Rechtschreib-Test* (SLRT) by Landerl et al. (1997). The final version of our test consisted of 36 sentences, each including one target word that had to be written to dictation. Sentences were read aloud with a consideration of the word-final syntactic vowelization (*ʔiÀra:b endings*). (For a discussion of phonemic and syntactic vowelization in Arabic, see Saiegh-Haddad and Henkin-Roitfarb, in this collection.) Chosen sentences to be spelled out were formed in terms of standards[7] that have

[6] nunation"/*tanwi:n*/is the addition of a final nun to a noun or adjective to indicate that it is fully declinable and syntactically unmarked for definiteness.

[7] Standards for spelling were provided in the teacher's guide for teaching Arabic in Egypt.

to be fulfilled by third graders to be good spellers. The criteria for Arabic spelling in the first 3 years had been thoroughly analyzed, and was provided by the teacher's guide for teaching Arabic in those years. Accordingly, target words for the test were selected based on the specific spelling skills that students should master in each grade. In order to get a differentiated impression of children's spelling skills one point was given for each grapheme that was written correctly (max. = 204). A test-retest reliability assessment (with a 1 month interval) among 43 children showed a coefficient of 0.92, $p < 0.01$ for grapheme spelling accuracy. As with the previous test, criterion-related validation was used that probed whether the test was capable of distinguishing between good, average, and poor spellers, based on teachers' observations and ratings of a random sub-sample of 84 students. ANOVA showed a significant group effect, $F(2, 82) = 12.28$, $p < 0.01$. Post hoc comparisons (Scheffé-Test) confirmed that poor spellers, as estimated by the teachers' ratings, received the lowest scores (mean = 68.4) as compared to average spellers (mean = 92), who in turn received a significantly lower score than good spellers (mean = 149.91, $p < 0.01$). Moreover the children's performance on a scholastic Arabic language achievement test was positively correlated with the scores on our spelling test, $r = 0.47$, $p < 0.01$ (see Mohamed et al. 2010, for further details).

*General Ability.* Children's general ability was assessed using "The Non-verbal Pictorial Mental Abilities" test (Saleh 1978). This test measures non-verbal deductive reasoning abilities between the ages of 8 through 18 years. The test takes 10 min to administer and may be applied in a group format. It contains 60 pictorial items, and children are asked to cross out the odd picture (Saleh 1978). Stimuli are drawn from the Egyptian environment but may be used in other Arab countries as well (Elbeheri et al. 2006).

### *5.2.3 Procedure*

First, the "Non-verbal Pictorial Mental Abilities" test was administered in a group format following typical school conditions; next the spelling test was given. Care was taken to make sure that the students did not copy from each other. An Arabic teacher read the sentences aloud one by one and children were asked to write down the target word correctly. Once the dictation task was completed, the response sheets were collected. Then, two separate one-minute word and pseudo-word reading tests were individually administered in a quiet place (the library). Administration of the two tests was counterbalanced. Children were encouraged to read the words aloud as fast as they could by giving them a practice trial of six items in each test. Their attention was specifically directed towards the diacritics, which would help them to read the vowelized script correctly. Then, they were allowed 1 min measured by a stopwatch for each sub-test.

### 5.2.4 Results

Mean scores of correctly read items in 1 min for the full sample of third graders was $26.5 \pm 17.4SD$ for words and $12.6 \pm 9.7SD$ for pseudo-words. For spelling, mean scores of correctly spelled graphemes were $159.0 \pm 48.5SD$. Children's mean IQ was $101 \pm 13SD$. Figure 5.1 presents box plots for the literacy measures for boys and girls separately in each school type. ANOVAs for each of the literacy measures with the between subjects factors of school type and gender revealed significant effects of school type on word reading: $F$ (3, 1098) = 56.6, $p < .001$ η2 = 0.13; pseudo-word reading: $F$ (3, 1098) = 63.3, $p < 0.001$, $\eta^2 = 0.15$; and spelling: $F$ (3, 1098) = 48,5, $p < 0.001$, $\eta^2 = 0.12$. No gender differences and no interactions between school type and gender were observed. Post-hoc Scheffé tests for school type indicated that for all three literacy variables (word and non-word reading and spelling) speed performance among children attending public schools was significantly lower ($p < 0.001$) than among students of the other three school types. For pseudo-word reading, students from private schools showed significantly lower speed ($p < 0.05$) than children from the experimental school.

Correlations between the test scores are presented in Table 5.1. Word and pseudo-word reading were strongly correlated (0.87) and were therefore combined into a reading fluency score that will be used for further analysis. Table 5.1 also demonstrates a strong association between reading and spelling in Arabic. The relation between general ability measured by the non-verbal IQ test and all literacy skills was only moderate, but still significant probably due to the large sample size.

The correlation between reading fluency (combined for words and pseudo-words) and spelling is further examined in a scatter plot in Fig. 5.2. Interestingly, the relation between the two skills appears to be exponential rather than linear: the lower left section of the graph presents children with varying degrees of grapheme knowledge, but their reading fluency is still very low. Only for children who were able to transcribe about 100 or more of the dictated phonemes correctly into graphemes, reading fluency shows a systematic increase. Thus, it seems that a certain level of familiarity with grapheme-phoneme translation needs to be acquired through spelling before an impact on reading fluency becomes evident. With regard to accuracy, Azzam (1993) showed that to acquire literacy, alphabetic mechanisms are required for accurate reading while orthographic strategies are crucial for competent spelling. In this sense, accurate reading seems to precede orthographic spelling which seems to precede competence in reading fluency among children acquiring the Arabic orthographic system.

#### 5.2.4.1 Prevalence of Reading and Spelling Disorders

In order to gain adequate cut-off scores for our *2-years-behind* criterion, the literacy tests were given to a control group of first graders who produced mean scores of 8 for reading and 84 for spelling, respectively. Based on these cut-off scores, 90 third

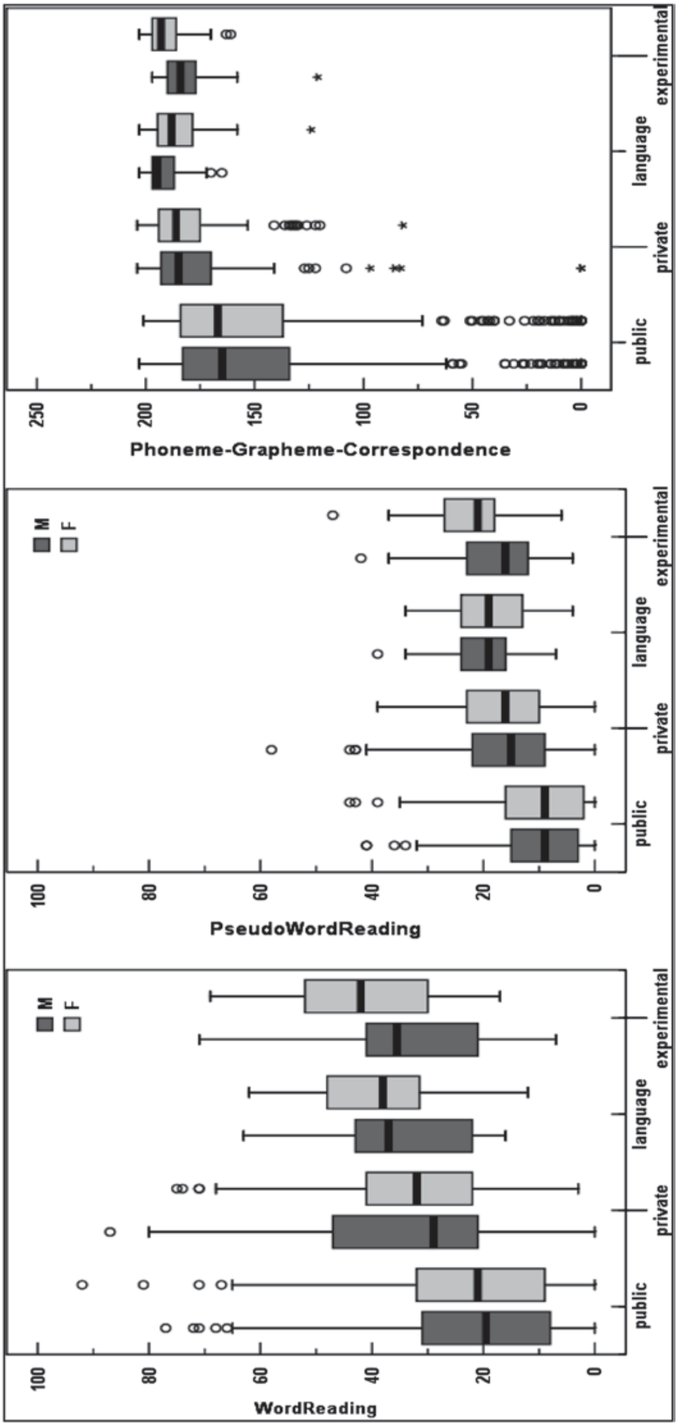


**Fig. 5.1** Box plots of word reading, non-word reading, and spelling in different school types separately for boys and girls. “M” stands for male, while “F” stands for female

**Table 5.1** Pearson correlation matrix for the whole cohort

| | IQ | Word reading | Pseudo-word reading | Reading |
|---|---|---|---|---|
| Word reading | 0.18 | | | |
| Pseudo-word reading | 0.18 | 0.87 | | |
| Reading (combined) | 0.19 | 0.98 | 0.95 | |
| Spelling | 0.23 | 0.67 | 0.63 | 0.67 |

All correlations are significant on the 0.001 level

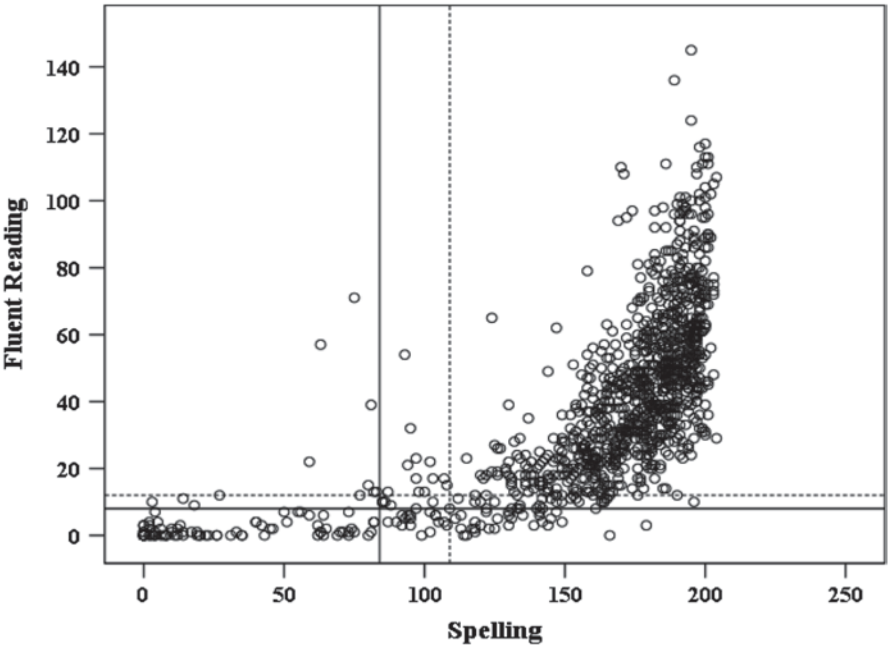


**Fig. 5.2** Plotting of fluent reading against spelling. Cut-off scores are represented by reference lines (*full line*: percentile 16, *dotted line*: percentile 25)

graders (8.1 %) were identified as severely poor readers and/or spellers. Interestingly, no significant gender difference was found: among the severely poor readers/spellers, 51 were boys and 39 were girls ($P=0.21$). Almost all severely reading/spelling impaired children attended public schools, only three cases were identified in private schools and not a single case of reading and/or spelling disability was identified in either Experimental or Language schools.

In order to calculate the prevalence of cases where reading and spelling skills show a marked dissociation, a more lenient selection criterion was defined, following Moll and Landerl's (2009) analysis for German-speaking children: all children who scored below the 16th percentile in either reading fluency or spelling were classified as poor readers/spellers. Children who scored above the 25th percentile were labeled as good readers or good spellers. These cut-off scores are presented in Fig. 5.2 as reference lines. Based on these selection criteria, we calculated the prevalence of three groups: good readers-poor spellers, good spellers-poor readers, and poor readers-poor spellers. As evident from Fig. 5.2, only few children with clear dissociations between reading and spelling skills could be identified. Only 1.1 % of the full sample was identified as good readers-poor spellers, and only 0.9 % of the sample was categorized as poor readers-good spellers. The prevalence of children who perform poorly in reading as well as spelling was clearly higher at 12.7 %. The low prevalence of children with isolated problems in reading or spelling is also evident from the finding that out of 150 children with poor reading skills, only 6.7 % showed good spelling skills, and out of 152 children with poor spelling skills, only 7.9 % had intact reading skills.

### 5.2.5 Discussion

The current study explored the prevalence of fluent reading and spelling disorders in a large sample of Arabic-speaking third graders. The assessment of reading speed is standard in orthographies with higher grapheme-phoneme consistency (transparent orthographies) as in these orthographies reading accuracy is high even in poor and dyslexic readers (Klicpera and Schabmann 1993; Landerl 2001; Wimmer 1993; Wimmer et al. 1998). Therefore, in more consistent orthographies, speed rather than accuracy is the appropriate diagnostic measure (Moll and Landerl 2009). We also wanted to know whether recent findings of marked dissociations between fluent reading and spelling development in German (Moll and Landerl 2009) and in French (Fayol et al. 2009) could be replicated for Arabic. The main findings of our study were as follows: (a) there is a strong association between the development of fluent reading and spelling in the vowelized Arabic script, (b) a certain amount of grapheme knowledge seems to be necessary in order to develop reading fluency, so, unexpectedly, the development of adequate spelling skills is very likely to precede fluent reading and at the same time enhances it, and (c) between 8 and 15 % of Arabic-speaking third graders exhibit specific reading and/or spelling disorders, but isolated disorders in reading or spelling are rare.

#### 5.2.5.1 Prevalence of Disorders in Reading and Spelling in Arabic

While most studies have defined dyslexia based on a reading level of bottom 16th percentile or one standard deviation below the mean with an IQ within the normal range (e.g. Lam et al. 2008; Lindergren et al. 1985; Rama 2000), in other studies (e.g. Gomez 2004) dyslexic children were diagnosed based on teachers' or parents' subjective reports. Based on the *2 years—behind grade level* (Farrag et al. 1988) as acriterion for a marked developmental delay, 8.1 % of our sample were identified as children with reading and/or spelling disorders. This incidence rate is within the range of 5 to 12 % reported for European languages. Cross-national comparisons showed an estimated incidence to be around 10 % in Italy, the U.S. (Lindergren et al. 1985) and Finland (Lyytinen et al. 2004). While prevalence of dyslexia ranges between 3 and 10 % in India, (Rama 2000), it was estimated to be around 10–12 % among Chinese school children (Lam et al. 2008). The only epidemiological study conducted in Malaysia reported 7 % of children with dyslexia (Gomez 2004).

Interestingly, we did not observe any systematic gender differences, either in the full sample analysis or with respect to prevalence rates of dyslexia. Such balanced gender ratios have also been shown for English (Shaywitz 1998) and Chinese (Lam et al. 2008). On the other hand, several epidemiological studies have found dyslexia to be 2–4 times more common in boys than in girls (Rutter et al. 2004) and it seems that this was probably not due to the tendency on the part of parents and teachers to refer more boys to clinics (Jorm 1983). However, Shaywitz and Shaywitz (2001) showed that when actual reading scores, and not teacher ratings, were used to identify children, there were no significant differences in the prevalence of dyslexia between boys and girls.

We observed systematic differences between the four school types, with children in public schools turning out to be underachievers in all literacy skills compared to the other types of school. Moreover, children with reading and spelling disorders were significantly more prevalent in public schools (12 %) than in private schools (1 %) while not a single case of dyslexia was identified in Language and Experimental schools. One plausible explanation for this difference may be that children in public schools typically have lower socioeconomic status (SES) compared to children in the other school types with a higher incidence of disabilities in reading and/or spelling. It has been reported that disabled readers or spellers are comparably rare amongst the highest social classes (Jorm 1983), in which home literacy environment (e.g., print exposure) is more favorable for the development of reading skills (Finucci 1985). Another possible explanation of the comparably good literacy skills in Language and Experimental schools may be that these children can profit from the early intensive bilingual education that is offered in these schools. Bournot-Trites and Tallowitz (2002) reported that children receiving bilingual teaching no longer show a lag behind monolinguals in their L1 literacy skills by grade 2 and 3, and this is due to the transferability of cognitive processes which contribute to the development of literacy skills between L1 and L2 (Cummins 1991). In line with this, Saiegh-Haddad and Geva (2010) conclude that transferability could be determined by (a) specific features of the linguistic and orthographic structure of the languages involved, (b) features of the learners, such as their linguistic proficiency, and the possibility of some proficiency threshold, and (c) contextual/instructional features such as explicit teaching and amount of exposure. Finally, it is worth noting that in our study, sample size was comparably small for Language and Experimental schools, so further research will be necessary to clarify the impact of bilingual education on the acquisition of literacy skills in L1 and L2.

### *5.2.6 Association between Reading and Spelling*

Our results showed that reading and spelling in Arabic are correlated and accordingly are based on similar processes, and this in turn suggests more associations than dissociations between the two skills in Arabic. First, the association could be potentially explained by the fact that the development of both reading and spelling in the vowelized Arabic script are dependent on similar cognitive processes. Evidence showed that accurate reading in vowelized Arabic is predicted by a straightforward phonological awareness (Saiegh-Haddad and Geva 2008), as well as by memory, rapid naming and most strongly by GPC recoding knowledge (Saiegh-Haddad 2005). This latter finding aligns with previous research demonstrating a heavy reliance on GPC rules in reading in transparent European orthographies (Seymour et al. 2003). Similarly, early stages of spelling development require predominant reliance on phonological processes in consistent orthographies (e.g., Wimmer and Landerl 1997) and in Arabic (Taha & Saiegh-Haddad, ms.). This is illustrated by our results showing that learners of Arabic, namely vowelized Arabic, need first to read at a threshold level and only then does their fluent reading develop. In 1993, Azzam adopted Frith's model (1985, 1986) for Arabic and showed that spelling in Arabic accelerates both the alphabetic and the orthographic phase and that reading develops only later.

Another possible explanation for the early development of spelling compared to fluent reading could be attributed to the phonological distance in Arabic diglossia between the spoken and the literary/standard representations of Arabic language (Saiegh-Haddad 2003, 2004, 2005). In line with this it has been shown that fluent reading of pseudo-words by the end of the first grade is not directly predicted by phonological awareness but more by cognitive factors such as the speed of converting graphemes to phonemes (Saiegh-Haddad 2005) and morphological processing (Saiegh-Haddad and Geva 2008).

### *5.2.7 Are there Dissociations of Deficits in Reading and Spelling in Arabic?*

As there were recent reports of a considerable proportion of children showing clear dissociations between reading and spelling skills in German (Moll and Landerl 2009) and French (Fayol et al. 2009), we aimed to investigate whether such isolated problems in reading or spelling could also be observed in our Arabic sample. Interestingly, such cases of poor readers-good spellers and good readers-poor spellers were very rare in our sample with prevalence rates of only 0.9 and 1.1 %. Thus, although there is some variability in the relation between reading and spelling in the full population, children who develop significant problems in literacy acquisition typically show serious deficits in both. This is an important finding with respect to intervention which should include both components, that is, reading as well as spelling.

## 5.3 Conclusion

The current analysis of an epidemiological sample of third graders acquiring the Arabic vowelized orthography in Egypt shows that a considerable proportion has developed serious deficits in reading and spelling. Epidemiological studies on Arabic are scarce, so this analysis provides important information for schools and health care systems to enable them to provide adequate support for affected children. This finding also points out the high relevance of research on the mechanisms underlying both typical and atypical reading and spelling development in Arabic.

It is important to note some limitations of the current research in Arabic. First, we used a reading measure that combined accuracy and speed into one score. Future studies might aim to design and administer measures that allow assessment of accuracy and fluency separately. Second, we used different materials for our reading and spelling tasks. Applying both, similar and different materials for reading and spelling will present a more differentiated view of the associations and dissociations between reading and spelling. Importantly, the role of diglossia in the relation between reading and spelling should be given more attention in order to adopt a broader sociolinguistic perspective for investigating reading and/or spelling deficits in Arabic orthography.

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# Chapter 6
# Types of Developmental Dyslexia in Arabic

**Naama Friedmann and Manar Haddad-Hanna**

**Abstract** Developmental dyslexia is a general term for various kinds of impairments in reading. More than 10 types of developmental dyslexia have been identified, each resulting from a deficit to a different stage in the reading process. The different deficits give rise to different patterns of errors in the various dyslexias and to different types of words that cause difficulty in reading. In this article we present types of developmental dyslexia that we have identified in Arabic, and survey their main characteristics, focusing on the unique properties of the Arabic orthography and their interaction with the manifestation of the various developmental dyslexia types. We present the patterns of developmental peripheral dyslexias, dyslexias that result from impairment at the orthographic-visual analysis stage, and of central dyslexias, which result from impairments at later stages. Within the peripheral dyslexias, we focus on the manifestation in Arabic of letter position dyslexia, which is caused by a deficit in letter position encoding and which results in letter position errors; on attentional dyslexia, a deficit in the attentional window in reading, which results in migrations of letters between words; on visual dyslexia, a deficit in the orthographic-visual analyzer that causes letter omissions, additions, substitutions, and migrations; and on left neglect dyslexia, a disorder that leads to visual errors only on the left side of words. We then report and discuss the manifestation of central dyslexias in Arabic: surface dyslexia—a deficit in the lexical route that causes reading via the sublexical route; vowel dyslexia—a selective impairment in vowel processing in the sublexical route that causes impaired reading of vowel letters; and deep dyslexia—a deficit in the sublexical and lexical routes, which causes reading via the comprehension of the word and leads to semantic and morphological errors. All but one of the dyslexias described here are reported for the first time in Arabic.

**Keywords** Attentional dyslexia · Arabic · Dyslexia · Deep dyslexia · Letter position dyslexia · Neglect dyslexia · Reading · Surface dyslexia · Visual dyslexia · Vowel dyslexia

N. Friedmann (✉)
Language and Brain Lab, School of Education and Sagol School of Neuroscience,
Tel Aviv University, Tel Aviv 69978, Israel
e-mail: naamafr@post.tau.ac.il

M. Haddad-Hanna
Tel Aviv University, Tel Aviv, Israel
e-mail: manarhad@gmail.com

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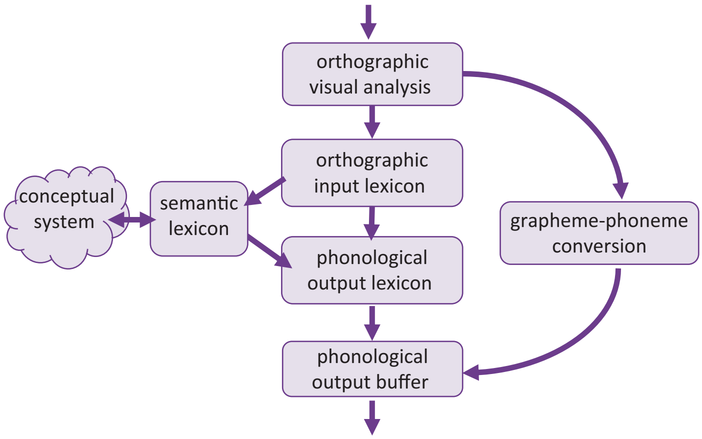


**Fig. 6.1** The dual route model for single word reading

## 6.1 Introduction

Developmental dyslexia has many forms. Depending on the exact nature of impairment in the single word reading process, completely different patterns of impaired reading can arise. Indeed, there are currently more than ten known types of dyslexia, resulting from deficits in different loci in the reading process, each with different characteristics, and, subsequently, each requiring different treatment approaches.

Importantly, the different loci of impairment in the reading process are not the only source of principled heterogeneity between individuals with developmental dyslexia. The properties of the orthography in which the dyslexic person reads create another source for differences between individuals with dyslexia. For example, individuals with a dyslexia that causes reading only via grapheme-to-phoneme conversion may find it much harder to read in an orthography like Arabic, in which many words can be read in various ways via the sublexical route due to the underrepresentation of short vowels in the orthography, than in other languages, such as Italian, in which grapheme-to-phoneme conversion usually yields the correct word. In the current study we survey the way the special characteristics of the Arabic orthography affect the manifestation of developmental dyslexia in Arabic.

To describe the various types of dyslexia, we will first describe the reading model that we assume in this research, and then describe the various dyslexias that can result from selective deficits in various components within this model. In Fig. 6.1 we present the dual route model for single word reading. This model is the result of a work of cognitive neuropsychologists over the past 40 years, including Max Coltheart, John Marshall, Tim Shallice, Karalyn Patterson, Lyndsey Nickels, David Howard, Andrew Ellis, Andrew Young, and others. Whereas many models of reading exist, this model allows the best and most straightforward way, in our minds, to account for and predict the various types of dyslexia.

The first stage of word reading is orthographic-visual analysis. This stage is responsible for the encoding of abstract letter identities, for the encoding of the relative position of letters within words, and for the binding of letters to the words they appear in, by setting the attentional window that allows for the allocation of attention to a single word (Coltheart 1981; Ellis 1993; Ellis et al. 1987; Ellis and Young 1988; Humphreys et al. 1990; Peressotti and Grainger 1995). A deficit in each of these three functions causes a different type of dyslexia, with different characteristics. Deficits in letter identity encoding result in letter-identification-visual dyslexia, which is characterized by letter substitutions and omissions (Cuetos and Ellis 1999; Friedmann et al. 2012; Lambon Ralph and Ellis 1997; Marshall and Newcombe 1973). When letter identity encoding is only impaired when accessed from the visual modality, but is unimpaired from other modalities such as the tactile and kinesthetic modalities, it is termed "visual agnosia for letters" (Nielsen 1937). A deficit in the encoding of relative letter order within words results in letter position dyslexia—a dyslexia in which the cardinal symptom is migration of letters within words (Friedmann et al. 2010a; Friedmann and Gvion 2001, 2005; Friedmann and Haddad-Hanna 2012; Friedmann and Rahamim 2007; Kohnen et al. 2012). A deficit in letter-to-word binding, namely, in the ability to focus attention on one word and attenuate attention to the words surrounding it, results in attentional dyslexia, a deficit that is characterized mainly by migrations of letters between words (Davis and Coltheart 2002; Friedmann et al. 2010b; Hall et al. 2001; Humphreys and Mayall 2001; Price and Humphreys 1993; Saffran and Coslett 1996; Shallice and Warrington 1977). Another type of visual dyslexia results from a deficit in the output of the orthographic-visual analyzer. This impairment causes a failure in the output of the three functions of the orthographic-visual analyzer—identity, position, and letter-to-word binding. This kind of visual dyslexia is termed "visual output dyslexia" (Friedmann et al. 2012). Another dyslexia that is located in the early stages of orthographic-visual analysis is neglect dyslexia. This dyslexia is a specific difficulty in shifting attention to one of the sides of the word, usually its left side. The main errors in this dyslexia are omissions, substitutions, and additions of letters in the neglected side (Vallar et al. 2010; and see Friedmann and Nachman-Katz 2004; Nachman-Katz and Friedmann 2007, 2008, 2009, 2010, for the developmental form of this dyslexia).

Apart from the various impairments in the orthographic-visual analyzer, dyslexias can result from impairment in the following routes. The dual route model includes two routes for reading aloud: the lexical route, which includes the orthographic input lexicon and the phonological output lexicon, and the sublexical route, in which reading proceeds via grapheme-to-phoneme conversion. The orthographic input lexicon holds the orthographic information about the written form of words we know, and the phonological output lexicon holds the phonological information about the sounds of the spoken words we know: their consonants, vowels, stress position, and number of syllables. The lexical route, i.e., the direct connection between these two lexicons, allows for a rapid and accurate conversion from a written word to its phonological form. This route allows the reader to know how to pronounce the word "now", how to pronounce the word "no", and to distinguish between the two according to their written forms. The other route for reading aloud is the sublexical route, in which letter strings are converted into sounds via grapheme-to-phoneme conversion. This route enables the reading of new words, which are not (or not yet) stored in the orthographic input lexicon. Whereas this route is very efficient with non-words, it is less accurate with existing words. This route would not be able to function well in the presence of ambiguity in the conversion of letters to sounds. For example, the grapheme-to-phoneme conversion route would not be able to distinguish between "now" and "no", and might pronounce *now* as "no".

A deficit in each of these routes creates a different pattern of dyslexia: a deficit in the direct lexical route causes surface dyslexia (Broom and Doctor 1995a; Castles et al. 2006; Castles and Coltheart 1993, 1996; Coltheart and Byng 1989; Coltheart and Funnell 1987; Coltheart et al. 1983; Ellis et al. 2000; Ferreres et al. 2005; Friedmann and Lukov 2008; Howard and Franklin 1987; Judica et al. 2002; Marshall and Newcombe 1973; Masterson 2000; Newcombe and Marshall 1981, 1984, 1985; Temple 1997; Weekes and Coltheart 1996). Readers with surface dyslexia cannot read via the lexical route, and therefore are forced to read all words by grapheme-to-phoneme conversion, as if they were new words. This not only makes their reading slower, but also causes problems in reading accuracy. For example, irregular words like *talk*, *walk*, *knife*, and *debt* might be read incorrectly. Even worse might be the case of potentiophones: words that, when read via the sublexical route, may be read as other existing words. For example, the word *now* that, as mentioned above, can be read, using the sublexical route, as sounding like "no", and the words *get* (jet), *island* (Iceland), *whose* (hose), *one* (own), and *phase* (face). Such deficit may also cause problems in the comprehension of homophones like *witch* and *which*.

Individuals who have a deficit in the sublexical route can read all words that are in their lexicon correctly, but fail to read new words and non-words. This dyslexia is called "phonological dyslexia" (Broom and Doctor 1995b; Coltheart 1996; Friedman 1996; Glosser and Friedman 1990; Southwood and Chatterjee 1999, 2001; Temple 1997; Temple and Marshall 1983). A specific type of impairment in the sublexical route is *vowel dyslexia* (Khentov-Kraus and Friedmann 2011). Recent findings from Spanish, French, English, and Thai indicate that vowels and consonants are treated separately by the sublexical route (Duñabeitia and Carrerias 2011; Lee et al. 2001; New et al. 2008; Perea and Acha 2009; see Winskel 2011 for a review). A selective deficit in vowels creates vowel letter omissions, substitutions, additions, and migrations whenever the reader reads via the sublexical route (when reading new words, and for individuals with surface dyslexia also when reading existing words via the sublexical route).

In addition to these lexical and sublexical routes for reading aloud, the model includes a connection between the orthographic input lexicon and the conceptual-semantic system, which includes the semantic lexicon and the conceptual system, the amodal storage of our concepts. This access to semantics allows for the comprehension of written words. An impairment to the connection between the orthographic input lexicon and the conceptual-semantic system leads to a dyslexia that is described as "reading without meaning" or "direct dyslexia". These readers perform at normal levels in converting written words and non-words into speech, but are very impaired in their comprehension of written words. Impaired comprehension of written words can also result from an impairment to the conceptual-semantic system itself, in which case the comprehension of heard words is also impaired (Castles et al. 2010; Friedmann et al. 2013; Nation 1999; Seymour and Evans 1992).

Finally, a dyslexia that results from a deficit in both the sublexical and the lexical route (between the orthographic input lexicon and the phonological output lexicon) is called "deep dyslexia" (Coltheart et al. 1987; Ellis and Young 1988; Luzzatti et al. 2001; Stuart and Howard 1995). Because none of the reading aloud routes are available for readers with deep dyslexia, they are forced to use a route that is not usually employed for reading aloud: the semantic route. They read via a path that involves the identification of the word in the orthographic input lexicon, activation of the relevant meaning in the conceptual-semantic system, and then naming of the concept. Reading exclusively through this path causes considerable difficulty in reading abstract words, function words, and non-words, and yields many semantic and morphological errors.

In recent years, more and more studies have accumulated, indicating that subtypes of dyslexia that have been identified in acquired dyslexia also appear in a developmental form. For a comprehensive survey of this literature see Castles et al. (2006, 1999), Castles and Coltheart (1993), Coltheart and Kohnen (2012); Jones et al. (2011), and Temple (1997). Among the types of developmental dyslexia that have been reported one can find developmental surface dyslexia (Broom and Doctor 1995a; Castles et al. 2006; Castles and Coltheart 1993, 1996; Coltheart et al. 1983; Friedmann and Lukov 2008; Judica et al. 2002; Masterson 2000; Temple 1997; Valdois et al. 2003), developmental phonological dyslexia (Broom and Doctor 1995b; Howard and Best 1996; Temple 1997; Temple and Marshall 1983; Valdois et al. 2003), developmental vowel letter dyslexia (Khentov-Kraus and Friedmann 2011), impaired semantic route (Castles et al. 2010; Glosser et al. 1997), as well as developmental deep dyslexia (Siegel 1985; Stuart and Howard 1995; Temple 1988, 2003). Selective developmental peripheral dyslexias were also identified—letter position dyslexia (Friedmann et al. 2010a; Friedmann and Gvion 2005; Friedmann and Haddad-Hanna 2012; Friedmann and Rahamim 2007, in press; Keidar and Friedmann 2011; Kohnen et al. 2012), attentional dyslexia (Friedmann et al. 2010b; Keidar and Friedmann 2011; Rayner et al. 1989), and neglect dyslexia (Friedmann and Nachman-Katz 2004; Nachman-Katz and Friedmann 2007, 2008, 2009, 2010).

The aim of the current study is to survey the types of developmental dyslexia in Arabic, and to closely examine the effect the Arabic orthography has on the reading patterns in the various dyslexia types.

### 6.1.1 A Bit About Arabic Orthography

Arabic is written from right to left. It includes 28 letters that are written in a cursive style. All Arabic letters can be used as consonants and three of them can also be used as long vowels (و ي ا). The short vowels are usually not represented in the orthography, except for in texts for beginning readers, which include vocalization diacritics.

Arabic, as a Semitic language, has a rich morphological structure in both nouns and verbs (see Saiegh-Haddad & Henkin-Roitfarb, in this handbook). Most verbs are constructed from three-consonant roots that are incorporated in verbal templates, and many nouns are similarly constructed from a three-consonantal root incorporated in nominal templates.

*Letter form* The written form of each Arabic letter is determined by two factors: its position in the word—initial, middle, or final, and whether or not it ligates to the letter that precedes it. Whether or not a letter ligates to the preceding letter depends on the preceding letter: six of the Arabic letters: ا , د , ذ , ر , ز , و (A, D, ð, R, Z, W) do not ligate to the following letter. The combination of position and ligation creates four letter forms: a form for letters in the beginning of the word, a form for letters in the middle of the word that ligate to the preceding letter, a form for final letters that ligate to the preceding letter, and a form for final letters that do not ligate to the preceding letter. Middle letters that do not ligate to the preceding letter are written using the initial letter form.

As shown in Table 6.1, 20 letters change their form between initial/medial and final positions, and 8 letters only change their ligation according to whether or not they are ligated to the preceding letter. For example, the letter H is written هـ when in initial position (or non-ligating middle position), ـهـ when in middle position and ligating to the previous letter, ـه when in final position and ligating to the previous letter, and ه when final and non-ligating.[1]

*Diglossia* Another aspect of Arabic that might have an effect on the manifestation of dyslexia is the diglossic situation of Arabic (see Myhill, Chap. 9). Written Arabic is Standard Arabic (SA), whereas the individuals who read it speak one of the spoken Arabic vernaculars. In our study, all the participants were speakers of Palestinian Arabic (PA), which differs in phonology, lexicon, and syntax from SA. Growing up, Palestinian Arabic is the main language that children are exposed to, although they occasionally hear Standard Arabic in some TV programs, and in prayers, for example (Saiegh-Haddad 2012; Saiegh-Haddad & Henkin-Roitfarb, in this handbook). Thus, children grow up speaking Palestinian Arabic, and learn Standard Arabic only later, usually in school. Hence, Standard Arabic can be viewed almost as a second language.

In addition to the diglossic situation between Palestinian Arabic and Standard Arabic, most Arabic speakers in Israel also speak Hebrew as a second language, and most of them also read Hebrew. This multi-language situation creates an interesting test case for the interaction between diglossia and some types of dyslexia: for example in deep dyslexia, in which reading proceeds exclusively via meaning, then if naming and speaking occurs in PA, reading words presented in SA might result in

[1] Throughout this article, we used the following phonemic transcriptions for vowels: i for kasra, i: for ي functioning as a long vowel, u for damma, w for و functioning as a long vowel, a for *fatħa*, and a: for ا functioning as the long vowel a. Hamza, ء which can appear alone, or with the letters *ʔalif, waw, yaʔ* (إ أ ئ ؤ), was transcribed as ʔ.

**Table 6.1** Arabic letter forms

| Final non ligated | Final ligated | Medial ligated | Initial (or medial non ligated) | IPA | Graphemic transcription |
|---|---|---|---|---|---|
| ا | ـا | ـا | ا | a | A |
| ب | ـب | ـبـ | بـ | b | B |
| ت | ـت | ـتـ | تـ | t | T |
| ث | ـث | ـثـ | ثـ | θ | θ |
| ج | ـج | ـجـ | جـ | ʒ | J |
| ح | ـح | ـحـ | حـ | ħ | Ħ |
| خ | ـخ | ـخـ | خـ | x | X |
| د | ـد | ـد | د | d | D |
| ذ | ـذ | ـذ | ذ | ð | ð |
| ر | ـر | ـر | ر | r | R |
| ز | ـز | ـز | ز | z | Z |
| س | ـس | ـسـ | سـ | s | S |
| ش | ـش | ـشـ | شـ | š | Š |
| ص | ـص | ـصـ | صـ | ṣ | ṣ |
| ض | ـض | ـضـ | ضـ | ḍ | ḍ |
| ط | ـط | ـطـ | طـ | ṭ | ṭ |
| ظ | ـظ | ـظـ | ظـ | ð | ð̣ |
| ع | ـع | ـعـ | عـ | ʕ | ʕ |
| غ | ـغ | ـغـ | غـ | ɣ | Ɣ |
| ف | ـف | ـفـ | فـ | f | F |
| ق | ـق | ـقـ | قـ | q | Q |
| ك | ـك | ـكـ | كـ | k | K |
| ل | ـل | ـلـ | لـ | l | L |
| م | ـم | ـمـ | مـ | m | M |
| ن | ـن | ـنـ | نـ | n | N |
| ه | ـه | ـهـ | هـ | h | H |
| و | ـو | ـو | و | w/u: | W |
| ي | ـي | ـيـ | يـ | y/i: | Y |
| ة | ـة | | | | Ḧ |
| ء (أ ؤ ئ) | ء (أ ؤ ئ) | ء (أ ؤئـ) | أ / إ | ʔ | ʔ |

the production of words in PA. We explore this and other predictions regarding the effect of diglossia in the study reported below.

### 6.1.2 Participants

All the participants with the various types of developmental dyslexia reported in this study were Arabic speakers. They were speakers of Palestinian Arabic and readers of Standard Arabic. None of them had a history of brain lesions, neurological disease, or loss of consciousness.

They were children and adolescents enrolled in regular classes in regular schools in central Israel and in the Galilee, who had learning problems or reading problems at school. They had been identified prior to our research as having some learning disabilities or reading difficulties by the special education teachers or by the speech therapists in their schools, but the exact nature of their reading difficulties or the type of dyslexia they had was not precisely diagnosed. They were referred to our Language and Brain Lab by their parents, special education teachers, or speech therapists for further diagnosis, to find out what the basis of their reading difficulties or reading comprehension problems was. In total, approximately 150 such children were referred to us for further diagnosis. Of these children, we diagnosed 74 children with various types of developmental dyslexia on the basis of the Arabic TILTAN screening test (Friedmann and Haddad-Hanna 2009), which includes 207 words, 27 non-words, and 23 word pairs. The items in the screening test were selected so that they can detect the various types of dyslexia—including words that, when read through the grapheme-to-phoneme conversion route, can be read as other words, for the detection of surface dyslexia; migratable words, words with a lexical potential for middle letter migration, for the detection of letter position dyslexia; words with many orthographic neighbors for detecting visual dyslexia; words with a lexical potential for omission or substitution on the left or on the right, for the detection of neglect dyslexia; abstract words and function words for the detection of deep dyslexia. The test also included a list of word pairs in which migration of a letter between the words creates an existing word, for the detection of attentional dyslexia, and nonwords of various types of the detection of phonological and deep dyslexia, as well as peripheral dyslexias.

For each individual, we analyzed the types of errors made in oral reading of this word list. We selected for our further explorations of developmental dyslexia in Arabic the individuals who had a high rate of errors in reading the screening test.

The *control group* for each of the tests reported below included 26 participants in third to fifth grade, without reading or language disabilities, and without any known neurological impairment, from the same schools as the participants or from schools in the same area, with similar socioeconomic status.

### *6.1.3 Developmental Dyslexia Types in Arabic*

#### Developmental Letter Position Dyslexia

One of the functions of the first stage of reading, the orthographic-visual analyzer, is the encoding of the relative position of letters within the word. This function is subject to a selective deficit, letter position dyslexia (LPD), which causes letter position errors in reading. LPD was first reported in its acquired form in Hebrew (Friedmann and Gvion 2001). The individuals reported by Friedmann and Gvion showed a selective deficit in letter position encoding, without migrations between words and without letter identity errors. Their main errors, in a variety of tasks, were migrations of letters within words. The errors occurred almost exclusively in middle letters, whereas first and final letters remained in their original positions (both when they were parts of the root and when they were part of an affix). Errors occurred mainly in "migratable" words, namely, in words for which a transposition of middle letters created another existing word (like *flies* and *files* in English). The patients did not make migration errors in symbol sequences or numbers.

The same dyslexia was also reported in a developmental form for Hebrew (Friedmann et al. 2010a; Friedmann and Gvion 2005; Friedmann and Rahamim 2007, in press; Keidar and Friedmann 2011: see Coltheart and Kohnen 2012, for a review), and recently also for English (Jones et al. 2011; Kohnen et al. 2012), and Italian (Luzzatti et al. 2011). The characteristics of letter position dyslexia in its developmental form are exactly like the ones of the acquired form: migrations of letters within words, mainly of middle letters, and mainly when the resulting word is another existing word, usually when the result is a more frequent word. Friedmann and Haddad-Hanna (2012) reported LPD in Arabic. They reported 10 children and adolescents with developmental LPD, and a person with acquired LPD, who all showed patterns of reading, reading errors, and effects on reading that are remarkably similar to the ones reported in Hebrew LPD.

The tendency of LPD readers to make more errors in migratable words is important when considering how LPD would be manifested in Arabic. In Arabic, migratable words are abundant due to a combination of the nature of Arabic orthography and morphology. Because of the underrepresentation of short vowels in the orthography, there are many degrees of freedom in reading Arabic. Thus, letter combinations resulting from letter migrations can be read in various ways, and one of them often yields another existing word. Another contribution to the large number of migratable words in Arabic is its Semitic morphology, which generates words from a consonantal root and a template. This yields many word pairs that only differ in the order of the root consonants (with the same template, such as يعملون and يعلمون, YʕMLUN and YʕLMUN in letter transliteration 'work-3rd-mas-pl' and 'know-3rd-mas-pl', or in their templates (with the same root), which may differ only in the position of a middle letter (for example, كاتب and كتاب, KATB and KTAB 'writer' and 'book'). These properties of Arabic should result in an orthography in which many migration errors create another existing word, and therefore, given a tendency to produce lexical responses in dyslexia, more errors cannot be ruled out by the reader. Based on these considerations it seems that Arabic-speakers with LPD would make more migrations in reading, and it would be easier to detect letter position deficit in Arabic, compared to languages like English, in which the result of a migration of middle letters is usually a non-word.

These properties of Arabic, then, predict LPD to yield *more* errors in reading Arabic than in other, non-Semitic, languages. On the other hand, another property of Arabic orthography suggests that in Arabic the rate of migrations within words would actually be *smaller* than in other languages. This property is the letter forms, which in Arabic is determined by letter position (and ligation). For some Arabic target words a letter position error creates a word with the exact same letter forms, only in different positions (like تمهل – تهمل TMHL-THML in letter transliteration, 'slowed down'—'ignore', in which the M and the H exchange positions but keep their form). For other target words, however, letter position errors create a word with different letter forms, as is the case when a ligated letter moves to a position after a non-ligating letter (like جهاز -جاهز JHAZ-JAHZ 'device'- 'ready', in which the H alternates between middle-ligating and initial/middle non-ligating forms). In these cases, the same letter has different forms in different positions, and hence, transposing the letters in the middle of the word while keeping their original letter forms would create an orthographically illegal sequence. For example, a migration of the H, keeping its original form in the target word, جهاز would yield جاهز (with an H in a ligating form after a non-ligating letter, which should have been جاهز). Such a sequence is orthographically impossible in all common Arabic fonts. Therefore, when taking letter form into account, fewer words are truly migratable (Friedmann and Haddad-Hanna 2012). Thus, there are two opposing forces with respect to the manifestation of LPD in Arabic and the migratability status of Arabic words, one pulling toward more LPD errors in Arabic, the other pulling in the other direction.

And indeed, reading of texts and of a list of single words that were not selected for the identification of LPD, namely, that did not include enough migratable words, did not reveal LPD for any of the participants. However, once we presented them with migratable words (and migratable non-words) in which migration did not affect the letter form, their LPD was clearly detectible. In fact, LPD turned out to be quite frequent in our sample of Arabic readers with dyslexia, provided that the appropriate words were employed.

Our participants with LPD were 12 individuals with developmental LPD, aged 10.0–17.5 years (average 12.1). We included in this analysis individuals who made significantly more migrations than the normal rate in the oral reading of single migratable words. To assess their oral reading, we asked the participants to read aloud 244 words, of which 75 words were migratable: 45 migratable words that keep the letter form, 15 migratable words that require letter form change, and 15 migratable words that change only the ligation between letters rather than the whole letter form (see examples for the various word types in Table 6.3). The other 169 words were non-migratable. In addition, we asked the participants to read 27 non-words, 12 of which were migratable.

The participants' reading aloud perfromance indicates that they make letter position errors in reading aloud, as shown in Table 6.1. Whereas Arabic readers without dyslexia in third to fourth grade made no more than a single migration error in the 75 migratable words (M = 0.7 % migrations, SD = 0.7), the participants with LPD made between 8 % and 37 % errors of middle letter migrations in the 75 migratable words (M = 18 % migrations, SD = 9 %).

The participants with LPD had a strong tendency to produce existing words, so they made errors predominantly on migratable words: whereas they made 18 % migrations in the migratable words, they made less than 1 % migration errors in reading the non-migratable words. In addition, most of their migration errors created existing words: 93 of the 102 migration errors they made in reading words were lexical.

**Table 6.2** Letter position dyslexia: Average percentage (and SD) of migration errors in various word reading tasks

| | Reading single migratable words | Reading migratable non-words | Migratable word-picture association | Migratable word-word association | Lexical decision: migratable non-words |
|---|---|---|---|---|---|
| LPD | 18[a] (9) | 33[a] (22) | 57[a] (21) | 31[a] (28) | 51[a] (24) |
| Control | 0.7 (0.7) | 4.2 (6.3) | 0 (0) | 1.5 (2.7) | 0 (0) |

[a] Significantly poorer than the control group

**Table 6.3** Examples of letter position errors made by the Arabic-speaking LPD participants

| Arabic | Graphemic transcription | Phonemic transcription | Translation |
|---|---|---|---|
| *Same form* | | | |
| يعلمون → يعملون | YʕLMWN → YʕMLWN | yaʕlamu:n → yaʕmalu:n | they know → they work |
| يكبتون → يكتبون | YKBTWN → YKTBWN | yakbitu:n → yaktobu:n | they pent up → they write |
| يشمون → يمشون | YŠMWN→ YMŠWN | yašummu:n→ yamšu:n | they smell → they walk |
| ينصع → يصنع | YNṢʕ→ YṢNʕ | yanṣaʕ→ yaṣnaʕ | shines → makes |
| يحملون → يحلمون | YĦMLWN → YĦLMWN | yaħmilu:n → yaħlumu:n | carrying → dreaming |
| *Ligation change* | | | |
| جسرين → جرسين | JSRYN → JRSYN | jisrayn → jarasayn | two bridges → two bells |
| *Form change* | | | |
| جاهز → جهاز | JAHZ → JHAZ | jahiz → jihaz | ready → instrument |

This tendency to only make a migration error when the result is another existing word is thus crucial for the diagnosis of LPD in Arabic: if one wants to be able to detect LPD, migratable words have to be included in the word list for diagnosis.

As shown in Table 6.2, the participants also made migration errors on reading migratable *non-words* aloud. They made migration errors on an average of 33 % of the non-words (8 %–75 %).

*Letter form* had a crucial effect on the rate of letter position errors of the participants with LPD. All participants presented the same pattern: they made fewer letter position errors when the change of position caused change in the letter form than when the position error did not change the letter form. In fact, they made almost no position errors that changed the letter form. Only one transposition of two consonant letters occurred out of a total of 45 words with a potential for form-change consonant migration. This is in contrast with the very high letter-position error rate of 21 %, when the middle letters that transposed did not change their letter form or letter ligation.

Similar results were found for the Arabic readers with developmental and acquired LPD reported in Friedmann and Haddad-Hanna (2012). We tested whether the existence of position-dependent letter forms in Arabic affects the rate of letter position errors in letter position dyslexia. We found, like in the present study, that there were fewer letter position errors when the word that resulted from the error required letter form change (2 % such errors), than when the word resulting from transposition includes the same letter forms as the original word (40 % errors). The participants not only refrained from moving letters that would change their own form, but also refrained from middle letter position errors when they created form change in the final letter, which did not move itself, but was affected by middle letter migration (4 % errors). In addition, even when only the ligation of the letter changed following migration, these errors occurred significantly less frequently (10 %) than migrations that did not change letter form and ligation. (See also Kinoshita et al. 2012, for a discussion of the effect of the position-dependent letter forms on transpositions in normal reading).

Thus, migrations are less likely to occur when they create an illegal orthographic sequence. This is another consideration that should be taken seriously for the diagnosis of LPD in Arabic—not only should the list include migratable words, it also should include migratable words in which the migration does not change the form of any letter.

The migrations of participants with LPD in the current study involved both consonants and vowels. The participants made 16 % migrations that involved only consonant letters changing position, and 19 % migrations in which a consonant letter and a vowel letter swapped positions.

Table 6.3 presents examples of letter migrations that the participants made in reading single migratable words. (In this table and in all other tables in this chapter, the written target words are presented to the left of the arrow, and the oral response, which was an incorrect reading or an "I don't know" response, is presented to the right of the arrow. The left column presents the Arabic target word and response, the next columns present the orthographic transcription, the phonemic transcription, and the translation to English of the target and the response.)

When ascribing migrations in reading to letter position dyslexia, one has to make sure that the migrations indeed result from incorrect letter position encoding in reading, and not from flawed production. This can be tested in two ways: administering reading tests that do not involve oral production, and testing word and non-word production in tasks that do not involve reading.

The reading tasks that do not involve oral production that our participants undertook included: lexical decision, word-to-picture matching, and semantic matching between written words. The lexical decision task included 40 letter sequences, of which half were real words, and half were migratable non-words (like "pecnil"). The participants were asked to decide whether each letter sequence was a word or not.

Another task required migratable word-to-picture matching. This task included triads of a written migratable word and two pictures. The participant was asked to silently read the target word, and to choose the appropriate picture from between two pictures—one matching the word and one depicting its migration counterpart. For example, the written word أسنان, ʔSNAN 'teeth' appeared with a picture of teeth and a picture of a man (corresponding to the migration counterpart, انسان, ʔNSAN ‘person’).

The migratable word association task included 37 triads of words, a target word and two words—one semantically related to the target word, and one related to a migration counterpart of the target word. For example, the participants were asked to choose the word that was more closely related to أسنان ʔSNAN ‘teeth’, from between the word فرشاة, FRŠAḦ, ‘(tooth)brush’, and the word رجل RJL ‘man’, which is related to the migration counterpart of ʔSNAN ‘tooth-brush’, ʔNSAN ‘person’). Here, too, the participant was requested not to read the words aloud and only to mark the matching word.

If the deficit indeed lies in the letter position encoding stage in the orthographic-visual analyzer, the participants are expected to fail not only in reading aloud but also in these reading tasks without reading aloud. If, however, their deficit is in the production stage, they should succeed in these tasks. The results were clear-cut: each of the participants showed a deficit in at least one of these tasks, making migration errors also when no reading aloud was involved. They made an average of 51 % errors in the decision on the lexicality of migratable non-words (20 %–90 % errors, SD = 24 %); an average of 57 % errors in the migratable word-picture matching task (20 %–90 % errors, SD = 21.7 %); and 31 % in the word association task (6 %–94 % errors, SD = 28 %). As summarized in Table 6.2, the performance of the LPD group in each of these tasks was significantly poorer than that of the control participants.

Their performance in the naming and repetition tasks led to the same conclusion: none of them made more migration errors in speech production than did the normal controls, indicating that their difficulty in reading aloud did not result from a production deficit, but rather from a reading deficit in the orthographic-visual analyzer.

Thus, LPD clearly exists in Arabic: it results from a deficit in the orthographic-visual analyzer, in the function of letter position encoding, and its profile is affected by the properties of the Arabic orthography, mainly in that migrations within words only occur when the migration does not cause a form change of any of the letters in the target word.

Importantly, whereas the parents and/or teachers of these children felt that their reading fell short of the level expected from their age and grade, previous reading assessments of these children did not reveal any impaired performance. However, once we used the appropriate type of stimuli, which, in the case of Arabic LPD, are migratable words in which migration does not change the letter forms in the word, the difficulty of the children was very clearly exposed. Using these stimuli, we could detect the high rate of migration errors they made in reading aloud (an average of 21 %) and in word comprehension tasks (up to 57 % errors), each of them making significantly more errors than children of the same age without dyslexia.

## Developmental Attentional Dyslexia

Attentional dyslexia is a reading deficit in which letters migrate between neighboring words, but are correctly identified and keep their correct relative position within the word. For example, the word pair *goat coal* can be read as *goal coal* or even *goal coat*. Another type of error that frequently occurs in attentional dyslexia is the omission of one of the instances of a letter that appeared in the same position in the two words. Such an error would cause the word pair *goat coal* to be read as *got coal*. Additional errors that occur less frequently than the two above are letter migrations from a word that no longer exists in the visual field ("buffer migrations"), and intrusions of letters from a neighboring word to the corresponding position without erasing the original letter in the same position (Friedmann et al. 2010b).

Descriptions of attentional dyslexia in Hebrew and English indicate that almost all migrations preserve the relative position of the migrating letter within the word, namely, the final letter in one word migrates into the same position, the final position, in the other word. This indicates that the between-word position can be impaired while the within-word position encoding remains intact. Letters migrate both horizontally and vertically, namely, from words above and below, to the left and to the right of the target word. Crucially, the lexical status of the migration result affects whether or not such error would occur. Many more migrations occur in attentional dyslexia when the result of migration is an existing word.

What are the predictions for the effect of Arabic orthography on the manifestation of developmental attentional dyslexia in Arabic? Clearly, given the lexical response effect explicated above, languages in which more position-preserving migrations between words create existing words are bound to give rise to more errors in the reading of individuals with attentional dyslexia. Because of the under-representation of short vowels and because of the Semitic morphological structure, position-preserving migrations between words are expected to often create existing words in Arabic. On the other hand, letter form can pull the rope in the other direction. We have already seen that in letter position dyslexia, letter forms reduce the rate of letter position errors in Arabic compared with other languages, because changes in letter form block migrations. This factor can reduce the rate of between-word migrations as well. Given that most migrations between words occur in final letters, and that final letters that ligate to the previous word often have a different form than the ones that do not ligate, migrations of the final letter between words might cause many letter form changes, and hence be blocked.

The results indicated, first, that the rate of developmental attentional dyslexia in Arabic was relatively low. Out of the 74 participants with dyslexia we tested, only two participants showed a reading pattern that is characteristic of developmental attentional dyslexia, one of whom had additional types of dyslexia as well.

The pattern of errors of these two participants was similar to those described in the literature from Hebrew (Friedmann et al. 2010b). The participants with attentional dyslexia, LA, a girl aged 9.1, and BO, a boy aged 9.0, made predominantly letter migrations between words. LA made between-word migrations in 22 % of the word pairs and in 10 % of the words presented one above another in the list; BO made 26 % and 6 %, respectively.

In addition, like the Hebrew-speaking developmental attentional dyslexics reported by Friedmann et al. (2010b), LA also made omissions of letters that occurred in the same position in the two words. She made 22 % such doubled letter omissions.

In most cases, when the participants read the target words incorrectly they ended up producing an existing word—LA produced only three non-words, and BO had six non-word errors. Migration errors between words occurred both horizontally, between two words in a pair, and vertically, when the words were presented one above the other in a list. (Some other responses were "don't know" responses, as shown in Table 6.4). Table 6.4 presents examples of between-word errors that the participants made in reading word pairs.

## Developmental Visual Dyslexia

Visual dyslexia is a deficit in the orthographic-visual analysis stage that causes visual errors in reading (Crutch and Warrington 2007; Cuetos and Ellis 1999; Lambon Ralph and Ellis 1997; Marshall and Newcombe 1973). Visual errors are substitutions, omissions, and additions of letters. An error is defined as visual error when at least half of the letters in the error response are present in the target word (Morton and Patterson 1980). Because there are other types of dyslexia that result from a deficit in the orthographic-visual analyzer and present specific types of errors (such as letter position errors in LPD), a further condition for classifying an error as a visual error is that the participant's errors cannot be accounted for by a specific deficit in the orthographic-visual analyzer such as letter position dyslexia, attentional dyslexia, or neglexia (Friedmann et al. 2012). (For example, the errors of a person who makes predominantly letter migrations, even if these errors are consistent with the definition of half of the errors in the response present in the target, would not be defined as visual errors, but rather as the more specific error type: letter position errors.) Visual dyslexia has two subtypes: one that results from a deficit in the orthographic-visual analysis system that selectively impairs the ability to encode abstract letter identity, and one that results from a deficit in the output of the orthographic-visual analyzer (Friedmann et al. 2012).

We identified 6 Arabic-speaking children who had developmental visual dyslexia, all of whom had visual dyslexia of the second type, namely, a deficit in the output of the orthographic-visual analyzer. The error types they made in reading aloud included substitutions, omissions, additions, migrations of letters within words, and between words, as shown in Tables 6.5 and 6.6. Each of the participants with developmental visual dyslexia made all these kinds of errors, and none of them showed a tendency to make errors on a specific side of the words. They made 42 % errors on average in word reading (range: 27 %–50 %, SD = 8 %).

Importantly, this pattern of errors of the six participants did not stem from a phonological output deficit. This can be deduced from the good performance of these participants on tests of phonological output that do not involve reading, and from a reading input test that does not involve phonological output. In a test of non-word repetition (ARABLIP, Haddad-Hanna and Friedmann 2010), five of the six participants with developmental visual dyslexia performed within the normal range, and made no more than 3 errors on the 42 complex non-words they repeated. One participant, AH, made many errors in the non-word repetition task, so it seems

**Table 6.4** Examples of between-word errors made by the Arabic-speaking attentional dyslexia participants in reading a list of word pairs

| Arabic | Graphemic transcription | Phonemic transcription | Translation |
|---|---|---|---|
| *Migrations between words* | | | |
| مفر قَطر[1] | QṬR MFR | | |
| أسد حبى → أسد قبى | ĦBA ʔSD → QBA ʔSD | Ħaba: ʔasad → qaba: ʔasad | crawl lion → non-word, lion |
| حصار عمان → حصان, مش عارفة | ʕMAN ĦṣAR → *D.K*, ĦṣAN | ʕamma:n ħisa:r →*D.K* ħisa:n | Amman siege → horse, DK |
| *Omissions of a doubled letter* | | | |
| حمير سرير → سر, مش عارفة | SRYR ĦMYR → SR, *DK* | Sari:r ħami:r → sir *D.K* | bed donkeys → secret, DK |
| بان صالون → بان صالو | ṢALWN BAN → ṢALW BAN | *ṣa:lun* ban → *ṣa:lu* ban | living room appear → living room (Pal. Arabic), appear |
| مفر قطر → مفر قط | QṬR MFR → QṬ MFR | qaṭar mafar → qiṭ mafar | Qatar escape → Qatar, cat |

The target Arabic word pairs are presented here from left to right for the ease of comprehension of the transcription and translation

*D.K* I don't know

[a] In this example, this word pair appeared above the next, and the migration was vertical, namely the letter K migrated from the top word to the word below it

**Table 6.5** Examples of visual errors made by the Arabic-speaking participants with developmental visual dyslexia

| Arabic | Graphemic transcription | Phonemic transcription | Translation |
|---|---|---|---|
| *Migration* | | | |
| وزير → وزري | WZYR → WZRY | Wazi:r → wazri: | minister → non-word |
| معطف → مطعف | MʕṭF → MṭʕF | miʕṭaf → miṭʕaf | coat → non-word |
| أمل → ألم | ʔML → ʔLM | ʔamal → ʔalam | hope → pain |
| *Omission* | | | |
| أكلت → أت | ʔKLT → ʔT | ʔakalat → ʔat | she ate → non-word |
| فادي → دي | FADY → DY | fa:di → di | name → non-word |
| مجدي → مجد | MJDY→ MJD | majdi → majd | name → name |
| *Addition* | | | |
| جاء → جاءت | JAʔ → GAʔT | ja:ʔ → ja:ʔat | he came → she came |
| صور → ضصور | ṣWR → DṣWR | ṣu:r → ḍaṣu:r | pictures → non-word |
| شر → شعر | ŠR → ŠʕR | šar → šaʕr | evil → hair |
| *Substitution* | | | |
| ضرب → عرب | ḍRB → ʕRB | ḍarb → ʕarab | beating → Arabs |
| كتان → كتاب | KTAN → KTAB | Kitta:n → kita:b | linen → book |
| كرم → كتم | KRM → KTM | karm → katam | generosity → mute |

**Table 6.6** Distribution of errors of the 6 participants with developmental visual dyslexia out of 204 words each participant read

| Total visual errors | Add—middle | Sub of visually similar letters | Om—middle | Mixed error—om + sub/add in several positions | Mig | Mig + add | Mig + om | Mig + sub | Mig between words | Om/sub/add—right | Om/sub/add—left |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *512* | 43 | 59 | 76 | 115 | 22 | 11 | 33 | 15 | 10 | 67 | 61 |

*sub* letter substitution, *om* letter omission, *add* letter addition, *mig* letter migration within word

that he also had a deficit in phonological output, but, crucially, he also had a deficit in reading input. His input reading deficit is indicated by his poor performance in lexical decision on 50 letter strings, that included 35 non-words for which letter addition, substitution, omission, migration, or diacritic marks errors creates an existing word; and by his chance performance, indicating a guessing pattern, in a written word comprehension task that required him to circle one of two migratable words that was semantically related to a third word (see the section on letter position dyslexia for the description of this test). Three other participants with visual dyslexia were tested in these input reading tasks, and all of them performed poorly on these tasks (average of 63 % correct on the lexical decision tasks, and 53 % correct on the migratable words association task), indicating an input-reading, rather than output-speech, impairment.

As shown in the examples in Table 6.5, unlike in LPD, migrations in visual dyslexia occur also in exterior letters—the first and the last letters do not necessarily preserve their within-word position.

### Developmental Neglect Dyslexia

Neglect dyslexia is a dyslexia that has been thoroughly described in its acquired form, for a large number of individuals with acquired neglect dyslexia in several languages (Arduino et al. 2002, 2003; Arguin and Bub 1997; Behrmann et al. 1990; Bisiach et al. 1986; Bisiach et al. 1990; Caramazza and Hillis 1990; Cubelli et al. 1991; Ellis et al. 1987; Ellis et al. 1993; Haywood and Coltheart 2001; Miceli and Capasso 2001; Patterson and Wilson 1990; Reznick and Friedmann 2009; Riddoch et al. 1990. See Vallar et al. 2010 for a review). Developmental neglect dyslexia has so far been reported only in Hebrew (Friedmann and Nachman-Katz 2004; Nachman-Katz and Friedmann 2007, 2008, 2009, 2010). Readers with neglect dyslexia at the word level (neglexia) neglect one side of the word. This results in omissions, substitutions, or additions of letters on one of the sides of the word, typically on the left side. Research in Hebrew showed that the left side of the word is more sensitive to neglect errors when it is part of the affix, and is almost never omitted when it is part of the root (Reznick and Friedmann 2009).

One feature of Arabic orthography that would lead to a different manifestation of neglexia from the one known from studies of (acquired) neglect dyslexia in English, Italian, and other European languages, is the reading direction in Arabic. Because Arabic is read from right to left, neglexia, which typically manifests itself on the left side of words, would affect the end, rather than the beginning, of words in Arabic.

One of our Arabic-reading participants, CR, showed this pattern of developmental neglect dyslexia. CR was a 10 year-old girl, in fourth grade. She made many visual errors in her oral reading: substitutions, letter omissions, additions, and migrations within words. She made no semantic errors. In the task of oral reading of single words, non-words, and word pairs presented in lists, she made 74 (47 %) visual errors on the word list, 12 (44 %) visual errors on the non-word list, and 13 visual errors (57 % of the pairs) on the list of word pairs. Therefore, we initially suspected that she had visual dyslexia. However, when we further analyzed her visual errors, we realized that her errors shared an important common feature—almost all of them occurred on the left side of the words. Namely, her errors actually resulted from neglect dyslexia. In total, 57 of her 74 visual errors on single words occurred on the left side of the word (77 %), and so did 10 of her 12 errors on non-words. In reading the 23 word pairs, 11 of her 13 visual errors occurred on the left side of the words.[2] Thus, her error pattern indicated neglexia. Examples of her errors are given in Table 6.7.

[2] An error was classified as left-side error when it occurred from a certain position in the word and until the end (left-side) of the word: namely, when the erroneous response was identical to the target word to the right of an identifiable neglect point in the target word, and shared no letters in

**Table 6.7** Examples of errors of an Arabic-speaking girl with developmental neglect dyslexia

| Arabic | Graphemic transcription | Phonemic transcription | Translation |
|---|---|---|---|
| *Omission* on the left | | | |
| بابا → باب | BABA → BAB | ba:ba → ba:b | daddy → door |
| وثبوا → وثب | WθBUA → WθB | waθabu: → waθaba | they jump → he jumps |
| *Addition* on the left | | | |
| ذباب → ذبابة | ðBAB → ðBABḦ | ðuba:b → ðuba:ba | flies → fly |
| ورقة → ورقارة | WRQḦ → WRQARḧ | waraqa → waraqa:ra | paper → non-word |
| *Substitution* on the left (same number of letters) | | | |
| جرح → جرّة | JRĦ → JRḦ | jarħ → jarra | wound → jar |
| ربحتم → ربحتل | RBĦTM → RBĦTL | rabiħtum → rabiħtul | you win → non-word |
| جمع → جمل | JMʕ → JML | jamaʕa → jamal | collect → camel |
| (different number of letters) | | | |
| طيارة → طياريقة | ṬYARḦ → ṬYARYQḦ | ṭayya:ra → ṭaya:riqa | plane → non-word |
| سلاح → سنيحة | SLAħ → SNYĦḦ | sila:ħ → saniħa | weapon → non-word |
| كمال → كان | KMAL → KAN | kama:l → ka:n | perfection/name → was |
| شعير → شعياج | ŠʕYR → ŠʕYAJ | šaʕi:r → šaʕYa:j | barley → non-word |
| كرة → كركر | KRḦ → KRKR | kura → karkar | ball → non-word |
| ضيعَّ → ضيالام | ḌYʕ→ ḌYALAM | ḍayyaʕa→ ḍaya:la:m | wasted → non-word |
| همام → همايا | HMAM→ HMAYA | hamma:m→ hama:ya: | name → non-word |

CR never omitted the words on the left side, only letters on the left side of the word. In reading the 23 word pairs, she made no omissions of the left word, indicating that her neglexia was at the word- rather than the text-level.

Her errors clearly resulted from a deficit in reading (neglexia), rather than an impairment at the phonological output buffer. In a picture naming task (SHAMS, Haddad-Hanna et al. 2010), she made 17 errors, but these errors were mainly semantic (which she never produced in reading), and none of them was phonological or involved the end (the left side) of the word. In addition, a non-word repetition task (ARABLIP) showed that she did not have specific difficulties with the ends of words. In fact, she made no errors at all in non-word repetition.

Thus, developmental neglect dyslexia also exists in Arabic, and it presents a reading pattern similar to the one reported for acquired neglect dyslexia. Given the reading direction in Arabic, when this impairment affects the left side of words, in Arabic it affects the end, rather than the beginning of the words.

common to the left of the neglect point (see discussions with regard to the definition of neglect errors in Ellis et al. (1987) and Vallar et al. (2010)). Therefore, for example, a left-sided error could be an omission or substitution of the last (leftmost) letter or an omission or substitution of all the last 4 letters.

**Developmental Surface Dyslexia**

So far, we have described the manifestation in Arabic of dyslexias that result from an impairment in the orthographic-visual analyzer. We now move to present and discuss impairments in later stages of reading, in the lexical and sublexical routes.

Individuals with surface dyslexia read via grapheme-to-phoneme conversion due to a deficit in the lexical route. Reading via the grapheme-to-phoneme conversion route instead of via the lexical route (which connects the orthographic input lexicon and the phonological output lexicon) creates several problems in reading. Firstly, individuals with surface dyslexia make more errors in reading irregular words than expected for their age. When presented with irregular words such as *listen,* door*,* or *come*, they are likely to read them incorrectly, because the accurate reading of such words requires the word-specific knowledge that is contained in the lexical route, and specifically, in the orthographic input lexicon. Regular words, namely, words for which reading via the sublexical route results in the correct phonological form, are usually read correctly. In this dyslexia, non-words, which are read only via the sublexical route, which is intact for individuals with surface dyslexia, are also read well. Surface dyslexia usually also affects the reading rate, causing a slower reading process (Spinelli et al. 1997). For individuals with surface dyslexia whose orthographic input lexicon is impaired, comprehension is impaired too: homophones like *which* and *witch*, which can only be distinguished on the basis of the orthographic input lexicon but sound the same when read via the sublexical route, are indistinguishable for them. Finally, data from Hebrew (Friedmann and Lukov 2008) show that words that can be read via the sublexical route as other existing words (*potentiophones*), are more susceptible to errors. For example, whereas a word like “now” can be read via grapheme-to-phoneme conversion sounding like “no”, an irregular word like “knife” cannot be read as another existing word, in which the k is sounded out, and hence, might be read correctly when the reader monitors the production of only existing words.

How do these characteristics manifest when a surface dyslexic reads Arabic? There are almost no homophonic letters in the Standard Arabic orthography. This could lead to better chances of correct reading, even via the sublexical route. On the other hand, short vowels are not represented in the orthography, so words can include consonant strings that are underspecified for vowels. In this case, a reader with surface dyslexia, who reads only via the grapheme-to-phoneme conversion route, has to guess the appropriate vowel, which is missing from the orthographic representation of the word. Notice, that the definition of irregular words has to be refined when we come to consider reading in surface dyslexia in Arabic. Whereas irregular words in English are words that include silent letters (like *talk, comb,* or *knife*), and words that include ambi-phonic graphemes (a letter or a group of letters) that can be converted in two or more ways into phonemes and are converted, in the specific word, into the less frequent phoneme (like the letter *i*, which is pronounced one way in *kid* and another way in *kind*), in Arabic, irregularity takes a different form. In Arabic (as is the case also in Hebrew, see Friedmann and Lukov 2008), a considerable source of irregularity is the underrepresentation of short vowels, which leads to many degrees of freedom in reading many words. Therefore, ambiguity in

**Table 6.8** Examples of errors made by the Arabic-speaking participants with surface dyslexia

| Arabic | Graphemic transcription | Phonemic transcription | Translation |
|---|---|---|---|
| *Incorrect choice of unspecified (lexically determined) vowels* | | | |
| جمعة → جمع | JMʕḦ→JMʕ | jumʕa→jamaʕa | Friday → collected |
| ضربة → ضرب | ḍRBḦ→ ḍRB | ḍarba→ ḍaraba | blow (noun) → he hit |
| فتحة → فتح | FTĦḦ → FTĦ | fatħa → fataħa | open/fatħa → opened |
| كي → كي | KY → KY | kay → ki | because → non-word |
| سوف→سوف | SWF → SWF | sawfa → su:f | will → non-word |
| كسرة → كسر | KSRḦ → KSR | kasra →kasara | piece → he broke |
| اصطفوا → اصْطَفَوَا | AṣṭFWA→ AṣṭFAWA | ʔisṭafu:→ ʔisṭafawa: | (they) lined → non-word |
| *Incorrect application of specific conversion rules* and dialect homophones | | | |
| ورقة → ورقت | WRQḦ → WRQT | waraqa → waraqat | paper → non-word |
| طمّ → طم | ṭM → ṭM | ṭamma → ṭam | covered → covered (Pal. Arabic) |
| الشمس→ الشمس | ALŠAMS→ ALŠAMS | ʔaššams→ ʔalšams | the-sun → phonologically non-exiting sequence |
| اذاً → اذا | AðA → AðA | ʔeðan → ʔeða: | so → if |
| ضار → دار | ḍAR → DAR | ḍa:r → da:r | harmful → house |
| وضيع → وديع | WḍYʕ → WDYʕ | waḍi:ʕ → wadi:ʕ | inferior → male name |

conversion is an important source of irregularity, and hence, of difficulty for individuals who read via the grapheme-to-phoneme conversion route.

This irregularity in Arabic would clearly lead individuals with surface dyslexia to incorrect reading, especially in cases where there are potentiophones that differ only with respect to their vowels. For example, the word فتحة, FTħḦ could be read in various ways if read via grapheme-to-phoneme conversion, because of the under-specification of the vowels on the first two letters. The correct reading of this letter string according to the lexicon is *fatħa* (the name of a diacritic marker representing the vowel/a/), but reading it via the sublexical route could lead to some other phonological strings that are existing words, such as *fataħa* 'he opened', which is written as فتح, FTħ.

Within our group of participants, nine participants had surface dyslexia. One of them had a pure surface dyslexia, and 8 had surface dyslexia in addition to another dyslexia. Most of the errors they made were in the vowel pattern of words, when this vowel pattern was lexically, but not orthographically specified (see examples in Table 6.8). These errors were especially frequent in potentiophonic words like *fatħa*.

Other errors that these participants made related to letters that are homophonic in their spoken dialect. For example, in some dialects of the Palestinian Arabic spoken in Israel, D and ð (د, ذ) sound the same. This infiltrated into the reading of the participants with surface dyslexia who speak this dialect, causing them to read one as the other, and hence, to have more homophonic-like and potentiophonic words than we had initially expected (see examples in Table 6.8). This dialectal homophony also led these participants to make errors in lexical decision, accepting non-words that for them were pseudo-homophones, as they included d instead of ð, or vice versa.

One frequent source of difficulty for Arabic-readers with surface dyslexia was words ending with UA (e.g., اصطفوا, AṣṭFWA). This letter combination is irregular because according to the conversion rules it should be read as *wa,* but it actually stands for the masculine plural ending of past-tense verbs, read as */u:/*.

Other errors that were frequent for the participants with surface dyslexia related to the conversion of special orthographic symbols such as *shadda* (ّ), which denotes the doubling of the consonant; *hamza* (ء), which appears alone or with a vowel letter and denotes a glottal stop; *tanwin fatħa*, (اً), which appears as a double fatħa; the diacritic sign for the vowel */a/*, sometimes followed by *ʔalif,* but which requires pronouncing an 'n' sound, which is not written, *ta:ʔ marbu:ṭa*(ة, transcribed in the examples as Ḧ), which appears in the end of the word and sounds like *fatħa (short a)* in unvoweled Arabic, but sounds like *t* when it appears in the end of the first word in a construct state nominal; and *ʔalef makṣu:ra* (ى), a short *a* sound that appears at the end of a word, written as the letter y without the dots diacritics (for example, مكوى, MKWA, iron). (For a discussion of the structure of Arabic language and orthography, see Saiegh-Haddad & Henkin-Roitfarb, Chap. 1).

The participants' error rate in word reading was quite high for words underspecified for vowels (that are not potentiophones, 31 % errors), for potentiophones (41 %), for words with sounds that are indistinguishable in their dialect (9 % errors), and for words with the special symbols described above (69 % errors). Their reading of non-words, which are read on the basis of grapheme-to-phoneme conversion rules, on the other hand, was quite good—they read 91 % of the non-words correctly (in this analysis we excluded the errors that result from the participants' additional dyslexia, if there was one).

## Developmental Vowel Dyslexia

Vowel dyslexia is a disorder that results from an impairment in the sublexical route, which selectively impairs the way the sublexical route processes vowels (Khentov-Kraus and Friedmann 2011). Individuals with vowel dyslexia omit, substitute, transpose, and add vowel letters. Relevant examples in English might be reading *bug* for *big*, *form* for *from*, and *boring* as *bring*, or *bring* as *boring*.

If a person reads normally, via the lexical route, vowel dyslexia would only be manifested when s/he reads non-words, because only when s/he uses the grapheme-to-phoneme conversion route does the deficit in this route evince. For readers with vowel dyslexia who also have surface dyslexia, the picture is different. Because they read even existing words via the sublexical route, they make vowel errors not only when reading non-words but also when reading existing words.

Interesting interactions of vowel dyslexia with Arabic relate to three aspects of the Arabic orthography. Firstly, unlike Hebrew, the only language in which vowel dyslexia has been documented so far, each vowel letter in Arabic corresponds to a single long vowel. This would allow for the assessment of the question of whether vowel dyslexia occurs in Hebrew because of the ambiguity of vowel letters. If it does, we should not expect vowel dyslexia to occur in Arabic. Another interesting aspect of the Arabic orthography relates to the differences between long and

**Table 6.9** Examples of errors made by the Arabic-speaking participants with developmental vowel letter dyslexia

| Arabic | Translation | Phonemic transcription | Graphemic transcription |
|---|---|---|---|
| *Vowel addition* | | | |
| جمع → جميع | GMʕ → GMYʕ | jamaʕa → jami:ʕ | plural → all |
| عمان → عامان | ʕMAN → ʕAMAN | ʕamma:n → ʕa:ma:n | Amman → 2 years |
| كوب → كواب | KWB → KWAB | ku:b → kwa:b | cup → non-word |
| *Vowel migration* | | | |
| جهاز → جاهز | JHAZ → JAHZ | jiha:z → ja:hiz | device → ready |
| يجود → يوجد | YGWD → YWGD | yaju:d → yu:jad | (he) grants to → exists |
| ختام → خاتم | XTAM → XATM | xita:m → xa:tim | end → ring |
| *Vowel omission* | | | |
| بحار → بحر | BĦAR → BĦR | biħa:r → baħr | seas → sea |
| ملاك → ملك | MLAK → MLK | mala:k → malik | angel → king |
| شعار → شعر | ŠʕAR → ŠʕR | šiʕa:r → šaʕar | symbol → felt |
| *Vowel substitution* | | | |
| صالون → صولون | ṣALWN → ṣWLWN | ṣa:lon → ṣulon | salon → non-word |
| سكين → سكان | SKYN → SKAN | sikki:n → sukka:n | knife → population |

short vowels. Arabic clearly distinguishes long from short vowels, and whereas the long ones are always encoded orthographically (and unambiguously so), the short vowels are almost never represented in written words. Therefore, Arabic provides a rare opportunity to test whether another type of vowel error occurs: whether, on top of vowel substitution, addition, migration and omission, individuals with vowel dyslexia also make short vowels long, and long vowels short. Thirdly, we have seen that Arabic letter-forms modulate migrations that result from an impairment at the orthographic-visual analyzer level, in LPD. Data from Hebrew vowel dyslexia indicate that vowel position errors are frequent in vowel dyslexia. We therefore found it interesting to assess whether letter-form also affects migrations that result from an impairment at the sublexical route or only migrations that result from a deficit in the early stage of the letter position encoding function in the orthographic-visual analyzer.

Vowel dyslexia, although never reported in Arabic, was surprisingly frequent in our sample of Arabic readers with developmental dyslexia. In fact, it was one of the most frequent types of dyslexia in our sample. The sample included 13 participants with vowel dyslexia, who made more errors in vowel letters than the control group, and more errors in vowel letters than in consonants. In total, they made vowel errors on 43.3 % of the single words in the TILTAN test that included vowel letters. These vowel errors were 15.7 % vowel additions, 14.9 % vowel migrations, 13.2 % vowel omissions, and 6 % vowel substitutions (see examples in Table 6.9). Many of the vowel addition and omission errors were in fact shortening of a long vowel, or elongation of a short vowel. This is because short vowels are not represented in the orthography, whereas long ones are represented with a vowel letter. We encoded the responses accordingly. Namely, when a participant said a short vowel, we wrote down his response, and encoded the short vowel he said with no vowel letter; when the participant said a long vowel, it was encoded with the relevant vowel letter. Therefore, the encoding of a target word with a short vowel sound (that is not represented in the orthography) that was read with a long sound included an addition of a long vowel letter. When the participants read the long vowel letter as a short vowel, it was encoded as the omission of this letter.

Similar to the Hebrew-readers with vowel dyslexia reported by Khentov-Kraus and Friedmann (2011), the Arabic-speaking participants made errors both when the vowel letter functioned as a vowel (i, a, u) and when it functioned as a consonant (y, ʔ, w). This is expected, given that vowel dyslexia is only manifest when one reads via the sublexical route, and the sublexical route does not have the information about the function of a vowel letter in a particular word.

Importantly, the errors in reading were not a result of difficulties in the spoken production of vowels, as indicated by the good performance of the participants in the ARABLIP non-word repetition test, as well as by their spontaneous speech and performance in the picture naming task.

Finally, a very interesting pattern was observed with respect to the vowel migration errors. Above we described the effect of letter form on letter migrations that result from a deficit at the orthographic-visual analysis stage: in LPD, letter form change blocks migrations. However, vowel dyslexia results from a deficit at a later stage of written word processing, in which letter form is no longer encoded. Therefore, vowel migrations that result from vowel dyslexia showed a different pattern: as exemplified in Table 6.9, vowel position errors occurred even when they required a change in letter form (such as جهاز → جاهز). This supports the distinction between vowel migrations that result from vowel dyslexia and vowel migrations that result from LPD, and suggests a way to distinguish between the two.

## Developmental Deep Dyslexia

Deep dyslexia is characterized primarily by semantic errors in reading, as well as by morphological and visual errors, a severe deficit in the reading of function words that results either in substitution for another function word or complete inability to read them; better reading of nouns than verbs and adjectives; and better reading of imageable and concrete words compared to abstract words (Coltheart 1980; Coltheart et al. 1987; Marshall and Newcombe 1973). This reading pattern was interpreted within the dual route model as multiple lesions in both the sublexical grapheme-to-phoneme conversion route and in the direct lexical route between the orthographic input lexicon and the phonological output lexicon, which force the reader to read via meaning (Ellis and Young 1988). Deep dyslexia has been studied intensively in its acquired form, but several studies have also reported cases of developmental deep dyslexia, with reading patterns that are similar to those reported for acquired deep dyslexia (Johnston 1983; Siegel 1985; Stuart and Howard 1995; Temple 1988, 1997).

The interaction of the unique properties of Arabic with deep dyslexia yields two main aspects in which deep dyslexia in Arabic would be manifested differently than in other languages. Firstly, the diglossic situation is expected to affect the reading of individuals with deep dyslexia. Written Arabic is Standard Arabic, whereas the Arabic spoken by our participants is Palestinian Arabic, which differs in phonology, lexicon, and syntax from the standard, written Arabic. In addition, our participants also speak Hebrew as a second language. This creates an interesting test case for the interaction between diglossia and deep dyslexia: if reading proceeds exclusively via meaning, and if naming and speaking occur in Palestinian Arabic, reading words presented in Standard Arabic might result in the production of words in Palestinian Arabic. The additional language that the participants speak and the multi-language culture they live in might also give rise to the preference of some Hebrew words that are used also in the Arabic-speaking environments.

A second interaction of the properties of Arabic and deep dyslexia relates to morphology in Arabic. Arabic, as a Semitic language, has a rich morphological structure in both nouns and verbs. Verbs are typically built from three-consonant roots that are incorporated in verbal templates, and many nouns are similarly constructed from a three-consonantal root incorporated in nominal templates. This allows for the investigation of the types of morphological errors that occur in deep dyslexia: would the root be kept and the template changed? Will the other type of errors also occur, with the template kept and the root changed? In addition, since some syntactic properties such as passive voice and tense are signaled in verb inflection, inflection plays a crucial role in the probability of correct reading. The reading of various types of inflection (tense, passive, subject agreement) was therefore assessed.

Five of our participants showed a reading pattern that was typical of developmental deep dyslexia. We will describe here the reading pattern of FA, a 15 year-old Palestinian Arabic-speaking boy. FA was supported by a remedial teacher and occupational therapist for reading problems, writing problems, and difficulty in coping with school assignments. FA was healthy, and has never sustained brain injury; therefore, one can assume that his dyslexia is developmental. The fact that FA's brother, HA, was also deep dyslexic further supports the congential, and possibly genetic source of FA's dyslexia.

We administered to FA an oral reading task of a long list of words that was sensitive to the special characteristics of deep dyslexia. The task included single words of various kinds that were selected to detect deep dyslexia: function words, abstract versus concrete nouns, words with a common synonym or words that are usually produced in another language (Palestinian Arabic, Hebrew, or English), morphologically complex verbs, inflected for various tense and agreement forms, and verbs with a bound object pronoun, and morphologically complex nouns. In addition, FA read non-words.

FA's reading was very slow and impaired and he got tired very quickly. During the test he complained he had a headache because of having to read, and three meetings were required to finish reading the list of 236 words. FA read a mere 4 % of the words correctly.

The error types that characterized FA's reading were exactly the ones that are typical of deep dyslexia. He made semantic errors, which is the error type that defines deep dyslexia. For example, he read طبل ṭBL 'drum' as دف DF, 'a hand drum', and يوميات, YWMYAT 'diary', as دفتر DFTR, 'notebook'. Another type of error that is frequent in deep dyslexia, morphological error, was also frequent in FA's reading. For example, he read تفاحة TFAĦḦ 'an apple' as تفاح TFAĦ 'apples', and كاتبتني, KATBTNY, 'she-wrote-me' as كتاب KTAB 'book'. He also made visual-then-semantic errors, reading تراب TRAB 'soil' as عصفور, ʕṣFUR 'bird', probably via the visual error غراب, ɣRAB 'crow'. He made some visual errors, such as رحمة RĦMḦ, 'mercy' which he read as حمامة ĦMAMḦ 'dove'.

Because readers with deep dyslexia read via the semantic route, the reading of words that do not carry a precise semantic content, such as function words and abstract words, is severely impaired. And indeed, FA read correctly only 2 of 20 function words. He made errors of reading another function word instead of the target function word, such as الى 'to' → من 'from', visual errors, أنه 'that-he' → الله 'God', substitutions with visually similar words in Palestinian Arabic, هل, a yes/no question word → هوا 'air' in Palestinian Arabic, don't know responses, and visual or semantic errors.

Abstract words are also especially difficult when reading via the semantic route. Indeed, FA read only 2 of the 25 abstract words correctly. Most of his errors were semantic errors, and other errors included morphological, visual-then-semantic, visual or semantic (شمعة ŠMʕḦ 'candle' → شمس ŠMS 'sun'), semantic or morphological (مكتب 'office'→ كتاب 'book'; مفتاح 'key' → مفتوح 'opened'), visual, and unclear errors, as well as "don't know" responses. FA substituted 17 of the abstract words for concrete words or proper names.

Morphological errors are also characteristic of deep dyslexia. And indeed, FA's reading of the two sets of morphologically complex words, the nouns and the verbs, was very impaired. In reading the morphologically complex verb list, FA could not read even a single verb correctly. He made 34 % morphological errors, mainly comprised of inflection errors and omissions of the bound pronoun, and 17 % morphological and visual errors. The rest were visual-then-semantic errors, visual errors, errors that could be classified as either morphological, visual, or semantic, and "don't know" responses. Interestingly, he also made what could be interpreted as morphological-then-semantic errors. For example, he read يجيبانه, YGYBANH 'they-both-are-answering-him', as سيّارة SYARḦ, 'car'. We suggest that what led to this error was first a morphological decomposition of the word, which isolated the root جيب GYB and then, because this root word means 'jeep', a further semantic error which led to the word 'car'. This kind of error has an important bearing on the order of morphological decomposition and semantic processing. Just like the consistent order of visual-then-semantic errors indicates the not-too-surprising fact that visual analysis of written words precedes semantic processing, the order of morphological-then-semantic errors indicates that the morphological decomposition occurs in a pre-semantic stage. This result supports studies of morphological decomposition that suggested an early, pre-semantic locus for morphological processing (Deutsch et al. 2000; McCormick et al. 2008; Rastle et al. 2000; Rastle and Davis 2008; Reznick and Friedmann 2009).

In reading morphologically complex nouns, FA showed a similar pattern. He managed to read correctly only 2 of the 35 words. He made mainly semantic errors (سيّارات 'cars' → ساق 'drove'), morphological errors (جذور 'roots' → جذر 'root'), visual errors, and visual-then-semantic errors (جارة, GARӞ 'neighbor' → دجاجة DGAGӞ 'hen', probably via جاجة GAGӞ, 'hen' in Palestinian Arabic).

To examine the effect of the special diglossic situation in Arabic on deep dyslexia, we presented FA with a list of words in Standard Arabic that have common synonyms in Palestinian Arabic or in Hebrew. FA could not read correctly even a single word from this list, which included 34 words. Again, he mainly made semantic errors, and also had some morphological, visual-then-semantic or visual errors. One particularly interesting visual-then-semantic error was made for the target word شاحن ŠAĦN 'charger', which he read as مريض MRYḌ 'sick', probably via the visual error ساخن SAXN, which means 'sick' in Palestinian Arabic. This error is not only a good example of visual errors occurring before the semantic ones during the reading of a word, but also shows the effect of diglossia on his reading. Other words were read with a more direct indication of the effect of diglossia and bilingual context on his reading: FA read دار, DAR 'house' in SA, as 'bet', house in PA, he read هاتف, HATF 'phone' in SA, as تلفون, 'telefon', an international word, used also in PA. Furthermore, because many speakers of PA are also speakers of Hebrew as a second language, and because some Hebrew words have become part of spoken PA, FA, who had basic knowledge of Hebrew, read some words as their Hebrew counterpart. For example, the word حاسوب, ĦASWB 'computer' in Arabic, was read *maxšev*, which is the Hebrew word for computer.

Another girl with developmental dyslexia, SU, who was tested when she was 16 years old, further demonstrated the crucial effect of the Arabic diglossia on reading in deep dyslexia. For example, when presented with the SA word for 'sit' جلس JLS, SU read the PA counterpart of the word, (قعد) أعد, ʔʕd 'sit' in Palestinian Arabic, and the word طبيب, ṬBYB, medical doctor in SA, was read *daktor*, the word used in PA. In addition, semantic errors usually did not only include a semantic paralexia but were also produced in PA, when the word was initially presented in SA. For example, the word لوح, LWĦ, 'blackboard' in Standard Arabic, was read as *maħħay*, 'eraser' in Palestinian Arabic. Like FA, she also read some words as their Hebrew counterpart. For example, she read the Arabic word بريد, BRID 'post', as the Hebrew word for post *doʔ*ar, and like FA, she also read the SA word for computer as its Hebrew counterpart.

In non-word reading, both FA and SU showed very severe impairment. FA could not read any item from the 47 non-word list. He lexicalized 38 of the non-words, reading them as words, and produced 8 "don't know" responses. His lexicalizations involved mainly visual errors: كدنرة KDNRӞ → كبيرة KBYRӞ 'big', and visual-then-semantic errors such as خزال, XZAL → زرافة, JRAFӞ 'giraffe', probably via غزال ƔZAL 'deer'. We presented SU with 39 three-to-five letter non-words. She could read only one of them. She responded to 17/39 non-words with a "don't know" response, and commented several times "I know all the letters but I cannot read it nevertheless". She made (11) lexicalizations; for some of them she said she knew it was not the target word. For example, for the non-word *rugaa,* she read *giraa* (glue) and said "I know it should start with 'r' but what actually goes out of my mouth is giraa."

## 6.2 Conclusion

This large-scale study of dyslexia in Arabic had two aims: to describe the effect of the special nature of the Arabic orthography and language on the manifestation of dyslexia, and to identify and characterize types of dyslexia in Arabic. Our results clearly show the intricate interactions between the characteristics of Arabic and the manifestation of each type of dyslexia.

This research identified and described for the first time 7 types of developmental dyslexia in Arabic: letter position dyslexia, attentional dyslexia, visual dyslexia, neglect dyslexia, surface dyslexia, vowel dyslexia, and deep dyslexia. The mapping of the various types of developmental dyslexia in Arabic joins a growing body of evidence for the existence of types of developmental dyslexia, each very similar to the respective type of acquired dyslexia. (For a comprehensive survey of this literature, see Brunsdon et al. 2002; Castles et al. 1999, 2006; Castles and Coltheart 1993; Coltheart and Kohnen 2012; Jones et al. 2011; Marshall 1984; Temple 1997.)

The mapping of types of developmental dyslexia has theoretical, as well as clinical and educational implications. Theoretically, more and more research seeks the functional and biological sources of dyslexia. Our findings indicate that a single source of deficit is not likely to be able to account for such a variety of developmental dyslexia subtypes. Rather, the various types of dyslexia, in Arabic as in other languages, can be naturally accounted for by a neuropsychological approach ascribing each type of developmental dyslexia to a deficit in a different component of the reading processes, similar to subtypes of acquired dyslexia (Castles et al. 2006; Castles and Coltheart 1993; Coltheart et al. 1983; Marshall 1984; Temple 1997).

The identification of subtypes of developmental dyslexia in Arabic also bears clinical and educational implications. With respect to diagnosis, given that each type of dyslexia has different characteristics and different types of words sensitive for its exposure, and given the interaction of each dyslexia and the properties of Arabic orthography, when one comes to diagnose an Arabic-speaking person with dyslexia, the diagnosis tools should accommodate the specific types of dyslexia and their specific manifestations in Arabic.

Furthermore, given that the source of each type of dyslexia is different, different types of treatment and approaches for reading instruction are required for the different dyslexias.

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# Chapter 7
# Narrative Development In Arabic: Story Re-Telling

**Dorit Ravid, Dina Naoum and Suheir Nasser**

**Abstract** Narrative discourse has become a favored site for language acquisition research in the last two decades. The current study is an experimental elicitation task of story re-telling administered to 97 participants in 7 age groups, from nursery school to adulthood, all mid-high SES native monolingual speakers of a PA dialect spoken in the north of Israel. They were read (in MSA) and consequently asked to re-tell a story in which a pigeon rescues an ant from drowning, is promised reciprocal help, and is indeed eventually saved by the ant from being shot by a hunter. Results showed that re-told stories grew longer with age and schooling and contained larger amounts of MSA lexicon and morpho-syntax. The number of errors declined concomitantly. Reconstruction level and linguistic referencing increased with age and schooling, with cut-off points across the whole developmental spectrum, indicating the long and arduous road to re-telling all of the components of a story. Foregrounded, more concrete scenes were more easily reconstructed than the backgrounded content units relating internal and abstract states. Both top-down (content and global structure) and bottom-up (morpho-syntactic and lexical) measures indicate the consolidation of narrative abilities in PA speakers across the school years.

**Keywords** Content units · Language development · Lexicon · Morphology · Narrative · Story retelling · Syntax

D. Ravid (✉)
School of Education and the Department of Communications Disorders,
Tel Aviv University, Tel Aviv, Israel
e-mail: doritr@post.tau.ac.il

D. Naoum
The Department of Communications Disorders,
Tel Aviv University, Tel Aviv, Israel
e-mail: d_naoum@yahoo.com

S. Nasser
The Department of Communications Disorders,
Tel Aviv University, Tel Aviv, Israel
e-mail: suheir_naser@yahoo.com

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## 7.1 Introduction

Narrative discourse has become a favored site for language acquisition research in the last two decades. Narratives are a universal type of discourse, familiar to children and adults alike, and common in all cultures (Flanagan 1993). Narratives focus on people and their psychological relationships. They express the flow and unfolding of events, and are thus organized by temporal, causal, and spatial dimensions of events (Berman 1997; Labov 1972). Narratives recruit the language-specific, age-appropriate linguistic resources available to a language learner to construct an extended discourse expressing the plot of a story with relation to a thematic point, often accompanied by evaluation of external and internal states (Berman 2003). This is why narratives provide an advantageous site for tracing the long developmental route from emergence to mastery in language acquisition (Berman 2004). The narrative texts that children construct during the school years provide optimal hunting grounds for unveiling their linguistic abilities, in a period when command of written language is opening up new avenues to linguistic knowledge (Berman and Ravid 2008).

Continuing Labov's seminal work (1972), the pioneering cross-linguistic study by Berman and Slobin (1994) on narrative development established a theory of narrative structure and function and of their acquisition (Berman 1997). It analyzed stories told by children and adults based on a wordless picture-book describing the adventures of a boy and his dog in search of a runaway frog. Findings of this narration in five different languages showed that even the youngest participants, aged 3–4 years, produce texts that are syntactically constructed in accordance with the grammatical structures of their first language. However it is only from age five onwards that children are able to recruit these lexical and morpho-syntactic abilities towards the production of a story which essentially delivers the 'bare bones' of the event structure. It takes until around age 9–10 years before children demonstrate well-formed global-level organization of narrative structure (Hickmann 1998; Peterson and McCabe 1983), though mostly geared towards foregrounded events with some descriptions elaborating background information (Ravid and Berman 2006). Rhetorical expressiveness coupled with interpretative expressions of internal states consolidates only in adolescence and adulthood (Berman 2008; Berman and Slobin 1994). Thus, despite the pervasiveness of stories in all languages and cultures, the route to the production of full-fledged, autonomous narrative texts is long and drawn out (Berman 2009a, b).

Many subsequent studies of narrative development in children of different ages and speaking different languages have followed the Berman and Slobin endeavor (Strömqvist and Verhoeven 2004; Verhoeven and Strömqvist 2001). Lately, the study of discourse development has been extended to the written mode and to another major genre, expository text (Berman and Nir-Sagiv 2007; Berman and Verhoeven 2002; Nippold and Scott 2009). The study of discourse development across different modalities and genres has come of age and is now established as an important psycholinguistic domain which can tell us much about the growth of global text production abilities (Berman and Katzenberger 2004). Moreover, it offers age-sensitive tools for the investigation of the interface of lexicon and morpho-syntax with discourse structure and functions (Berman and Nir-Sagiv 2009; Nir and Berman 2010; Ravid 2005; Ravid and Berman 2009) in typically developing (Ravid 2006; Ravid and Berman 2010; Ravid and Levie 2010; Ravid and Zilberbuch 2003) and disordered school-going populations (Andreu et al. 2011; Berman et al. 2011; Scott and Windsor 2000).

Psycholinguistic narrative analysis of the kind undertaken in the current context revolves around two orthogonal motifs (Berman and Ravid 2008). First, it deals with text production—hence, with speaking and writing rather than listening and reading. Concern is with authentic texts constructed by non-expert, ordinary language users rather than with edited texts produced by specialist writers, journalists, translators, and so forth. Second, such analyses focus on the "language of literacy"as reflected in different types of texts constructed by speaker-writers from middle childhood across adolescence. That is, concern is with later, school-age language, as reflecting three major developments:an extended repertoire of linguistic items, categories, and constructions; new pathways for integrating formerly unrelated elements and systems into complex linguistic schemata and syntactic architectures; and more efficient and explicit modes for representing and thinking about language. Current research shows that in this period, language use diverges markedly from what has been observed for young children (Berman 2004; Nippold 2007), although not yet reaching the level of educated adult usage (Ravid and Zilberbuch 2003). For example, derivational morphology plays an increasingly important role at the interface between vocabulary and syntax (Carlisle 2000); vocabulary is extended to allow for greater lexical diversity and semantically more specific encoding of concepts (Nippold 2002); and syntax relies increasingly on more marked, less frequent constructions such as passive voice, center embedded clauses, and non-finite subordination(Berman and Nir-Sagiv 2007; Ravid and Saban 2008). These developments in school-age language knowledge go hand in hand with increased command of metalinguistic abilities and access to higher order, non-literal language (Ashkenazi and Ravid 1998). Moreover, the role of language is critical in this respect: cross-linguistic studies of oral narrative development such as Berman and Verhoeven (2002) suggest that target language has a marked impact on "thinking for speaking" (Slobin 1996) and how native speakers of different languages, such as Arabic, use linguistic forms to encode narrative content. Against this background, the current study is a developmental analysis of narrative production abilities in the Palestinian Arabic spoken in the north of Israel.

To the best of our knowledge, no published study to date has investigated the developmental path of narrative production in Arabic-speaking children. This is especially interesting for two reasons, each of which generates expectations from this study. One is the fact that Arabic constitutes a classical case of linguistic diglossia, which, according to Ferguson (1959), is a situation where

> … in addition to the primary dialects of the language … there is a very divergent, highly codified (often grammatically more complex) superposed variety, the vehicle of a large and respected body of written literature… which is learned largely by formal education and is used for most written and formal spoken purposes but is not used by any section of the community for ordinary conversation.

This is indeed the case in the Arabic-speaking world, where children grow up speaking a local spoken dialect, whereas at school they are formally taught Modern Standard Arabic, with focus placed on reading and writing, grammatical knowledge and linguistic accuracy (Holes 2004). According to Saiegh-Haddad (2005, 2012), Modern Standard Arabic is the language of the textbooks, while school instruction takes place in Spoken Arabic. Literate Arabic speakers are thus in possession of two versions of Arabic—some might say two languages—used for two complementary sets of social functions: spoken Arabic, mainly used for performing informal everyday conversational functions, and Modern Standard Arabic, for writing and for formal oral functions such as religious sermons, speeches, and news broadcasts. This dual linguistic context is a constant reality for Arabic-speaking children, who interact in Spoken Arabic while being exposed to Standard Arabic in a variety of literate contexts at school and at home. The literature points to the existence a code-mixed variety combining the lexicon of Standard Arabic with the phonology and the morpho-syntax of Spoken Arabic in literate homes (Saiegh-Haddad et al. 2011). In addition to the developmental trajectories already witnessed in narratives produced in other languages, we thus expect younger participants to tell their stories in the spoken vernacular, and for older ones, who are also more literate, having gone through several years of formal Arabic instruction and exposure to MSA, to use more MSA elements in their stories.

A second incentive to investigate narrative acquisition in Arabic is the need to determine the typological character of story telling in Arabic. While narratives are a universal phenomenon, the syntactic devices used in packaging information in texts vary across languages and cultures and create different styles (Ravid 2013). It makes sense to assume that children produce texts in the style they have been exposed to. This study would thus be a first foray into the developmental psycholinguistics of Arabic narrative production.

## 7.2 Method

The current study revolves around an experiment whereby children and adults were told a story accompanied by pictures and then asked to re-tell the story. According to Berman (1995), varying contexts of story elicitation in children can result in very different levels of story telling. As discourse production and comprehension involves the construction of a mental map of the text under consideration (Graesser et al. 2003), story re-telling can do much to inform us of children's narrative abilities in a way that does not demand that they supply the content and the structure of the story. Re-telling has long been a well-established tool in the field (Geva and Olson 1983), since the investigator provides the content and the linguistic expression, which supports children's own expression (Irwin and Mitchell 1983). Moreover, the investigator can easily track the way children re-produce forms and functions from the target story in their own re-tellings (Sutter and Johnson 1995).

*Participants* In the current study, the re-telling task was administered to 97 participants in 7 age groups. Of these, 5 groups were composed of 16 participants (8 boys and 8 girls) each: nursery schoolers (4–5 year olds), kindergarteners (5–6 year olds), 1st graders (6–7 year olds), 2nd graders (7–8 year olds), and 4th graders (9–10 year olds). These groups correspond to the age groups covered in Berman and Slobin's classical 1994 study. In addition, there were two older groups with 9 participants each—7th graders (12–13 year olds) and adults. All participants were mid-high SES native monolingual speakers of a PA dialect spoken in the north of Israel, with no language or developmental disorders.

*Research instrument* The task involved participants' re-telling of the story of a pigeon and an ant (which appears to be a variation on the classical fable of the lion and the mouse), in which a pigeon rescues an ant from drowning, is promised reciprocal help, and is indeed eventually saved by the ant from being shot by a hunter. The original story was longer than the version we used, and accompanied by 20 pictures. After extensive piloting with 11 children, the story was shortened, all repetitions and reiterations were taken out, and the coda was re-written so as to make the end of the story more salient.

*Procedure* Data was collected by the second and third authors, both native speakers of the same Palestinian Arabic dialect spoken by the participants, as part of their MA theses. Participants were tested orally and individually in a quiet room at their school (adults were tested at home) by the second author. The revised Pigeon and Ant story was read out in MSA to each participant, accompanied by ten pictures (see Appendix) bound into a book, with an additional picture showing the pigeon and the ant on the book's cover. They were told as follows "Please listen to the following story that I am going to read from this picture book. I will then ask you to tell me that story. You will be able to use the picture book." The story was read twice to participants from the five younger groups (up to age ten), and once to the older participants. The re-telling was audio- and video taped. A strict protocol, devised by the three authors, was followed regarding intervention and prompts. In cases of hesitations or problems in starting the story, the investigator prompted re-telling by saying "Once upon a time there was a pigeon who was thirsty…", and was allowed to provide prompts twice more during the re-telling. If a participant asked about how to re-tell the story, the investigator said "however you think fit, however you understand", and did not answer further questions during the re-telling.

## 7.3 Results

We present numerical results in this section and discuss them in the subsequent one. All statistical details can be found in Dina Naoum's master's thesis (Naoum 2009).

*Intervention* We start by presenting data on the amount of intervention provided in each of the age groups (Table 7.1). By *Intervention* we mean requests for help

**Table 7.1** Mean amount of prompts required and provided in each group, on a scale of 0–2, with standard deviations in brackets, by age/schooling group

| Group | Prompts 0–2 |
|---|---|
| Nursery Schoolers (4–5) | 1.19 (0.91) |
| Kindergarteners (5–6) | 1.13 (0.89) |
| 1st Graders (6–7) | 0.56 (0.73) |
| 2nd Graders (7–8) | 0.00 |
| 4th Graders (9–10) | 0.00 |
| 7th Graders (12–13) | 0.00 |
| Adults | 0.00 |

on the part of the participants as well as prompts on the part of the investigator, as described above. We used a scale of 0–2, from no intervention required (0), to some intervention required (1), and much intervention required (2). The requirement for prompting indicates that the story teller has not yet construed it as a full, autonomous text (Ravid and Tolchinsky 2002).

*Text size* Text size is a good measure of the ability to construct a text (Berman and Ravid 2008). Tables 7.2 and 7.3 provide information on participants' text size in terms of words and clauses. Words were counted twice—once including disfluencies such as false starts, hesitations and immediate repetitions, and once more excluding them (Ravid and Berman 2006).

Clauses were identified and counted following the definition in Berman and Slobin, (1994), and in addition we present mean clause length (number of words divided by number of clauses), a reliable measure of syntactic complexity (Berman and Ravid 2008).The number of words excluding disfluency was used for this purpose (Table 7.2).

*Errors* Next, we present morpho-syntactic errors in texts. Since texts were of different size, text size was neutralized by dividing the total number of morpho-syntactic errors by the total number of clauses (Fig. 7.1).

*Reconstructing content units* The re-telling methodology we used placed us in control of the target text, which made it possible to determine which parts of the text were harder to reconstruct. To measure content re-telling, the story was divided into ten narrative content units–events, descriptions, or interpretations (Ravid and Berman 2006). Each re-told content unit received a score of 0–3, running from 0 (no mention of unit content) to 3 (full reconstruction of content). Figure 7.2 presents information on the reconstruction of 7 content units. Figure 7.3 assesses the quality of the opening and closing (coda) of the texts, salient narrative sites which can serve as a dependable proxy in the assessment of narrative production (Berman 2008).

*Referencing* Referring to the protagonists and antagonists in a story is critical in creating coherent text quality (Graesser et al. 2003; McNamara et al. 1996). Figure 7.4 shows the quality of the introduction of the three animate figures in the story—the pigeon, the ant, and the hunter. These were ranked on a scale of 0–2, from no mention at all (0), to a pronoun or a definite noun (which assume that this is given information –1), to a proper introduction of the protagonist by an indefinite lexical noun (2). Figure 7.5 presents percentage of inappropriate referencing (beyond the introduction) and usage of deictic body language instead of appropriate verbal reference.

**Table 7.2** Mean number of words in texts including and excluding disfluencies, with standard deviations in brackets, by age/schooling group

| Group | # Words including disfluency | # Words excluding disfluency |
|---|---|---|
| Nursery Schoolers (4–5) | 82.88 (24.77) | 64.44 (20.73) |
| Kindergarteners (5–6) | 75 (29.19) | 60.31 (21.93) |
| 1st Graders (6–7) | 100.06 (30.19) | 83.94 (26.33) |
| 2nd Graders (7–8) | 121.47 (26.3) | 108.53 (23.33) |
| 4th Graders (9–10) | 156.38 (41.76) | 130.75 (35.22) |
| 7th Graders (12–13) | 204.89 (56.49) | 179.56 (47.88) |
| Adults | 205.44 (98.35) | 190 (91.5) |

**Table 7.3** Mean number of clauses in texts and mean clause length, with standard deviations in brackets, by age/schooling group

| Group | # Clauses | Mean clause length |
|---|---|---|
| Nursery Schoolers (4–5) | 20.25 (6.42) | 3.20 (0.5) |
| Kindergarteners (5–6) | 20.13 (5.78) | 2.94 (0.42) |
| 1st Graders (6–7) | 26.13 (8.06) | 3.26 (0.5) |
| 2nd Graders (7–8) | 33.2 (5.48) | 3.25 (0.31) |
| 4th Graders (9–10) | 36.63 (8.91) | 3.55 (0.3) |
| 7th Graders (12–13) | 49.22 (12.21) | 3.64 (0.21) |
| Adults | 50.44 (18.53) | 3.66 (0.48) |

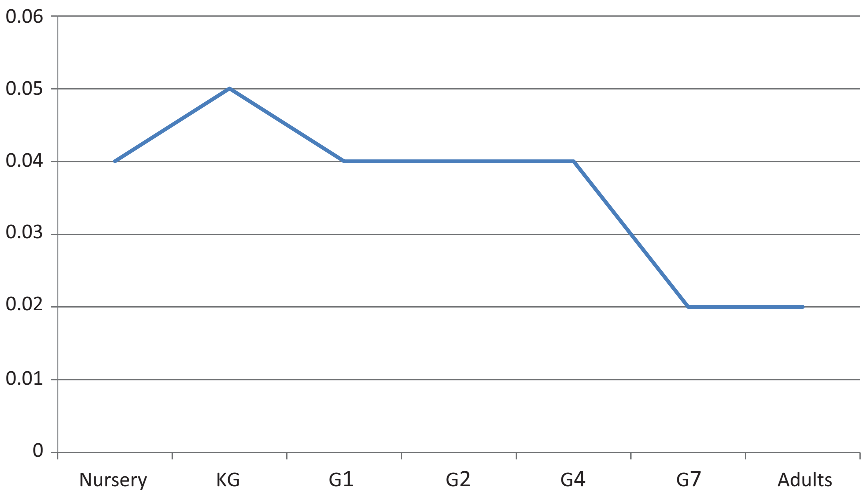



**Fig. 7.1** Mean number of morpho-syntactic errors per clause in texts, by age/schooling group

*Lexicon* Lexical items, especially content words, constitute the cornerstone of text construction (Ravid 2006; Ravid and Levie 2010). In the case of re-telling, usage of target lexical items from the text can be examined. To examine lexical knowledge, we selected 11 verbs and nouns from the text and measured their reconstruction on a scale from 0–6, with MSA usage adding to scores on the scale. In addition, we

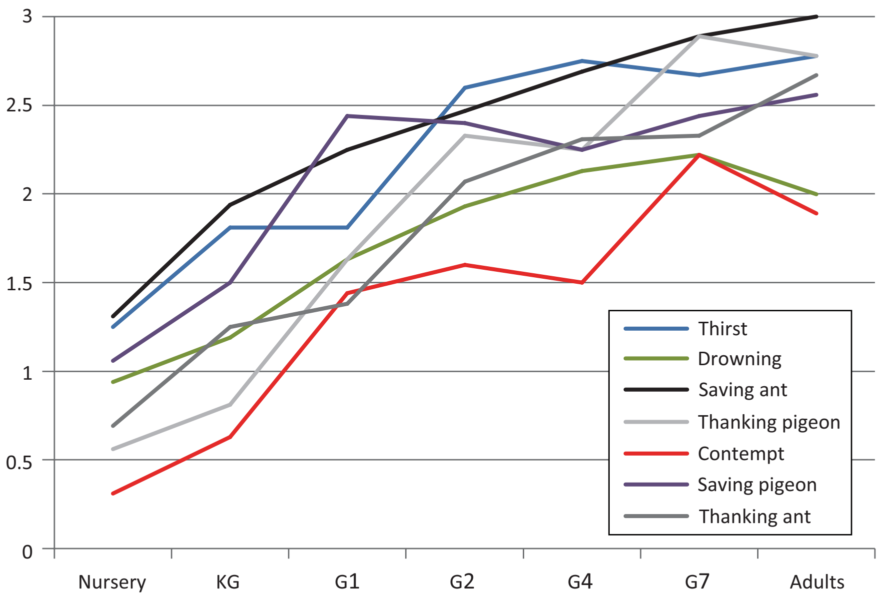
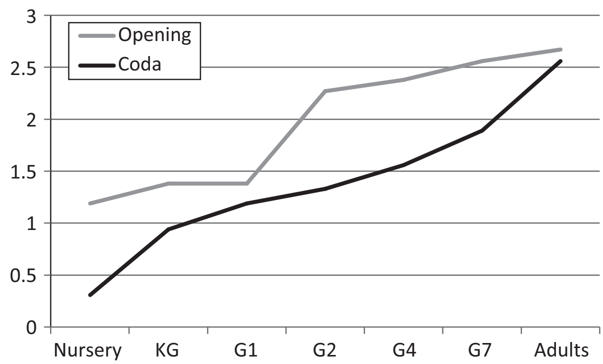



**Fig. 7.2** Content reconstruction in 7 content units on a 0–3 scale, by age/schooling group

**Fig. 7.3** Quality of opening and coda on a 0–3 scale, by age/schooling group




identified all adjectives in the participants' texts, compared them with the original 10 adjectives appearing in the target text, and calculated the total amount of adjectives out of the number of words (Figs. 7.6 and 7.7).

## 7.4 Discussion

This study aimed to provide new information about oral narrative development in Arabic-speaking children across the early childhood and gradeschool years, compared with pre-adolescents and adults. The research instrument was a story re-told

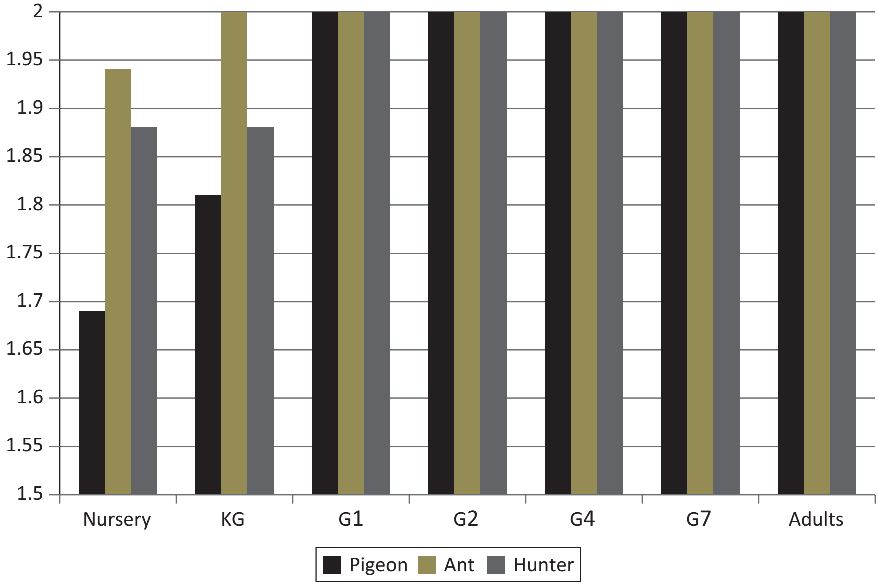



**Fig. 7.4** Quality of first mention of protagonists on a 0–2 scale, by age/schooling group

from a picture book containing 10 pictures. Investigators and participants were native speakers of a dialect of Palestinian Arabic spoken in the north of Israel. To the best of our knowledge, this is the first published study investigating oral narrative acquisition in Arabic.

From a general developmental perspective, results not only confirm our predictions, they are also consistent with similar studies on participants speaking other languages (Berman and Slobin 1994). In the current study, quantitative and qualitative results provide a well-rounded picture of how narrative production abilities develop in PA speaking children. One measure we used was the ability to re-tell the story (which had been told in MSA) without reliance on prompts from the investigator and without requesting assistance. This ability was shown here to increase with age and schooling, with only pre-schoolers, and to some extent 1st graders, seeking help. For example, a boy in nursery school asked كيف يعني احكي اصه 'how [does one] tell a story'? and a nursery school girl said مش عار فه ايش بالأول 'I don't know what was at the beginning'; while one kindergarten girl asked أيش صار بعدين 'what happened afterwards'? and yet another commented مش عارفه هون مفهمتش عليكي كيف انت حكيتيها 'I don't know, here I didn't understand how you told this'.[1] These changes in the amount of prompts sought indicate not only an increase in executive control and memory abilities (Van Dyke and McElree 2006) but also in the perception of the narrative as an entire, autonomous piece of discourse (Tolchinsky et al. 2002).

[1] Free translation of participants' commentary transcribed into Arabic.

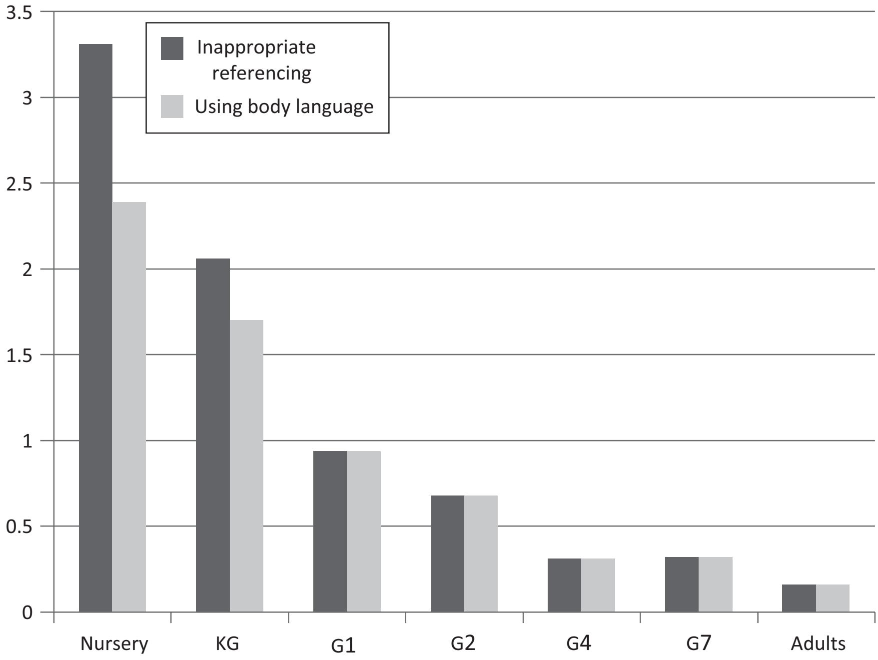



**Fig. 7.5** Percentage of inappropriate referencing and body language, by age/schooling group

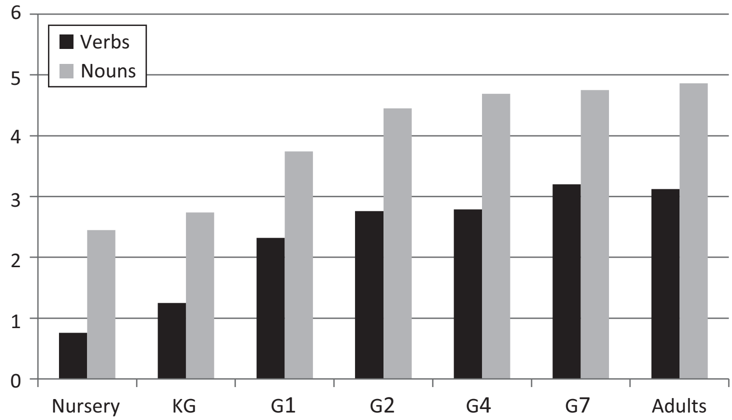



**Fig. 7.6** Mean score on a scale of 0–6 of 11 reconstructed verbs and 6 reconstructed nouns, by age/schooling group

*Text size* From a different perspective, results indicated that participants' re-told stories got longer in number of words (most notably when disfluency is disregarded) and clauses, in both cases with the cut-off point between 4$^{th}$ grade and the youngest groups, on the one hand, and the older groups, on the other hand. This was

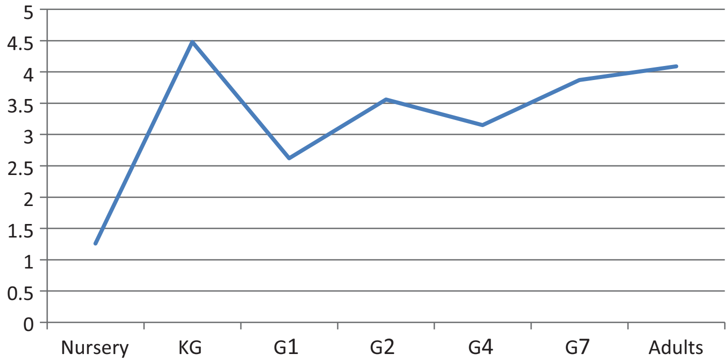



**Fig. 7.7** Percentage of adjectives out of words in texts, by age/schooling group

also apparent in the mean length of clauses, again spurting from mid-grade school onwards. As longer clauses indicate more informative content, more phrases per clause and more words per phrase, this measure reliably records syntactic development (Berman and Ravid 2008).

The critical mediating role of diglossia was already apparent at this stage of our analysis. Recall the target story was originally told to participants in MSA, and they re-told it according to their choice. An interesting finding was that when the story was re-told in its entirety in MSA—and this happened only in the older age groups—texts were shorter than those told in the PA dialect by same-group peers. For example, consider the following two comparisons of re-tellings in the older groups. First, three adult texts, of which two are outliers in terms of length:the shortest text in the adult group was re-told in its entirety in a literary/Classicalform by a man; it consisted of 93 words (excluding disfluency) and 31 clauses. A second text was also fully re-told in MSA by another man, consisting of 185 words and 53 clauses. Finally, the longest adult text was told by a woman in the PA dialect, consisting of 394 words and 88 clauses. And now consider two texts in the 7$^{th}$ grade group—one entirely re-told in MSA by a girl, containing 130 words and 34 clauses, and another, re-told in the PA dialect by a boy, containing 261 words and 67 clauses. None of the other age groups had full re-tellings in MSA, and those containing MSA segments and items did not differ in length from the peer group mean. This analysis indicates that in the context of the current study, reconstructing and consequently re-telling the entire story in MSA was a linguistically (and perhaps also cognitively) difficult endeavor, constraining the production abilities of those adolescents and adults who were able to do so and resulting in very short texts compared to the group mean. In contrast, older participants' PA re-tellings were particularly long, relying on familiarity with the use of linguistic devices and an ease in recruiting them for the purpose of the task.

*Linguistic indicators* Errors in re-telling the Pigeon and Ant story were another indicator of developing narrative abilities. Errors were morpho-lexical, morpho-syntactic and syntactic in nature, and were examined in their contexts, i.e., both in the PA dialect and in MSA. Consider the following examples, all from different participants. There were inflectional errors in verb gender agreement in nursery schoolers regarding the (female) pigeon *كان اه تشرب* and the (male) hunter *اجت صياد*; and derivational errors in the application of verb pattern *وأشكرت الحمامه* 'thanked the pigeon = the pigeon thanked' (girl, 1st grade), in applying a perfective instead of a continuous pattern *لائت نمله مغروقه* 'found an ant that was drowning' (girl, 1st grade), and in selecting an incorrect adjectival pattern *بينما كانت الحمامة عاطشه* 'when the pigeon was thirsty' (girl, 4th grade). Other errors included erroneous prepositions or connectives, e.g., *ومسكا من اجريه* 'held her from his leg (instead of in his leg)' (boy, nursery school), or *منيوم كانت الحمامه* 'from the day was-the pigeon (instead in the day)' (boy, kindergarten). Syntactic errors included the choice of erroneous definite article *فأسرعت إلى النهرقريب* 'hurried to a nearby river' (girl, 7th grade) or the incorrect combination of direct and indirect speech *ئالت بدا تشكرا لأنها نجتيني* 'she said that she wanted to thank her because you saved me' (girl, 7th grade). In general, and as expected, the number of morpho-syntactic errors in the re-told stories (with text length neutralized) dropped with two developmental cut-off points: between 4th and 7th grade, and between 7th grade and adulthood. This cline indicated a growing ability to recruit grammatical and lexical resources in the service of telling a story (Berman In press).

*Text content and structure* As presented above and depicted in the Appendix, the text was divided into 10 content units, which made it possible to examine their reconstructions in view of their discourse roles. In general developmental perspective, reconstruction level increased with age and schooling, with cut-off points across the whole developmental spectrum: adults and pre-adolescents did better than gradeschoolers, who did better than 1st graders, with subsequent cut-off points between 1st grade and kindergarten, and then kindergarten and nursery school. This very gradual trajectory is in line with both the general non-Semitic and Hebrew literature, indicating the long and arduous road to re-telling all of the components of a story, based on growth in cognitive abilities, linguistic resources, and experience with narrative texts (Berman 2009b; Geva and Olson 1983; McNamara et al. 1996).

From the discursive perspective within the content units themselves, we find the following hierarchy: 1+3>4+8>2+6+10>5+7+10, that is: Opening scene—thirst/drinking + Pigeon rescues ant > Ant thanks pigeon + Ant crawls up hunter's boots > Ant drowns + Ant on its own + Pigeon thanks ant > Ant saves pigeon + Hunter threatens pigeon + Pigeon contemptuous of ant. This shows that the foregrounded, more concrete scenes were more easily reconstructed than the backgrounded content units relating internal and abstract states. The most challenging scene was the contempt content unit, which was not reconstructed at all by most nursery school and kindergarten groups. In fact, only 9 participants fully reconstructed it, all of them adults. In this context, a good indicator of discursive abilities was the re-telling of the opening and coda segments, both of which showed steady increase across the age/schooling cline.In this analysis as in previous ones in the literature, the opening scene was among the easiest to reconstruct, with the coda less easy to reconstruct (Berman and Slobin 1994; Ravid and Berman 2006).

Given the inherent difficulty presented by the coda, we focus here on the analysis of coda segments in the re-tellings, which improved dramatically from almost none in nursery school to appropriate and interesting endings in the older groups. The coda in the current study consisted at the very least of the pigeon thanking the ant, as in the examples from a kindergarten boy *ئالتلها الحمامه شكرا* ‘the pigeon told her thank you’, a kindergarten girl *ساعدتيني طارت الحمامه وئالت للنمله ”شكرا عشان* ‘the pigeon flew and told the ant “thank you as you helped me”’; and the thoughtful though not very coherent coda by a 2nd grade girl *أجت بالوئت النادم عشان تساعدها وخلصت وبعدين شكرت االحمامه لأنه* ‘and then the pigeon thanked her because she had come at the suitable time to help her and that’s it’. More mature codas encompassed the entire finalsegmentas the ending of the story, summing up the reciprocal nature of the saving events regarding the two major protagonists. For example, a woman participant said *عنجد أنقزتي حياتي وأن اكتير ممنونه لألك ”توتا توتا خلصت الحتوته شافتا الحمامه وآلتلا “شكرا كتير كتير لأنك* ‘the pigeon saw here and said to her “thank you very much as you saved my life and I really owe you”—and this is how the story ends’. And a coda by a male participant focusing on both participants *هون وبديت تشكرها االتلا ”كيف انت شو داتعمل دا ترجع اللي انت عملتي هادا العمل معاي“ تشكر النمله زي م االنمله شكرتها لما رجعت اجت النمله لعند الحمامه مع بعض وتوتا توتا خلصت الحدوته انقذتي حياتي أن أانقذت كمان حياتك فآلتلا ”كتير أن امبسوطه منك وصارو التنتين صحاب* ‘what will she do? She will return to thank the ant as the ant had thanked her. When she returned the ant came to the pigeon and thanked her, saying “as you had saved my life thus I saved yours”. And then she said to her “I am so pleased with you having done this deed to me”. Then the two became friends—and this is how the story ends’. In both cases the adults used a conventional Arabic narrative expression (*tuta-tuta*) to indicate the end of the story, akin to ‘and they lived happily ever after’.

Interestingly, four participants produced novel codas containing fable-like lessons, which had not been part of the original story. Thus a 2nd grade boy said *شكراً هناك شيءٌ أريد أن أخبرك فيه أنا آسفةٌ كنت أحكي عنكِ عندما ذهبتِ كلامٌ قاسي وقالت الحمامةُ للنمله ” شكر* ‘and the pigeon told the ant “thank you thank you, I want to tell you something—I am sorry, I said hard things about you when you left”’. Although this coda relates specifically to the protagonists and is not explicitly didactic, it indicates an early ability to construe psychological relationships. Older participants were able to express this relationship more clearly in their codas, as did a 4th grade girl who talked explicitly of the internal mind states of the ant and the pigeon *بكل بكل فرح لأنه هي إدرت تردلا الجميل والحمامه طلع ظناغلط الحمامه أجت شكرت النمله والنمله ضحكت* ‘the pigeon came and thanked the ant, and the ant smiled happily, because she had succeeded in repaying her good deed, and the pigeon had been wrong in her thought’. Finally, older participants related the story events to an abstract, generically applicable lesson in their codas, e.g., a 7th grade boy *الحمامه فكرت انه هي بتآدرش تساعدا وهيك الإدرت النمله تساعد هادا المخلوء لكبير إللي* ‘and so the ant succeeded in helping this large creature, which the pigeon had thought she could not help’; and a man ended his re-telling by encapsulating the final events as well as adding a lesson *يضيع لأن كل إنسان أو حيوان كل كائن حي بحاجه إلى كائن بينما عادت الحمامه لتشكر النمله وعرفت الحمامه أن أي معروف أو أي عمل لا*. ‘the pigeon returned to thank the ant, and the pigeon knew that each person or animal, every living creature needs another living creature'.

The younger participants found it in general easier to re-tell the more dynamic, concrete, foregrounded events such as rescuing the ant, and had more difficulty in reconstructing inner states and events and background components such as the ant thanking the pigeon, the pigeon thanking the ant, and the pigeon's feelings of contempt towards the ant. But even with regard to dynamic events such as the pigeon saving the ant (content unit 3), participants were exposed to a segment that required not only paying attention to concrete details but also to protagonists' motivation, internal states and saving unit was presented as follows, *هذه النملة المسكينة , نسيت عطشها عندما رأت الحمامة, التقطتها بمنقارها حتى كبيرة قشة وجدت أن م. الغرق من النجاة على بها لتساعدها قشة عن تبحث وأخذت الغرق. وقفت الحمامة على حافة النهر, فأمسكت بطرف القشة, ومدت طرفه االآخر إلى الماء. فتمسكت النملة بها وصعدت عليها. وأسرعت لإنقاذ النملة من* *'When the pigeon saw that poor ant she forgot her own thirst and started looking for a piece of straw to help her with it to escape drowning. When she had found a large straw she immediatelytook it in her beak to save the ant from being drowned. The pigeon stood on the bank of the river holding the piece of straw at one end, and put out the other end to the water. The ant held onto it and went up on it'.*

It is interesting to note how this scene was played out in the young participants' responses, who mostly narrated the events either at face value or devoid of the context. For example, a nursery school boy described this scene thus *من البحر النهر ولما الحمامة كانت تشرب مي ساعدت النملة لم االحمامة ساعدت النملة , النملة طلعت* 'whenthepigeon was drinking, she helped the ant, and when the pigeon helped the ant, the ant came out of the sea, the river'. Most school-aged and older participants were able to construe the rescue situation in some ways, as did a 1st grade boy as follows *مسكت غصن الشجر هو أجت مدته لتنقزها أجت مسكت النمله بغصن الشجره وأجت الحمامه وأجت الحمامه* 'the pigeon held onto the tree twig and put it out in order to save her; the ant held onto the tree twig and the pigeon pulled the twig in order to save her'. Although this reconstruction is not entirely coherent, it contains the essential components of the rescue event. And a 4th grade boy elaborates even more, indicating the construal of the rescue event: *عه تفتش ععصاي طويله وبس لائتها يالعصاي ركضت لعندا وأفت عالرمل ومدت العصاي لألا وطلعت النمله بس شافت الحمامه هاي النمله راحت بسر راحت*' 'when the pigeon saw that ant, she went fast to look for a long stick, and when she found this stick, she ran to her, stood on the sand and presented her with the stick and the ant came out'.

*Referencing* Maintaining a chain of reference across a narrative makes a critical contribution to text cohesion (Berman and Slobin 1994; Hickmann 1998). Reference was analyzed in two ways in this study. First, we looked at *first mention* or introduction of the three animate protagonists of the story—the pigeon, the ant and the hunter, as a measure of participants' understanding that they constitute new information. All three were appropriately introduced even in the youngest groups. Only two children—one from nursery school and the other from kindergarten—did not make reference to the pigeon at all, whereas four—three from nursery school and one from kindergarten—inappropriately introduced it using a pronoun. Only one participant introduced the ant as a pronoun, while the hunter was not referenced at all by only one nursery school participant and first mentioned as a pronoun by two kindergarten children. It thus seems that by 1st grade, the overwhelming majority of the participants were able to introduce the story protagonists properly. At the same time, using body language and deictic pronouns to refer to protagonists dropped dramatically by 1st grade. This again indicated participants' ability to construe the story as an autonomous piece of discourse, maintaining protagonists' identity appropriately across the text.

*Lexicon* Verbs proved to challenge this study's participants more than nouns, given that the whole story hinges upon both mental and concrete predications. Verbs denoting emotions were the most difficult to reconstruct. For example, لا تجرح 'will not hurt' was reconstructed by only 14 participants, none younger than 1st grade.

The 10 adjectives in the text proved to be another useful measure of lexical knowledge ofthe text. Although there was an increase in the number of reconstructed adjectives with age and schooling, most adjectives used by participants were not the ones in the original text. Thus nursery schoolers produced 8 adjective lemmas, none from the original 10 adjective list. By kindergarten and 1st grade, twice as many adjective lemmas wereproduced, two from the original list in kindergarten– كبيره 'big, Fm' and صغير 'small, Fm', andfour in 1st grade, with مسكينة 'poor, Fm' and شديد' 'strong' from the text. 2nd graders had 27 adjective lemmas, of which 7 were reconstructed, including الأخره 'the other, Fm' -العذبه 'clear', and مؤلمه 'hurtful, Fm'. 4th graders had 20 adjective lemmas, only four of which were reconstructed. The two oldest groups had the largest number ofadjectives (29 and 38 respectively), also reconstructing abstract and mental adjectives such as جدّيه 'serious, Fm', المناسب 'suitable' and محتم 'certain'. This analysis indicates both a growth in the adjective vocabulary as well as a growing ability to use the adjectives attributed in the text to the protagonists, starting with general and concrete adjectives and moving to specific and mental ones.

## 7.5 Conclusion

Both top-down (content and global structure) and bottom-up (morpho-syntactic and lexical) measures indicate the consolidation of narrative abilities in the population described here. In addition, the reconstructed narratives clearly showed the effect of school literacy. The two preliterate groups used hardly any MSA words or any other constructions, and when they did it was with erroneous morphology. School-going participants used more MSA lexical items and also tried to change spoken dialect words into more literate ones by exerting morpho-phonological changes—while at the same time changing MSA words into spoken dialect forms. Finally, word order was the most salient property of narrative style from early on, with verbs preceding subjects and same-subjects often deleted across large segments of text, as in "ورجعت الحمامَه وألت للنمله: "شكرا لأنك ساعدتيني" and came back the pigeon and told the ant "thank you, for you have saved me" (1st grade girl).

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# Chapter 8
# Cognitive Predictors of Early Reading Ability in Arabic: A Longitudinal Study from Kindergarten to Grade 2

**Hanadi Abu Ahmad, Raphiq Ibrahim and David L. Share**

**Abstract** The present study set out to explore the underpinnings of early reading acquisition in Arabic among native Arabic speakers. Specifically, we compared the contribution of intra-lexical versus supra-lexical factors, assessed in kindergarten, to individual differences in later word recognition and reading comprehension. Our aim was to determine the extent to which word recognition in Arabic can be characterized as "modular" given the unique complexities of this script. At the end of kindergarten, 194 native Arabic speakers living in Israel were administered a battery of tests assessing a variety of intra-lexical factors and supra-lexical factors. Word recognition and reading comprehension were assessed at the beginning of Grade 2. The results revealed that decoding skill in Arabic at the beginning of Grade 2 is relatively poor compared to English and Hebrew. Word recognition skill was found to depend mainly on sub-lexical and lexical abilities which together explained 33 % of the variance in Grade 2. The stronger predictors were phonemic awareness and phonological processing followed by early print concepts, morphology and visual-orthographic processing. Alongside these intra-lexical abilities, supra-lexical abilities also accounted for 11 % of the variance in word recognition, consistent with the multiple complexities of the script. Reading comprehension skill was found to rely heavily on decoding skill but also on higher-order linguistic and cognitive abilities.

**Keywords** Arabic · Longitudinal study · Modularity · Orthography · Phonemic awareness · Reading acquisition

H. A. Ahmad (✉) · R. Ibrahim · D. L. Share
Learning Disabilities Department, University of Haifa, Israel
e-mail: hanad.abuahmad@gmail.com

R. Ibrahim · D. L. Share
The Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, University of Haifa, Haifa, Israrel

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## 8.1 Introduction

Over the past several decades a substantial body of research has focused on the pre-school foundations of reading development. Much of this work has been motivated by the need for early identification and intervention aimed at preventing later literacy difficulties (Snow et al. 1998). It is important to keep in mind, however, that reading is a not a single unitary construct, but includes at least two distinct components. The first is the identification of printed words (word recognition), and the second the comprehension of text. It is often unclear whether the findings of studies aimed at elucidating the factors that place the pre-school child at risk of later reading difficulties apply to word recognition, reading comprehension, or both. Studies examining reading comprehension have demonstrated that this skill is partly dependent on efficient word recognition such that good comprehenders are typically good decoders (Perfetti 1985; Stanovich 1982). This literature has also highlighted other factors related to reading comprehension, most notably broader oral language competencies such as listening comprehension, syntax, and vocabulary (see, e.g., Catts et al. 2003). In addition, many studies have pointed to the role of higher-order cognitive abilities in reading comprehension such as working memory, inference making and comprehension monitoring (Cain et al. 2004). It appears that reading comprehension relies on a wide range of abilities including “lower-level” skills such as word recognition, as well as higher-order “supra-lexical” abilities such as semantics and syntax and high-level cognitive skills.

Consistent with these observations, a number of researchers have proposed that word recognition is dissociable from those higher-order abilities involved in comprehension processes (Hoover and Gough 1990). This approach is typified by Stanovich’s (1990) extension of Fodor’s (1985) theory of modularity, in which (skilled) word recognition is characterized as a modular autonomous process dependent primarily on sub-lexical information sources, and largely unaffected by higher-order processes. Evidence for cognitive autonomy of the word recognition process derives from the twin phenomena of hyperlexia and dyslexia. Hyperlexia is distinguished by proficient word recognition yet poor comprehension among persons with below average intelligence such as mental retardation or autism (Nation 1999). In contrast, dyslexia is characterized by impaired word recognition skills in the presence of spoken language competence and normal levels of intelligence (Stanovich 1991).

Some researchers, however, have disputed a strong version of the modularity hypothesis and argued that additional lexical (i.e., morphology and word-level meaning) and supra-lexical contextual information such as syntax and higher-order cognitive processes such as working memory and general intelligence, may also play an important role in word recognition (see, for reviews, Bowey 2005; Swanson and Alexander 1997).

The current state of our knowledge about reading is largely based on reading research on speakers of English. However, the underlying processes that predict word recognition may vary depending on the complexity or depth of the script. Share (2008) proposed that the degree of word recognition modularity is a function of orthographic transparency. According to Share's hypothesis of a "transparency-by-modularity" interaction, the relative contributions of lexical (word-level) and supra-lexical information (in alphabetic orthographies) depend on script transparency. This notion is also consistent with the Orthographic Depth Hypothesis (Katz and Frost 1992), which suggests that word recognition in a phonologically opaque script requires a greater degree of "top-down" lexical support compared to a less opaque script. Consistent with Share's modularity-by-transparency hypothesis and the ODH, several English language studies have demonstrated a significant role for oral vocabulary and syntactic skills in word recognition, particularly for irregular words and in readers with poor decoding ability (Bowey 2005; Ricketts et al. 2007). In addition, several English-language studies have demonstrated an association between higher-order cognitive processes such as working memory and word recognition (Siegel and Ryan 1989).

The contribution of lexical and supra-lexical factors in transparent scripts is less apparent. In a longitudinal study of early reading acquisition in Hebrew's regular pointed script, Shatil and Share (2003) showed that Grade 1 word recognition (a composite of speed and accuracy) was predicted by kindergarten sub-lexical measures such as phoneme awareness, phonological processing, early literacy measures and visual processing; neither oral vocabulary nor syntax made a significant contribution. In contrast, reading comprehension was well predicted by broader domain-general measures such as general intelligence, oral language (assessed by measures of syntactic awareness and listening comprehension), reasoning and meta-cognitive abilities. The findings supported Shatil's (1997) hypothesis of "cognitive modularity" in early reading in a highly regular orthography.

Regardless of the depth of an orthography, substantial research evidence has converged on two main sub-lexical antecedents of word recognition—phonological awareness (e.g., Adams 1990; Ehri et al. 2001; Goswami and Bryant 1990; Saiegh-Haddad 2003; Shatil and Share 2003) and letter knowledge (Adams 1990; Byrne et al. 2000; Treiman and Kessler 2003; Saiegh-Haddad 2005; Shatil et al. 2000; Snow et al. 1998). These two so-called "alphabetic" skills—phonemic awareness and letter knowledge—have been labeled "co-requisites" to alphabetic literacy (Share 1995) or, more recently, "co-determinants" (Bowey 2005).

However, despite the pervasive importance of alphabetic skills, the strength of these associations appears to vary depending on the nature of the script. Whereas studies of English reading have demonstrated that phonological awareness and letter knowledge are typically the strongest predictors of early reading (Share et al. 1984; Snowling 2000), studies of more transparent orthographies such as German and Dutch have revealed that the acquisition of phonemic awareness and decoding accuracy is acquired more rapidly and the reading-phonological awareness (PA) correlation is weaker (de Jong and van der Leij 2003; Landerl and Wimmer 2000; Wimmer et al. 2000).

It is important to stress that alphabetic skills are not the only predictors of early reading ability. A somewhat different line of evidence suggesting that visual (or visual-orthographic) processing may be important in word recognition emerges from a study by Van den Bosch et al. (1994). These researchers developed a two-dimensional measure of orthographic complexity representing the intersection of (i) the complexity of letter-phoneme alignment (graphemic parsing) and (ii) the complexity of grapheme-phoneme correspondence in each of three languages, English, French and Dutch. In terms of grapheme-to-phoneme mappings, English was shown to be by far the most complex (i.e., irregular), but somewhat less complex than French and similar to Dutch in the complexity of graphemic parsing. Studies of Hebrew (Meyler and Breznitz 1998; Shatil and Share 2003), Arabic (Abu-Rabia et al. 2003; Ibrahim et al. 2002; Eviatar et al. 2004) and Urdu (Rao et al. 2011) suggest that the link between graphemic complexity and reading ability is an important topic for future research especially in the case of Arabic given its cursive components.

An additional lexical or word-level factor likely to be important in word recognition is morphological awareness. Studies in English have pointed to a positive relationship between morphological awareness and reading (and spelling) development (Carlisle 2000; Deacon and Kirby 2004; Singson et al. 2000; Treiman and Cassar 1996). This relationship has not only been extended to non-concatenative orthographies such as Hebrew and Arabic which combine morphemes in a non-linear fashion and are also characterized by high morphological density (Abu-Rabia 2007; Abu-Rabia et al. 2003; Ben-Dror et al. 1995; Levin et al. 1999; Ravid and Schiff 2004; Saiegh-Haddad and Geva 2008), but the strength of this relationship may be even greater owing to the exceptionally rich morphology of Semitic languages (Abu-Rabia et al. 2003).

To sum up, the literature documented thus far indicates that, although there is much in common, the antecedents of early word recognition may vary somewhat across languages and/or orthographies depending on the complexity or depth of the orthography. The present study aimed to explore the underpinnings of early reading acquisition in the Arabic language among native Arabic speakers. This appears to be the first longitudinal study to address the relationship between cognitive processes in kindergarten and early reading ability in Arabic. Although early reading acquisition in Arabic takes place within the orthographic context of fully vowelized script, which is conventionally considered to be a highly transparent orthography, this script has numerous complexities that are likely to pose a challenge to the novice reader. These include diglossia, multiple graphemic complexities such as letter shapes, morphological density (multiple morphemes in a single letter string) and morpho-phonological rules which in the case of Arabic lead to orthographic opacity. (For a discussion of the structure of Arabic language and orthography, see Saiegh-Haddad and Henkin-Roitfarb, Chap. 1).

## 8.2 The Arabic Language

Several studies carried out by Saiegh-Haddad (2003, 2004, 2005, 2007a) and recently Saiegh-Haddad et al. (2011) examined the effect of the phonological distance between spoken Arabic vernacular (SAV) and Modern Standard Arabic (MSA) on the acquisition of phonemic awareness in children. Results showed that

MSA phonemes, even when accurately articulated, were significantly more difficult for both kindergarten and first grade children to isolate (identify) and to recognize. Also children's performance in pseudo-word decoding was lower when the items included MSA phonemes that are not present in their SAV. These results were interpreted as reflecting low-quality phonological representations, which may be associated with a deficiency in the phonological encoding of words in long-term memory (Saiegh-Haddad et al. 2011). The phonological awareness performance of Arabic-speaking children has also consistently shown that CV sub-syllabic units were more accessible to children's metalinguistic awareness than the phoneme or any other sub-syllabic unit in Semitic Arabic (Saiegh-Haddad 2007a). Similar findings have also been reported for Semitic Hebrew (Ben-Dror et al. 1995; Saiegh-Haddad 2007b; Share and Blum 2005). Nonetheless, it is worth remarking that the outcomes of most studies of the acquisition of reading in Arabic agree that phonological skills are an important factor in reading development in fully-voweled Arabic script (Abu-Rabia et al. 2003; Saiegh-Haddad 2003, 2005) and unvoweled Arabic alike (Elbeheri and Everatt 2007).

Besides diglossia and the phonological distance between the spoken and written forms of words, the Arabic orthography introduces a set of additional challenges for the novice reader and makes the script functionally opaque for reasons other than transparency (see Saiegh-Haddad and Henkin-Roitfarb, Chap. 1). These relate to the graphemes of Arabic which embody a system of fully-fledged graphemes (letters) and a system of diacritics. Further, some (though few) graphemes are encoded but not pronounced, as in the case of plural marking ?Alif on verbs, and others have multiple spellings (like *hamza*). Another important aspect of Arabic orthography is the visual/graphemic complexity of the letters. In line with the graphemic complexity, researchers have suggested that basic visual perceptual and memory processes may be especially important for reading Arabic script (Abu-Rabia et al. 2003; Ibrahim et al. 2002; Eviatar et al. 2004).

Finally, an additional unique feature of Arabic concerns morphology. Arabic morphology is non-concatenative, morphemically dense and has a rich inflectional and derivational structure. These features as well as evidence from empirical studies in Arabic suggest that lexical information such as morphological knowledge may be an important contributor to early reading development in Arabic (Abu-Rabia 2007; Elbeheri and Everatt 2007; Saiegh-Haddad 2013; Saiegh-Haddad and Geva 2008). For a detailed discussion of the structure of Arabic language and orthography see Saiegh-Haddad and Henkin-Roitfarb, in this volume.

To sum up, although voweled Arabic orthography is considered a transparent script in terms of grapheme-phoneme correspondence, the features briefly described above create considerable complexity for the beginning reader. This leads to the prediction that vowelized Arabic word recognition might oblige the reader to rely on information beyond the word level, namely, "supra-lexical" or "extra-lexical" information. A cross-linguistic study of Arabic-English bilinguals reading voweled words and pseudo-words revealed that deficits in syntactic awareness in addition to phonological processing and working memory, are characteristic of poor Arab readers (Abu-Rabia and Siegel 2002). Abu-Rabia et al. (2003) also found deficits among fifth grade Arabic-speaking dyslexics in a wide range of cognitive processes including phonology, morphology, working memory, syntax and visual memory. Both these studies, therefore, suggest that individual differences in reading vowelized Arabic (transparent script) may be related to a variety of factors reflecting not only sub-lexical or intra-lexical processing (e.g., phonological and visual-orthographic aspects of print), but also lexical (morphology and word-meaning) and supra-lexical (syntax and working memory) abilities.

The present longitudinal study focused on the extent to which intra-lexical and supra-lexical factors, assessed in kindergarten, predict individual differences in later word recognition and reading comprehension. Specifically, to what extent can word recognition in Arabic be characterized as "modular"?

Four hypotheses were tested.

1. Based on the traditional notion of orthographic transparency, we hypothesized that the main predictors of early fully-vowelized word recognition in Arabic would be "intra-lexical" precursors such as phoneme awareness, phonological processing, early literacy measures and morphological awareness.
2. In view of the unique graphemic complexity of Arabic letters: visual similarity of the letters, letter-shape (allographic) variants and ligaturing, we hypothesized that visual-orthographic processing would play a significant role in word recognition.
3. The combined effects of graphemic complexity, diglossic phenomenon and morphological density were expected to increase reliance on supra-lexical factors in word recognition.
4. Reading comprehension is expected to depend on both intra-lexical and supra-lexical measures.

## 8.3 Method

194 native Arabic speakers living in Israel were tested two times: once in the final months of kindergarten (mean age: 5.9 years, SD: 3.6 months) and again at the beginning of Grade 2 ($n=177$). In kindergarten, children were administered a battery of tests assessing a variety of intra-lexical factors (phonemic awareness, phonological processing, visual-orthographic processing, pre-school print concepts and morphological awareness) and supra-lexical factors (general non-verbal ability, receptive vocabulary, syntactic awareness and working memory) . There were at least two individual measures in each block (a group of tasks designed to tap the same basic construct). Word recognition and reading comprehension were assessed in Grade 2.

It is important to note that in the kindergartens participating in the present study there was no explicit reading/literacy instruction. While some kindergartens emphasize exposure to MSA by story reading, others focus on structured literacy activities such as learning the letter names and writing letters. Nevertheless, it should be remarked that the Arabic language curriculum has undergone considerable changes since 2008 when reforms focused greater attention on phoneme awareness and letter knowledge.

With respect to phonological awareness, the new pre-school curriculum designates specific goals for each age: for instance, a child is expected to become aware of rhyme, syllables, sub-syllabic units such as the body (CV) and coda and singleton phonemes within the context of various activities such as comparison, isolation, segmentation, blending and deletion. ([al–bunyah al/asa| siyah lilqira|/a walkita|bah fil–lughah al– |arabiy–yah] Ministry of Education, Pre-school Curriculum 2008). Letter knowledge includes knowing standard letter names, their alphabetic order, their shapes (and position-dependent variants) and grapheme-phoneme correspondences.

Arabic reading instruction in Israel normally starts in the first grade and rarely employs phonics (phoneme-level instruction) or a phonemic awareness component in code instruction, only blending and segmenting at the syllable level. Letter recognition is also emphasized, including both the standard and colloquial names of the letters and not the letter "sounds" (i.e., isolated phonemes) (Levin et al. 2008), with special emphasis on the ability to write the different shapes of each letter. The most popular first grade reading scheme for Israeli Arabic-speakers at the time of testing is ?Al RA?id (1991). This method uses short texts to introduce letters and sometimes additional vowels or orthographic signs. Some letters, particularly those representing MSA phonemes which are not present in the present sample's SAV such as (/θ/-/ ð/-/ð̣/), and superscript orthographic signs such as *tAnwi:n*, the definite article and *maddeh*, are introduced only at the very end of the school year. As a result, Arabic-speaking children living in Israel often do not attain proficiency in decoding at the end of Grade 1. Nevertheless, it should be remarked that the Arabic reading acquisition curriculum has also undergone considerable changes since 2008 which include specific recommendations to teach words analytically via sub-lexical units and not as whole word patterns ([at–tarbiyah al–lughawiy–yah] Ministry of Education, Elementary School Curriculum for 2008).

In the current study, it was not possible to assess reading achievement at the end of Grade 1 because new letters and some superscript orthographic signs were still being introduced in the final days of the school year. Consequently, reading ability was assessed at the beginning of Grade 2 (October/November, 2007). Word recognition and reading comprehension measures were administered to the whole class in a fixed 60-minute time slot.

### *8.3.1 Measures*

*Kindergarten intra-lexical blocks*
*Visual orthographic processing*

*VMI Developmental Test of Visual Perception (Beery and Beery* 2004*).* In this test, the child is required to select one of three geometric figures which matches a test figure. Following three demonstration items, an additional 24 items are presented for completion within a three minute time interval. Internal consistency was 0.69 after excluding two items with poor item reliabilities.

*Short-term symbol memory.* This task was developed especially for this study. The children were presented with ten cards printed with symbols from different scripts with which they were unlikely to be familiar, such as Chinese or Gargish. The child was encouraged to look closely at each card for 5 s and then try to memorize the exact order and position of the symbols. The card was then removed from view, three test cards were presented, and the child was asked to select the card that exactly matched the previewed string. The three alternatives included the following items: the identical symbol string, the same symbols but in a different order, and a sequence of symbols each of which differed from the original symbols. Internal consistency was 0.44.

### 8.3.2 Phonological Awareness

*Initial consonant isolation.* The child heard sixteen monosyllabic pseudo-words and was asked to pronounce the initial phoneme of each pseudo-word. For example, the examiner said "Say su:k", the child first repeated the word and then was asked what the beginning sound/phoneme was. One point was given for each correct response. All the initial sounds were consonantal (š -j-m-n-f-s-r-z) and common phonemes in the spoken vernacular of this sample. There were six training items to ensure that the participants understood the task, with feedback provided by the examiner. If the child's response was a CV sub-syllabic unit which has been found more accessible than isolated phonemes in Arabic (Saiegh-Haddad 2003, 2004, 2007), the examiner explained that */su:/* includes two sounds and they should only pronounce the first sound. Internal consistency for this task was 0.88.

*Initial and final phoneme identity.* This task was also adapted to Arabic from Bowey's (2001) final phoneme identity task. Ten items tested final phonemes and ten initial phonemes. For each item, children saw a test picture (e.g., the picture of a house) and three additional pictures (*a strawberry, a mouse, and a banana*). It was then explained that the word *da:r* 'house' ends with the sound */r/*. They were then asked, "Which of these three pictures below ends with */r/*?" The alternatives were pronounced by the investigator to avoid retrieval difficulties. Three practice trials preceded the test items and no feedback was provided for test items. The first subtest contained the final phoneme items. Following this, three examples were given of initial phoneme items. In each of the two sub-tests, five items were monosyllabic words and five were disyllabic words. The phoneme identity test was found to have internal consistency of 0.78.

### 8.3.3 Phonological Memory

*Rapid serial naming (RAN objects and colors)*, adapted from Shatil and Share (2003). In the serial naming of objects, the child was presented with a sheet containing five familiar pictures (*flower, house, dog, tree and table*). All pictures were named in the spoken Arabic vernacular of the sample. There were a total of 21 items arranged in seven rows of three. The child was asked to name these items as quickly as possible. In the serial naming of colors, children were presented with a series of 21 circles painted in five colors: red, yellow, blue, green, and black arranged in seven rows of three. Naming times in seconds and number of errors were recorded. The naming speed of objects and colors combined evinced satisfactory internal consistency (alpha = 0.75).

*Pseudo-word repetition* (adapted from Baddeley et al. 1998). Children were asked to repeat 40 pseudo-words adhering to Modern Standard Arabic phonology varying in length and syllabic structure. These items ranged from one to five syllables. The child heard each pseudo-word spoken by the investigator and was asked to repeat the item. Internal consistency was 0.84. This task has also proven to be a good kindergarten predictor of reading ability in Grade 1 (e.g., Gathercole and Baddeley 1993).

### *8.3.4 Pre-School Literacy*

*Letter naming*. Children were asked to name 12 printed letters. All the letters were in their non-ligatured form. Either the standard (MSA) name of the letter or the colloquial name was accepted. Internal consistency was 0.91.

*Concepts about print* (Clay 1979). This test was adapted from the Shatil and Share (2003) task, which, in turn, was adapted from Clay's (1985) English test. Children are presented with a story book and required to answer 16 questions assessing knowledge of print conventions and text handling such as page, line, word, letter, writing and pictures. Two additional questions tested the awareness of the Arabic short vowels, namely, their location and shape. Cronbach's alpha for this test was 0.77.

*Word-likeness*. In this task, the child was presented with (10) real Arabic words or with (10) non-Arabic word-like symbol strings. The non-Arabic foils were real words in which the original Arabic letters were changed to symbols such as a question mark or a letter from another script such as Chinese. Some foils contained changes in the number or location of the dots in an Arabic letter (e.g., a letter with two dots written with four dots). The child was asked to look closely at the word and decide if this was a word in Arabic. Internal consistency was 0.78.

*Morphological awareness* (based on Shatil 2002). This test examined the awareness of the morphological structure of spoken Arabic words. It included twenty items, each consisting of a pair of pseudo-words designed to assess different aspects of inflectional morphology and knowledge of word structure such as gender, number, tense etc. For example, the tester asked which of two words (one with the plural suffix and one without) indicated that there is only one thing *(lu:d- lu:di:n*). The test used pseudo-words that adhere to the structure of the spoken Arabic vernacular of the sample. Two demonstration items were given before the test, and repeated if necessary. Internal consistency (alpha) was 0.65.

### 8.3.5 Kindergarten Supra-Lexical Blocks:

General ability

*Raven's Colored Progressive Matrices* (RCPM; Raven et al. 1995). This test of non-verbal reasoning consists of 36 items presented in a multiple-choice format with a matrix-like arrangement of figural symbols. Sets A, AB, and B were administered. Internal consistency was 0.71.

*Peabody Picture Vocabulary Test-Revised* (Form B, Dunn 1965). This test, which is widely considered to be a proxy measure for verbal IQ, was adapted to (MSA). The test was discontinued after 6 errors in 8 consecutive items. Split-half reliability was 0.85; $p < 0.01$.

*Working memory* (based on Siegel and Ryan 1989). This test contains (spoken) sentences with missing words. The child had to supply the missing words orally and then recall all the missing words in the correct order. The test was divided into 3 sub-tests and each sub-test included two attempts at 2, 3 and 4 sentences respectively. The test was discontinued if the child failed both items in the two sets in a block; one point was awarded for each missing word supplied, with an additional point given if the participant recalled all the missing words in the correct order. This test was administered in the Spoken Arabic vernacular of the sample. Internal consistency was 0.65.

*Syntactic awareness* (based on the Test of Receptive Oral Grammar—TROG, Bishop 1982). In the TROG, the child is shown a page with four pictures, and must select the picture that matches a spoken sentence. There are 80 items divided into 20 blocks of four items. The test is discontinued after five consecutive blocks in which one or more errors are made. The test was translated into (SAV). It should be noted, however, that the complex sentence structures in this test were more characteristic of MSA than SAV. Split half reliability was 0.66.

### 8.3.6 Grade 2 Assessment of Reading Ability

*Context-free oral word naming.* This test consisted of 50 vowelized words in Arabic (MSA) divided into three sets of items of increasing difficulty in terms of syllabic structure and frequency. The first set contained twenty familiar words chosen from two first grade reading books, one of which was the instructional book for the present sample in Grade 1. The words in this set varied in length from one to four syllables. The words were considered to be highly familiar to Arabic-speaking Israeli children in Grade 2. The second set comprised 15 lower frequency words which also appeared in the children's first grade reading texts. These items varied in length from two to three syllables. The final set included words with lower frequency that did not appear in the reading books of Grade 1: these varied from one to three syllables. Children were required to read all the words aloud as quickly and accurately as possible. As well as accuracy and overall reading time, the number of words read in one minute was also recorded. One point was allocated for each word read correctly. Internal consistency (alpha) was 0.90.

*Pseudo-word naming*. A list of vowelized pseudo-words was specially developed in this study. It included 50 items varying in length and syllabic structure. Half the items were monosyllabic and half were disyllabic. Following five practice items, children were asked to read the list aloud as quickly and accurately as possible. Scoring procedures were the same as for the previous word naming task. Internal consistency (alpha) was 0.91.

*Semantic categorization* (adapted from Raviv 2002). In this test, 50 fully vowelized words were presented for semantic decision. Half of the items named edible foods and the other half named familiar objects or animals. The participants were asked to read the list silently and circle the words that indicated food items. Both accuracy and total time were measured. In addition, the number of items correctly read (i.e., categorized) in one minute ("*wpm*"—words-per-minute) was recorded too. Although no test-retest reliability was available for this task, adequate reliability is implicit in the high correlations observed between accuracy of semantic categorization and the two word naming tasks: the correlation with real word decoding accuracy was 0.81 and the correlation with pseudo-word naming accuracy was 0.80.

### *8.3.7 Reading Comprehension*

All three reading comprehension tasks: sentence comprehension, reading comprehension of narrative text and the expository text were administered to whole classes in the course of a single 60 min lesson-period.

*Sentence comprehension*. (Metzav test for Grade 2 in Israel, 2005). Ten printed sentences (3–4 words long) were accompanied by four pictures arranged in a table of four boxes. The child was asked to read the sentence (silently) and to circle the appropriate picture. One point was given for each correct item. Internal consistency (alpha) was 0.80.

*Reading comprehension: Narrative text*. (Metzav test for Grade 2 in Israel, 2005). This test consisted of a passage of 61 words relating a story about a girl's birthday party. Ten multiple-choice questions followed the narrative passage, each containing three options. Five questions tested factual (text-explicit) comprehension and five tested inferential comprehension. Internal consistency (alpha) was 0.58 (two items were deleted).

*Reading comprehension: Expository text*. (*Metzav* test for Grade 2 in Israel, 2005). The format of this test was the same as that of the narrative text. The text included six sentences (39 words long) describing an alligator. For this text, seven questions tested information explicitly provided by the text, and another three questions tested integration and interpretation. Internal consistency (alpha) was 0.73.

## 8.4 Results

The reliability indices were all moderate to high, with the exception of the short-term symbol memory task, which included relatively few items and was quite difficult for most children (see Table 8.1). It should be noted, however, that performance in this task was significantly above chance (33 %). The reliability of RAN accuracy (calculated as the average number of errors in naming objects and colors) was understandably low since more than half of the sample made no errors.

All the word recognition measures were combined into a single composite measure including accuracy and speed. Accordingly, a principal components analysis was undertaken. The results revealed that the first principal component accounted for 72 % of the variance with high positive weights for all six measures. Consequently, a single composite measure of word recognition was calculated as the mean of z scores of all these tasks. A principal components analysis of the three tests of reading comprehension produced a very similar outcome: the first measure principal component accounted for 68.5 % of the variance with high positive weights for all three measures. A single composite measure was therefore created for reading comprehension calculated as the mean of z scores of those three tasks.

To assess the unique contribution of each block to word recognition and reading comprehension, three separate types of multiple regression analyses were carried out. First, each set of intra-lexical variables, namely, phonemic awareness, phonological processing, visual processing and morphological awareness were entered set-wise, once with word recognition as the dependent variable and then with reading comprehension. The same analyses were conducted with the supra-lexical measures. Second, hierarchical regression was used to test the unique variance explained by each block after controlling general ability as measured by Raven and Peabody tasks and, in a final set of analyses, with all supra-lexical measures partialled out (Raven, Peabody, Working memory, and TROG). The results of these analyses are summarized in Table 8.2.

It can be seen that the intra-lexical sets each contributed significant and substantial variance to word identification and to reading comprehension. Phonemic awareness was the strongest predictor; phonological processing, pre-school literacy and morphological awareness all made similar contributions, with visual-orthographic processing making a more modest but still non-trivial contribution.

As predicted, supra-lexical factors also contributed non-trivial variance to word recognition although, as expected, this contribution was overshadowed by the contribution of intra-lexical factors. On the other hand, these same supra-lexical variables (with the exception of working memory) were more potent in predicting reading comprehension.

To illuminate the degree of modularity in early Arabic reading, separate multiple regression analyses were carried out on the intra-lexical sets and supra-lexical sets, respectively, with word recognition and reading comprehension as the dependent variables (see Table 8.3).

**Table 8.1** Means, standard deviations, maximum and minimum scores and reliability coefficients for kindergarten predictors and Grade 2 reading measures

| | M | SD | Max score | Min score | Reliability |
|---|---|---|---|---|---|
| | Kindergarten measures | | | | |
| Phonemic awareness | | | | | |
| Initial consonant isolation | 72.1% | 29.04% | 100% | 0% | 0.88 |
| Initial/final phoneme identification | 63.1% | 20.36% | 100% | 25% | 0.78 |
| Phonological processing | | | | | |
| RAN (speed in secs) | 32.0 | 9.85 | 64.9 | 16 | 0.75 |
| RAN (errors) | 0.6 | 0.93 | 5.0 | 0.0 | |
| Pseudo-word repetition | 82.8% | 12.87% | 100% | 32.5% | 0.84 |
| Visual-orthographic processing | | | | | |
| Beery Visual Perception | 13.7 | 3.10 | 21 | 4 | 0.69 |
| Short-term symbol memory | 47.9% | 21.98% | 100% | 0% | 0.44 |
| Pre-school literacy | | | | | |
| Letter naming | 42.6% | 34.11% | 100% | 0% | 0.91 |
| Concepts about print | 51.2% | 20.39% | 93.8% | 0% | 0.77 |
| Word-likeness task | 71.2% | 19.59% | 100% | 10.5% | 0.78 |
| Oral language | | | | | |
| T.R.O.G (syntax)[b] | 7.8 | 3.22 | 18 | 2 | 0.66 |
| Morphological awareness | 68.2% | 18% | 100% | 18.8% | 0.65 |
| General ability | | | | | |
| Raven's matrices | 40.9% | 13.11% | 80.6% | 5.6% | 0.71 |
| Peabody picture vocabulary | 42.9 | 9.55 | 65 | 13 | 0.85 |
| Working memory | 3.1 | 2.51 | 13 | 0 | 0.65 |
| | Grade 2 reading measures | | | | |
| Word recognition | | | | | |
| Word decoding (accuracy) | 67.5% | 21.16% | 98% | 8% | 0.90 |
| Word decoding (speed in secs) | 251.9 | 271.66 | 2043 | 66 | [c] |
| Pseudo-word decoding (accuracy) | 62.9% | 27.28% | 100% | 0% | 0.91 |
| Pseudo-word decoding (speed in secs) | 200.3 | 142.33 | 922 | 67 | [c] |
| Semantic categorization (accuracy) | 91.6% | 11.57% | 100% | 38% | [d] |
| Semantic categorization (speed in secs) | 194.1 | 105.93 | 887 | 63 | [c] |
| Reading comprehension | | | | | |
| Sentence comprehension | 84.8% | 20.42% | 100% | 0% | 0.80 |
| Narrative text comprehension | 61.8% | 22.60% | 100% | 0% | 0.58 |
| Expository text comprehension | 56.6% | 25.93% | 100% | 0% | 0.73 |

Intra-lexical cognitive factors explained around one third of the variance in word recognition, and close to one half of the variance in reading comprehension. Supra-lexical factors explained a more modest but still significant 11% of the variance in word recognition, and just over one quarter of the variance in reading comprehension. It is especially noteworthy that intra-lexical factors explained over twice as much variance in reading comprehension as the supra-lexical factors.

**Table 8.2** Variance in word recognition and reading comprehension explained by blocks of kindergarten predictors before and after controlling for general ability (Raven and Peabody) and after controlling all supra-lexical measures

| | Adjusted $R^2$ | | | | | |
|---|---|---|---|---|---|---|
| | Word recognition | | | Reading comprehension | | |
| | Unpartialled (%) | Partialled[a] (%) | Partialled[b] (%) | Unpartialled (%) | Partialled[a] (%) | Partialled[b] (%) |
| Intra-lexical blocks | | | | | | |
| Phonemic awareness | 24 | 19 | 14 | 28 | 15 | 11 |
| Phonological processing | 18 | 13 | 9 | 26 | 12 | 10 |
| Visual-orthographic processing | 11 | 7 | 4 | 19 | 7 | 4 |
| Pre-school literacy | 17 | 13 | 10 | 23 | 11 | 8 |
| Morphological awareness | 17 | 12 | 9 | 24 | 11 | 9 |
| Supra-lexical blocks | | | | | | |
| Syntax | 11 | 5 | | 21 | 5 | |
| Working memory | 3 | 1[ns] | | 3 | 0.1[ns] | |
| Raven & Peabody | 6 | | | 23 | | |
| All supra-lexical measures | 11 | | | 27 | | |

$p<0.001$
[a] Raven and Peabody controlled for
[b] all supra-lexical measures controlled for
[c] non-significant (ns)

**Table 8.3** Variance in word recognition and reading comprehension collectively explained by intra-lexical and supra-lexical sets (combining sets)

| | Word recognition | | Reading comprehension | |
|---|---|---|---|---|
| | Multiple R | Adj.$R^2$ (%) | Multiple R | Adj.$R^2$ (%) |
| Intra-lexical sets | 0.61 | 33 | 0.70 | 45 |
| Supra-lexical sets | 0.36 | 11 | 0.54 | 27 |

* $p<0.001$

## 8.5 Discussion

The results confirmed the hypothesis that the main precursors of word recognition in fully vowelized Arabic, which is typically considered a transparent orthography, are intra-lexical factors such as phonemic awareness, phonological processing, early literacy and morphological awareness, rather than higher-order extra-lexical factors such as semantics, syntax, general cognitive abilities and working memory. It is worth noting, however, that the contribution of each intra-lexical set to word recognition declined substantially (by around half) after controlling for general non-verbal and verbal (vocabulary) ability. Nonetheless, even after partialling out supra-lexical sets, the combined contribution of all four intra-lexical sets remained substantial and significant, accounting for 25 % of the variance in word recognition. This finding confirms that early word recognition in Arabic is related first and foremost to the more word-specific, intra-lexical skills (alphabetic, visual-orthographic and morphological) that underpin identification of individual printed words. Converging evidence was reported by Saiegh-Haddad (2005) in a cross-sectional study where it was shown that RAN, working memory and letter recoding speed were the best predictors of reading fluency at the end of Grade 1, and where PA was found to be a strong indirect predictor of fluency and a direct predictor of letter recoding speed.

The strongest individual predictor of word recognition in the current study was phonemic awareness. This finding is at odds with earlier evidence reported in Hebrew by Shatil and Share (2003) in their longitudinal study of early pointed (fully-vowelized) Hebrew reading. They found that phonemic awareness plays a weak role in word recognition at the end of Grade 1, accounting for only 11 % of the variance in word recognition and, furthermore, failing to account for any unique variance after controlling for the variance explained by other domain-specific and domain-general measures. The results of Shatil and Share replicate earlier Hebrew studies such as Bentin and Leshem (1993) and Geva and Siegel (2000). This finding has also been obtained in other transparent orthographies such as Latvian (Sprugevica et al. 2006), Turkish (Oney and Durgunoglu 1997) and Finnish (Leppanen et al. 2006), prompting Share (2008) to propose that the phonological awareness (PA) -reading association is strongest when script *per se* is complex or when incomplete mastery of the code makes the script functionally opaque; once the learner has mastered the code, however, the PA-reading relation declines.

The present study revealed another important finding. The accuracy of Arabic word reading (67 %) and pseudo-word reading (63 %) at the beginning of Grade 2 was very low, implying that children are making around one error every three words. This means that Arabic-speaking children living in Israel have not yet mastered the alphabetic code at the beginning of Grade 2, thereby reinforcing the claim regarding script complexity. This finding contrasts sharply with studies with pointed Hebrew showing that a majority of Israeli beginners achieve proficient decoding by the end of Grade 1 (Feitelson 1989; Share and Levin 1999). In their cross-linguistic study of 14 European nations, Seymour et al. (2003) found that most children from a majority of (European) countries were reasonably accurate and fluent decoders by the end of the first school year, averaging 87 % accuracy. After English (34 %), the next lowest result was Danish (71 %). This places Arabic among the poorest performers, at least relative to European nations. A similar finding was recently reported by Saiegh-Haddad (2011), who found that even the good readers of Arabic do not reach these high levels of accuracy in Grade 1 and probably only in Grade 2.

To summarize, the prominent role of phonemic awareness in Arabic decoding and the low levels of decoding accuracy, suggest that reading acquisition in Arabic is a considerable challenge despite its spelling-sound consistency.

In addition to phonemic awareness, the other phonological measures including pseudo-word repetition and RAN also explained significant variance in word recognition. This finding was anticipated since a substantial body of research has repeatedly demonstrated that basic phonological processing abilities that develop prior to the start of schooling are essential for reading acquisition across orthographies (see, for example, Boets et al. 2007; Van Leeuwen et al. 2006). It is worth remarking that the contribution of phonological processing, particularly the RAN test, was lower than that of phonemic awareness. In this context Ziegler et al. (2010) argued that phonological awareness is important in all languages but that its impact is modulated by the transparency of the orthography; thus, phonological awareness might be a stronger predictor in opaque orthographies, whereas rapid automatized naming (RAN) is weaker and limited to decoding speed and the reverse in transparent orthographies. Like Danish and English, Arabic poses considerable challenges for the novice reader, hence, the contribution of phonological awareness is particularly salient.

As expected, morphological awareness was found to be an important additional contributor to early vowelized word recognition. This finding is in accordance with many studies reviewed in the introduction which point to a positive relationship between morphological awareness and reading development in different orthographies including English and Hebrew, as well as Arabic (see Saiegh-Haddad and Geva (2008).

The centrality of Arabic morphology in the spoken and written language has already been discussed above. Suffice it to note that the present study used a purely aural task that included pseudo-words adhering to the structure of the *spoken* vernacular of the sample. This task only assessed knowledge of inflectional morphology such as gender, number, tense etc. Yet, this single task accounted for unique variance in word recognition not only when phonemic awareness was controlled, but even when all supra-lexical abilities were partialled out. This finding suggests that, alongside intra-lexical abilities, reliance on word-level information such as inflectional morphology also contributes to decoding skill in Arabic. Future longitudinal research will need to address the predictive utility of additional morphological abilities such as root extraction and derivational knowledge.

Among the other significant predictors were pre-school literacy measures which were assessed with tasks of letter naming, concepts about print and word-likeness explained a similar portion of variance to morphological awareness—17 %. This finding adds to a long list of studies demonstrating a relationship between alphabetic and print knowledge in kindergarten and future reading achievement. It is worth remarking on the generally low performance on the letter naming task in kindergarten. Indeed, additional analyses revealed wide differences between kindergarten means in letter naming. For instance, the lowest average accuracy in one kindergarten was 7 % and the highest was 70 %, with the mean of the other kindergartens in the 38–53 % range. These data point to major differences in instruction. As already noted in the method section, Arabic-speaking kindergartens in Israel at the time of testing received no explicit literacy instruction. Some kindergartens emphasize story-reading and thereby exposure to MSA, others include systematic literacy activities such as learning letter names and writing letters, but ignore phonological awareness. Nevertheless, as already noted, the Arabic-sector curriculum has undergone considerable changes since 2008 when reforms focused attention on phoneme awareness and letter knowledge. Unfortunately, no systematic research has been carried out to determine the extent to which these reforms have been implemented *in situ*. Only this way can the influence of instruction be evaluated. This remains, therefore, a crucial question for future investigation because many of the key cognitive predictors in this study are likely to have their source in instructional factors that vary from site to site.

In addition to instructional factors, the poor performance on letter naming may be partly attributable to the visual complexity of the graphemes. Support for this assumption can be found in the significant correlation between the letter naming task and the two visual processing tests. Converging evidence was recently reported by Levin et al. (2008) which revealed that the visual similarity of the Arabic letters increased letter confusability among Israeli Palestinian kindergartners.

The second hypothesis proposed that visual/orthographic processing would play a significant role in word recognition (Abu-Rabia et al. 2003; Elbeheri and Everatt 2007; Ibrahim et al. 2002; Eviatar et al. 2004). Although visual perception and short-term visual memory contributed unique variance to word recognition, this contribution shrank considerably (to 4 %) after controlling for the variance explained by all supra-lexical variables. Nevertheless, it is worth noting that the visual-orthographic memory test developed in this study had low reliability and relatively few items. In any case, future research will need to replicate the visual processing finding with more reliable tasks, and, above all, elucidate the locus of this effect. At least four factors will need to be investigated: graphemic similarity, short-vowel diacritics, ligatured letters and allographic variants of letters. In addition to the unique visual complexities of Arabic, there may also be a universal cross-linguistic visual component in learning to read, as visual processing has been found to contribute to word recognition in other Semitic languages such as Hebrew (Meyler and Breznitz 1998; Share and Levin 1999; Shatil and Share 2003) and, in some reports, even English (Badian 2005; Olson and Datta 2002; Pammer and Kevan 2007; Stein et al. 2001). The latter English-language studies attest to a renewed interest in the role of visual processing in reading ability which diminished considerably following the publication of Vellutino's (1979) authoritative book on dyslexia which provided compelling evidence against visual deficits as a cause of dyslexia.

The case of Arabic, however, presents an interesting argument for the role of visual factors. As discussed in the introduction, the complexity of letter-phoneme alignment (graphemic parsing) needs to be considered separately from issues of grapheme-phoneme correspondence. While English appears to be the most complex alphabetic orthography in terms of grapheme-phoneme correspondence, it seems less complex in terms of graphemic parsing than French for instance (Van den Bosch et al. 1994). Arabic appears to represent the inverse of English—visual/graphemic complexity co-occurring with grapheme-to-phoneme consistency. This 2-dimensional conception of orthographic complexity underscores the limitations of the dominant one-dimensional regularity-based or consistency-based taxonomy and offers a useful theoretical framework for future research into the predictors of reading in Arabic and cross-linguistic studies in general.

One of the most salient findings in the present study related to the third hypothesis which predicted a significant role for supra-lexical antecedents in word recognition due to the unique complexities of Arabic. Variables such as general verbal ability and syntax, in addition to working memory and non-verbal reasoning, all contributed significantly to Arabic word recognition. The most prominent variable in this set was syntactic awareness which explained a significant 11 % of the variance, and continued to account for significant variance (5 %) even when general ability (non-verbal ability and receptive vocabulary) was controlled. This suggests that the inexperienced reader must rely to a certain extent on contextual (supra-lexical) information to facilitate word recognition. This finding is in accordance with English-language studies showing syntactic involvement in the recognition of irregular words and among poor decoders (Bowey 2005; Strain and Herdman 1999).

Working memory accounted for only a few percentage points of the variance in word recognition. This finding converged with studies that showed an association between working memory deficits and poor word recognition (e.g., Siegel and Ryan 1989; Swanson and Alexander 1997). However, it is important to note that working memory no longer continued to contribute to word recognition once general ability was controlled. Some studies have found that a deficit in working memory is also characteristic of poor readers of Arabic (Abu-Rabia et al. 2003; Abu-Rabia and Siegel 2002). Additionally, Saiegh-Haddad (2005) showed that Arabic pseudoword reading fluency in first grade was primarily predicted by letter recoding speed (a composite measure of accuracy and speed of converting letter symbols into their corresponding phonemes), followed by working memory. In the current study, the contribution of working memory to word recognition was marginal, but this must be qualified by a methodological limitation: the present working memory task was very difficult for the kindergarteners and also had low reliability (0.65), hence future research will need to rectify this shortcoming.

Turning to the supra-lexical set of general ability measures adopted in the present study, these included non-verbal reasoning as assessed by Raven's matrices and receptive vocabulary as assessed by the Peabody Picture Vocabulary test (Dunn 1965). This pair accounted for modest variance in word recognition, but this finding should be treated with caution since the vocabulary test was adapted to MSA and not to the spoken vernacular. Thus, this contribution may partly reflect aspects of the literacy environment such as exposure to written Arabic and MSA vocabulary. Future research may need to assess both forms of vocabulary knowledge, namely, MSA and SAV in order to provide a clearer picture of the role of verbal (vocabulary) skills in word recognition in the initial phase of reading acquisition. It must also be acknowledged that despite the fact that the syntactic awareness task (TROG) was adapted to spoken Arabic, the complex sentence structures that make up many of the items in this test are more characteristic of MSA than SAV. Thus, it cannot be ruled out that these two supra-lexical abilities are partly tapping exposure to MSA.

This investigation also addressed a further question—the degree of modularity in early Arabic reading. The modularity-by-transparency interaction (Share 2008) predicts that an opaque script demands a greater degree of lexical and supra-lexical processing than a less opaque script. The finding that supra-lexical factors made a significant contribution to word recognition variance suggests that Arabic orthography may be considered only moderately transparent or semi-transparent among novice readers due to its complexity. This lack of transparency obliges the reader to resort to lexical and, wherever possible, supra-lexical or extra-lexical information. Thus, reading in Arabic may be a case of "semi-modularity". This finding is clearly very different from the conclusion reached by Shatil and Share (2003) regarding the cognitive modularity of pointed (full voweled) Hebrew. Their study showed that word recognition is highly dissociable from higher-order or supra-lexical abilities. This implies that the two linguistic cousins (Hebrew and Arabic) depend on somewhat different cognitive resources. However, it should be noted that the current study did not examine extrinsic/environmental factors (such as instruction) that are likely to distinguish between Arabic and Hebrew novice readers, so the question of teaching methods in Arabic remains to be pursued.

The designation of semi-modularity is corroborated by the finding that the contribution of intra-lexical abilities to word recognition (and reading comprehension) declined appreciably after we controlled for all supra-lexical measures (25 %). Furthermore, the current results revealed considerable overlap between intra- and supra-lexical abilities. A principal components analysis was undertaken for the four supra-lexical variables. Results showed that the first principal component accounted for 55.7 % of the variance with high positive weights on all four measures. Factor score coefficients for syntactic awareness, Raven, Peabody and working memory were 0.371, 0.344, 0.338, and 0.279 respectively. Using this principal component variable as the criterion variable in multiple regression, all intra-lexical abilities together explained a substantial proportion of the variance in supra-lexical abilities (multiple $R=0.70$, adjusted $R^2=0.45$). This finding confirms a high degree of overlap between intra-lexical and supra-lexical abilities in Arabic. Indeed, the combined set of intra-lexical abilities explained no less than 45 % of the variance in supra-lexical abilities when the latter was coalesced into a single composite measure based on the first principal component in this set. Two explanations for this overlap come to mind. The first concerns the complexities of Arabic script, the second relates to the diglossic context. It must be acknowledged that the current study did not address the diglossic issue directly, and some kindergarten measures included items tapping written Arabic (e.g., syntax (TROG) and vocabulary (Peabody). Future research will need to explicitly distinguish spoken and written aspects of Arabic-language processing.

The fourth hypothesis related to reading comprehension. As predicted, reading comprehension was explained by both intra-lexical and supra-lexical measures. This indicates that early reading comprehension in Arabic relies heavily on word recognition, hence the significant role of intra-lexical factors. In addition, extra-lexical factors such as higher-order thinking skills, vocabulary and sentence-level skills are necessary for the high-order reasoning processes required for reading comprehension.

Consistent with the cognitive breadth required for reading comprehension, supra-lexical abilities explained substantially higher unique variance in reading comprehension than in word recognition. Setting aside the problematic working memory task, it was found that general ability and syntactic awareness contributed unambiguously to individual differences in reading comprehension. This finding converges with earlier studies showing that reading comprehension is a global ability that depends on a wide range of precursor skills such as oral language proficiency and higher-level cognitive skills (Laurie and Hollis 2006; Nation et al. 2004).

The largest contributions to reading comprehension within the intra-lexical set of abilities were made by phonemic awareness and phonological processing. This reaffirms the crucial role of basic decoding ability (and its phonological foundations) in early reading comprehension in Arabic. However, it is important to note that all other intra-lexical abilities contributed significantly to reading comprehension even after partialling out general ability. The larger contribution of intra-lexical measures to reading comprehension than to word recognition replicates the finding reported by Shatil and Share (2003) in their Hebrew study. One possible explanation for this finding relies on the simple model of reading comprehension (LaBerge and Samuels 1974) which assumes that relatively weak lower-order or "bottom-up" skills impair comprehension not only because words are misidentified, but because fewer cognitive resources can be devoted to the processing of meaning. Consequently, word recognition difficulties in Arabic constitute a major stumbling block in comprehending written text in initial literacy learning. Support for this can be seen in the large inter-correlation between word recognition and reading comprehension ($r=0.69$). The present results diverge from Shatil and Share (2003) who found a lower word recognition/comprehension correlation in Hebrew ($r=0.46$).

## 8.6 Conclusion

To summarize, the present study provided some novel insights into the nature of the cognitive and psycholinguistic precursors of early reading acquisition in Arabic. Word recognition skill in the early grades depends mainly on sub-lexical and lexical abilities, most notably phonemic awareness and phonological processing, but also early literacy such as letter knowledge and print concepts, visual- orthographic processing and morphology awareness. Alongside these intra-lexical abilities, more general cognitive abilities and linguistic abilities such as syntactic awareness and vocabulary were shown to be significantly related to word recognition in Arabic, owing to the multiple complexities of the script as well as perhaps the diglossic context. This finding implies that word recognition in Arabic is only moderately autonomous or "semi-modular" in spite of the near perfect match between graphemic and phonemic units. Early reading acquisition in Arabic is slow and difficult—a fact that suggests that fully voweled Arabic is a relatively opaque Arabic orthography, although the uni-dimensional notion of transparent-opaque orthographies may not be the most adequate framework for conceptualizing the present findings. Overall, early Arabic reading comprehension skill relies heavily on decoding skill as well as higher-order linguistic and cognitive abilities.

An immediate implication of this study relates to initial reading instruction. The present results show that phonological awareness develops slowly in Arabic and is a strong predictor owing to the complexities of the orthography. It would, therefore, seem to make sense to include phonemic awareness instruction as an integral component of reading instruction from kindergarten onward.

Because the present results revealed a non-trivial contribution of supra-lexical abilities to word recognition, initial instruction may also need to emphasize the syntactic structures of MSA sentences and MSA vocabulary.

Finally, an interesting implication of this study relates to reading comprehension skill. The present results revealed a high correlation between decoding skill and reading comprehension, implying that a significant number of reading comprehension difficulties in the early grades may be related to decoding difficulties. Remediation programs will consequently need to focus on developing decoding skill in young children.

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# Part IV
# Arabic Diglossia, Language and Literacy

# Chapter 9
# The Effect of Diglossia on Literacy in Arabic and Other Languages

**John Myhill**

**Abstract** This paper shows that basic literacy rates in Arabic-speaking countries are far lower than would be expected based upon their relative wealth, and argues that much of the explanation for this lies in their usage of a standard language which is based upon an earlier version of the language which no one speaks anymore—comparative evidence shows that languages of this type around the world consistently have uncommonly low literacy rates. The best policy for addressing this problem, so as to achieve a high rate of literacy while maintaining the traditional written language, would appear to be to use a strategy parallel to that adopted for languages such as Chinese, Japanese, and Sinhala: base early literacy, through the third or fourth grade, on written phonological representations of the different spoken dialects, and then switch to the traditional written language after this, when children are better able to deal with a writing system which is quite different from their own spoken languages.

**Keywords** Arabic · Diglossia · Language policy · Literacy · Mother tongue · Spoken language · Written language.

## 9.1 Introduction

One of the most obvious and striking features regarding Arabic is the remarkably low rate of basic literacy in Arabic-speaking countries. Consider the UNESCO data from 2007–2008 in the following table[1] (Table 9.1):

I thank Raphiq Ibrahim and Elinor Saiegh-Haddad for their helpful comments on an earlier draft of this paper.

[1] Unless otherwise indicated, basic literacy data for individual countries which I will refer to in this study are from 2007–2008 and taken from http://en.wikipedia.org/wiki/List_of_countries_by_literacy_rate (based upon UNESCO data). Data on literacy and GDP per capital were not available

J. Myhill (✉)
Department of English Language and Literature,
University of Haifa, Mt. Carmel, 31905 Haifa, Israel
e-mail: john@research.haifa.ac.il

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**Table 9.1** Literacy ranking for Arabic-speaking countries (out of 180 countries)

| Country | Literacy rate (%) | Literacy rank |
|---|---|---|
| Kuwait | 94.5 | 76 |
| Qatar | 93.1 | 84 |
| Jordan | 91.1 | 92 |
| UAE | 90.0 | 98 |
| Lebanon | 89.6 | 101 |
| Bahrain | 88.8 | 104 |
| Libya | 86.8 | 113 |
| Saudi Arabia | 85.0 | 116 |
| Syria | 83.1 | 119 |
| Oman | 81.4 | 121 |
| Tunisia | 77.7 | 128 |
| Algeria | 75.4 | 132 |
| Egypt | 66.4 | 148 |
| Sudan | 60.9 | 156 |
| Yemen | 58.9 | 158 |
| Morocco | 55.6 | 162 |
| Total | 70.5 | |

**Table 9.2** National literacy rates according to income of each state

| Income level | Literacy rate (%) |
|---|---|
| High income | 99.0 |
| Middle income | 89.9 |
| Low income | 60.2 |

We see here that of the 16 Arabic-speaking countries for which there are data, 14 have literacy rates which are lower than the average for the 180 countries listed, and even the two exceptions, Kuwait and Qatar, are barely above average.

Such data are alarming. But the literacy situation in Arabic-speaking countries is even worse if we consider how much money these countries have available to support education. Wealthier countries have more money to spend on education and can thus be generally expected to have higher literacy rates, and this is clearly supported by UNESCO data presented below in Table 9.2:[2]

Given the general association of income with literacy rates illustrated in Table 9.2, it might be thought that the low literacy rate in Arabic-speaking countries is the result of relative poverty in these countries. But this is not the case—in fact, the 16 Arabic-speaking countries taken together rank above average in terms of GDP per capital, with an average ranking of 72 out of 182 countries. Nonetheless, their

for Iraq and the Palestinian territories. The data from Sudan are only from northern Sudan; southern Sudan is entirely non-Arabic speaking and has been in a state of almost constant war against the north for the last 50 years, so presumably the literacy rates are lower there. The overall literacy rate of 70.5 % for Arab countries is lower than the median for the countries because there is a strong tendency for the Arab countries with the highest literacy rates to have the smallest populations.

[2] Unless otherwise indicated, GDP per capita data which I will refer to in this study are from 2009 and are taken from http://en.wikipedia.org/wiki/List_of_countries_by_GDP_%28nominal%29_per_capita.

**Table 9.3** Literacy ranking and GDP per capita ranking for Arabic-speaking countries (out of 180/182 countries)

| Country | Literacy rate (%) | Literacy rank | GDP/capita | GPD/cap rank | GDP rank -lit. rank | Expected lit. rate (%) | Lit.rate-exp. lit. rate (%) |
|---|---|---|---|---|---|---|---|
| UAE | 90.0 | 98 | $ 45,615 | 9 | −89 | 99.7 | −9.7 |
| Qatar | 93.1 | 84 | $ 59,990 | 4 | −80 | 99.8 | −5.7 |
| Oman | 81.4 | 121 | $ 15,996 | 39 | −82 | 99.0 | −17.6 |
| S. Arabia | 85.0 | 116 | $ 14,745 | 42 | −74 | 99.0 | −14.0 |
| Bahrain | 88.8 | 104 | $ 19,817 | 33 | −71 | 99.0 | −10.2 |
| Libya | 86.8 | 113 | $ 9,511 | 54 | −59 | 97.8 | −11.0 |
| Morocco | 55.6 | 162 | $ 2,882 | 108 | −54 | 88.0 | −32.4 |
| Kuwait | 94.5 | 76 | $ 27,835 | 26 | −50 | 99.0 | −4.5 |
| Lebanon | 89.6 | 101 | $ 8,951 | 57 | −44 | 97.6 | −8.0 |
| Algeria | 75.4 | 132 | $ 3,996 | 95 | −37 | 90.7 | −15.3 |
| Tunisia | 77.7 | 128 | $ 4,171 | 92 | −36 | 91.5 | −13.8 |
| Egypt | 66.4 | 148 | $ 2,450 | 116 | −32 | 85.5 | −19.1 |
| Sudan | 60.9 | 156 | $ 1,397 | 128 | −28 | 77.7 | −16.8 |
| Yemen | 58.9 | 158 | $ 1,061 | 140 | −18 | 71.8 | −12.9 |
| Syria | 83.1 | 119 | $ 2,615 | 112 | −7 | 87.0 | −3.9 |
| Jordan | 91.1 | 92 | $ 4,199 | 91 | −1 | 91.2 | −0.1 |
| *Average* | | *119* | – | *72* | *−47* | | *−12.2* |

literacy rates are **still** remarkably low. Table 9.3 shows the literacy ranking and GDP per capita ranking for Arabic-speaking countries.

Table 9.3 summarizes data from the 16 Arab states for which data are available for literacy rates (the first column), GDP per capita (the third column), ranking in these two categories out of the 180 and 182 countries listed (the second and fourth columns), GDP rank minus literacy rank (the fifth column, e.g. for the UAE 9−98=−89), the expected literacy rate based upon GPD per capita (the sixth column, for example, as the world's fourth wealthiest country Qatar would be expected to have a literacy rate of 99.8%, equal to that of Latvia, the country with the fourth highest literacy rate), and the real literacy rate minus the expected literacy rate (the seventh column, for example, for Morocco 55.6%−88.0%=−32.4%).

As Table 9.3 shows, every single Arab state has a lower literacy rate than would be expected given its per capita GDP—more than that, it is generally **much** lower, an average of 47 places out of 180 on the world scale and 12.2%. The situation looks worse in different countries depending upon which measure is used. In general, the wealthier Arab countries are worse in terms of relative ranking (in fact the top five countries in Table 9.3 have the five lowest GDP-rank-minus-literacy ranks in the world), while the poorer Arab countries are worse in terms of comparison between actual and expected literacy rates (Oman and Morocco are extremely bad no matter which criterion is used), but with the exception of Syria and Jordan the situation is quite bad everywhere however this is calculated.

**Table 9.4** Percentage of GDP spent on primary education

| Region | GDP (%) |
|---|---|
| North America and Western Europe | 21.8 |
| Central and Eastern Europe | 16.6 |
| East Asia and the Pacific | 14.6 |
| Arab states | 13.5 |
| Sub-Saharan Africa | 12.8 |
| Latin American and the Caribbean | 12.6 |
| South and West Asia | 9.7 |
| Central Asia | 9.3 |

The unfortunate situation described above cannot be attributed to low funding for primary education in Arab countries. In fact, the Arab states taken as a whole are slightly **above** average in terms of the percentage of GDP spent on primary education, as shown in Table 9.4 above:[3]

Nor is evidence for the literacy problem in Arabic-speaking countries limited to shockingly low literacy rates only. In an article published in the Journal of Higher Education entitled 'The Arabic publishing scene is a desert, critics say', Del Castillo (2001) writes:

> … the quantity of books published in the Arab world is small, especially relative to the region's population. There are 275 million Arabic speakers in 22 countries, but for Middle Eastern publishers, print runs of 5,000 are considered huge. (p. 55)

In the same vein, in her summary article on literacy in the Arab world for 'The Cambridge Handbook of Literacy', Haeri (2009, p. 423) observes that:

> All available statistics on literature and book-reading point to the generality of the conclusion that the public educational systems in most countries in the Arab world produce graduates or dropouts who do not like to read or write beyond a minimum that is required of them. (p. 423)

What is the cause of this literacy problem in the Arab world? We really do not know (see Saiegh-Haddad and Spolsky, in this collection). In fact, as noted by Haeri (2009), there have been almost no ethnographic studies of how Arabic literacy is taught (or fails to be taught) in Arabic-speaking countries, the only such study being Wagner (1993). As Wagner and Haeri observe, social factors such as attitudes towards literacy and uninspiring teaching methodology may certainly play a role (see Rosenhouse, in this collection). But anyone who has much experience with school systems around the world will know that Arab countries are not at all unusual in this respect—in fact such a situation is quite normal in many if not most countries, but rarely is the literacy situation as dismal as it is in Arab countries, so this cannot be the main cause of the problem.[4] It makes sense, then, to ask whether the explanation

[3] The data in Table 9.4 are from 2005 and taken from http://www.uis.unesco.org/template/pdf/EducGeneral/Factsheet07_No6_EN.pdf.

[4] The unusually low literacy rates in Arab countries do not appear to be the result of distinctive cultural biases discouraging female literacy. Arab countries show male/female literacy differentials which are typical of countries around the world, with substantially lower female literacy in

could lie in what Arabic-speaking students are being asked to learn, that is, the written form of the Arabic language itself. In this vein, on the basis of her own observations in Egypt, Haeri (2009, pp. 422–423) notes that studying the Arabic language generally turns Arabic speakers off to reading:

> … the majority of students feel alienated from such [Arabic language] classes and tell countless jokes about the language and teachers of grammar … [T]hey as well as older adults who were interviewed about their school experience stated that they found Arabic language classes extremely boring and unbearable—some even said that they hated these classes … A striking comment made both by high school students and older adults, men and women, was that they grew to dislike reading in general, especially 'longer pieces' like books. This was true even for the librarians that I interviewed. With few exceptions, people educated in public schools stated that they find the language of books too difficult and it takes them too long just to read a few pages. For fiction and nonfiction reading material, they commented that they found the language 'heavy' and 'scary' and that they simply did not enjoy the activity. [pp. 422–423; emphasis in original].

What it is it about the Arabic language that discourages reading and hinders literacy? A number of factors related to the Arabic script have been identified by researchers which may contribute to literacy problems in Arabic. These include in particular the facts that (1) many of the letters have a variety of different forms, and (2) diacritics are used extensively and in a manner which is phonologically inconsistent (see e.g. Azzam 1984; Bentin and Ibrahim 1996; and Ibrahim et al. 2002, 2007 for comparison with Hebrew; Frost et al. (1987) for comparison with English and Serbo-Croatian; and Roman and Pavard 1987 for comparison with French).

In the present paper, however, I would like to consider the possible effect of a different factor. This is the radical difference between on the one hand the established written language which is taught in school in Arab countries and upon which literacy acquisition and evaluation are based, and on the other hand the spoken dialects which children acquire before coming to school and speak in their day-to-day life (see Saiegh-Haddad and Henkin-Roitfarb, in this collection). This difference is one example of a situation which linguists have referred to as *diglossia* (see e.g. Ferguson 1959, 1991; Wexler 1971; Fellman 1975; Eckert 1980; Scotton 1986; Berger 1990; Daltas 1993; Schiffman 1997; Hudson 2002; Saiegh-Haddad 2003, 2004, 2005, 2007, 2012; Saiegh-Haddad et al. 2011; Khamis-Dakwar 2005, 2007). In a diglossic situation, the spoken language in a community, referred to by linguists as L (for 'low'), differs significantly from the community's written language, known as H (for 'high'); in some cases L may have some limited written usages (e.g. for folk poetry, songs, children's books, etc.), while conversely H may have some spoken usages (e.g. in television news, in speeches and religious sermons, or in the language in which teachers speak to students, etc.), but the general division of functions is clear.

Arabic was one of the four exemplary cases of diglossia discussed in Ferguson's foundational article and it has remained one of the cardinal exemplars of this

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countries with generally low literacy rates but the gap being narrowed or even eliminated in countries with higher literacy rates—for example, for the four Arab countries with a literacy rate of at least 90 %, the average male–female difference is only 2 %.

phenomenon. In popular Arabic usage (which I will follow in the present paper), the H language is referred to as *fusħa* while the various dialects of L (which differ from each other enough so as to be in many cases mutually unintelligible) are referred to as *ʕa:mmiyya*. Fusħa and the various *ʕa:mmiyya*s differ significantly in a number of linguistic features, including phonological inventory of both consonants and vowels, phonotactics, agreement patterns, grammatical case, vocabulary, basic word order, etc.

Given the diglossic situation described above, Arabic-speaking children who are learning to read in primary school are thus confronted with a task which is quite different from the one encountered by their peers who speak and learn to read, for example, Hebrew or English. We will see that facts related to literacy in languages around the world give considerable reason to believe that such a radical difference between the child's spoken language and the language s/he learns to read and write in primary school results **in every other case** in serious problems in acquiring literacy, and so it stands to reason that this is true for Arabic as well (this does not mean, however, that the diglossic situation is the **only** source of the literacy problems being experienced in Arabic-speaking countries).

It should be made clear that this study is based upon **basic** literacy rates, associated with people 'who can with understanding both read and write a short simple statement on his everyday life', rather than **functional** literacy rates, associated with someone 'who can engage in all those activities in which literacy is required for effective functioning of his group and community and also for enabling him to continue to use reading, writing, and calculation for his own and the community's development' (from UNESCO's *Revised Recommendation concerning the International Standardization of Educational Statistics*; see e.g. Gray 1956; Levine 1994; Verhoeven 1994, 1997). Basic literacy rates are measured somewhat differently in different countries, so that simple comparison can in certain cases be misleading. My general approach to dealing with this limitation has been to simply gather and report data from as many countries as possible and to focus upon conclusions which are supported by a huge amount of clear data from a relatively large number of languages. For example, the conclusion that there is a serious problem with literacy in Arabic-speaking countries is based upon data from 16 different countries in **all** of which the literacy rates are lower than expected and in **most** of which they are **much** lower than expected. Most of my discussion here will be based upon data of this type (although there will be a few cases in which I will make speculations based upon less extensive data, and this will be made clear to the reader).

The 'basic literacy' which is measured by basic literacy tests is very basic indeed—just the ability to understand a 'short simple statement'. What is really more important to a person's ability to contribute productively to society is **functional** literacy, and it would of course be preferable to compare data from different countries on functional literacy rather than basic literacy, but unfortunately such data do not exist, and furthermore the criteria for calculating functional literacy differ even more radically from one country to another than do the criteria for calculating basic literacy, so that in doing a broad comparative study there is no choice but to use basic literacy data. It can be assumed that under normal circumstances the number of functionally illiterate people in a given country will be far greater than the number of people who cannot pass a basic literacy test. For example, Doets (1994) estimates that even though the basic literacy rate in Holland is 99+%, functional illiteracy among native speakers may be as high as 18%, depending upon how this is measured. Given that the overall basic literacy rate in Arab countries is only 70.5%, this means that functional literacy is really a very serious problem in Arabic countries in terms of the implications it might have on the employability and productivity of the population.[5]

Section 9.1 of this paper will present evidence suggesting that education in the mother tongue—at least in the first few years of schooling—is the most effective way to teach literacy. In Sect. 9.1.2, we will see that a certain type of diglossic situation, of which Arabic is one example, in which the H language is based on usage from hundreds of years ago and not remotely corresponding to anyone's everyday spoken language today, is particularly problematic in terms of literacy. This gives evidence that at least part of the literacy deficit in Arab countries may be due to this type of diglossia, which is supported by data from studies such as Eviatar and Ibrahim (in this volume, see also references therein), which have shown that from a cognitive perspective *Fusħa* is effectively a non-native language for Arabic speakers today, even though it is popularly considered to be 'the same language' as *ʕa:mmiyya*. Section 9.1.3 then discusses how literacy problems in Arabic-speaking countries resulting from this situation might productively be addressed.

### *9.1.1 The Importance of Education in the Mother Tongue*

One of the most important issues affecting language policy is the connection between the acquisition of literacy and the relationship between the spoken language of the child and the written language which s/he is learning. It has been recognized for some time that it is problematic for a child to begin to learn to read and write using a written form which is understood to be a different language from the language which s/he has grown up speaking (see Saiegh-Haddad and Spolsky, in this collection). Thus already in the 1950s UNESCO observed that:

[5] Available comparative literacy data refer specifically to the **attainment** of literacy by **adults**, which is not the same thing as the **acquisition** of literacy by **children**. It would obviously be preferable for the purposes of the present study to rely upon the latter type of data, but unfortunately, comparable data of this type from a wide variety of languages do not exist. In such a situation the best that can be done is to assume that the correlations which are found between language policy and adult literacy data reflect the effect which these policies have upon the acquisition of literacy by children, particularly if a plausible account can be given to explain these correlations. The distinction between data on adults' attainment and data on children's acquisition is particularly problematic in countries in which there are a significant number of immigrants who are not native speakers of the national language. In practice, however, this phenomenon is almost entirely restricted to Western European and Anglophone states in which the basic literacy rate is in any case assumed to be at least 99%.

> On educational grounds, we recommend that the use of the mother tongue be extended to as late a stage in education as possible. In particular, pupils should begin their schooling through the medium of the mother tongue because they understand it best and because to begin their school life in the mother tongue will make the break between the home and the school as small as possible. (UNESCO 1953, pp. 47–48)

This position has been supported by numerous empirical studies (see e.g. Gudschinsky 1977; Okedara and Okedara 1992; Dutcher and Tucker 1997; Mehrotra 1998, etc.).

I will add to these studies further evidence taken from the language policies of the countries which were colonized by Great Britain and France and then became independent after the Second World War (see discussion of language policies in these countries, both before and after colonization, in e.g. Calvet 1974; Bokamba 1984; Phillipson 1992; Dumont and Maurer 1995; Alidou 1996; Fishman et al. 1996; Bokamba and Tlou 1997; Gill 1999; Powell 2002; and Salhi 2002). We can divide these countries into three groups: (1) those which no longer use the colonial language but have rather developed an indigenous language as their official language, (2) those which use both the colonial language and one or more indigenous languages as official, and (3) those which only use colonial languages as official. It turns out there is a very strong pattern of literacy rates being highest in ex-colonies which have entirely rejected the colonial language as official, while literacy rates are lowest in those ex-colonies which continue to use only the ex-colonial language as official while not giving this status to indigenous languages. This is shown in Tables 9.5, 9.6, and 9.7 on the following pages.[6]

When indigenous languages have official status, they will naturally be used in schooling from the earliest age, and this will mean that children will generally be educated in, and be taught how to read from the beginning in, their native language (although this will not invariably be the case, as in some cases they may be speakers of a non-official indigenous language which is not used in education), and this is presumably why the literacy rates are highest in countries which have rejected the colonial language. On the other hand, when only foreign ex-colonial languages are official, children will generally not be educated in their mother tongue (although there may be cases in which non-official languages are used for some limited educational purposes). We see in Tables 9.5, 9.6, and 9.7 that there is an extremely strong tendency for ex-colonial countries which use an indigenous language as their official language to have much higher literacy rates than ex-colonial countries which use English and/or French as their official language.

Furthermore, a number of the exceptions to this general pattern have obvious explanations. For example, in Bangladesh, where the literacy rate is only 53.5 % even though the only official language, Bengali, is indigenous, written Bengali is nevertheless radically different from spoken Bengali, a diglossic situation parallel to that of Arabic, which means that the language which young children learn to read and write is still very different from the language they have already learned how

[6] I have excluded from Tables 9.5, 9.6 and 9.7 countries in which the majority of people speak English, French, and Arabic and/or which use Arabic as their official language.

**Table 9.5** Literacy rates in ex-colonies of Great Britain and France which only have indigenous languages as official

| Country | Literacy rate (%) |
|---|---|
| Cyprus | 97.7 |
| Israel | 97.1 |
| Maldives | 97.0 |
| Brunei | 94.9 |
| Myanmar | 91.9 |
| Sri Lanka | 90.8 |
| Vietnam | 90.3 |
| Cambodia | 76.3 |
| Laos | 68.7 |
| Nepal | 56.5 |
| Bangladesh | 53.5 |
| *Average* | *83.2* |

**Table 9.6** Literacy rates in ex-colonies of Great Britain and France which have English and/or French but also indigenous languages as official

| Country | Literacy rate (%) |
|---|---|
| Singapore (E) | 94.4 |
| Fiji (E) | 94.4 |
| Malta (E) | 92.4 |
| South Africa (E) | 88.0 |
| Botswana (E) | 82.9 |
| Lesotho (E) | 82.2 |
| Swaziland (E) | 79.6 |
| Vanuatu (EF) | 78.1 |
| Comoros (F) | 75.1 |
| Uganda (E) | 73.6 |
| Kenya (E) | 73.6 |
| Tanzania (E) | 72.3 |
| Malawi (E) | 71.8 |
| Madagascar (F) | 70.7 |
| India (E) | 66.0 |
| Papua NG (E) | 57.8 |
| Pakistan (E) | 54.2 |
| CAR (F) | 48.6 |
| *Average* | *75.4* |

to speak, so that the same explanation for low literacy rates which we will see in Arabic-speaking countries also accounts for the low literacy rate of Bangladesh. A similar account may be given for the low literacy rate in Pakistan: the indigenous language used in education, Urdu, is only spoken natively by 8 % of the population of the country, so that for the overwhelming majority of Pakistanis, primary education requires children trying to become literate in a foreign language, a task which barely half of them succeed in accomplishing.

A radically different colonial language policy was practiced by the leaders of the Soviet Union who inherited the territories which the Russian Empire had accumulated in the preceding centuries. These territories were occupied by speakers of a great variety of languages, the overwhelming majority of which had never or almost

**Table 9.7** Literacy rates in ex-colonies of Great Britain and France which only have English and/or French as official

| Country | Literacy rate (%) |
|---|---|
| Zimbabwe (E) | 91.2 |
| Gabon (F) | 86.2 |
| Rep. Congo (F) | 81.1 |
| Solomon Isl. (E) | 76.6 |
| Belize (E) | 75.1 |
| Nigeria (E) | 72.0 |
| Zambia (E) | 70.6 |
| Cameroon (EF) | 67.9 |
| Ghana (E) | 65.0 |
| Togo (F) | 53.2 |
| Ivory Coast (F) | 48.7 |
| Gambia (E) | 42.5 |
| Senegal (F) | 41.9 |
| Benin (F) | 40.4 |
| Sierra Leone (E) | 38.1 |
| Guinea (F) | 29.5 |
| Burkina Faso (F) | 28.7 |
| Niger (F) | 28.7 |
| Mali (F) | 26.2 |
| *Average* | *56.0* |

never been written before. Bolshevik language policy was focused upon making everyone in the country literate as quickly and efficiently as possible, because of both general egalitarian ideals and a specific desire to have everyone read ideological writings. The leaders recognized that the most effective way to do this was by teaching everyone to read and write a written version of the language or dialect which they already spoke—even though in almost all cases this meant sending linguists into the field to develop new writing systems for languages which had more or less never been written before (Ornstein 1968; Lewis 1972; Pool 1978; Azrael 1978; Simon 1991).

In cases in which there were two or more related but distinct dialects, different writing systems were developed for each dialect, thereby turning them into separate languages and minimizing the difference between the spoken and written language in every case. Thus, the Turkic languages Kazakh, Kyrgyz, Uzbek, Turkmen, and Azeri were distinguished from each other, as were the Slavic languages Russian, Ukrainian, and Belarusian and the Baltic languages Lithuanian and Latvian. This is the reverse of the situation of Arabic, where a single written language is used to represent a huge variety of very distinct spoken dialects, in many cases mutually unintelligible. Soviet language policy also called for written languages based upon local dialects to be used in cases in which there was a related but distinct language with an already-established writing system in use outside of the Soviet Union. Thus written Moldovan was used instead of the related Romanian, written Tajik was used instead of the related Persian, written Estonian was used instead of the related Finnish, and the written Turkic languages mentioned above were used instead of the related Turkish.

**Table 9.8** Literacy and GDP per capita for ex-Soviet Republics (out of 180 countries for literacy and 182 countries for GDP per capita)

| Country | Literacy rate (%) | Literacy rank | GDP/capita | GDP/capita rank | GDP-lit |
|---|---|---|---|---|---|
| Tajikistan | 99.6 | 10 | $ 667 | 153 | 143 |
| Kyrgyzstan | 99.3 | 17 | $ 851 | 147 | 130 |
| Georgia | 100.0 | 1 | $ 2,450 | 117 | 116 |
| Moldova | 99.2 | 19 | $ 1,514 | 127 | 108 |
| Armenia | 99.7 | 7 | $ 2,615 | 113 | 106 |
| Ukraine | 99.7 | 7 | $ 2,569 | 114 | 107 |
| Turkmenistan | 99.5 | 13 | $ 3,451 | 101 | 88 |
| Belarus | 99.7 | 7 | $ 5,166 | 80 | 73 |
| Azerbaijan | 99.5 | 13 | $ 4,798 | 83 | 70 |
| Uzbekistan | 96.9 | 63 | $ 1,176 | 133 | 70 |
| Kazakhstan | 99.6 | 10 | $ 6,930 | 67 | 57 |
| Russia | 99.5 | 13 | $ 8,681 | 59 | 46 |
| Latvia | 99.8 | 3 | $ 11,466 | 47 | 44 |
| Lithuania | 99.7 | 7 | $ 11,115 | 50 | 43 |
| Estonia | 99.8 | 3 | $ 14,402 | 43 | 40 |
| *Average* | | *13* | | *96* | *83* |

At least for the 15 Union Republics, the language of the republic continued to be the language of primary education and also usually secondary education throughout the Soviet period. When the republics became independent in 1991, these languages became their respective languages of education. The results of this policy are shown Table 9.8, which gives data for the ex-Soviet Republics in 2007:[7]

As can be seen, the policy of educating people in written languages based directly upon their spoken usage has been astonishingly successful, producing basically universal literacy, even in countries which have very little money to spend on education, with literacy rankings which are on the average 83 points higher than what would be expected considering their GDPs per capita (and as we will see later in this paper, the only ex-Soviet state with a literacy rate lower than 99.5 %,

[7] It should be noted that in the overwhelming majority of cases, the numbers in Table 9.8 indicate literacy in the language of the state rather than in Russian. There is no reason to suspect that Russians are any more literate than are non-Russians in ex-Soviet states; indeed, the three republics with the highest proportion of ethnic Russians—Kazakhstan, Latvia, and Estonia—all have **higher** literacy rates than does Russia itself. It is possible that the government of the Soviet Union invested a relatively high proportion of their resources in basic education and that this would result in a relatively high rate of literacy compared to GDP per capita. While this hypothesis is certainly worth investigating, it should be pointed out that the data in Table 9.8 are from 2007, 16 years after the dissolution of the communist government of the Soviet Union, that I do not know of evidence that the Soviet Union spent a high proportion of its resources on education, and that in fact at present the countries listed in Table 9.8 are if anything spending a disproportionately **low** percentage of their GDP per capita on education (see http://www.nationmaster.com/graph/edu_edu_spe-education-spending-of-gdp, which has data for all of these countries other than Uzbekistan and Turkmenistan), averaging only 4.2 % and a ranking of 76 out of 132 countries, making their high literacy rates even more impressive.

**Table 9.9** Literacy percentages for Soviet republics whose languages had no previous literary tradition

| Country | 1897 | 1926 | 1939 | 1959 |
|---|---|---|---|---|
| Azerbaijan S.S.R. | 9.2% | 28.2% | 82.8% | 97.3% |
| Kazakh S.S.R. | 8.1% | 25.2% | 83.6% | 96.9% |
| Kyrgyz S.S.R. | 3.1% | 16.5% | 79.8% | 98.0% |
| Moldavan S.S.R. | 22.2% | (n.d.) | 45.9% | 97.8% |
| Tajik S.S.R. | 2.3% | 3.8% | 82.8% | 96.2% |
| Uzbek S.S.R. | 3.6% | 11.6% | 78.7% | 98.1% |
| Turkmen S.S.R. | 7.8% | 14.0% | 77.7% | 95.4% |

Uzbekistan, is also the only one which did not really follow standard Soviet procedure in terms of defining a nationality and establishing a standard language). These patterns are not the result of these countries focusing whatsoever limited financial resources they have on education—on the contrary, as we have seen in Table 9.4, Central Asia, where most of the countries with the highest GDP-literacy ranking are located, has the lowest rate of per capita spending on primary education of any region in the world.

Additionally, many of these cases involved developing literacy from scratch in the last century, using written languages which were invented by linguists sent by the Soviet government to create them on the basis of local usage. Table 9.9 shows the remarkable success of Soviet language policy in increasing literacy in republics whose languages had no previous literary tradition:[8]

As can be seen, literacy rates had only increased moderately by 1926, as the policy emphasizing mother-tongue literacy had only begun to be implemented and had not yet substantially affected the older adult population (based on whom literacy rates are calculated) who had grown up before the Revolution, but already by 1939 dramatic increases had taken place and this trend was even stronger in 1959 (progress in Moldova was slower because it did not become a Union Republic until after the Second World War). It is quite striking to compare the great success of these literacy programs with the catastrophic failure of language policies in ex-British/French colonies demonstrated in Tables 9.6 and 9.7, which rely upon English and French.

There is strong evidence, then, that primary education in a native language is much more efficient in terms of literacy than is education in a non-native language. But what about diglossic situations, in which education is in a written language which is not socially or politically foreign but which is nevertheless quite different from the spoken language? In the following section, we will consider a wide variety of cases of this type from around the world.

[8] The data in Table 9.12 are from Lewis (1972, p. 175). Data from 1897 are from the areas of the republics, which did not yet exist as political entities, and they are for languages other than those of the present-day republics, which had not yet been written.

### *9.1.2 Diglossia and Literacy*

In the sense in which it was originally used in Ferguson (1959), the term *diglossia* refers specifically to the case in which H and L are understood to be forms of the same language which differ significantly one from the other and are used for complementary sets of social functions. Given this very general understanding, it is not clear **how** different the forms should be in order for the situation to be considered diglossia—presumably it would be reasonable to characterize different situations according to **degrees** of diglossia so that some are more diglossic while others are less diglossic, according to the magnitude of the difference between the H and the L.

Setting aside the question of degree of diglossia linguistic distance, there is reason to believe that there is a marked difference in the effects upon literacy rates of different **types** of diglossia, which I will enumerate in this section.

For one type of diglossia, the H language is the spoken language of people in a **different** country. Literacy data for this type of diglossia are given in Table 9.10.

The first six of these countries are in a very similar sociolinguistic situation: they are islands in the Caribbean where the people speak an English creole as their native language but the language of literacy is the same standard English which is used in schools in other countries (the United States or Great Britain), which is based on the native dialect of high-status people in these countries; I will refer to this type of diglossia as *external* diglossia.[9] The creoles are quite different from the standard language, which is essentially not spoken by anyone in these countries as a first language, so that these represent cases of diglossia in the sense that Ferguson originally used the term, but this in itself does not seem to be a great barrier to literacy—for the six countries, the average literacy rank is 57 while the average GDP per capita rank is 61. The situation in Switzerland is of the same general type—the languages of literacy (standard German, French, and Italian) are all based upon dialects spoken in other countries (Upper Saxon in Germany, Parisian in France, and Tuscan in Italian), and at least in the cases of German (constituting 75 % of the population of Switzerland) and Italian (constituting another 5 %), these are very different from the local versions. Switzerland is therefore also generally characterized by external diglossia—in fact, Swiss German was one of Ferguson's initial exemplary cases of diglossia—and Switzerland's GDP-lit of −30 might appear to suggest some negative effect of diglossia on literacy, but this is misleading: in fact, basic literacy in Switzerland is essentially universal, the rate of 99.0 % being conventionally assigned to Western countries with more or less universal literacy—given this convention, Switzerland's literacy ranking is in fact as high as it could be, even though this is not as high as its GDP per capita ranking. The cases listed in Table 9.10 suggest, then, that external diglossia is not in itself a great obstacle to literacy.

[9] The sociolinguistic situation on these islands is parallel to that of Haiti at the time of Ferguson's original article, when he used Haiti as one of his four exemplary cases of diglossia. Haiti differs in that the creole is French-based and the H was French. I have not included Haiti in Table 9.10 because the creole there has recently begun to be used as a language of education, so the situation is no longer diglossic in this sense.

**Table 9.10** Literacy rates of countries in which the H language is based upon the everyday usage of spoken by people living in **another** country

| Country | Literacy rate (%) | Literacy rank | GDP/capita | GDP/ capita rank | GDP-lit |
|---|---|---|---|---|---|
| Antigua | 99.0 | 33 | $ 13,150 | 45 | +12 |
| Barbados | 99.7 | 6 | $ 14,105 | 44 | +38 |
| Grenada | 96.0 | 67 | $ 5,969 | 73 | −6 |
| Jamaica | 86.0 | 115 | $ 4,684 | 84 | −31 |
| Saint Lucia | 94.8 | 73 | $ 5,671 | 76 | +3 |
| Trinidad | 98.7 | 49 | $ 15,000 | 41 | −8 |
| Switzerland | 99.0 | 33 | $ 63,536 | 3 | −30 |

But there is a different type of diglossia, in which the H is not at present spoken as an everyday colloquial language by **anyone anywhere** but is rather based upon texts written in the fairly distant past which are understood to represent the 'correct' version of the language, on the basis of which present-day linguists have devised a standard language. We can call this *frozen* diglossia, in the sense that the written standard presumably represents a preserved version of the language as it was spoken long ago (the written language does continue to evolve, although in a manner more or less independent of the spoken language, and so I will use the term 'frozen' in scare quotes to emphasize that this is a technical usage). Arabic is one such language of this type, and we have already seen that literacy rates in Arab states are very low, particularly considering the relative wealth of these states. Table 9.11 on the following page gives literacy rates from a number of other cases of this type.

As can be seen in Table 9.11, the literacy rates for these cases of 'frozen' diglossia are generally quite low. Furthermore, they are even lower than would be expected given the relative wealth of these states. For instance, Iran is ranked 87th in the world in terms of GDP per capita but only 121st in terms of literacy rate, Bangladesh is 158th in terms of GDP per capita but only 164th in terms of literacy rate, and within India, Tamil Nadu, Andhra Pradesh, West Bengal, and Karnataka rank 8th, 11th, 10th, and 9th, respectively, in terms of GDP but only 11th, 13th, 16th, and 18th in terms of literacy rate.[10, 11] Thus, in almost every case of the 'frozen' type

[10] Per capita income data from Indian states are taken from http://en.wikipedia.org/wiki/List_of_Indian_states_by_GDP.

[11] Astonishingly, Wagner, Spratt, and Ezzaki come to a completely different conclusion, that "the findings support the proposition that children in certain social and linguistic contexts need not be taught in their mother tongue in order to achieve literacy norms of the majority language group" (p. 31)—that is, that children can be taught literacy just as efficiently in a second language as in their mother tongue. The authors seem to be under the impression that it would be satisfactory for Berber-speaking Moroccans 'to achieve literacy norms of the majority language group', that is, Arabic-speaking Moroccans, apparently having neglected to check what these norms actually are. In fact, the results of Morocco's literacy program for **Arabic** speakers are not merely unsatisfactory but catastrophic: the literacy rate in Morocco is only 55.6 %, **32.4 %** lower than what would be expected give the GDP per capita in the country—this is the third worst differential in the world, being exceeded only by Chad (64.6 % − 31.8 % = 32.8 %) and Mali (59.3 % − 26.2 % = 33.1 %), two countries which have only foreign languages as official—and it was undoubtedly even lower in 1989 when the article was written. This is presumably not due to the fact that 45 % of the

**Table 9.11** Literacy rates for countries/states with 'frozen' diglossia

| Country | Literacy rate (%) |
|---|---|
| Sri Lanka (Sinhala) | 90.7 |
| Iran (Persian) | 82.3 |
| Tamil Nadu (Tamil) | 74.2 |
| Andhra Pradesh (Telugu) | 72.5 |
| West Bengal (Bengali) | 71.6 |
| Karnataka (Kannada) | 69.3 |
| Bangladesh (Bengali) | 53.5 |

The languages are given in parentheses; Tamil Nadu, Andhra Pradesh, West Bengal, and Karnataka are states in India. (Literacy data from Indian states are from http://en.wikipedia.org/wiki/Indian_states_ranking_by_literacy_rate)

of diglossia which Arabic also represents, the literacy rate is lower than would be expected considering the relative wealth of the state, although the differences in the cases listed in Table 9.11 are not nearly as great as in the Arab states. The one exception to this pattern is Sri Lanka, which ranks 121st in the world in per capita income but 94th in the world in literacy rate. This pattern is exactly the reverse of the pattern observed in all of the other states with 'frozen' diglossia. I will return to this one exceptional case later in this paper.

Further data in support of the conclusion that 'frozen' diglossia is a serious obstacle to literacy come from comparing Persian and Tajik, which are fairly closely related languages, belonging to the same branch of the Indo-Iranian family. Until the Soviet period, Tajik was understood to be a dialect of Persian and, to the extent that speakers of what is known today as Tajik were literate at all, they used Persian as their literary language. As we have seen, the Soviet government developed Tajik as a distinctive written language, based upon the spoken language of Tajikistan. Comparative literacy and GDP data are given for Tajikistan and Iran in Table 9.12:

As can be seen, Tajikistan's literacy rate is more than 17 % higher than that of Iran, even though the GDP per capita of Tajikistan is less than 1/6 that of Iran. Literacy in Tajikistan has obviously benefited enormously from developing and using a standard written language based directly on the local spoken language rather than the 'frozen' Persian standard.

Greek provides further evidence supporting the same conclusion. Until 1976, Greek was a case of 'frozen' diglossia, but since then the H language, Katharevousa, which was based upon the Byzantine language rather than on any group's contemporary spoken usage, has been replaced as the standard language by a written language based upon the spoken language, which is called Demotiki (meaning 'the

population of Morocco are native speakers of Berber rather than Arabic, because Wagner, Spratt, and Ezzaki report that there is no difference in reading ability between Berber speakers and Arabic speakers. The real situation is therefore not that Berber speakers do as **well** as Arabic speakers but rather that Arabic speakers do as **badly** as Berber speakers—being a native speaker of Arabic is not an advantage in learning to read Arabic. But this is only the situation because the traditional written language in Arabic is completely different from the spoken dialects.

**Table 9.12** Literacy rates and GDP per capita in Tajikistan and Iran

| Country | Literacy rate (%) | Literacy rank | GDP/capita | GDP/capita rank |
|---|---|---|---|---|
| Tajikistan | 99.6 | 10 | $ 667 | 153 |
| Iran | 82.3 | 121 | $ 4,399 | 87 |

**Table 9.13** Literacy rates in Greece with and without ‘frozen’ diglossia

| Year | Literacy rate (%) |
|---|---|
| 1971 (with ‘frozen’ diglossia) | 86.0 |
| 2007 (without diglossia) | 97.1 |

language of the people’; see Browning 1982; Frangoudaki 1992). After this was done, literacy rates increased drastically, as is shown in Table 9.13:

The pattern, then, is quite clear: ‘frozen’ diglossia appears to be associated with very adverse consequences for literacy, not just for Arabic but in general. However, this does not appear to be necessarily true of **external** diglossia, as we have seen in Table 9.10. Why is there this difference? There are a number of possible explanations. It may be the case that the difference between the everyday spoken language and the standard language is simply much greater in the cases of ‘frozen’ diglossia than in the cases of external diglossia (although it is not clear how this would be tested, as there are no established criteria for measuring linguistic distance) . Or it may be that when H is spoken in other countries as is the case in external diglossia, speakers of L can at least hear it used naturally in everyday speech when they interact with or overhear native speakers of H when one or the other is traveling, or on television or radio, so that their acquisition of H is facilitated by naturalistic exposure, whereas when H is never spoken as in ‘frozen’ diglossia this does not happen. Or it may be that ‘frozen’ diglossia Hs are characterized by many artificial grammatical rules which prescriptive linguists have devised but which are not natural for average people to learn or use, whereas the grammatical rules of the spoken languages in external diglossia Hs are for the most part based upon naturalistic everyday usage, albeit of people living in a different country, and this makes these languages easier to learn. Or it may be a combination of these factors.

To sum up, the comparative evidence clearly suggests that Arabic diglossia, as an instance of ‘frozen’ diglossia, poses a significant obstacle to literacy. This has in fact been suggested on the basis of language-internal evidence by studies by Abu-Rabia (2000), Maamouri (1998), and Saiegh-Haddad (2003, 2004, 2005, 2007, 2011). In fact, psycholinguistic research has demonstrated that from a cognitive perspective (though not a social or political one), Fusħa is a non-native language for native speakers of colloquial Arabic (see Eviatar and Ibrahim in this volume and the extensive research referred to there), so that in this sense the situation in Arabic-speaking countries is parallel to that of ex-colonial countries which use English or French as their only official language—it is then to be expected that the literacy situation in Arab countries would be more or less equally dismal. Haeri (2009, p. 420) states in her summary article on literacy in the Arab world that:

My central argument in this chapter is that the main reason for exceedingly low literacy in most of the Arab world is that the language of education in the public educational systems is Classical Arabic and modernized versions of it.

### *9.1.3 What is to be Done?*

What then can be done about this situation, to improve the extremely low literacy rates of Arabic speakers? One possibility is to replace the current H language, based upon the spoken languages of pre-Islamic tribes as well as the Koran and the old Arabic literature, with a new H language based upon one of the spoken dialects. Presumably Egyptian Arabic would be the most reasonable choice, given the fact that (1) it is by far the most widely known of the present-day spoken dialects, particularly because of the popularity of Egyptian movies, and (2) it is relatively 'central' as a dialect, not having as many distinctive characteristics as dialects spoken farther to the west or farther to the east (other than the pronunciation of jeem as [g]). This approach might replace the present H of 'frozen' diglossia with an H that is spoken in Egypt and might turn the situation into external diglossia elsewhere. This might have a positive effect on literacy rates, as we have seen external Hs are much easier to learn than 'frozen' Hs.

There are, however, a number of problems with this approach. First, it would be very difficult to eliminate the currently-existing H, because of its enormous cultural and religious value. Second, it would in a significant sense privilege Egypt over other Arab states, which would run counter to the general egalitarian spirit of Arab nationalism. And third, although such an approach might result in a significantly higher literacy rate among Arabic speakers than the present situation, it would still be less than ideal in the sense that the great majority of Arabic speakers would still be educated in a standard form which is quite different from their own spoken dialect, and there is reason to believe that this would produce less than optimal results regarding literacy.

Why is this? There is evidence suggesting that basic literacy is most effectively learned not only in the children's native language but specifically in a written language which is as close as possible to the child's native **dialect**, and that it is more efficient in terms of literacy to divide up neighboring dialects into different languages and to devise different written languages for each one. Consider for example data from the Slavic languages. The Slavic-speaking peoples are divided up into 11 different language-based nationalities with each nationality living in an area within which a fairly narrow range of dialects are spoken. This means that written languages can be used which are very close to the spoken daily language of essentially the entire population. Literacy and GDP per capita data for the Slavic-speaking countries are presented in Table 9.14 on the following page.

We see here that not only for the three ex-Soviet republics but also for Slavic languages in general, literacy rates are a good deal higher than would be expected on the basis of the GDP per capita. This supports the idea that literacy is most

**Table 9.14** Literacy and GDP per capita rankings for Slavic-speaking countries

| Country | Literacy rate (%) | Literacy rank | GDP/capita | GDP/capita rank | GDP-lit |
|---|---|---|---|---|---|
| Ukraine | 99.7 | 7 | $ 2,569 | 114 | 107 |
| Belarus | 99.7 | 7 | $ 5,166 | 80 | 73 |
| Russia | 99.5 | 13 | $ 8,681 | 59 | 46 |
| Poland | 99.3 | 17 | $ 11,302 | 49 | 32 |
| Bosnia | 96.7 | 64 | $ 4,365 | 88 | 24 |
| Macedonia | 97.0 | 61 | $ 4,546 | 85 | 24 |
| Slovenia | 99.7 | 7 | $ 24,111 | 30 | 23 |
| Bulgaria | 98.3 | 51 | $ 6,623 | 72 | 21 |
| Serbia | 96.4 | 66 | $ 5,821 | 75 | 9 |
| Slovakia | 99.0 | 33 | $ 16,282 | 38 | 5 |
| Czech Republic | 99.0 | 33 | $ 18,256 | 35 | 2 |
| Croatia | 98.7 | 49 | $ 15,284 | 40 | −9 |
| *Average* | | *34* | | *64* | *30* |

efficiently taught in a written language which is as close as possible to the particular spoken dialect of the language learner.

Data on related languages from the ex-Soviet republics (see Table 9.8) support the same conclusion—literacy rates are extremely high for not only the Slavic languages Russian, Ukrainian, and Belarussian but also the Baltic languages Latvian and Lithuanian and the Turkic languages Kazakh, Kyrgyz, Turkmen, and Azeri. And, strikingly, they are significantly **lower** for Uzbek, which was the only language of a Union Republic for which the principle dividing distinct spoken forms into different languages was not followed. For various cultural and political reasons, having to do with pre-modern political borders and the idea that Uzbeks were understood to be inherently sedentary while Turkmen, Kazakhs, and Kyrgyz were understood to be inherently nomadic, the Soviet authorities drew the borders of Uzbekistan and defined the Uzbek language to include not only the highly distinctive Southeastern dialects which are completely different from Kazakh, Kyrgyz, and Turkmen, but also some Northwestern Turkic dialects which are linguistically much closer to Kazakh and Kyrgyz. This meant that Uzbek was dialectally split in a way that none of the other languages of Soviet republics were, and because Standard Uzbek is based upon the Southeastern dialect, this means that the many Uzbeks whose native dialect is Northwestern have to learn a written language in school which is very different from their own spoken language. This is presumably related to the fact that of the ex-Soviet republics only Uzbekistan has less than essentially universal literacy.

So would it then be reasonable to adopt such an approach to the Arabic dialects, developing different written languages for each? It seems that it would not, for both religious and national reasons, because it would mean both eliminating the classical language **and** linguistically dividing among people who are now considered to be speakers of different dialects of the same language and belonging to the same nationality.

**Table 9.15** Literacy rates and GDP per capita for Sri Lanka and Arabic-speaking states with comparable GDP per capita

| Country | Literacy rate (%) | Literacy ranking | GDP per capita | GDP ranking |
|---|---|---|---|---|
| Sri Lanka | 90.8 | 94 | $ 2,085 | 121 |
| Morocco | 55.6 | 162 | $ 2,882 | 108 |
| Syria | 83.1 | 119 | $ 2,615 | 112 |
| Egypt | 66.4 | 148 | $ 2,450 | 116 |
| Sudan | 60.9 | 156 | $ 1,397 | 128 |
| Yemen | 58.9 | 158 | $ 1,061 | 140 |

There is, however, a way to get around this problem. This would be to use a written version of the local dialects specifically in **primary** education, for the first three or four grades, before switching to teaching the established literary language beginning in the fourth or fifth grade. The most striking evidence supporting this approach comes from the only country with a 'frozen' diglossia and hence a non-spoken H which has a literacy rate which is **higher** than what would be expected from its GDP per capita. This country is Sri Lanka, whose national language is Sinhala. It will be remembered that in every other case of a 'frozen' diglossia H—Arabic (in every Arabic-speaking country), Persian, Bengali (in both Bangladesh and the Indian state of West Bengal), Tamil, Telugu, and Kannada—the literacy rate is lower, and often **much** lower, than would be expected from the GDP per capita. In contrast, in Sri Lanka we see exactly the reverse pattern, with a literacy ranking of 94th but a GDP per capita ranking of 121st. Consider for example the data in Table 9.15, which compares literacy rates in Sri Lanka with those of Arabic-speaking countries with a GDP close to that of Sri Lanka (within 20 places on the GDP per capita ranking).

As we see in Table 9.15, Sri Lanka's literacy rate is 25 % higher than the average of these five Arab countries (65 %). This difference becomes even more striking when it is considered that about 20 % of the population of Sri Lanka speak Tamil as their native language, and although separate literacy figures are not available for the Tamils of Sri Lanka, it would be safe to assume that the Tamil speakers pull down the overall literacy rate, because the literacy rate in Tamil Nadu in India is only 74.2 %.

Why do we find in Sri Lanka a completely different literacy situation from what we observe in any other state with 'frozen' diglossia? This is a question that requires further investigation. However, there is one obvious thing distinguishing Sri Lanka from the other cases considered here and this is that **reading in Sinhala is taught in L for the first four years of school, with students only beginning to learn to read in H in the fifth grade**. This is not the case for **any** of the other languages with 'frozen' diglossia Hs, either the Arabic-speaking countries or any of the states listed in Table 9.11.

Striking as this finding may seem, it is exactly what would be expected if we assume both that basic literacy is best taught through the mother tongue—as is the assumption of UNESCO—and that the Hs in 'frozen' diglossia contexts are cognitively non-native languages from the perspective of speakers of the associated Ls (see Eviatar and Ibrahim in this volume). Sinhala-speaking children acquire literacy effectively because they are initially educated in a written version of their own spoken language; thus the Sinhalese have managed to achieve relatively high literacy ranking while at the same time preserving their culturally valued ‘frozen’ H. In contrast, speakers of other languages with ‘frozen’ diglossia do not acquire literacy effectively because they are initially educated in the non-spoken ‘frozen’ H, which is cognitively a foreign language to them. The same sort of thinking lies behind teaching methodologies such as the Pitman Initial Teaching Alphabet (Downing and Latham 1967), which uses a modified version of the Latin alphabet, augmented to 43–45 letters, to write English in a (more or less) phonetically consistent way so as to make it easier for young children to learn to read and write. After initially learning to read and write using the Initial Teaching Alphabet, children then make the transition to normal English orthography.[12]

In fact, this argument may be carried a step further, because in fact literacy rates in Sri Lanka are not merely **as good as** would be expected given the country’s GDP per capita—they are **better**, 27 places better. It may be that from the point of view of literacy there is actually an unintentional side benefit to using a ‘frozen’ H, if the introduction of this H is delayed until fourth or fifth grade: it makes it psychologically easier to begin schooling with a maximally simple writing system based directly on the spoken language of the children who are learning to read. On the other hand, in languages which are clearly understood **not** to be diglossic, such as English or French, it is psychologically more difficult to divide the language in two in such a clear way: primary school children are immediately taught in essentially the same language as adults, which is not necessarily so easy for them. But in a diglossic language like Sinhala, it is relatively conceptually simple to expand the functional domain of L to include early literacy.[13]

[12] After some initial successes in the early 1960s, the Initial Teaching Alphabet was abandoned for a number of reasons. It was not sufficiently supported by either parents (who did not make the necessary effort to learn the system in order to help their children to read) or publishers (who did not publish many books using the new alphabet). The alphabet was specifically designed for children speaking Received Pronunciation, who only constitute a tiny fraction of the children in the school system, and did not take dialectal distinctions into consideration. And the transition to traditional English orthography was done much more quickly than would have been best, even in the first grade.

[13] Alexis Manaster-Ramer (personal communication) told me an interesting anecdote supporting this conclusion. Like many linguists, he had studied a number of languages from teach-yourself books and then attempted to put what he had learned into practice to talk to speakers of these languages, and also like many linguists he was frustrated to discover that speakers of e.g. French, German, etc., do not speak as the books taught—that is, the people writing the books do not feel that they should literally teach a completely colloquial version of the language. But he was quite surprised after having studied Sinhala from a book and speaking with Sinhalese that the people really did speak as the book had described—that is, the linguist writing the book really had taught the colloquial language—and it seems reasonable to attribute this to the fact that Sinhalese clearly distinguish between H and L versions of their language so that they can conceptualize actually teaching the L.

This can also be related to what seem to be remarkable data regarding literacy in ideographic languages (Chinese, Japanese, and Korean). Any adult who has studied these languages can testify that they seem to be enormously difficult to learn to read and write, because the ideographs are not obviously phonologically motivated and because so many ideographs need to be learned. Yet Japan, South Korea, and North Korea all have essentially universal literacy while the literacy rate in China (93.3 %) is **higher** than would be expected given the country's capita income (ranking 83rd in the world as opposed to a ranking of 99th in GDP per capita). How is this possible? The answer, I would argue, lies in the way that literacy is taught in these three languages, which is structured so as to make the language which primary school children learn to read first as close and as transparently related to their spoken language as possible. At the beginning of children's literacy education, all of these languages focus on consistent and simple systems of sound-based writing (the Japanese system is predominantly phonetic, the Chinese one phonemic, and the Korean one morphophonemic). Japanese uses a syllabary consisting of only 48 characters, and Korean and Chinese use basically alphabetic systems; the Korean one is purely indigenous, the only complication being that letters are organized into syllables in a conventionalized way, while the Chinese one, known as pinyin, uses a Latin alphabet designed specifically to represent Chinese sounds consistently. In all of the languages, children are introduced to ideographs gradually, as their cognitive abilities allow, and learning the ideographs is aided in the early stages by writing in small sound-based notation next to them to tell or remind the children how to pronounce them. Computers are enormously helpful in this, because even if a student only knows a particular ideograph passively, he can enter the pronunciation into the computer phonetically, and the computer will be able to turn this into the correct ideograph (the more sophisticated programs will consider the context in doing this) or at the very least give the child a few options from which to choose the correct one. This is particularly important because it is clear that children can learn to **recognize** ideographs much faster than they can learn to **write** them. Using computers in this way makes it possible for children to write everything they can say from a very early age, rather than being restricted to writing words for which they actively know the ideographs, which is very limiting and makes writing boring (Zhang and Liu n.d.).

These examples show that even in languages in which the established standard language is in one way or another not a consistent phonological representation of people's spoken language, **it is possible to get impressive literacy results from the creative use of phonologically consistent writing systems to teach basic literacy to children for the first few years of primary school**. In the case of Arabic, this would necessarily entail using different writing systems in different areas for the first few years of primary school, because of the differences between the different spoken dialects, but after a few years they could all be taught the same standard language.

In fact, as it happens, young Arabic speakers have in the last 10–15 years begun to develop writing systems of this type, with the advent of electronic writing in media such as SMS and email messages, Messenger, forums, and Facebook (see e.g. Warschauer et al. 2002; Wheeler 2003; Palfreyman and al-Khalil 2003; Garra 2007). A typical example of this type of writing—in this case by an Arabic-speaking citizen of Israel writing in Latin letters—is given in (1) (Garra 2007, p. 89, 90):[14]

> (1) Kolhen be2refo, bs Haifa elle 3anjad btestahal la2ano btjanen ow jamalha tabe3e.. ama elba2aya kolhen 3amaleyat tajmeel.. matalan dina hayek ma heye bte2ref shu 7elo feha ya3ne?? wala elissa mahe tomha a3waj ow mesh 7elwe shelleama zoo2 3aleko ya nas..lesh najwa karam 7elwe?? araaaaaaaaf!! wala amal 7ejazy mhye zai el amwat manzarha belzat bel look eljded!!! welko ya nas shu sayebko?? hadol!! 7elwat???? shelle la2
> They [celebrities who participated in a beauty contest]'re disgusting, Haifa [a famous Arab singer] deserves [to win the beauty contest] because she's gorgeous and her beauty is natural. But all the others [singers] have had cosmetic surgery. Like Dina Hayek, what's beautiful about her? She's ugly! And Elissa, her mouth is twisted! She isn't beautiful at all! What kind of taste have you people got? And Najwa Karam is beautiful? Get real! Ugh! And Amal Hijazi!! She looks like a corpse, especially her new look. What's wrong with you people? These women are beautiful? Absolutely not!

Young Arabic speakers all around the Arab world are writing like this in improvised writing systems, based upon their spoken dialects, using the Arabic, Latin, or even (among Israeli Arabs) Hebrew alphabets. This is part of a general worldwide development—young people naturally write in such contexts in their colloquial language, and when their colloquial language happens to be radically different from the established written language, they write it in an improvised orthography. I first became aware of this phenomenon in the late 1990s when a 40-year-old Swiss woman taking one of my classes in Israel reported to me that her son back in Switzerland wrote email messages to her in Swiss German dialect, which the mother of course also spoke but which is radically different from the standard German which has been traditionally written. I have since found that the same sort of thing is happening in diglossic languages like Persian, Bengali, and Sinhala, as well as local dialects which differ radically from the national standard, like Sicilian in Italy and Galician in Spain (Myhill 2009).

Although this new electronic writing was first used in a purely improvised way, we are seeing, in the case of Arabic, the gradual development of regional norms of writing it, based upon a combination of the local Arabic dialect and writing conventions which users are agreeing upon (without, at this stage, any conscious planning). I will give here a few examples of this. For Israeli Arabs, although different speakers can pronounce the uvular stop/q/ which the Arabic letter qaaf ق represents as either [ʔ], [q], [k], or [g] in more personal communications they can write this phoneme, for which no obvious Latin letter exists, as <2>, <q>, <k>, or <g>. It has become understood in Israel in recent years that the normal 'public' written form is <2>—but in North Africa, where the glottal stop is not used, the normal written form for quaff is <9>, while in the Gulf area, where the normal pronunciation of qa:f

[14] This example was taken from the Panet forum.

is [g], this is written as <g> or <8>. On the other hand, in the Gulf area <9> is normally used to write ṣa:d ص, the emphatic voiceless alveolar fricative, while in the Levant and North Africa this phoneme is normally written as <s>, like the parallel non-emphatic. The post-alveolar voiceless fricative[*š*] is written <sh> by Israeli Arabs, based upon the English spelling, while Lebanese, Algerians, and Moroccans write it with <ch>, based upon French, but recently, Jordanians have found a third and monographic way to write this sound, as <$>. Similar variations are appearing in writing using the Arabic script. For example, in the Gulf, where the voiced alveo-palatal fricative/affricate *ji:m* is pronounced as [*j*], this is written with the letter *ya:ʔ* ي instead of *ji:m* ج (see discussion in Garra 2007).

These local ways of writing have not yet become fixed, but there is an unmistakable trend in this direction, particularly among users below the age of 23–24 (as I write this in 2011). Further, these conventions are almost universally known among young people who are affluent enough to have a cellular phone. Assuming that linguists in each area developed a conventionalized way to write these *ʕa:mmiyya*s which could be used in school, which would entail a minimal amount of work, they would be ideal as the basis for teaching early literacy to primary school children, because they are entirely phonetic and very easy to learn to read and write. In fact, this is exactly why young people have independently invented and begun to use them recently.

The next generation of Arabic teachers will come to their job already having informally learned how to write this way and will be completely used to it. Such systems for writing *ʕa:mmiyya* could be tailored to suit various needs. For example, in cases in which students have access to computers, computer programs could be designed which would enable the students to enter what they want to write in *ʕa:mmiyya* and then the computer would translate it into Fusħa. This would make it possible for beginning students to focus on learning to **read** Fusħa rather than learning to **write** it, which is much more difficult and frustrating (this is parallel to the way in which Chinese education policy makes use of Latin letters in teaching literacy in Chinese). In cases in which there is emphasis on learning English or French in early grades, a Latin writing system could be used which would introduce students to the Latin letters from an early age. Such steps would constitute a creative and productive approach to the serious literacy problems which are universal today in Arabic-speaking countries.

## 9.2 Conclusion

There is clearly an enormous literacy problem in Arabic-speaking countries. Some part of it is likely to be to due to specific features of the Arabic script (see e.g. Azzam 1984; Bentin and Ibrahim 1996; Frost et al. 1987; Ibrahim et al. 2002, 2007; and Roman and Pavard 1987), but there is every reason to believe that a very large part is due to the radical difference between the spoken Arabic dialects and the official written language which is taught in school and used for all academic materials

(Saiegh-Haddad 2003, 2004, 2007, 2012). An enormous mass of evidence from languages around the world supports the idea that children learn to read most efficiently when the language of their primary schooling is as close as possible to their native dialect—whether or not they switch afterwards to being educated in another written language. It is clear that traditional written Arabic is so different from the spoken dialects that from the point of view of learning it is effectively a foreign language. This means that we would expect that programs which attempt to teach literacy in fusħa from first grade will have very poor results, and this is in fact what we find.

Arabic speakers are similar to many linguistic groups around the world in that they are confronted with the challenge of catching up with developed countries in terms of literacy rates, and they would do well to observe which tactics have been successful and which tactics have been unsuccessful for other groups facing similar situations. Among those groups which have been successful, the ex-Soviet groups and the Slavic groups devised writing systems based directly and closely on the local spoken language, in the process making up a large number of new written languages. The Chinese, Japanese, and Koreans have continued to use their traditionally ideographic writing systems but have also made extensive use of sound-based writing systems corresponding to the spoken language in primary education, and in the case of the Chinese they have even used the Latin alphabet to do this. The Sinhalese have maintained their traditional H language but have introduced a written version of their L language for the first four grades of primary school. These programs have varied in a number of regards but they have had one thing in common: they have all instituted programs in which, in the first few years of schooling, children are taught to read and write in a phonologically transparent writing system which is based directly upon the spoken language which they have already learned.

On the other hand, there are two approaches which have been extremely **un**successful in terms of promoting literacy. One is the retention of foreign ex-colonial languages, in particular English and French, as the language of education even in countries where people do not speak English or French as their native language. The second is the use of a 'frozen' H language as the language of education, as in Arabic, Persian, and a number of diglossic languages of the Indian subcontinent (but not Sinhala).

The obvious conclusion to draw from this is that Arabic speakers would be well-advised to switch from the latter type of strategy to the former. The cases of Sinhalese, Chinese, Japanese, and Korean have shown that it is possible to do this and to radically increase literacy rates while at the same time maintaining traditional and highly-valued standard written languages, if a certain amount of creative ingenuity is employed. The new writing systems which young Arabic speakers have recently been developing for use in electronic media would seem to be ideal—and their construction at the present time highly fortuitous—for this purpose, but use of these systems in primary education is only one possible way of making Arabic literacy programs more efficient. What is really important is the general principle: literacy is best taught by **beginning** with a sound-based writing system which is as close as possible to the spoken language which the child already knows

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# Chapter 10
# Acquiring Literacy in a Diglossic Context: Problems and Prospects

**Elinor Saiegh-Haddad and Bernard Spolsky**

**Abstract** Many people still believe, as once was commonly assumed, that literacy simply means knowing how to read and write a particular script. Thus, we divide people into literates and illiterates, and worry about how to teach the latter a skill that would move them into the former class. However, as a result of the work of Scribner and Cole (The psychology of literacy. Cambridge MA: Harvard University Press, 1981), we are now more inclined to talk about "literary practices", the application of reading skill "for specific purposes in specific contexts of use" (1981, p. 37). The old simple model that assumed that literacy was a result of schooling has been shown to leave out the many cases in which various groups develop literacy skills for particular purposes, and scholars nowadays are as likely to speak about literacies or multi-literacies (See Macken-Horarik and Adoniou (2008), Handbook of educational linguistics (pp. 367–382). Malden MA: Blackwell Publishing) as about being able to read and write. This complexity is important when we attempt to understand the problem of the relationship between literacy in a standard or sacred language and literacy practices in the vernacular variety. In this paper, we will discuss problematic aspects of developing literacy in a diglossic situation. We will then describe a project that attempted to address some of these difficulties in the context of diglossic Arabic.

**Keywords** Arabic · Diglossia · Education · Exposure · Literacy · Literacy practices · Standard language · Reading · Vernacular literacy

E. Saiegh-Haddad (✉) · B. Spolsky
English Linguistics and Literature Department
Bar-Ilan University, Ramat Gan, Israel
e-mail: saieghe@mail.biu.ac.il

B. Spolsky
e-mail: bspolsky@gmail.com

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## 10.1 Introduction

### *10.1.1 Some Problematic Aspects of Vernacular Literacy*

The sociolinguistic phenomenon defined originally by Ferguson (Ferguson 1959) as diglossia is complex and has far-reaching educational consequences (see Myhill, Chap. 9). Ferguson used the term to refer to a limited number of situations where two related varieties of the same language were used for distinct purposes. The languages he described were German (specifically the distinction between High German and Swiss German in Switzerland), two varieties of Greek (*demotiki* and *katharevousa)*, French and Haitian Creole in Haiti, and Classical and local varieties of Arabic. In each case, the standard or classical variety is used for a number of higher functions—public use, religious practices, formal occasions, and most literacy—while the vernacular variety is the normal spoken language of daily use and of the home. One obvious educational consequence is that children grow up speaking the vernacular and are required to develop proficiency in the standard variety as well as literacy in it when they come to school. Fishman (Fishman 1967) and others extended this definition to fit societies where the higher functions are filled by a language unrelated to the home variety: this of course applies to the millions of children who come to schools using as language of instruction a standard language different from their home variety (Walter 2008). (Hudson 2002) refers to (Fernández 1993), a bibliography of more than 3,000 items on diglossia, and adopts the original, though slightly modified definition of Ferguson while considering the others to be cases of societal bilingualism. While there is still no general consensus (e.g., Fishman 2002), most agree that the Arabic case is a typical diglossia. None the less, Ennaji (2002) describes the greater complexity in the Maghreb, where alongside diglossia (Classical versus Colloquial Arabic), there is "standard-with-dialects" (Modern Standard Arabic versus Educated Spoken Arabic) and societal bilingualism (French versus Arabic; Arabic versus Berber).

There are several ways in which these kinds of situation could have arisen. While the earliest functions of writing seem to have been bureaucratic and economic (making lists of goods stored or given), its main development was in religious and sacred practices, preserving divinely-inspired texts (Watt and Fairfield 2008). Initially limited to an elite priesthood, transmission to a wider public required one of two strategies. Either the text had to be changed into or accompanied by a contemporary vernacular version, or an educational system had to be established to teach the standard language and literacy in it. Judaism did both, providing from early on a vernacular Aramaic translation of the classical Hebrew text, and establishing schools which taught (using the current Jewish vernacular) the meaning of the sacred Hebrew text. Christianity on the whole preferred translations into the vernacular, although for some centuries the Roman Catholic Church insisted on a Latin version and resisted until Vatican II the use of the vernacular. Islam early chose to require the original language of the Quran, and set up a strong grammatical tradition to preserve it from any of the influences which were changing the nature of the spoken language as it was spread by conquest over the Middle East and North Africa.

It is interesting to trace later developments. In Judaism, the teaching of Hebrew sacred literacy using the vernacular, and the effects of the spread of the Jewish population throughout the growing Diaspora, encouraged an unofficial informal use of Hebrew letters to write the vernaculars. Jewish languages, like Yiddish and Ladino and Judeo-Arabic, could easily be exploited in an increasing number of functions, and emancipation and assimilation encouraged the addition of high levels of literacy in the co-territorial vernacular. Similarly, the growth of national identity in Europe encouraged the development of what became standard language in the various vernaculars—Italian, French, English, German, and in all the languages of the nations which became independent in the nineteenth century. At the same time, Protestant missionaries in the empires established in the eighteenth and nineteenth centuries introduced vernacular literacy as a stepping stone to the development of elite literacy in the metropolitan language. A similar vernacularization might have followed for Arabic, but as Suleiman (1994, 1996a, b) has shown, it was blocked not just because of the strength of the argument for the sacredness of Classical Arabic, but also because of the political attractiveness of Pan-Arabic ideology which would have been challenged by developing literacy in each of the current local varieties of Arabic at the beginning of the twentieth century.

The result was a virtual fossilization of Arabic diglossia, with the resultant educational problems set out by Maamouri (1998) and recently investigated empirically in a limited number of works (Abu-Rabia 2000; Feitelson et al. 1993; Levin et al. 2008; Saiegh-Haddad 2003, 2004, 2005, 2007, 2011, 2012; Saiegh-Haddad et al. 2011, Zozovsky 2010). To provide some background for this discussion without venturing to suggest a simple solution, we will present three relevant issues: the pedagogical argument, the notion of preparation for literacy, and the power of the standard language.

## The Pedagogical Argument in Diglossia

When the writing system that has been adopted for or imposed on a speech community provides a relatively close phonetic or phonemic fit to the spoken language, the teaching of reading or writing is reasonably straightforward. (See Myhill, Chap. 9). Of course, even in cases of literacy in the vernacular, there can be many complications—one sound represented by several letters, one letter or letter combination with different pronunciations. This factor is the basis for the long continuing controversy between adherents of the whole-language and the phonetic Phonics approach to teaching reading (Liberman and Liberman 1992; National Reading Panel 2000). But diglossia, whether in the Ferguson sense of two varieties of the same language or in the Fishman sense of two distinct languages, produces a more fundamental issue. Generally, without a major reform (like the Turkish transition from the Perso-Arabic script to the Western alphabet), it can normally be assumed that there will continue to be a gap between writing in the Classical or Standard variety and the spoken vernacular that children bring to school. The question then arises, is it better to start teaching reading and writing skills in the vernacular and later transfer to the standard language, or should one start directly teaching the standard?

The argument for starting with initial instruction in the vernacular is that it will be possible to show directly that the written variety is a record of the spoken, for it will have similar grammar and lexicon. Teaching reading in the standard or classical language will involve teaching in its lexicon and grammar concurrently, a much more complex task (see Rosenhouse and Laks and Berman, Chap. 11). There have been many studies of the question: one that is often quoted is Modiano (1973, 1988), which showed that Indian children in Chiapas taught to read in their native language learnt to read Spanish faster and better than those taught initially in the standard language. This was replicated in studies with Navajo children (Rosier and Holm 1980; Spolsky 1975), and is presumably an important factor in accounting for the evidence of success of educational programs that provide initial instruction in the native language (Walter 2003, 2008) and of many vernacular and bilingual programs (Hull and Hernandez 2008; King and Benson 2008; Reaser and Adger 2008; Reyes and Moll 2008).

Pedagogically, then, in a diglossic situation one would seem to have a choice of either teaching initial literacy in the vernacular language which children bring from home, or in delaying it until they have been taught to speak in the standard language; but of course this second option is likely to be unsuitable when the standard language is not generally spoken. Either way, there are a number of necessary conditions to fill before adopting an option. The two most obvious are availability of reading material and the training of teachers. If there is no material to read in the vernacular, as is generally the case with the L language in a diglossia or with endangered or indigenous minority languages, the development of such materials is a first step.

## Preparation for Vernacular Literacy

Preparation for literacy means here the readiness of a society to add literacy functions to the vernacular. It also implies the distinction that seems to exist between societies with indigenous functions that will happily add literacy in the vernacular for such functions as opposed to societies where the functions are alien and so able to be carried out with an alien language.

In a study of vernacular literacy (Engelbrecht and Ortiz 1983; Spolsky et al. 1983a, b), we set out to ask why various Polynesian societies such as Tongan (Spolsky et al. 1983a, b) and Maori (Spolsky 1990, 2003, 2005) seemed open to literacy in the vernacular, and others such as Navajo (Spolsky and Holm 1973; Spolsky and Irvine 1980) and Guarani (Engelbrecht and Ortiz 1983), while willing to develop it in the alien language, were reluctant to develop vernacular literacy.

Literacy was introduced to the Navajo Indians through the schools that they were required to attend by the War Department, which was responsible initially for their education, and by Christian missionaries. McCarty (1998, 2002) reports on the traumas suffered by young children drained off from their homes to boarding schools where English was the only language used. Once schooling on the reservation was universal, school became the principal institution promoting English and English literacy. There were some modest attempts to develop literacy in the vernacular, however. In the late 1930s, the U.S. government established an orthography and prepared materials explaining the need for stock reduction and later encouraging support for the war effort (Young 1977). Protestant missionaries also encouraged vernacular literacy and produced a Navajo Bible in the 1950s. However, by the 1970s, it was clear that there was a diglossic pattern, with Navajo the spoken and English the normal written language. The language of the home was Navajo, and the language of the school was English. The Tribal Council (established by the Bureau of Indian Affairs to approve giving away mineral rights) conducted its business in Navajo (with translation into English for the government officials present) but the minutes and all laws were written in English. The local FM radio stations interspersed the country music that they played with news and announcements in Navajo, but the announcers kept their logs in English, and the tribal newspaper used only English. The tribal courts were conducted in Navajo, but their records were kept in English. Essentially, there were no indigenous functions for which literacy was used, so that it was considered appropriate to use an alien language for alien functions. Schooling, tribal government (Navajos had no chiefs and lived alone and not in villages), and Christianity were all alien. As a result, the attempts in the 1950s and again in the 1970s to establish bilingual education generally failed (Spolsky 2002).

In Polynesia, however, we have interesting accounts of the rapidity with which vernacular literacy introduced by Protestant missionaries was accepted. The first missionaries came to Tonga in 1820 and quickly brought a printing press to handle the demand for written material. By 1860, many classic English books were being translated into Tongan and senior high school students were taking down Sunday sermons in shorthand. The way that the society was prepared for literacy is revealed in a fascinating account of the experience of an English sailor shipwrecked in Tonga at the end of the eighteenth century, 20 years before the missionaries arrived. He demonstrated literacy to one of the most powerful contemporary chiefs who immediately recognized the value of the technology for sending instructions to other villages under his rule. Some 50 years later, decisions of the King and his Parliament were communicated in writing to villages throughout the islands. The sailor also recognized its usefulness in his love life, suggesting that women but not their husbands be instructed in the skill. The literature of the mid-19$^{th}$ century in Tongan includes some classic love letters, and when we visited a high school in 1980, we were told that boys regularly received letters on a Friday making assignations for the weekend. At that time, Tonga was both biliterate and bilingual—the weekly newspaper continued (on royal instruction) to publish its main edition in Tongan.

A similar acceptance of vernacular literacy appears to have occurred in other Polynesian societies, where the local people took advantage of the willingness of the Protestant missionaries to develop written vernacular material. In New Zealand, the result was a higher level of Maori literacy than of English literacy in the nineteenth century, corrected only after the Maori wars and the establishment of English-only education in the latter part of the century. With all that, Maori newspapers continued to be published well into the twentieth century. However, the changed policy finally had its effect, and while the current regeneration movement has been successful in moving Maori literacy into the schools, the only written material apart from schoolbooks appears so far to be legally required translations of government documents.

One interesting case that we found supporting this functional argument was Paraguay (Engelbrecht and Ortiz 1983), where there are two exceptions to the more normal diglossic pattern with Spanish for higher and written functions and Guarani for lower and spoken use. The first is a fascinating corpus of letters written by soldiers to their families during the Chaco war with Bolivia in the 1930s. The second is the printing of folk songs in the newspapers and in pamphlets.

In the case of Arabic, as long as writing and education were under the control of religious authorities committed to avoiding any impurity, and once the educational systems took over the same ideology for political reasons, the development of vernacular literacy was blocked.

## The Power of the Standard Language

It was the rise of European nationalism that encouraged the development of vernacular literacy, with the national languages (already used for bible translation and for literature) replacing Latin for almost all functions (legal and medical Latin persisted longest). True, many of the beliefs associated with classical languages, such as the insistence on purity and correctness, were carried over to the school's teaching of standard languages but in non-diglossic situations, it was at least the same language. The standard language, commonly a cultivated form of the dialect spoken in the capital city, was regularly associated with political power, good birth, a high level of education, and consequent economic success. The major forces for standardization were the education system (religious or secular), the printing press (spelling only became important as printing and popular education developed), and the bureaucracy (with its desire for consistency in documents and styles).

The inevitable result of this process was a widespread ideological support for the standard written variety and associated disdain for the various lower-class or regional spoken dialects. No doubt, this accounts for opposition to writing the L variety in a diglossic situation.

It follows from the above that three factors converge in making the implementation of vernacular literacy difficult in the case of diglossic Arabic: (a) the unavailability of written educational materials in this variety, (b) the resilience of the community to allow new functions, especially H ones, to be delivered through the L variety, and (c) a strong religious-political ideology of the Standard language being sacred and unifying. Hence, literacy acquisition in Arabic will continue to happen, at least in the foreseeable future, in the Standard not vernacular variety. One question that follows is: "how then can literacy acquisition in a diglossic context be promoted?" In the next section we will describe a research project that attempted to address this question in the context of diglossic Arabic.

### *10.1.2 Enhancing literacy acquisition in diglossic Arabic*

Good reading skills are foundational to learning across the academic content areas and difficulty learning to read negatively impacts reading to learn academic content from texts. As a means and a carrier of knowledge, language becomes central to the instructional process and its mastery is an indicator of educational success or failure.

There is a general agreement among educationalists that the appallingly low literacy rates in Arabic are rooted in two factors: (a) the linguistic complexity of Standard Arabic—the language of literacy (Suleiman 1996a, b), and (b) the linguistic distance between the language of literacy and the spoken vernacular (e.g., Ayari 1996; Maaomouri 1998, Saiegh-Haddad 2003, 2007, 2011, 2012). As such, the linguistically complex structure of Standard Arabic, which has since the standardization of Classical Arabic in the early days of Islam become 'fossilized', compounded with the sociolinguistic diglossic context which minimizes the opportunity for linguistic exposure and practice in the linguistically distant Standard form, have resulted in persistently low literacy rates, as well as in linguistic insecurity and lack of spontaneity in the use of Standard Arabic among native speakers of the language (Suleiman 2003). In light of the foregoing, it has been argued that:

> if the Arab countries want to prepare their countries to face the changes of globalization and market economies, it seems that an obvious choice would be to aim at achieving necessary attitudinal changes. These changes would lead to a deliberate and accepted attempt to interfere with their language in order to bring about higher levels of linguistic self-confidence and desirable social change. (Maamouri 1998, p. 5)

The above proposal by Maamouri replicates earlier suggestions which have included, in addition to the proposal to simplify the standard language cited above, the dissemination of one spoken vernacular to all Arab countries, as well as the proposal to spread the standard language among all native speakers, including the illiterate middle-to-low class (e.g., Al-Afgany 1962; Al-Husary, *cf.*, Milson 1967).

The widely attested difficulty in acquiring literacy in Standard Arabic was also attributed to improper pedagogical practices; the traditional and outdated instructional methods and textbooks. As such, it was argued that learners are not taught the Arabic language as their mother tongue. Rather, it is delivered to them in the form of prescriptive grammatical rules and frozen templates that they are asked to parrot rather than acquire with logic. The emphasis on fossilized structures rather than on functional language, it is argued, has resulted in learners failing to write a simple text in spite of spending years in the study of the Arabic language (free translation, Abd-Elrahman 1969, p. 199). Recently, researchers have also investigated the role of orthographic factors in reading difficulty in Arabic (see Eviatar and Ibrahim, Chap. 4). As the foregoing suggests, academic discussions of the literacy problem in Arabic are not new and are very similar in content to contemporary propositions that attribute reading failure in Arabic to pedagogical and linguistic factors.

As we have argued in the previous section, the uniquely strong power of the Standard language in a diglossic context, compounded with the national, political and religious resilience to allow literacy practices in the vernacular, has blocked the development of written educational materials in the Spoken Arabic vernaculars and has meant that Arabic-speaking children are required to develop concurrently linguistic proficiency and literacy in the non-spoken and largely unfamiliar Standard language. This task has been shown to challenge children in several ways because it requires the acquisition of novel linguistic structures that are not within their spoken vernacular (Saiegh-Haddad 2003, 2007, 2011, 2012).

In this state of affairs, early oral exposure to the Standard language appears to be the only means available to bridge the literacy-orality gap and to prepare children for literacy acquisition in Standard Arabic. Indeed, recent research has endorsed the effectiveness of early oral exposure to Standard Arabic in enhancing some of the basic language and literacy skills that children need in order to embark on the literacy acquisition journey (Abu-Rabia 2000; Feitelson et al. 1993). However, the implementation of oral exposure policies in formal educational institutions brings about genuine challenges. First, in a diglossic context, there is a rigid separation between the social functions that are delivered through the Standard versus the Spoken language varieties; the Spoken for informal daily conversation and the Standard for formal linguistic interactions and for literacy. The use of the Standard language, either at home or even in the classroom setting, especially with young children and to communicate informal everyday needs and thoughts not directly related to literacy will sound artificial. Second, the implementation of a comprehensive Standard Arabic linguistic policy requires high proficiency in this language variety on the part of teachers. Given the linguistic complexity of Standard Arabic (especially the linguistic mood and case-marking system), the limited access to and use of the Standard variety in the general public sphere, as well as the dominance of other languages, primarily English and French, in many Arab countries (and Hebrew in Israel) make attainment of this oral proficiency, even by teachers, difficult if not impossible.

The above implies that one approach to enhancing literacy would be to adopt a simplified version of Standard Arabic so that all teachers, and not only Arabic language teachers, can use it as a medium of instruction, and hopefully also as the language of the school setting, rather than the language of the textbooks. Yet, the transmission in school language policy and practice into a simplified version of Standard Arabic requires a change in attitude; an attitudinal change in terms of what constitutes an acceptable simplified, rather than 'distorted' form of Standard Arabic. Also, some form of linguistic uniformity is warranted which will form the basis for a new language policy. In other words, there has to be consensus on what linguistic features define a simplified form of Standard Arabic. These attitudinal and language policy changes will only be realized if speakers become convinced that this linguistic change will benefit their very economic, educational, and social future, rather than undermine the sanctity of their language or the unity of their nation (Maamouri 1998).

### 10.1.3 Exposure through Reading Program (ERP)

As explicated earlier, exposure to Standard Arabic is critical in enhancing proficiency in this variety. Yet, one major challenge confronting educational systems in their attempt at implementing a Standard Arabic oral language policy may be proficiency in Standard Arabic and spontaneity in its use. In light of that, and given the significance of linguistic proficiency in enabling children to acquire reading in the language of literacy, the project outlined below offers an alternative program, namely, *Exposure through Reading Program (hereafter, ERP)*. This program aims to increase exposure to Standard Arabic and, as a consequence, enhance reading achievement, by enhancing linguistic proficiency in Standard Arabic *through reading*. The tenets of the ERP program are simple and they mimic the principles that underlie the *Reading Method* approach proposed by Michael West in the U.K. as a means of enhancing second language acquisition (West 1953). These tenets are: (a) it is possible to increase a learner's proficiency in the written language through reading; (b) it is possible to promote reading skills by controlled and structured exposure to the language encoded in print, or the written language.

A foundational assumption of ERP is that literacy acquisition in a language that is not spoken by children, as is the case in Standard Arabic, requires explicit, structured and controlled exposure. This is because: (a) given the socio-functional complementarity of the spheres of use of the spoken and the written language, exposure to Standard Arabic is usually highly restricted. Therefore, the linguistic input that children receive is not sufficiently rich to allow the use of natural language acquisition processes, such as pattern extraction, which are used in the acquisition of the first language, in order to develop language ability; and (b) exposure to Standard Arabic, and unlike some contexts of societal bilingualism, does not occur early in the life of children when they are biologically endowed to acquire language (DeKeyser 2000). Given the foregoing, ERP proposes the use of scientifically informed control over the linguistic input that children receive in the texts that they are exposed to. This linguistic control has three dimensions: (a) *Content*: what linguistic structures (phonological, morphological, syntactic, and lexical) children are exposed to; (b) *Time*: when to expose children to various linguistic structures; (c) *Quantity*: how much exposure to a particular linguistic structure is needed. Controlled exposure that is explicit about the three dimensions of *what*, *when*, and *how much*, is expected to lead to an easier transition from orality to literacy and a more successful acquisition of the various Standard Arabic linguistic structures and of reading in this variety. Further, it will allow a systematic, comprehensive, and valid assessment of the acquisition of these linguistic structures. Yet, the question that remains pending pertains to the scientific, evidential basis for these questions. In other words, how do we decide on the *what, when*, and *how much* dimensions of the program? This question is addressed in the next sections.

*Exposure through Reading Program: Objectives and methods* The Exposure through Reading Program is a controlled reading exposure program. In order to implement such a program two knowledge bases are required. One is a description and analysis of the linguistic structure of Standard Arabic, the Standard written language used today in the textbooks used by children, in the current media and in other modern written Arabic texts. Another is a comparable linguistic description of the child's spoken language variety. A basic and most significant aspect of such linguistic descriptions is lexical.

Vocabulary control is critical to a successful linguistic exposure program, because words are the smallest free meaningful building blocks of language. Also, lexical knowledge is basic to language comprehension and reading comprehension (Perfetti 2007). Thus, a basic step in the development of an exposure program is to compile a graded list of the Standard and the Spoken language lexicons. Then, a policy is needed on how Standard lexical items should be mediated to children, respecting the three dimensions of *content*, *time*, and *quantity*, and also respecting the lexicon that children have already acquired in the Spoken variety. In this program, the children's lexicon in the Spoken variety will form the basis and a stepping stone in building up and extending the lexicon of the children in the Standard variety of the language. Compiling the two graded (by frequency) word lists in Standard Arabic and in the specific dialect of the Spoken variety used by children was the *first objective* of the pilot project described here.

In diglossic Arabic, the lexicon of Spoken Arabic coincides only partially with the lexicon of Standard Arabic. This is because Spoken Arabic comprises non-standard words that are not used in Standard Arabic and do not have, therefore, a conventional written form. A second category of Spoken Arabic words are paired-lexical items, or cognate (partial cognate) words, which are used in both Standard Arabic and in Spoken Arabic but have different surface phonological forms in the two varieties. The third category of words is overlapping or shared words, which have a similar lexical form (excluding case marking and other inflections used in Standard Arabic only) in both Standard and Spoken Arabic. In the light of that, the *second objective* of the project was to compile separate lists of the three types of words described above. These lists are essential for the construction of a controlled and graded exposure program which utilizes what is lexically and phonologically familiar to build up the children's lexical knowledge in Standard Arabic.

A second linguistic description that the implementation of ERP requires is morphological description of the lexicon of Spoken and Standard Arabic. Morphological coding of the two lexicons will allow a description of the distribution of the different root and word-pattern morphemes, which constitute basic units in the linguistic structure (see Saiegh-Haddad and Henkin-Roitfarb, Chap. 1) and psycholinguistic processing (see Boudelaa, Chap. 2) of words in Arabic. Root and word-pattern coding will also enable a quantification of the distribution of the major lexical categories (mainly nouns and verbs) and minor classes of function words (prepositions, pronouns, etc.) in the two language varieties. All this allows the construction of an exposure program that is linguistically explicit about the morphological and morpho-syntactic structure of Spoken Arabic, the language that readers bring to the reading task, at different points in development, and of Standard Arabic, the structure of the language of the text. Morphological coding of the lexical basis of Spoken and Standard Arabic was the *third objective* of the project.

The *fourth objective* of the project was to qualify and quantify the lexical gap between Spoken and Standard Arabic. As the ultimate goal of ERP is to build up the lexical knowledge of children in Standard Arabic, it is important to identify the lexical basis of the reading materials that children are required to handle at the early grades of school, and the extent to which this lexical basis overlaps with or is different from the lexicon that children have already acquired in Spoken Arabic. A quantification of the lexical gap will enable an estimation of the readability level of various Standard Arabic texts and the likelihood that these texts may serve to leverage Standard Arabic language development. A qualification of the lexical gap, on the other hand, will provide a description of the linguistic distance parameters that separate the linguistic forms of words as they are used in the reading materials as against the spoken variety used by children.

*Data Collection* Compiling a representative sample of the spoken lexicon in Child Arabic is not easy. This is because the different dialects of Spoken Arabic are lexically and lexico-phonologically different from each other, with some words used in some dialects but not in others, and with similar words obtaining different meanings and different surface phonological forms in different dialects. Another problem is that the different words used in Spoken Arabic dialects may vary in degree of phonological distance from or proximity to their forms in Standard Arabic. This affects the degree to which the same Standard Arabic word may be identifiable by children from different Spoken Arabic backgrounds. To address these challenges, the current corpus of Spoken Arabic was collected from three different geographical sites in Israel: North, Centre, and South, which represent the three main dialects of Palestinian Arabic spoken in Israel.

A total of 96 five-year-old children from the three data collection sites mentioned above participated in the study. A small microphone was attached to each child for approximately two consecutive hours during the school day and the language that the child produced in interactions with peers and teachers was automatically recorded. Only the language produced by the child with the microphone was analyzed. Background noise, including the teacher's output and the output produced by other children in the recoding site were ignored.

*Data Analysis* The data was collected and transcribed phonetically into CHILDES, an international program for the coding and analysis of children's language. Phonemic transcription into CHILDES allowed a generation of a list of the words in Spoken Arabic (hereafter, *the spoken corpus*) by frequency of occurrence in the corpus.

The lexical basis of the first-grade reading primer and of first and second grade books was also transcribed. This transcription allowed a generation of a similar list of a sample of the lexicon of Standard Arabic that children first encounter at school by frequency of occurrence (hereafter, *the standard corpus*).

*Morphological Coding* Morphological coding of both the spoken and the standard corpora accounted for the word's lexical category, namely, noun, verb, preposition, pronoun, etc. and for the word's root and word-pattern morphemes. The morphological coding of the data allowed an examination of the frequency and distribution of the various lexical categories in the spoken corpus as against the standard corpus and of the distribution and frequency of various roots and word-patterns in the two corpora.

*Phonological Coding* A coding of the phonological form of the words in the spoken corpus (by phonological length and syllable structure) and of the distance between this form and the form of the same word in Standard Arabic was also produced. A number of phonological distance parameters were identified, including consonant change, vowel change, vowel addition, glottal stop omission, and epenthetic vowel addition. This analysis allowed a description of the different phonological distance parameters in the spoken corpus and, hence, helped quantify the phonological distance between the forms of words in the Spoken variety and their form in Standard Arabic. The phonological distance coding was used to address the question of which and how many Spoken Arabic words had an identical lexico-phonological form in the Standard language (identical words), and how many had an overlapping form (cognates), or a completely different form (unique words).

*Some Preliminary Findings* In this section we present a short account of some of the findings obtained from the corpus collected in one of the three dialects targeted in this project, the Central dialect (Kufr Qaraʕ village) comprising 17,499 word tokens and 4,408 word types collected from a total of thirty 5-year-old children. These findings pertain to the lexical makeup of Child Arabic and to the distance between Spoken and Standard Arabic.

An analysis of the spoken corpus showed that 93 % of the total word types produced by children were Spoken Arabic words, yet 5 % were Standard Arabic forms, which were used when children were singing or reciting poems in Standard Arabic, and 2 % were code-switched Hebrew words. The results also showed that verbs predominate in Child Arabic and they make up 45.9 % of the total word types generated by children. These were followed by nouns, making up 29.7 %, then by adjectives making up 8.4 % and finally by adverbs making up 1.4 %.

An analysis of the phonological structure of Spoken Arabic revealed that 61.1 % of the words used by children in Spoken Arabic were bi-syllabic words, followed by 21.3 % tri-syllabic and 16.5 % monosyllabic words. Quadri-syllabic words made up only 1 % of the total spoken corpus. We also found that the most predominant sub-lexical syllable type in Spoken Arabic was CVC making up 51.8 % of the total syllable types produced by children followed by CCVC making up 26.8 %. In Standard Arabic, however, the most predominant syllable type was CVCC making up 46 % of the total syllables followed by CVC making up 42 %.[1] The most frequent syllabic structure of bi-syllabic words in both Spoken and Standard Arabic was CVC/CVC followed by CVC/CV and then by CV/CVC.

As explicated earlier, one critical analysis that the project aimed to perform was a description and analysis of the words in Standard Arabic and of the overlap/distance between the lexical basis of Spoken and Standard Arabic. To achieve this, all words

[1] Note that our analysis of Standard Arabic words did not account for word-final vocalic case and mood endings.

in the spoken corpus and their renderings in Standard Arabic were phonologically analyzed. Then phonological distance parameters were identified and counted per word. Finally, we generated lists, and counted the distribution of three types of words: (1) those that maintain their surface phonological form in Spoken and Standard Arabic (overlapping words), (2) those that change their phonological form, yet keep their lexical form (cognates), and (3) those that change their lexical form completely (unique words). In the case of cognates, we classified words in terms of the type and number of phonological distance parameters they depict (such as consonant change, vowel change, glottal stop omission, etc.).

The results showed that the most predominant type of lexical items in Child Arabic is the class of cognates making up 40.6 % of the total number of word types. These are words that are used in Spoken Arabic, yet their phonological form is altered in Standard Arabic as a result of various largely predictable computational processes, such as consonant change, or glottal-stop deletion/addition (e.g., Spoken *δahab* versus Standard *dahab* 'gold' or Spoken *sama* versus Standard *sama: ʕ* 'sky'). 30.9 % of the words were unique words that have a lexical form in Spoken Arabic that is not used in Standard Arabic and hence does not have a conventional written form. In this case, Standard Arabic has a completely different lexical item to encode the same meaning (e.g., Spoken *ħaṭ* versus Standard *waḍaʕ* 'he put'). Finally, only 21.2 % of the words in Spoken Arabic were overlapping words that are also used in Standard Arabic (e.g., Spoken and Standard *janu:b* 'north' or *daftar* 'notebook'). This latter finding is critical and it might explain why young Arabic-speaking preliterate children cannot understand a simple story read to them in Standard Arabic.

## 10.2 Conclusion

Recent research has documented the intimate relationship between oral language skills and reading achievement (Gough and Tunmer 1986). It follows that reading instruction should be based on a clear understanding of the structure and the function of the oral language of children and on its distance from or proximity to the language encoded in print. The lexicon is a major building block of language. Lexical knowledge and processing is directly related to meaning construction and reading comprehension (Perfetti 2007). This implies that characterizing the lexicon of the spoken language of children is essential in the preparation of educational and pedagogical materials for children that aim at nurturing their reading and language skills. This is what the Exposure through Reading Program aimed to accomplish.

Enhancing Arabic literacy also requires a detailed linguistic description of the spoken language/s of children and of the linguistic disparity between the Spoken and the Standard language varieties. This research will allow a characterization of the linguistic distance between the two language varieties and, in turn, an identification of potential areas of difficulty in the development of language ability and the acquisition of literacy skills in Standard Arabic.

The project we described in this chapter is a first step in this direction. It attempts to provide such a linguistic platform. It describes the Spoken language variety of children and attempts a quantification of the lexical gap between this language and a sample of the language children encounter at school. It also provides a morphological coding of the two language corpora and a phonological description of the distance between the representation of words in the Spoken language and their representation in Standard Arabic. The project provides a rich database that has the potential to inform educational practice and policy in Arabic. This is because it enables policy makers and education officers to understand the linguistic reservoir that children bring to school and hence to make linguistically informed decisions about language and literacy instruction. This information should be the stepping stone in any scientifically-sound, evidence-based language/reading education program.

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# Chapter 11
# A New Look at Diglossia: Modality-Driven Distinctions between Spoken and Written Narratives in Jordanian Arabic

**Lior Laks and Ruth A. Berman**

**Abstract** This paper compares written and spoken versions of film-based narratives elicited from native speakers of Jordanian Arabic, focusing on two main differences that emerged between the two versions: (1) Case marking: Overt case marking, assumed a key means of differentiating standard and colloquial , turned out to be distinctive only in the rare cases when diacritics were in fact added to the word-final consonant, so that no clear evidence could be attested for use/non-use of case marking. (2) Nominalization: Distinct means were used to substitute for the lack of a morphologically marked infinitive in both standard and colloquial Arabic: the written texts in our sample relied heavily on derived nominals, which are far less common in their spoken counterparts. The study sheds fresh light on grammatical differences between spoken and written usage in contemporary Arabic, while its corpus-based approach points to new avenues for research on Arabic dialectology and applications to language pedagogy.

**Keywords** Adverbials · Aspect · Case markers · Infinitive · Modalized propositions · Nominalizations · Subjunctive · Spoken/written narratives

## 11.1 Introduction

The study examines grammatical differences in Modern Standard Arabic (hereafter MSA) and Jordanian Colloquial Arabic (hereafter JA) by means of a comparison of texts produced by native speakers of Jordanian Arabic in both writing and speech. The data-base consists of narratives based on a 7-minute film entitled *Quest* in which an imaginary clay figure searches for water in four mythical landscapes.[1]

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L. Laks (✉)
Department of English Linguistics and Literature, Bar-Ilan University, Ramat-Gan 52900, Israel
email: Lior.Laks@biu.ac.il

R. A. Berman
Department of Linguistics, Tel Aviv University, Ramat Aviv 69978, Israel
email: rberman@post.tau.ac.il

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Arabic is recognized as a diglossic language, in which two varieties exist and are used side by side by the same speakers: Modern Standard Arabic and Colloquial Arabic (Ferguson 1959; Kay 1994; Maamouri 1998; Myhill, in this collection). MSA is used mainly in written texts and formal settings, and is relatively uniform across the entire Arab world, in contrast to Colloquial Arabic, which covers a variety of spoken dialects that differ from one Arab country or community to the next, along geographical, religious and socioeconomic lines. Linguistic differences between various dialects of colloquial Arabic and MSA are manifest in all domains—phonology, morphology, syntax, and semantics (as documented, for example, by Abu-Rabia et al. 2003; Eid 1990; Ibrahim 1983; Ibrahim and Aharon-Peretz 2005; Holes 1995; Meiseles 1980; Rosenhouse 1997; Saiegh-Haddad 2005; Saiegh-Haddad 2012; Henkin 2010). For a discussion of the structure of Arabic and some of the linguistic differences between Standard and Spoken Arabic, see Saiegh-Haddad and Henkin-Roitfarb, in this collection.

Schooling in the Arab world is conducted orally in Colloquial Arabic, but textbooks (see Rosenhouse, in this collection), tests (see Khamis-Dakwar and Makhoul, in this collection), and assignments are written in MSA (see Saiegh-Haddad and Spolsky, in this collection). This means that native-speaking children are required to master use of MSA as a linguistic system lying outside of their everyday experience as native speakers of a given dialect. As a result, children's acquisition of MSA is delayed as compared to situations in which there is a closer and more transparent relation between spoken language use and literacy-related activities (Abu-Rabia 2000; Al-Batal 1992; Al-Toma 1969; Elgibali 1996; Feitelson et al. 1993; Khamis-Dakwar 2005, 2007; Khamis-Dakwar and Froud 2007; Khamis-Dakwar et al. 2012; Saiegh-Haddad 2003, 2004, 2005, 2008; Saiegh-Haddad et al. 2011; Wagner 1993).

The goal of the present study is to shed new light on disparities between the two varieties of Arabic by comparing parallel texts elicited in the two modalities of speech and writing from the same participants, native speakers of Jordanian Arabic. Underlying our study is the assumption that the written texts will reflect linguistic expression more typical of formal written language—hence closer to MSA—as compared with the everyday, colloquial style of oral discourse. Analysis concerns the domains of inflection, derivational morphology, morpho-syntax, and semantics, which prior research comparing parallel texts produced by participants of similar background in other languages has shown to differentiate markedly between the two modalities (e.g., Berman and Nir 2010—for English; Berman and Nir 2011a; Berman and Ravid 2000—for Hebrew; Jisa 2004—for French; and Strömqvist et al. (2004)—for Swedish).

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### *11.1.1 Description of Study*

The study was conducted in the framework of a large-scale cross-linguistic project (see note 1 above). Analysis is conducted of 54 narrative texts, half written and half spoken, elicited from 27 native speakers of Jordanian Arabic, aged in their 20s and 30s, all at least high school graduates, most with some level of higher education as well. Participants were all shown a 7-minute silent film entitled *Quest* depicting an imaginary clay figure in a series of episodes in which he conducts a string of unsuccessful searches for water in four different mythical worlds—of sand, rocks, paper, and machines. They were then asked to both write and retell the contents of the film, starting with the Arabic equivalent of the phrase "once upon a time". For the written elicitation, participants were told to use MSA (*fuṣħa*) and for the oral version, they were instructed to use the vernacular (*ʕa:mmiyya)*. Order of elicitation was balanced, so that half the participants first produced their texts in writing and then orally, while the other half of the participants began with the oral narrative followed by a written version. Use of this methodology provided a shared point of departure for comparison of text produced in the two modalities by means of a common narrative-type discourse based on the same sequence of fictitious events. This procedure ensures comparability of thematic content, hence isolating features of linguistic expression for detailed cross-modality analysis.

### *11.1.2 Findings and Analysis*

In analyzing the usage and distribution of linguistic features in the two types of text, attention is focused on features that emerged as particularly characteristic of diglossic differences between spoken and written usage: case-marking inflections (Sect. 3.1) and nominalizations and subjunctives (3.2).

*Case Marking* The occurrence of overt case markers is commonly assumed to be a key feature of the difference between standard and colloquial Arabic, with the former but not the latter marking the case of nouns and adjectives by suffixation (for a description of Arabic language and orthography, see Saiegh-Haddad and Henkin-Roitfarb, in this collection). Yet, this feature can be observed only when the speaker-writer actually adds a case-ending vowel-marking diacritic to the word-final consonant—as is rarely done, not only in our corpus, but in unvoweled written Arabic in general. Only consonants and long vowels are represented by letters in such texts. Consequently, the texts analyzed here in fact display no real evidence one way or another for use of case marking. Instances where case is explicitly indicated in our sample are restricted to accusative case, adverbials, and to so-called "sound" masculine plurals and dual forms, where case-assignment is marked by the addition of one or more (consonant) letters, as detailed below for use of bound suffixes in Direct Objects (3.1.1), Adverbials (3.1.2), Duals (3.1.3), and in Copular Constructions (3.1.4).

*Direct Object* Indefinite direct objects in MSA are marked by addition of the letter ?Αλιφ at the end of the word, as well as by vowel-marking diacritics, and pronounced as the suffix—*an*. Examination of the texts reveals that participants across the board apply this marker correctly in their written texts, adding the final letter in all and only appropriate contexts, but they never pronounce this marker in the spoken versions of their narratives. This contrast is shown by use of Direct Object ACC in (1), from a written text [wr], with no ACC marking environment in the comparable excerpt from a spoken narrative [sp] in (2).[2]

1. *ra?a* ***maṣdar-an*** *li-l-ma?* [wr-15a]
   - saw source- ACC of-water
   - 'saw the source of water'
2. *bišu:f* ***may*** [sp-19a]
   - sees water
   - '(he) sees water'

*Adverbials* Relatedly, most words that function as adverbs in MSA are adjectives or nouns with a suffixed accusative case marker. For example, the adjective *sari:ʕ* 'quick' is the base for formation of the adverb *sari:ʕan* 'quickly' in (3), as is the noun *yami:n* 'right' for the directional adverb *yami:n-an* 'rightways' ~ 'to the right' in (4)—both in written texts.

3. *yadχulu-hu* ***sari:ʕan*** [wr-16b]
   - entered-it quickly
   - '(he) went into it quickly'
4. *wa-yaltafitu* ***yami:n-an*** *wa-* ***šima:l-an*** [wr-5a]
   - and-turn right-Adv and-left-Adv'
   - 'and he is turning right and left'

   Arabic adverbials can also be formed analytically, by means of prepositional phrases like *bi-surʕa* 'quickly' (lit. 'in speed'), typically with the prepositional *bi-* followed by an abstract derived noun, as in Hebrew (Nir and Berman 2010; Ravid and Shlesinger 2000). Both strategies of adverb formation were found in the written texts in our corpus, MSA, including instances where the same person used both options in writing, as is the case with the bound suffix in (3) and the analytical prepositional phrase in (5), both used by participant #16 to denote the manner adverb meaning 'quickly'.
5. *yaħfuru* ***bi-surʕa*** [wr-16b]
   - is digging in-speed
   - '(he) is digging quickly'

In contrast to MSA, the colloquial JA spoken texts show evidence of reliance mainly on prepositional phrases for expressing manner, rather than adjectives or nouns

[2] Examples are rendered in broad phonemic transcription for the written versions and in phonetic form of the spoken pronunciation. The numbers in square brackets indicate the serial number of each participant in the group, wr=written text, sp=spoken, and a/b refer to the order in which the two texts were produced.

with a suffix that makes them adverbial.[3] Exceptions are confined to a limited group of set, formulaic items that have become lexicalized with the—*an* case marking suffixing, as in the words *fajʔat-an* 'suddenly' and *tilqa:ʔiyy-an* 'automatically' in (6a) and (6b) below, both from spoken texts.

6. a. *wu-* ***fajʔat-an*** *rijeʕ nafs il-ṣo:t* [sp-20b]
   - and-suddenly returned same the-voice
   - 'and suddenly the same voice returned'

   b. *ha:y il-ʔa:la:t ka:nat ʕamm titħarrak* ***tilqa:ʔiyy-an*** [sp-13a]
   - these the-machines were move automatically
   - 'these machines were moving automatically'

MSA also exhibits use of the same case marker for denoting adverbs of state with the participial form, as in the excerpts from written texts in (7) and (8).

7. *yaṣilu ila manbaʕ al-maʔ* ***mustaχdim-an*** ***ħajar-an*** [wr-19a]
   - arriving to source the-water using rock
   - '(he) is arriving at the water source using a rock'
8. *fa-ḍaraba al-arḍ* ***ya:ʔis-an*** [wr-15a]
   - and-hit the-ground desperate-Adv
   - 'and he hit the ground desperately'

In sum, as expected, the more conservative written texts use the case-marking suffix—*an* as a bound morphological marker not only of Direct Objects (Sect. 3.1.1) but also of adverbs of manner and state, an option that is almost entirely avoided in the spoken versions of the same narrative.

*Dual Forms* The dual form in MSA is used whenever the category of 'two' applies to nouns, verbs, adjectives, as well as to pronouns, by suffixation of a dual marking morpheme. In JA, in contrast, the dual form was restricted to nouns. Items that are semantically dual in other lexical classes like adjectives and verbs take a plural marker. Moreover, in MSA (here, the written texts), the dual suffix alternates in keeping with the case of the item to which it is attached: the suffux -*a:ni* is used for nominative case nouns and for predicates, and the suffix -*ayni* for all other cases. Because dual marking has an orthographic manifestation in MSA and consequently in the written corpus we analyzed, our data provide evidence for the continued use of case-marking in the language, as illustrated in (9) through (11) below.

9. *fi al-mašhad-ayni al-sa:biq-ayani* [wr-17b]
   - in the-episode-Dual the-previous-Dual
   - 'in the last two episodes'
10. *wajada nafsahu muħa:ṭ-an bi-ħa:ʔiṭayni min kull ja:nib* [wr-1a]
    - found himself surrounded-Acc in-wall-Dual from each side
    - '(he) found himself surrounded by two walls on each side'
11. *wa-al-****ħa:ʔiṭa:ni yaqtariba:ni*** *minhu ħatta* ***inṭabaqa:*** *ʕalayhi* [wr-1a]
    - and-the-wall-Dual get-close-Dua l from-him until closed-Dual on-him
    - 'the two walls were getting closer to him until they closed on him'

[3] Interestingly, a closely parallel phenomenon characterizes current Hebrew usage, where *be-*+Abstract Nominal forms are preferred for expression of manner adverbs over and above by bound suffixation to adjectives (Berman and Nir 2011b).

A dual form was almost never used in the oral JA texts, in marked contrast to its quite common occurrence in the written versions. This constitutes further evidence for the more conservative retention of morphologically bound suffixes in MSA compared with colloquial Arabic usage.

*Copula Constructions* Adjectives taking the accusative case marker occur in copular constructions, as illustrated in excerpts from the written texts in (12) and (13).

12. *wa-la:kinna al- sawṭ ma: za:la* ***mawju:d-an*** [wr-2b]
    - and-but the-voice still present-ACC.
    - 'But the voice remained'
13. *aṣbaħa al-waraq* ***θaqi:l-an*** [wr-7a]
    - became the-paper heavy-ACC.
    - 'The paper grew heavy'

Again, as in the three other constructions noted in this section, use of a case-marking bound suffix is confined to the written texts in our sample, hence can be taken as typifying MSA and as contrasting with its omission in the colloquial style of spoken narrative discourse.

*Nominalizations* The most striking morpho-syntactic property that emerged in this study as differentiating between the two varieties is reliance on nominalizations in the written as compared with the spoken narratives in our sample. By nominalizations, reference here is to the construction termed *maṣdar* 'source' in Arabic grammars, corresponding largely to the class of *shmot pe?ula* 'action nominals in Hebrew (Berman 1978; Ravid and Avidor 1998), where each verb conjugation or *binyan* has an associated nominalized form, for example, *waṣala* 'arrived' ~ *wuṣu:l* 'arrival', *mawwala* 'financed' ~ *tamwi:l* 'financing' (Hazout 1995; Rosenhouse 1990, 2008; Watson 2002; Wright 1889) and to (verb-derived) abstract lexical nominals in English and other languages (Chomsky 1970; Comrie and Thompson 2007). These typically replace simple clauses by nominalized forms, so neutralizing arguments and features of temporality and voice (e.g., active vs. passive) overtly marked in tensed clauses (compare: *they destroyed the city* ~ *the city was destroyed* versus *the destruction of the city*; or Hebrew *χakirat ha-kacin* 'interrogation-Gen the-officer' in which the noun meaning 'officer' could stand for either the subject or the direct object of the activity of interrogating, that is, *χakar* 'interrogated', *χoker* 'is-interrogating', or *neχkar* 'is ~ was-interrogated').

The present analysis revealed use of nominalizations to be a major modality-dependent strategy in our sample of texts, with nominalized forms preferred in writing as against (irrealis) subjunctive or tensed forms of verbs in the spoken narratives produced by the same participants. Note, in this respect, that neither standard (written) nor colloquial (spoken) Arabic has a distinct morphological form corresponding to infinitives in Hebrew or European languages. Instead, each of the two varieties deploys distinct means to form constructions where other languages might rely on infinitival forms. Specifically, the written texts in our sample reveal extensive use of nominalizations in a variety of syntactic environments (e.g., *ħa:wala al-muru:r*, lit. 'tried the passing'); such forms are far less common in the spoken narratives, in which subjunctive forms are preferred (e.g., *ħa:wal yemurr*, lit. 'tried that he pass', see Rosenhouse 2002, 2008). Nearly 200 instances of derived nominals were found in the written texts in our sample—accounting for 2.5 % out of the total word-tokens in the written narratives (178 out of 7010), as against a few sporadic occurrences of these constructions in the corresponding spoken texts. In addition, 24 out of the 27 participants (88 %) used a nominalized form at least once in their written texts, but these were found in only two (7 %) out of the total spoken texts.

Not only were nominalizations common in the written texts, they occurred in various syntactic positions, serving for a variety of semantic functions like temporality, all of which could be expressed by either derived nominals or subjunctive forms. These two constructions were used interchangeably in the MSA written texts. In contrast, the semantic functions detailed below were expressed in JA almost exclusively by (irrealis) subjunctive forms or by tensed clauses. The varied functions are illustrated below with respect to Aspect (Sect. 3.2.1), Modality (3.2.2), and different classes of Adverbials (3.2.3).

*Aspect* The subjunctive form is required in Arabic after a range of aspectual verbs that denote inception or continuation, with some verbs confined to subjunctive complements, but with others also taking nominalizations. Lexically, some such aspect-marking verbs occur in both the written and spoken texts, others in only one of the two dialects. The verbs occurring in the written texts included verbs of inception—*badaʔa* ‘start’ (in (14a) to (14c) below) and *aχaða* ‘begin’ (lit. ‘take’) in (15a), (15b). The verbs *ballaš* ‘start’ in (16) and *ṣa:r* ‘begin’ (lit. ‘become’) in (17), in contrast, occurred only in spoken texts.

Note that most of the aspectual verbs in these excerpts have the sense of ‘begin, start’, that is, they encode inceptive aspect, although some have a different sense when they stand alone, rather than followed by another verb (e.g., *aχaða* ‘begin’ means ‘take’ in such contexts).

14. a. *badaʔa fi* ***l-ħafr*** [wr-15a]
    - started in the-digging = excavation
    - ‘(he) started digging’

    b. *badaʔa* ***yaħfur*** [wr-15a]
    - started dig-3 sg. [Subjunctive]
    - ‘(he) started digging’

    c. *badaʔat ʔar-rima:l* ***bi-imtiṣa:ṣi-hi*** [wr-17b]
    - started the-sand in-absorption-him
    - ‘the sand started absorbing him’
15. a. *wa-****aχaða yaħfur*** *ħatta balaʕat-hu l-arḍ* [wr-1a]
    - and-began dig until swallowed-him the-land
    - ‘(he) began digging until the land swallowed it’

    b. *aχað* ***yibħat*** [sp-10a]
    - started search-3 sg.
    - ‘started to search’
16. *ballaš* ***yitmašša*** [sp-15a]
    - started walk-3 sg.
    - ‘started walking’

17. *ṣa:r* ***yaħfur yaħfur yaħfur*** [sp-7a]
    - 'start dig-3 sg. dig-3 sg. dig-3 sg.'
    - 'starts digging and digging'

Nominalizations also occurred after verbs denoting a protracted activity, as in (18) and (19).

18. *wa-yaqu:mu* ***bi-s-sayr*** [wr-6b]
    - and-perform in-the-walking
    - 'and walks'
19. *wa-yastamirru* ***bi-l-ħafr*** [wr-6b]
    - and-continue in-the digging
    - 'and continues digging'

These examples demonstrate use of nominalized forms to encode protracted activities such as digging, seeking, or walking. These nominalized forms function as complements of aspectual verbs like *begin, continue, keep on.* The preference for nominalizations in such contexts contrasts with constructions used for expressing phases in a given process (inception, protraction, completion, etc.) in European languages as well as in Hebrew, where aspectual verbs are typically followed by an infinitival or participial form of the verb—as in English *began walking ~ began to walk,* Hebrew *heχel holeχ ~ hitχil laleχet* respectively (Berman and Slobin 1994). The effect of nominalization here, as discussed further in the conclusions to this paper, is that it involves deformation of simple-clause structure by neutralizing both the arguments and the Tense-Mood-Aspect (TMA) features of the complements (Berman 1993; Comrie and Thompson 2007).

*Modalized Propositions* Here, "modalization" refers to cases where the basic referential content of a proposition is modulated by expressing an attitude on the part of a speaker or writer concerning the desirability, necessity, possibility, or likelihood that a given state of affairs will obtain (Bybee and Fleischman 1995; Brustad 2000; Holes 2004). Instances of modality in the sample analyzed here included verbs denoting 'can', 'try' and 'have to', as illustrated in examples from the written texts in (20) to (26) below, where the first two examples reflect the alternation between a nominalized form of the verbs meaning 'descend = get-down' and 'dig' in (20) versus use of a subjunctive form of the verb meaning 'arrive, reach' in (21) both used in the narrative text written by the same person.

20. *ʕindama ħa:wala* ***n-nuzu:l*** *ʕanha….wa-ħa:wala* ***ħafr*** *as- ṣaxr*
    - [wr- 15a]
    - When tried the-descent from-it ….and-tried digging the-rocks
    - 'when he tried to go down ….. and tried to dig through the rocks
21. *fa-yuħa:wilu* ***ʔan yaṣila*** [wr-15a]
    - and-trying that arrives
    - 'and tries to arrive'

The fact that the same person uses both a nominalization and a subjunctive form following the same modal verb 'try' in a single written text is further evidence of the interchangeability of these two constructions. In contrast, in JA, this verb does not take a nominalization as complement, but only a subjunctive form, as shown in (22)–(23).

22. *ħa:wal* ***yela:qi fih*** *il-may* [sp-3b]
    - tried find-3 sg. in-it the-water
    - 'tried to find water in it'
23. *biħa:wel* ***ʔinno yiftaħ*** [sp-1a]
    - try that-he opens
    - '(he) is trying to open'

Along similar lines, the modal verb meaning 'can' is followed by nominalized version of the verb meaning 'arrive' in the written excerpt in (24), as against a subjunctive form of the verb 'escape' following the modal verb 'can' in the spoken JA excerpts in (25) and the modal verb meaning 'have to ~ want' in (26).

24. *yastaṭ:iʕu* ***l-wuṣu:l*** *ʔila maṣdar ṣawt al-maʔ* [wr-b4]
    - can the-arrival to source voice the-water
    - '(he) can arrive at the source of the voice of the water'
25. *ma qider* ***yihreb*** [sp-20b]
    - *not could escape-3 sg.*
    - 'couldn't escape'
26. *biddo* ***yu:ṣal*** *li-hay il-may bi-ʔayy-wasi:le* [sp-6b]
    - want arrive-3 sg. to-this the-water in-every-way
    - 'he has/wants to reach the water in every way'

Interestingly, in corresponding narrative texts in Modern Hebrew, a closely related language, aspectual as well as modal verbs with similar senses are nearly always complemented in written and spoken texts alike by infinitival forms in constructions termed *nasu murxav* 'extended predicates' (Berman and Neeman 2004; Reilly et al. 2002). As such, the constructions noted in this section demonstrate a particularly striking instance of the diglossic situation in Modern Arabic, in the contrasting preferences of written (representing MSA) as against spoken (colloquial) representations of the same content.

*Adverbials* Nominalizations also occur in a range of adverbial functions, typically in the form of prepositional phrase constructions. In the context of film-based narratives, these are mainly temporal adverbials describing the background circumstances in which temporally sequenced narrative events are embedded. Such constructions may express simultaneity, where the activity denoted by the nominal form is durative, or anteriority, where both the 'falling' and the 'searching' in the examples in (27) and (28) precede the event that follows.

Use of nominalizations in temporal adverbials in the written texts also demonstrates structural variation, occurring both in isolation and with complements such as Noun Phrases in (27) and Prepositional Phrases in (28).

27. *wa-baʕda* ***sama:ʕ -ihi ṣawt l-maʔ*** [wr-18b]
    - and-after hearing-its voice the-water
    - 'after he heard the voice of the water'
28. *wa-ʕinda* ***suqu:ṭi-hi fi l-maʔ*** [wr-17b]
    - and-at falling-his in the-water
    - 'and when fell into the water'

In JA, in contrast, temporality is expressed mainly through tensed clauses, as shown in (29a) and (29b), from the oral narrative of the same subject.

29. a. *baʕed ma yešu:f* [sp-6b]
    - after sees
    - 'after he sees'

    b. *lamma nizel la-huna:k* [sp-6b]
    - when went-down to-there
    - 'when he went down there'

Non-temporal adverbials of purpose and reason demonstrate a similar contrast between the two varieties. Again, the few instances of nominalizations occurring in expressions of purpose in our corpus were all from the written, not the spoken sample, as shown in (30a) and (30b).

30. a. *badaʔa yaħfuru* ***li-l-wuṣu:l*** *ʔilayha* [wr-3b]
    - started dig-3 sg. for-the-reaching to-it
    - 'he started to dig in order to reach it'

    b. *yastaχdimu ʔada: ħa:dda* ***li-ħafr*** *l-ʔarḍ* [wr-4b]
    - using tool sharp for-digging the-ground
    - 'he is using a sharp tool to dig the ground'

In contrast, this same function is expressed in JA only with the subjunctive form as in (31) or with fully tensed verbs as in (32).

31. *ʕaša:n yela:qi il-may* [sp-7a]
    - for find-3 sg. the-water
    - 'so that he (will) find water'

32. *ʕala ʔasa:s byiktaššef* [sp-5a]
    - so that find-out-3 sg.
    - 'so that he (will) find out'

Nominalized forms occurred occasionally in writing with adverbs of reason as well, as in (33).

33. ***bi-sabab suqu:ṭ*** *qiṭʕa ħajariyya* [wr-17b]
    - in-reason falling piece stone-like
    - 'because of the falling of a piece of stone'

In spoken texts however, reason adverbials occur in regular prepositional phrases, with non-nominalized nouns, like 'strength' in (34a) or 'greatness' in (34b).

34. a. *min* ***šiddat*** *ir-riya:ħ* [sp-1a]
    - from strength the-winds
    - 'because of the strong winds'

    b. *min* ***kiter*** *il-ʕaṭaš* [sp-1a]
    - from greatness the-thirst
    - 'because of the great thirst'

*Syntactic positions* The range and breadth of nominalizations analyzed here is attested by the fact that not only do they serve a variety of semantic functions as noted in the preceding sections, they also occur in various syntactic positions in MSA including: Subject as in example (35), Direct Object as in (36), Oblique Object (37), and Noun Complement (38).

35. *wa-ka:na* ***aṣ-ṣuqu:ṭ*** *ʕala saṭħ maʕdani* [wr-3b]
    - and-was the-**falling** on surface-metallic
    - 'The falling was = took place ~ occurred on a metal surface'

36. *munṭaðir-an* ***ṣuqu:ṭ*** *al-qaṭara:t* [wr-7a]
    - anticipating **falling** the-drops
    - ‘anticipating the falling of the drops (of water)’
37. *wa-tafa:jaʔa* ***bi-ʕulu*** *ṣ-ṣuΞu:r ʕan l-qa:ʕ* [wr-7a]
    - and-surprised in-**ascent** the-rocks from the-bottom
    - ‘he was surprised by the ascent of rocks from the bottom = by the fact that the rocks rose’
38. *wa-naðara ʔilayha wa-ʔila maka:n* ***ṣuqu:ṭi-hi*** [wr-7a]
    - and-looked to-it and-to place **fall**-his
    - ‘and (he)looked at it and at the place of his falling = where he fell’

## 11.2 Conclusion

The study shows that clearly defined diagnostic measures can be devised to characterize the well-known phenomenon of Arabic diglossia, as reflected in spoken and written discourse respectively. This is done by means of carefully controlled elicitation methods which allow for direct comparability between linguistic constructions preferred in each of the two modalities. The study sheds light on grammatical differences between spoken and written usage in terms of the expressive strategies adopted by native speakers in the course of text construction, focusing on the use and lack of use of nominalizations on both modalities. The continued reliance of MSA on abstract nominalizations in contrast to their relatively rare occurrence in JA is indicative of the more formal register and syntactic complexity characteristic of written compared with spoken language in general, as has been shown for other languages (Berman 1993; Berman and Ravid 2009; Biber 1998; Chafe 1994; Halliday 1989; Ravid and Berman 2009). As such, it underlines the expressive density of the written modality (Berman 1993), as well as the formality of standard language compared with colloquial varieties of language use in general, and in the extremely diglossic context of Arabic in particular.

Closely similar patterns were found in narrative and expository texts written in Hebrew by highly proficient college students, native speakers of Palestinian Arabic for whom Hebrew is a second language (Kupersmitt and Laks 2007). Comparing the texts they produced with those written by their peers for whom Hebrew is a first language, it was found that both groups used nominalizations to the same extent in terms of overall quantity. However, even though the texts produced by both groups of students related to the same content (the *Quest* film for narratives and the topic of coping with challenges in the expository text), Arabic L1 speaker-writers used nominalizations for a wider range of functions and in more different syntactic positions than the Hebrew L1 participants. This finding further demonstrates the central role of nominalizations as a feature of written Arabic (hence of MSA), one that has largely disappeared in (the Jordanian variety of) spoken Arabic.

The study also points to directions for further research and pedagogic applications. One would be to extend analysis to other linguistic and discursive domains of analysis. For example, in the sample of narrative texts examined here, iterativity was expressed differently in the standard written compared with the colloquial spoken texts, with the latter far more often relying on repetition of verbs for this purpose (e.g., *yuħfur yuħfur* 'digs digs', to indicate that the protagonist went on digging again and again)—as discussed, for example, in Johnstone's (1991) study. Analysis could also be extended to other types of discourse, requiring the same participants to both write and tell personal-experience stories rather than the film-based narratives examined here, and/or to produce informative or expository rather than narrative texts. In educational and developmental perspectives, texts elicited from schoolchildren and high-school students assigned the same task in both speech and writing could be compared with those produced by educated adults, to ascertain at what age-schooling levels and to what extent speaker-writers master the relevant differences between standard and colloquial varieties of Arabic.

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# Chapter 12
# Literacy Acquisition and Diglossia: Textbooks in Israeli Arabic-speaking Schools

**Judith Rosenhouse**

**Abstract** Arabic is a language known for being diglossic. That is, it has spoken colloquial Arabic dialects (CA), which are the native speakers' mother tongue, and a formal, written Modern Standard Arabic (MSA). Literacy instruction in Arabic has long been a major concern and educators and students have long complained about difficulties in acquiring MSA and reading in it. The study asks (1) What structural elements of MSA and CA cause particular difficulties? (2) Do these differences vary in different grades? One way to examine the similarities and differences between MSA and CA is by comparing the parallel grammatical elements of CA and MSA in language (grammar) textbooks as in Rosenhouse and Shehadi (Philosophy, language, arts: Essays in honor of Alexander Barzel (251–272), 1986) for 1st and 2nd grades. The present paper applies this method to new 1st, 2nd, 4th, 8th, and 11th grade books. The vocabulary of the textbooks that were examined and about twenty morphological and syntactic forms that occur in the books studied in that earlier paper are compared with parallel structures used in the recent textbooks in Israeli CA. Our findings show variability in the occurrence of these features in the textbooks of the various grades. The comparison of the recent textbooks with findings in Rosenhouse and Shehadi (Philosophy, language, arts: Essays in honor of Alexander Barzel (251–272), 1986) reveals both differences and similarities regarding the examined linguistic features.

**Keywords** Colloquial Arabic · Diglossia · Grammar · Israeli Arabic-speaking schools · Language acquisition · Literary Arabic · Modern Standard Arabic · Textbooks · Vocabulary

## 12.1 Introduction

Arabic is a language known for being diglossic (see Myhill, Chap. 9), that is, having spoken colloquial Arabic dialects (CA), which are the native speakers' mother tongue, and a formal, written and read Modern Standard Arabic (MSA). (For a discussion

J. Rosenhouse (✉)
Swantech Ltd., 89 Hagalil St.,
3268412 Haifa, Israel
e-mail: swantech@013.net.il

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of some of the differences between the two language varieties, see Saiegh-Haddad and Henkin-Roitfarb, Chap. 1). Literacy in diglossic Arabic has long been a major concern (see Saiegh-Haddad and Spolsky, Chap. 10). One of the first reports of difficulties involved in learning Modern Standard Arabic appeared in Frayha (1955) and it remains a major concern nowadays in acquisition, instruction, and assessment (see Khamis-Dakwar and Makhoul, Chap. 13). Over the years since Arabic became an official language in Israel and the primary language of education in Arab schools, teaching methods have changed. Inspired by recent research showing that linguistic differences between Spoken and Standard Arabic constitute a stumbling block in the acquisition of literacy, namely Saiegh-Haddad (2003, 2004, 2005, 2007, 2012) and Saiegh-Haddad et al. (2011), and others supporting the contribution of early exposure to Standard Arabic to language and literacy development (Abu-Rabia 2000; Feitelson et al. 1993) MSA is now introduced at the kindergarten level though book reading and academic class discussions. Further, in the light of evidence for the potential effect of the Arabic orthography on reading development (Ibrahim 2005, 2010a, b), literacy instruction (letter knowledge in particular) is now taught at kindergarten level too.

Contemporary Arabic basically comprises two language varieties or registers: Colloquial Arabic (CA) spoken dialects and Modern Standard Arabic (MSA). The latter is a modern descendent of Classical Arabic, which is the variety used in written texts since about the seventh century CE. Early Arab linguists were aware that spoken and written Arabic differed, as noted, e.g., in descriptions of the correct Bedouin speech in *The Book* by Sibawayhi from the eighth century CE (Sibawayhi 1967). Various later treatises referred to speakers' oral deviations from the correct grammatical norms of the written Arabic language.[1] The difference between CA and MSA has been recognized in the modern linguistic literature as 'diglossia' (Ferguson 1959) and many ensuing studies have examined this property of the Arabic language. Due to the spread of literacy during the last century or so, MSA and CA have undergone mixing, so that educated speech has been named Middle Arabic, Educated Arabic etc. (Badawi 1973; Mitchell 1986; Kaye 1994; Bousoffara-Omar 2006). The nature of Arabic diglossia is not yet settled, but its existence makes it difficult for school students to acquire it after CA, their mother tongue.

Becoming literate in Arabic by learning how to read and write in fact involves students' acquiring a related but new language system (Ibrahim 2010a, b; Ibrahim and Aharon-Peretz 2005). Formally, children begin learning Modern Standard Arabic in the 1st grade.[2] Students' difficulties in acquiring literacy in MSA as manifest in their performance and achievements were described in the linguistic literature (cf., e.g., Frayha 1955, p. 137; Altoma 1969) with publicly expressed complaints about these difficulties attested since the end of the nineteenth century.[3] Since that period

[1] Such deviations were named *Laħn al-ʕa:mma,* e.g., Ayoub 2007.

[2] Yet they may be exposed to MSA through TV, listening to stories or songs earlier, in the kindergarten or at home.

[3] Sulaiman (1993, p. 22–23) mentions that already in 1899 activity was underway to facilitate the structure of the Arabic alphabet and thus its acquisition.

many literary writers,[4] as well as linguists, have been advocating the simplification of MSA grammar which they considered frozen, conservative, preserving ancient traditions, and inadequate for modern life (e.g., Bint Al-Shatiʔ 1971; Diem 1974; Sarraj 1964; Taimur 1950; Darwish 1999; Al-Shobashi 2004).

The goal of this paper is to examine MSA elements in their relation to CA in the context of Arabic diglossia. For this purpose we study some of the linguistic elements of MSA as found in eight language textbooks (i.e., not mathematics, literature, etc.) of several grades in Israeli Arabic-speaking schools.[5] We ask two main research questions: (1) What are the MSA structural features that occur in the textbooks and how do they vary from CA? (2) Do these differences between MSA and CA vary across different textbooks?

Our method is described in Sect. 12.2. In Sect. 12.3 we present our qualitative comments and observations on each of the studied books. In Sect. 12.4 we study differences between our present findings and those in Rosenhouse and Shehadi (1986). As about 25 years have passed since that study, we compare the "new" textbooks with the "old" ones examined in that paper. This comparison intends to find whether the "new" books reveal different attitudes to teaching Arabic language and literacy skills. Section 12.5 discusses the findings and sums up our conclusions.

## 12.2 Method and Materials

In Israel, school education usually begins at age 6 and ends at age 18 with matriculation exams.[6] The educational system includes an elementary school stage with six grades, middle school with grades 7–9, and high-school grades 10–12. In this paper we analyze textbooks of the three stages of literacy acquisition in grades 1, 2, 4, 8 and 11.

MSA elements are gradually taught in the Arabic language textbooks (including old and modern literature books). According to the curriculum for elementary school grades, grammar is not taught explicitly (by rules) and various grammatical topics are left unexplained though such unexplained elements (e.g., the dual forms, rules of various verb conjugations, etc.) may occur in the texts.[7]

Our material for this analysis includes the following books:

[4] These include Lebanese Christian writers such as Khalil, Nuʕaima, and others.

[5] The public education system in Israel has separate schools for native Hebrew speakers and native Arabic speakers, but individuals can learn in either, or in (a few) bilingual schools.

[6] Kindergarten education is also obligatory from age 5, but in fact many children begin kindergarten education at earlier ages. We do not study this stage here, however.

[7] This method in fact involves "tacit" or "implicit learning" (see e.g., Polanyi 1966; Reber 1993; Ellis 1994; Rosenhouse 2008), i.e. acquiring a subject without special effort or attention to it. This method is used in some Israeli kindergartens (probably without being aware of the theory of implicit learning). The benefit of listening to stories in MSA read aloud by the kindergarten teacher has been investigated concerning later enhancement of MSA acquisition (Feitelson et al. 1993).

1. *ar-ra:ʔid*[8] [the scout, explorer] (1990) a reading primer for grade 1, part 2.
2. *al-ʕarabiyya luɣatuna*: [Arabic is our language] (2010) for grade 1, part 1 and part 2.

This book is the most recent school book for this student population in Israel and is used by a large proportion of students in the north of Israel (around Haifa).

3. *ar-ra:ʔid* [the scout, explorer] (1990) for grade 2.
4. *al-ʕarabiyya luɣatuna*: [Arabic is our language] (2010) for grade 2.
5. *ʔana ʔaqraʔ$^{u}$, ʔana ʔ*ufakkir$^{u}$ [I'm reading – I understand] (1995) for grade 4.
6. a*l-dʒadi:d fi: qawa:ʕid l-luɣa l-ʕarabiyya* [Innovations in the rules of Arabic] (2000) for grade 8.
7. a*l-dʒadi:d fi: qawa:ʕid l-luɣa l-ʕarabiyya* [Innovations in the rules of Arabic] (1989) for grade 11.

*al-ʕarabiyya luɣatuna:* follows a new syllabus for reading acquisition as defined and declared in 2009 (Israel Ministry of Education), whereas the other books follow a previous syllabus.[9]

Although the grammatical material is more or less the same for all school books, book authors are free to choose the texts and much of the vocabulary and the exercise forms. Thus, various language features occur at different rates in different books and complicate the comparison in our study. Due to this situation we examine the occurrence of about twenty MSA grammatical structures in the texts of the listed books only (not in exercises or explanatory sections).[10] The findings are summarized in Tables 12.2, 12.3, 12.4 and 12.5. But before that, Table 12.1 lists the elements that are studied as follows:[11]

(1) 'Sun letters' + definition This is the conventional Arabic term for a group of 15 out of the 28 MSA phonemes that assimilate the/l/ of the definite article/-al/ when it directly precedes them, as in: *al-da:r* (written) *ad-da:r* (pronounced) 'the house' vs. *al-ba:b* (written) *al-ba:b* (pronounced) 'the door'. This feature is common to CA and MSA.

(2) Genitive structures (also named annexation or construct state). This structure refers to the compounding of two nouns or more (governed by certain syntactic rules) as in

[8] We use the IPA transcription for the Arabic names and words.

[9] The difference between these two methods is that the new 'synthetic' method basically begins with teaching letters combining them into words, whereas the previous 'analytical' method starts with words and breaks them down to syllables and letters.

[10] The CA examples in our comparison reflect the urban dialect of Jerusalem. When just "Arabic" is mentioned, we mean the Arabic language in general.

[11] For more comprehensive descriptions see e.g., Ryding (2005); Holes (2004).

**Table 12.1** Indexed List of target linguistic elements

| Index | Linguistic structure |
|---|---|
| 1 | 'Sun letters' + definition |
| 2 | Genitive structures |
| 3 | False genitive |
| 4 | Suffixed personal pronouns |
| 5 | Numerals |
| 6 | Unit nouns |
| 7 | Demonstratives (Deictics) |
| 8 | Relative particles |
| 9 | Arabic verbs |
| 10 | Subjunctive and jussive verb forms |
| 11 | Auxiliary + main verb phrases |
| 12 | Dual agreement |
| 13 | The particles: *ʔinna, ʔanna* |
| 14 | Verb + *ʔan* |
| 15 | Case endings for definite (15a) and indefinite (15b) nouns |
| 16 | Elatives (16a) and superlatives (16b) |
| 17 | Circumstantial phrases and clauses |

*MSA qalam$^{u}$ l-muʕallim$^{i*}$*

pen the-teacher-of

'the teacher's pen'

*The superscript vowels or syllables mark MSA case endings.

Some such genitive structures form a single semantic item, e.g.

MSA *bait$^{u}$ l-ma:l$^{i}$*

'house (of) the-money', i.e., 'the treasury'.

The syntactic relation between the nouns is expressed in MSA by suffixes indicating case endings; in most CA dialects the structure remains the same but lacks case endings.

(3) False genitive (*ʔiḍa:fa ɣayr ħaqi:qiyya* 'unreal construct state'). This structure exists in MSA but is usually not used in CA. It compounds a noun with an adjective (not a noun) in the genitive structure and *for definition* governs two definite articles, prefixed to both the noun and the adjective. Cf.:

MSA: *ṭawi:l$^{u}$ l-qa:mat$^{i}$* *ħasan$^{u}$ l-wadʒh$^{i}$* *al-ħasan$^{u}$ al-wadʒh$^{i}$*

'long the-height-of' 'pretty the-face-of' 'the-pretty the-face'

'tall (lit.: long statured) 'a man with a pretty face' '(the man with) a pretty face'

**Table 12.2** Summary of present findings in the early grades (1st and 2nd)

| Book / Category Number | Al-ʕarabiyya Luɣatuna: (grade I) | Al-ra:'id (grade I) | Al-ʕarabiyya Luɣatuna: (grade II) | Al-ra:'id (grade II) |
|---|---|---|---|---|
| 1 | + | From lesson 22 | + | + |
| 2 | + | From lesson 22 | + | + |
| 3 | 1 | – | 2 | 3 |
| 4 | + (sg. and pl.) | 1 sg., 3 sg. m. f. | + | + |
| 5 | Only 1 ('4 pm') towards the end | 20 and 30 + sg. noun, time: 7 morning | 2 + 2 dual | 8 (1, 2,3 5, 10, 500, third, dual noun) |
| 6 | No explicit teaching | … (except one 'Group noun': *samak* 'fish') | 1 | No explicit teaching, (but occur: a piece of cheese, money, (a) glass) |
| 7 | + (from the 2nd vol.) | 'Near': sg. m. f., (from lesson 33) 'Far': sg. | 33 ('Near' and 'Far', m. and f., sg. and pl.) | 'Near': sg. m., f., dual 'Far': sg. m. |
| 8 | + 3 (f. sg.—*allati:*), 1 (m sg.—*allaði:*) | 1 *allaði:* (lesson 47) | 13 (sg. m., f. and m. pl.) + 3 (asyndetic relative clauses) | "Near": *allaði:* sg. m., also asyndetic relative clause) |
| 9 | + | 1 (sg.), 2 (m.), 3 (sg. m., f.), 3 (pl. m.) | + | + (past and imperfect in moods) |
| 10 | 17 (*an*, *kai* + subjunctive, *lam* + jussive, etc.) | 2 | 40 (*kai, ʔan, li-, lan, baʕda, du:na ʔan*+ subjunctive, *lam*+ jussive) | + (*li* + subjunctive, *lam* + jussive, verbs + *ʔan*) |
| 11 | 7 | 2 (*ka:na… ʔan taɣsila, badaʔu yataħa:daθu:na*) | 22 (*sˤa:ra, badaʔa, ka:na, ra:ħa, yumkinu ʔan, ʔuri:du, ʔuħibbu, xa:fa, istatˤa:ʕa, ʔasˤbaħa, xatˤara laha* :…) | + (*ʔaxaða, sˤa:ra, ka:da, dʒaʕala, ʔar:ada, yumkinu* etc.) |
| 12 | 15 (verb, noun, pronoun adjective) | – | 10 (verbs, noun, pronouns) | nouns, verbs, adjective |
| 13 | 11 (presentation, with pronouns, after verbs etc.) | 1 | 22 (*ʔanna*+pronoun, after verb, *bi+ʔanna,* verb+*ʔinna,* adjective+*ʔanna, la: ʃakka*+ʔanna) | 13 (in various structures: verbs, particles, etc.) |
| 14 | 11 | 3 | 28 | 18 |
| 15a | + From the beginning | From lesson 26 | + From the beginning | + From the beginning |
| 15b | + From the beginning | In lesson 23, 25, 29 | + From the beginning | + From the beginning |
| 16a | 4 | – | 5 | – |
| 16b | 6 | – | 3 (+2 *ma: ʔafʕala*) | 3 |
| 17 | 4 (phrases, not clauses) | – | 19 | 20 |

Category numbers reflect the category numbers in Table 12.1; '+' indicates presence of a category; '–' indicates the lack of a category. The slots present comments about the occurrence of the category: numbers in the slots indicate frequency of occurrences of the category per book; bracketed numbers and words in the slots are examples and explanations of the category, sometimes in Arabic with English translation; *sg.* singular, *m.* masculine, *f.* feminine, *pl.* plural.

**Table 12.3** Summary of present findings in the higher grades (4th, 8th and 11th)

| Book / Category | ʔana ʔaqra'u – ʔana ʔufakkiru (4th grade) | Al-dʒadi:d (8th grade) | Al-dʒadi:d (11th grade) |
|---|---|---|---|
| 1 | + From the beginning | + From the beginning | + From the beginning |
| 2 | + From the beginning | + From the beginning | + From the beginning |
| 3 | 3 | 7 | 3 |
| 4 | + From the beginning | + From the beginning | + From the beginning |
| 5 | +(4, 5, 40, first, dual) | 5 Nos.: (0.5, 1, 2, 15, dual) | 18 (Nos.: 73, dual, first, dates and Nos.: 1, 3, 5, 6, 10, 11, 16, 24, 31, 46, 55, 160, 900, 4883, 1988) |
| 6 | 3 | – | 5 |
| 7 | 6 ('Near' sg. m.); 3 (sg. f.); 5 ('far' ms. sg.) | 11 ('Near' sg, m.) 3 (f), 2 (dual: 1 m., 1 f.), 1 (pl. m.); ('Far': 2(sg.m.), 1 (f.) | 9: 'Near': 3 sg.m., 2 sg. f., 1 pl. m. 'Far': 3 sg. m. |
| 8 | 1 (sg. f.) | 6: (m. sg.) 4, (sg.) 12 (f.) dual 1; (indefinite relative clause) | 4 (Indefinite relative clauses) |
| 9 | + | + | + |
| 10 | 20 *(ʔan, ħatta:, li-, tastatˤi:ʕu*+subj.) 10 (*lam*+subj.) | 10 (*yaku:nu, li-, ʔan min baʕdi ʕan+subj.,man, ħaytuma:*+jussive) | 9: 4 (l*am)*, 1 (*li-*), (+ madʒzu:m), *ʔan* 4 |
| 11 | 8 *(ʔaxaða, ðalla, ka:na, badaʔa, ibtadaʔa, ʔasˤbaħa, labiθa*+impf.;*ʔuħibbu, ʔardʒu:+ʔan*) | 7 (*ka:na, ʔiyya:ka, yadʒibu, yuħsanu, yanbaγi:, yatawadʒdʒabu, ʔaxada, la: budda*.) | 3: 2 (*ka:na)*, 1 (ʔaxaða+impf. Verb). |
| 12 | 16 (verbs, nouns, pronouns, adjectives) | 9 (nouns, pronouns) | 2 |
| 13 | 16: 9 (*ʔanna)*, 3 (*ʔinna*), 2 (*liʔanna*), 2 (*la:kinna*) | 1 (*ʔanna*),<br>2 (*ʔinna*) | 4 (*ʔanna*), 1 (*ʔinna*)*,* 1 (*ʔinnama*) |
| 14 | 17 | 18: 10 (not verbs preceding *ʔan*) 8 (with verbs) | 6 |
| 15a | + (From the beginning) | + (From the beginning) | + (From the beginning) |
| 15b | + (From the beginning) | + (From the beginning) | + (From the beginning) |
| 16a | 9 | 1 | 4 |
| 16b | 5 | 1 | 4 |
| 17 | 13 (phrases and clauses) | 5 | 9 (phrases and clauses) |

Category numbers reflect the category numbers in Table 12.1; + indicates presence of a category; '–' indicates the lack of a category. The slots present comments about the occurrence of the category: numbers in the slots indicate number of occurrences of the category per book; bracketed numbers and words in the slots are examples and explanations of the category, sometimes in Arabic with English translation; *sg.* singular, *m.* masculine, *f.* feminine, *pl.* plural

**Table 12.4** Summary of relevant findings. (Adapted from Rosenhouse and Shehadi (1986, p. 270))

| Book / Category | Kita:bi: al-ʔawwal Grade 1 | Naqraʔu wa-nalʕabu Grade 1 | Al-muʃawwiq Grade 1 | Al-riya:dˤ Grade 2 | Al-qira:ʔa al-dʒadi:da Grade 2 |
|---|---|---|---|---|---|
| 1 | From p. 27 | From p. 36 | From the beginning | From the beginning | From the beginning |
| 2 | From lesson 2 | From p. 1 | From the beginning | From the beginning | From the beginning |
| 3 | – | – | 4 | – | 7 (including 3 with superlatives) |
| 4 | 1,3 sg. and pl. | 1(sg.) & 1 (pl.)., 3 (m,.f.), 2 (s.m.) | 1 (sg.), 3 (sg.), 3 (pl.), 3.(dual) | All but 2 (f. sg.) | All but 2 (f. sg., pl.) |
| 5 | 1 only (3 girls) | 15 occurrences | 14 occurrences | 4 occurrences | 1 only(3 men) |
| 6 | 6, intended teaching | No intended pairs | 1 pair | 1 pair | No intended pairs |
| 7 | 3 ('Near' m., f.) | 2 ('Near' m., f.) | 1 ('Near' m), 2 ('Far' m.) | 2 ('Far' m.) | 1 ('Near' m.), 1 ('Far', m.) |
| 8 | 1 m.sg. | – | 1 m.sg. | – | – |
| 9 (not taught) | | | | | |
| 10 | – | 3 | 4 | 4 | 5 |
| 11 | 5 | 1 | 5 | 7 | 5 |
| 12 (not taught) | | | | | |
| 13 | 1 | – | 1 | – | 1 (*ʔinna*), 2 (*ʔanna*) |
| 14 (not taught) | – | – | – | – | – |
| 15a, 15b | from p. 27 | From p. 50 | From the beginning | From the beginning | From the beginning |
| 16a (not taught) | | | | | |
| 16b | – | – | 1 | – | 4 |
| 17 | – | – | 5 | 1 | 10 |

Category numbers reflect the category numbers in Table 12.1; + indicates presence of a category; – indicates the lack of a category. The slots present comments about the occurrence of the category: numbers in the slots indicate number of occurrences of the category per book; bracketed numbers and words in the slots are examples and explanations of the category, sometimes in Arabic with English translation; *sg.* singular, *m.* masculine, *f.* feminine, *pl.* plural

**Table 12.5** Summary of frequency of occurrence of parts of speech in 'new' books for 1st and 2nd grades in this study

| Vocabulary / Book | Nouns | Verbs | Adjectives | Particles, misc. |
|---|---|---|---|---|
| Al-ra:ʔid | | | | |
| Grade 1 | 5 | 13 | 1 | 3 |
| Al ʕarabiyya luʕatuna: | | | | |
| Grade 1 part 1 | 7 | 21 | 1 | 5 |
| Grade 1 part 2 | 30 | 47 | 9 | 15 |
| Al-ra:ʔid | | | | |
| Grade 2 | 34 | 54 | 11 | 9 |
| Al ʕarabiyya luɤatuna: | | | | |
| Grade 2 | 61 | 60 | 15 | 14 |
| *ʔana:ʔaqraʔu- ʔana: ʔufakkiru* | | | | |
| Grade 4 | 34 | 34 | 12 | 8 |
| *Al-dʒadi:d* | | | | |
| Grade 8 | 51 | 61 | 8 | 4 |
| *Al-dʒadi:d* | | | | |
| Grade 11 | 41 | 37 | 12 | 5 |

(4) Suffixed personal pronouns. In MSA personal pronouns and their bound forms (when suffixed to a noun or a verb) include 3 persons (1st, 2nd, 3rd), two genders (masculine, feminine) and three numbers (singular, dual, plural). For example: *baiti:* ‘my house’, *baituhu* ‘his house’, *baituha:* ‘her house’ *baituhuma:* ‘the house of the two of them’. Suffixed personal pronouns in CA are somewhat similar to those of MSA, though they are morpho-phonologically different. Also, the dual number marking has been lost.

(5) Numerals. Numbers in MSA differ morphologically and syntactically from CA numbers, although the lexical root consonants are almost identical. Cf.: MSA: *θala:θat*$^{u}$*ʔawla:d*$^{in}$ CA: *talat iwla:d* ‘3 children’; MSA: *θama:niyat*$^{a}$ *ʕaʃar*$^{a}$ *walad*$^{an}$ CA: *tamantaʕʃar walad* ’18 children’; MSA: *miʔata: walad*$^{in}$ CA: *mite:n walad* ‘200 children’.

(6) Unit nouns: unit nouns refer to individual items of a mass noun in both MSA and CA. Morphologically they are related so that [a mass noun + suffixed/–a/] makes a unit noun; thus:

*MSA and CA: tuffa:ħ + a -→ tuffa:ħa*

‘apples’ ‘(an) apple’

(7) Demonstratives (Deictics). In MSA deictic pronouns are inflected for number and gender, including dual forms (*ha:ða:ni ’these two masc’. ha:ta:ni ’these two fem’.*). In CA, the dual is lost, and plural is used instead. See the following examples (CA as used in Israel):

| | | | | | |
|---|---|---|---|---|---|
| MSA | *ha:ða* | *ha:ðihi* | *ha:ða:ni* | *ha:ta:ni* | *ha:ʔula:ʔi* |
| CA: | *ha:da* | *ha:di* | *had:ol* | *had:ol* | *had:ol* |
| ‘this | m.s. | f.s. | dual (f., m.) | | pl.(f., m.)’ |

(8) Relative particles. CA has a single relative pronoun/illi/ ‘that, which’. The MSA relative pronoun *allaði*: ‘that, which’ is inflected for gender and number as follows:

| | | | | | | |
|---|---|---|---|---|---|---|
| MSA: | *al-laði:* | *al-lati:* | *al-laði:na* | *al-lawa:ti:* | *allaða:ni:* | *al-lata:ni:* |
| | that m. | that f. | that pl.m. | that pl. f. | that dual (m.) | that dual (f.) |

(9) Arabic verbs are conjugated for tense, person, gender and number. The MSA and CA verb systems are basically similar but differ in many details. See, e.g.:

| | | | | |
|---|---|---|---|---|
| MSA | *katabtu* | *kataba:* | *yaktub*$^{u}$ | *taktubu:na* |
| CA | *katabt* | *katabu* | *b-yuktub* | *b-tuktubu* |
| | ‘I wrote’ | ‘the 2 of them wrote’ | ‘he writes/is writing’ | ‘you pl.m. write/are writing’ |

(10) Subjunctive (*mansˁu:b*) and jussive (*madʒzu:m*) verb forms. CA does not distinguish these moods morphologically (by suffixes), but MSA subjunctive and jussive verb forms differ in their suffixed vowels from the indicative verb forms. The vowels are attached to the base form of the indicative, thus:

| Indicative | Subjunctive | Jussive |
|---|---|---|
| *yaktub*$^{u}$ | *yaktub*$^{a}$ | *yaktub* $^{\text{(no vowel)}}$ |
| ‘he writes/is writing’ | ‘that he writes’ | ‘(let him) write’ |

(11) Auxiliary + main verb phrases. In Arabic the auxiliary verb is conjugated to any tense and person while the main verb appears in the subjunctive mood in the appropriate person, and there are differences between MSA and CA in these forms. Thus, e.g.,

| | | |
|---|---|---|
| MSA | *badaʔa yaktub*$^{u}$ | *yuri:d*$^{u}$ *ʔan*[*] *yaktub*$^{a}$ |
| CA | *ṣ ā:r yuktub* | *biddo yuktub* |
| | ‘he began to write’ | ‘he wants to write’ |

[*]ʔan 'that' is used in MSA but not in CA.

(12) Dual agreement. As noted, a dual noun occurs mainly in MSA, where agreement rules require dualization of any syntactic member the head noun governs, whether verb, adjective, personal pronoun or relative pronoun. In CA only nouns take the dual suffix and syntactic agreement is usually marked by plural verb forms. Cf:

| | | | |
|---|---|---|---|
| MSA: | *ha:ða:ni* | *walada:ni* | *ʃa:ṭˁira:ni* |
| CA : | *hado:l* | *walade:n* | *ʃa:ṭˁri:n* |
| | ‘These-2 (are) | children-2 | diligent-2’ |

(13) The particles: *ʔinna, ʔanna*. These are MSA particles with rules that govern their respective use; in CA *ʔanna* does not exist and *ʔinna* is used instead. See the following examples:

| | | | | | | |
|---|---|---|---|---|---|---|
| MSA | *qa:la* | *ʔinnahu* | *fi: l-baiti* | *raʔaitu* | *ʔannahu* | *fi: l-baiti* |
| CA | *qa:l* | *inno* | *fi-l-be:t* | *šuft* | *inno* | *fi-l-be:t* |
| | ‘said (he) | that-he | (was) at home’ | ‘saw(I) | that-he{was) | at home’ |
| | ‘He said that he was at home’ | | | ‘I saw that he was at home’ | | |

(14) Verb + ʔan. In MSA verbs take the particle *ʔan* to mark the subjunctive mood (with the meaning of [to + infinitive] in English). This particle does not exist in CA and the structure of form 11 (see above) is used. Cf.:

MSA: *yuri:d*$^{u}$ *ʔan* *yaktub*$^{a}$ CA: *biddo* *yuktub*

'wants-he that will-write- he' 'wants -he will-write- he'

'he wants to write' 'he wants to write'

(15) Case endings. MSA, but not CA, distinguishes definite from indefinite nouns through a system of case endings. Three vowels /u, a, i/ mark nouns in the definite nominative, accusative and genitive cases, respectively; thus:

MSA *al-bait*$^{u}$ (nominative) *al-bait*$^{a}$ (accusative) *al-bait*$^{i}$ (genitive) 'the house'

(16) Elatives and superlatives. These structures use the same adjective pattern in MSA and CA, but syntactically MSA and CA differ. MSA has inflected forms for gender and number while CA uses only one form:

MSA *ʔakbar* *kubra:* *kubr*

'bigger m.sg., 'bigger, f.sg. 'bigger, common pl'.

CA *ʔakbar*

'bigger, all genders and numbers'

The pattern for superlatives is the same as for the elative in MSA and CA. The definite particle is prefixed to the elative form, e.g.: *al-ʔakbar* 'the biggest, m. sg'., *al-kubra:* 'the biggest, f. sg'. CA has again only one form, *al-ʔakbar* 'the biggest'.

(17) Circumstantial phrases and clauses. In both MSA and CA these structures exist, but with some differences in pattern and frequency. Cf.:

MSA: *qaʕada na:ʔiman* CA: *qaʕad na:yim*

'sat-he asleep' 'sat-he asleep'

MSA ð*ahaba* *(wa-huwa)** *yufakkiru* CA: *ra:ħ* *u-hu* *bifakker*

'walked-he (and-he) (is) thinking 'walked-he (and-he) (is) thinking

'he walked thinking' 'he walked thinking'

*The pronoun in the brackets is optional in MSA and obligatory in CA.

The structural elements described above were chosen since they were among the elements with highest frequency in the material (textbooks) used in Rosenhouse and Shehadi (1986).[12] Their occurrence rates can thus be compared with our present study.[13]

Clearly, in addition to the language of the textbooks, the students acquire MSA by reading, writing and exercising many other texts in the humanities and sciences lessons. Thus, they learn much more than the limited selection we use in this study. But since we are interested here in features-per-grade, this sample was thought to be adequate and to enable an examination of the questions we address.

To study these features we studied the texts in the above books, noted the selected grammatical categories as they occurred in each book and in which lessons, and tabulated the features that occurred (Tables 12.2 and 12.3). This method is similar to the one used in Rosenhouse and Shehadi (1986) and therefore enabled us later to compare between the ones used there and in the presently examined books. We focus on the occurrences of the noted linguistic elements and what they can teach us, but as most of the occurrences per category were few, statistical analysis was not possible.[14]

## 12.3 Findings

### *12.3.1 First Grade Books*

**The book *al-ʕarabiyya luɣatuna:* part 1**. This book is arranged in four chapters: in class, on the beach, at the zoo and in the playroom. The first part begins with the letters (Makhoul 2010a, b, pp. 4–33). The chapters contain reading texts which, as the exercises indicate, are used for teaching new words and grammatical elements. The chapters also contain texts for listening comprehension with more grammatical structures and MSA vocabulary. The texts for listening comprehension are heard aloud in class from a digital recorder; these texts are also written in the book, so that after or simultaneously with the texts students can read them and do the exercises.

This method of teaching MSA through reading comprehension and listening comprehension texts goes on in the second volume, part 2, of *al-ʕarabiyya luɣatuna:* for the 1st grade which includes more texts and exercises. Altogether there are 26 texts, six of which are for listening comprehension.

[12] This was also the picture in Rosenhouse (1990), which studied Classical and modern Arabic literature.

[13] We do not discuss the basic negation particles *ma:* or *la:* which are shared by MSA and CA, although MSA and CA differ in their syntax. We will note only more "specifically MSA" forms, such as *lam* which is used only in MSA and not in CA (i.e., being non-cognate lexical items), if they occur.

[14] Neither do we discuss pedagogical issues which are usually discussed in the context of MSA teaching and literacy acquisition (see Wahba 2007), such as the teacher's role before and after reading a new text. For instance, usually the teacher first discusses the topic orally and explains some new words and notions. Then, the text is read and exercises on it are conducted both in class and as homework.

Our analysis of the texts in this book revealed use of the following grammatical elements: definition (No. 1[15]), construct state (No. 2), bound pronouns (No. 4), a form of the relative pronouns (No. 8), demonstrative particles (No. 7) and verb forms in independent and phrase structures (No. 9, 10). In addition, we found more advanced forms such as dual nouns (No. 12) and bound pronouns (No. 4) suffixed to a verb or to a preposition, the subordinating conjunctions *ʔinna* and *ʔanna* (No. 13), special superlative adjectives (No. 16b, e.g., the best[16] etc.), a circumstantial phrase (No. 17), and several function words (e.g., *qad* and *laqad* 'already' (governing a past tense verbs), *ʔin* 'if', *laisa* '(there is) not'), and nominal sentences (i.e., with varied verb-less predicate patterns). (See Table 12.2 for frequency of occurrence).

***ar-ra:ʔid* for grade 1, part 2**.[17] This book (which begins with Chap. 5) includes three parts: "I am reading", "I can read" and "Reading freely". Chapter 5 begins with some reading conventions: the gemination mark *šadda*, the *madda* and the glottal stop *hamza*, as well as the target features: definite article with sun letters (No. 1), word final definite and indefinite case endings (No. 15a, 15b). Among the grammatical subjects covered in the texts themselves we found: definition (No. 1), the genitive structure (No. 2), bound pronouns (No. 4), a singular (sg.) relative pronoun (No. 8), a few numerals with their head nouns (No. 5), and some conjugated verb forms (No. 9). The verbs occur in the past tense, the imperfect, the imperative, and even a passive form occurs.[18] Verb phrases with various particles governing the subjunctive and jussive modes also occur (see Table 12.2). The non-CA-cognate MSA vocabulary[19] is smaller than in *al-ʕarabiyya luɣatuna:* which means that the children are exposed to more MSA vocabulary in the latter book. (See Table 12.2 for frequency of occurrence.)

## *12.3.2 Second Grade Books*

For grade 2 we chose to study two books from the above series: *al-ʔarabiyya luɣatuna: for grade 2* (2010) and *ar-ra:ʔid for grade 2 (1992)*. This enables us

[15] The numbers 1–17 refer to the studied elements presented in Table 12.1 and detailed above.

[16] The form of this MSA adjective 'good' *xair* remains unchanged, unlike regular adjectives such as *al-ʔ*akbar 'the biggest'.

[17] Part 1 of this book teaches the alphabet, and is usually used in kindergartens related to the school; to be able to compare a book of the ***al-ʕarabiyya luɣatuna:*** series we therefore used part 2.

[18] This form is also called 'internal (or apophonic) passive', since it involves modifying the vowels of the active verb pattern. Cf. *kataba* '(he) wrote' vs. *kutiba* '(it) was written'. It is mentioned here because it does not exist in sedentary CA dialects in Israel.

[19] Cognate words are related to CA and MSA lexical items in being derived from the same consonantal root. e.g., MSA: *kita:b* CA: *kta:b* 'book'. They often differ in their morphological patterns, however, as in MA: *masaka* CA: *misek* '(he) held, seized'. Non-cognate lexical elements differ in both root and pattern. For example, cf. MSA: qasˁsˁa CA: ħaka 'tell (a story)'. These structural differences are expected to affect MSA acquisition for students who are native speakers of CA.

to note the linguistic progress in each series and each of these two grades (see Table 12.2 for frequency of occurrence).

***al-ʕarabiyya luɣatuna:* for grade 2.** This is a long book, with 205 pages. The book is written in colored fonts and is full of pictures, some of which are intended to be cut out and pasted next to certain texts as exercises. Whole pages are marked for 'listening comprehension', and these are heard in class, but unlike the book for 1st grade they are not printed in the book. Two types of texts are used: narrative and informational/expository.

The vocabulary in the book contains a larger number of non-CA-cognate words than the 1st grade books, and relatively more than in *al-ra:ʔid* for the 2nd grade. (See Table 12.5 for numbers of occurrences per category and book.) An interesting aspect of the texts is that they refer not only to traditional subjects such as the child's environment in town and the countryside or hygiene, but also to modern objects such as the cellular phone, the internet, robots and playful 'magic' (i.e., physics experiments). These topics involve new vocabulary which is usually coined in MSA and is not cognate to the CA vocabulary.

**A*r-ra:ʔid* for grade 2.** Like the volume for the 1st grade, this volume contains texts without exercises, which are presented and filled in by the students in a separate work book. The 55 texts in this volume are usually not longer than one page, and the opposite page always shows a big color illustration relevant to the text. About a third of the texts are poems and the rest are prose texts. The general lexical level is rather high, but the grammatical elements are mostly basic, i.e., using the definite article, definite and indefinite case endings (No. 15), the genitive structure (No. 2), and verb forms (No. 9), which are common to MSA and CA. Certain genuine MSA structures (which are not shared with CA) occur infrequently; such forms include dual nouns (No. 12), *ʔinna/ʔanna* structures (No. 13), exclamitics of the type [*ma: ʔafʕ*ala] e.g., *ma: ʔakbara* 'how big', verbs in subjunctive and jussive forms (No. 10), circumstantial phrases and clauses (No. 17), conditional clauses, lexical items of adjectives, verbs, etc. The poems use a poetic vocabulary, i.e., an elevated lexical register, but the grammatical forms are very basic: the verbs are mainly in the past tense, subjunctive forms hardly occur, and because the sentences are short and simple, few relative pronouns and clauses are used. In the prose texts, MSA words may be non-CA-cognate and therefore 'difficult', but they are more frequent in the prose texts of the book than in the poems. A glossary appears at the end of the book to explain the 'difficult' words.

### *12.3.3 The Fourth Grade Book*

From among the 4th grade books we examined the book *ʔana ʔaqraʔ*$^{u}$ – *ʔana ʔufakkir*$^{u}$ (Habib Alla and Khatib 1991). As its title suggests, its main goal is to improve reading skills and reading comprehension.[20] The book therefore includes mostly short texts (three of which are poems) and numerous exercises aimed at enhancing cognitive skills through the analysis of grammatical structures and lexical patterns.

[20] Makhoul (2011) notes that in fact all the textbooks aim at reading comprehension.

The grammatical categories in this book yield a picture which somewhat resembles that of *ʔal-ʕarabiyya luɣatuna:* for grade 2. There are more subjunctive and jussive verb forms (No. 10) than in the earlier grade books, as well as relatively many elative and superlative adjectives (No. 16a, 16b); demonstratives (No. 7) occur in the texts but not in large numbers, and relative pronouns (No. 8) are few (see Table 12.2). But there are also structures which do not appear in the 1st and 2nd grade books: indefinite relative clauses (which do not take the relative pronoun), a considerable number of circumstantial phrases (No. 17), dual noun forms (No. 12), many adjectives, verbs and prepositional phrases and clauses of various structures. We also find here several structures using the particle *ma:* for negation of verbs, nouns and adjectives, and the particle *qad* governing the imperfect verb[21] (see Table 12.2).

The vocabulary in the different texts includes varying numbers of non-CA-cognate MSA words. It is interesting to note that most of these words are verbs, i.e., there are more non-CA-cognate verbs than nouns in this book (other non-CA-cognate lexical items in the book are nouns, adjectives, mostly in the elative form, and particles).

### *12.3.4 The Eighth Grade Book*

From the 7th grade on, the series entitled (for abbreviation) *al-dʒadi:d*, i.e., 'The Innovations' is used for language teaching in many Arabic-speaking schools in Israel. From this series, we used the book for the 8th grade (Abu Khadra et al. 2000). This is explicitly a grammar book, with a MSA grammatical term as the title of each chapter. The subjects in the book include noun structures such as emphasizing devices, apposition, demonstratives, relative pronouns, and interrogatives, as well as basic and derived verb forms and verbal nouns. These grammatical structures are not very frequent in MSA, but they are taught because they make part of the MSA grammatical system. The definition and explanation of each topic are longer (in number of words and sentences) than in the books of the elementary school grades discussed above. The 8th grade textbook also quotes explanations from Classical Arabic grammars. Visually, too, this book differs from books of the lower grades: it is totally devoid of pictures, though certain text sections or words are printed in red, green or yellow.

Each grammatical topic (which may be sequentially studied in more than one lesson) follows the pattern already seen in the books of the lower grades: a relatively short text serves to demonstrate a specific language form. This text is followed by a discussion, explanations and comments which precede exercises of different types for various grammatical goals. Such discussions are not found in the elementary level books.

[21] This structure signifies a potential but uncertain event. This is a new role for this word which also governs verbs in the past tense, yielding a past perfect tense, and in this role occurs in 2nd grade books (see Sect. 3.1 above, p. 14).

The vocabulary in the texts is clearly MSA. Due to the partly philosophical or abstract contents of the texts there are few CA-cognate words (which usually refer to commonplace activities) and most of the words belong to the high register. The texts include MSA topics that are not usually discussed or expressed in CA, such as Koran verses, classical sayings or maxims and passages from “belle lettre” works, e.g., Brutus’ famous speech about Julius Caesar from Shakespeare’s *Julius Caesar* and an excerpt from Mikhaʔil Nuʕaima’s autobiography *sabʕu:n* (‘70’). In some cases, the MSA vocabulary is CA-cognate, but the associated meanings often differ from those of the CA meanings. See, for example, MSA *yatarattabu* ‘(it) will be required’ vs. CA ‘(it) be will arranged, put in order’, *iða:* MSA ‘lo, there was’ as well as ‘if’, vs. CA ‘if’ (only) both from the *sabʕu:n* excerpt (p. 67). This structure expands the students’ semantic fields and extends the meaning of the lexemes, whether CA-cognate or not, which necessitates intentional (explicit) learning. In addition, Classical Arabic style effects are created by the use of relatively infrequent MSA grammatical structures, such as the internal accusative,[22] the ‘false genitive’ (No. 3 in Table 12.1), verb phrases with various auxiliary and main verbs, as well as stylistic aspects which include numerous adjectives, verbal nouns (*maṣdar*), rare nominal word-patterns, etc.[23] (See Tables 12.2 and 12.3).

### *12.3.5 The Eleventh Grade Book*

For this grade also we examined a volume of the *al-dʒadi:d* series. Though the copy we used was marked ‘experimental edition’ secondary schools have been using it since it appeared in 1989. The structure of this book and the method (texts, explanations, exercises) are very similar to those of the 8th grade, but the style and vocabulary of the texts reflect Classical Arabic more than MSA: the texts in this volume are poems written in the Classical period of the Islamic Arabic culture, prose texts from the beginning of the twentieth century, or excerpts of religious Muslim and Christian traditions—all using eloquent rhetorical style, i.e. elevated Classical style.

The grammatical topics of the book include emphasis (*tawki:d*), specification (*tamyi:z*), circumstantial clauses, apposition (presented in a manner that differs from that used in lower grades), numerals (ordinal and cardinal numbers, dates, etc.) and diptote nouns (i.e., nouns that do not take the indefinite case marking, *tanwi:n*). These structures (except for the numerals) are relatively infrequent in MSA, but they are traditionally important in MSA grammar. The special properties of this book are clear when we compare the findings in Table 12.3 with those of the lower grades in Table 12.2. Table 12.3 shows that in addition to certain frequent ‘basic’ elements, others are hardly used while some ‘rare’ structures occur considerably frequently.

[22] ‘The ‘internal object’ or ‘cognate accusative’ (*mafʕu:l muṭlaq*) is the structure where ‘an action is intensified through use of a verbal noun cognate with the verb (i.e., derived of the same root)’ (Ryding 2005, p. 174).

[23] Rosenhouse’s (1990) analysis also reflects this kind of text style.

It is noteworthy that one of the texts in this book is only two lines long, whereas other texts are between four lines and over a page (e.g., the long text demonstrating numerals). This fluctuation suggests that the texts serve mainly to demonstrate the linguistic element under discussion.

This approach contrasts with that of the elementary grade books, where MSA is acquired implicitly through reading and writing, along with the textual contents and vocabulary, as noted above. The 'meta-linguistic approach' in the higher grades (above the 4th grade) aims at explicit teaching of MSA/Classical Arabic grammar, in special-purpose grammar sections, while textbooks of other subjects use implicit learning of MSA, without discussing grammatical aspects directly.[24]

## 12.4 Discussion

Our two main research questions related to formal and practical issues of MSA acquisition. Question 1 asked about the MSA structural features found in the textbooks and how they varied from CA (assuming that such differences might cause students' difficulties in the MSA acquisition process reported in the literature mentioned in section 1). Question 2 asked whether the (grammatical and lexical) differences between MSA and CA as reflected in the textbooks varied in the different grades. Our main findings pointed at the following issues:

a. Most of the studied structures are shared by MSA and CA, but their realization and distribution is not identical. The differences between them in this respect become more variegated, fluctuating and uneven in succeeding grades. The examination of vocabulary has also shown that the quantity of MSA items is growing from 1st grade on, in particular in the books above grade four.
b. In the 1st grade books, both nominal and verbal sentences are used, with nominal sentences appearing in lessons preceding those using verbal sentences.
c. Linguistic issues are taught implicitly in the lower grades, in contrast with the explicit method applied in the higher grades. We found several topics that were first implicitly and then explicitly taught: cases, false genitive, *ʔinna, ʔanna* and related particles, verb forms, verbal structures with *lam, ʔan*, etc., numerals, deictics and relative pronouns.
d. Morpho-syntactically, some structures, neither linguistically simple nor very frequent, are already used in the 1st grade books. See for example, the 'false genitive' which occurs once in 1st grade books, 5 times in 2nd grade books, three times in the 4th grade book, 7 times in the 8th grade book and 3 times in the 11th grade book.
e. In general, we saw that the higher the grade, the higher the register of the studied vocabulary. Yet, the vocabulary of *al-ʕarabiyya luɣatuna:* was relatively higher than that of the other 1st and 2nd grade books.

[24] We do not discuss here other school subjects and their language, but this statement is based on books of e.g., biology and mathematics which we have perused.

f. Deictics were fewer in the lower grade books compared to the higher grade ones. This has probably to do with the fact that deictics are generally considered to reflect a less advanced language acquisition stage (Rosenhouse et al. 1997, p. 179) and are therefore avoided here.
g. Relative pronouns occurred in the studied books but generally not frequently. This may be related to the fact that relative pronouns occur in complex sentences, which are used less often in the lower grade books. In contrast, nominal and verbal sentences, which are common to MSA and CA, though they usually differ morphophonetically, occur even in 1st grade books.
h. A feature that distinguishes CA from MSA is case marking; it is obligatory in MSA grammar but is not used at all in CA. We found frequently occurring attention, implicit and explicit, to this linguistic feature in the textbooks.
i. Numerals also differ between CA and MSA, and are explicitly taught in the 11th grade book we studied, though various cardinal and ordinal numbers appear (i.e., are implicitly learnt) in the lower grade books.

The findings summarized above reveal many differences among the books of the different grades. The results also show remarkable differences between the currently studied books, so-called 'new' books and the 'old' books studied in Rosenhouse and Shehadi (1986).

### *12.4.1 A Comparison of 'Old' and 'New' Books*

The books we examined here have all appeared later than those studied in Rosenhouse and Shehadi (1986). That study used books for the 1st and 2nd grades which appeared in the 1970s. A comparison between the two sets of books, with a time gap of about 20–30 years between the 'old' and the 'new' books, reveals trends indicating modernizing activity, methodology and material in the teaching of MSA in Israel, following the general progress of educational efforts in Israel and general development of psycholinguistic and educational research internationally and in Israel. This period yielded, among others, the Arabic language teaching internet site of the Ministry of Education, and a new Arabic language teaching curriculum (2009). Nonetheless, MSA grammar has hardly changed during this period, so the same grammatical elements are taught now as in the past.

The present goal of the study reported in this chapter is similar to that of Rosenhouse and Shehadi (1986); even though our research questions and method (cf. Sect. 12.2) differ to some extent from those in that paper (Rosenhouse and Shehadi 1986). In this section we will attempt to examine differences between the 'old' and the 'new' books and see how these differences are manifest in the textbooks.[25] The comparison is limited to 1st and 2nd grade books because only those textbooks were studied in Rosenhouse and Shehadi (1986).

[25] Teaching the new books requires modifications in teachers' pedagogical methodology, but this issue is not part of the present study.

With these limitations in mind we compare the findings described in Sect. 12.3 concerning the 'new' books with those of the 'old' ones. Our comparison includes the 17 elements mentioned in Sect. 12.2, from among those which were studied in the 1986 paper. Table 12.4, adapted from Table 12.3 in that paper, presents these features.

Our comparison shows that in both the 'new' and 'old' books the number of occurrences (tokens) of the examined features is larger in grade 2 than in grade 1, though this increase is not equal and does not show the same rate for all the features: from the very beginning, certain features show steadily growing numbers of occurrences than other features; these are, e.g., definition and correct use of "sun letters" (No. 1), the genitive structure (No. 2), and suffixed personal pronouns (No. 4). Other features such as the false genitive (No. 3) hardly occur in these books, even in the higher grades (as examined in the 'new' books). Some other features, in particular the various verb phrases in the subjunctive mood or with the particles *ʔinna, ʔanna*, *ʔan* (No. 9, 10, 11, 13, 14) seem to increase immensely after a slow start in the first pages of the books (see Table 12.4).

Another finding (not reflected in the Tables above) is that certain lessons were found to be dense with linguistic features, while other lessons focus on few (new) structures with the rest of the text using a variety of other simpler forms. This trend is similar in both the 'old' and the 'new' books (cf. Tables 12.2 and 12.4).

In addition to the features listed in Tables 12.2 and 12.4, we noticed in most of the 1st and 2nd grade books (as well as in books of higher grades) the repeated occurrence of many non-CA-cognate particles and discourse markers, e.g., *qad* 'already; maybe'*, laqad* 'already', *lam* 'not' (marking past actions, used with the jussive), *lan* 'not ever' (used with the subjunctive), *la: σʃakka* 'no doubt', *la: budda* 'no doubt, necessarily'. Such words occur relatively often in the MSA texts, though without any explicit discussion of their linguistic-communicative functions or structural properties (at least not in the studied books).

The comparison also showed that vocabulary differences are not less prevalent than the grammatical features of MSA-CA differences. Rosenhouse and Shehadi (1986) studied vocabulary by targeting lexical categories such as word patterns used in deriving nouns and verbs. One of our present goals in examining the vocabulary in the textbooks (cf. Tables 12.2, 12.3 and 12.4) is, however, to distinguish MSA and CA cognate vs. non-cognate lexical items. A direct comparison with Rosenhouse and Shehadi (1986) is difficult, because the vocabulary makeup (contents) of the texts in the 'old' and 'new' books is different. For example, the internet and cellular phones (taught in *al-ʕarabiyya luɣatuna:* for 2nd grade) could not have appeared in the 'old' books simply because these objects did not exist in the 1970s–1980s (at least not in Israel). Values of ecology, nature preservation and animal consideration surfaced likewise only towards the end of the 2nd millennium. Therefore, Table 12.5 summarizes the frequency of non-CA-cognate MSA words in the 'new' books only, as based on a dictionary look-up, in order to give some idea of the structure and development of vocabulary in these books. Generally, the overall impression is that the quantity and ratio of non-CA-cognate MSA vocabulary (nouns and verbs) is smaller in the lower grades than in the higher ones. A scrutiny of the lexical items (only in 1st and 2nd grade books) also shows larger numbers of many modern and high-tech nouns, as well as derived verbal patterns, e.g., passive forms in the verb pattern inCaCaCa, as well as verb pattern iCtaCaCa and verb pattern istaCCaCa.[26]

## 12.5 Conclusion

We have examined a sample of Arabic language textbooks used in Israeli schools for native Arabic-speaking students. As expected, grammatical and lexical differences have been found between the 'new' books for the lower and higher grades as well as between the 'new' and 'old' books. Here are our main conclusions:

Book formatting (e.g., page size, total page number, letter size, font forms, and colorful illustrations) as well as linguistic structure, content (topics) and exercises differ between the 'new' books in the various grades, so that the books for 1st and 2nd grades contain more color pictures and shorter texts than the books of the higher classes.

The texts in *Al-ʕarabiyya luɣatuna:* are varied in length and exercises, including in addition to reading texts, specific texts for 'listening comprehension', which are read aloud by the teacher or heard from a recording device at class. Neither *ar-ra:ʔid* nor higher grade books adopt this method.

A feature common to all the lower grade books (both 'old' and 'new' ones) is that, MSA grammar is taught mainly implicitly and functionally, while in the higher grades, grammar is taught explicitly, as reflected in the grammatical sections and the exercises. The frequency of the grammatical structures studied here varies across the different texts because some are more basic and necessary for MSA language use than others.[27]

Also, we should note the methodological split in MSA grammar teaching beginning in about 4th grade.[28] This split involves specific explicit and meta-linguistic attention to grammar in Arabic language lessons. Simultaneously, various other MSA language skills and the vocabulary of non-linguistic school subjects are enriched (in other school books).

The manner of curriculum design (first implicit and later increasingly more explicit) is in line with the new Ministry of Education instructions to teachers (Karayani n.d.). Though it partly continues earlier goals of MSA language teaching, it reveals a more 'modern' approach.

26 In these three verb patterns, C stands for a root consonant.

27 This point has hardly been investigated, but cf. Badry-Zalami (2007) and Wahba (2007).

28 We say "at least" because we have not checked the relevant book(s) of the 3rd grade. The author of *al-ʕarabiyya luɣatuna:* has in the mean time published the 3rd grade book of the series (Makhoul 2013).

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# Chapter 13
# The Development of ADAT (Arabic Diglossic Knowledge and Awareness Test): A theoretical and clinical overview

**Reem Khamis-Dakwar and Baha Makhoul**

**Abstract** Children growing up in an Arabic-speaking community must learn both a vernacular language variety (Spoken Arabic or SA) used in everyday life, and a standard language variety (Modern Standard Arabic or MSA) used for writing and formal language functions. A diglossic situation such as this poses special challenges for professionals engaged in the assessment of children's emergent learning skills because of issues related to the simultaneous acquisition of two distinct linguistic systems. Most, if not all available Arabic language and reading assessment tools test children only in MSA. In contrast with this traditional stance, recent approaches have proposed evaluation in SA only, or in both MSA and SA, depending on the modality: written tasks versus spoken tasks. In this chapter, we will outline the development of "ADAT", the Arabic Diglossic Knowledge and Awareness Test, which was designed to assess diglossic and metadiglossic knowledge at the elementary school level in the two language varieties of Arabic (MSA and SA) and across all language domains.

**Keywords** Arabic · Diglossia · Emergent literacy · Language acquisition · Language assessment · Language-literacy connections · Speech language pathologist · Speech disorder · Palestinian Arabic · language development

## 13.1 Introduction

The study of reading development and reading disabilities has been predominantly focused on findings from British and American research (Miles 2000). There are two main challenges in applying findings from these studies to the understanding and assessment of reading cross-linguistically. The first challenge is whether the

R. Khamis-Dakwar (✉)
Department of communication Sciences and Disorders, Adelphi University,
1 South Avenue, Hy-Weinberg Center, Room 136, Garden City NY 11530, USA
e-mail: Khamis-Dakwar@adelphi.edu

B. Makhoul
Haifa University, Haifa, Israel
e-mail: baham@cet.ac.il
The Centre for Educational Technology (CET), Tel-Aviv, Israel

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phenotypic patterns of children or adults with reading disability demonstrate a similar manifestation across languages. Specific deficiencies may not affect reading in the same way in different languages. For example, since Spanish has a transparent orthography, children with a reading disability would not necessarily demonstrate phonological reading difficulties as might be more evident in English readers. English written language holds more exceptions with regard to grapheme-to-phoneme correspondence rules, therefore these phonological decoding difficulties seen in English readers with a disability may not surface in reading Spanish or other transparent languages. Indeed, several studies show that valid measures of phonological deficiencies in English fall short of identifying phonological processing deficits in Spanish, and that measuring phonological processing deficiencies in transparent languages is better diagnosed through pseudo-word reading (e.g. Gonzalez and Hernandez 2000), reading slowness (e.g. Zoccolotti et al. 1999), rapid naming and phonological memory deficits (e.g. Landerl and Wimmer 2000).

The second challenge relates to the interpretation of the performances of individuals with reading disabilities in different languages. For example, several studies of Italian, French, and Spanish provide evidence in support of the phonological deficit model for dyslexia (Zoccolotti et al. 1999) whereas studies of German provide evidence against it (Landerl and Wimmer 2000) supporting the double deficit hypothesis (Wimmer et al. 2000).

Reliance on a framework that assumes a match between written and oral linguistic systems may lead to conclusions that are not applicable to different sociolinguistic situations. Such situations would include the case of native vernacular Arabic speakers learning to read and write in MSA; or native speakers of African American English (AAE) learning to read and write in Standard American English (SAE) (see Myhill, Chap. 9). There is a scarcity of studies investigating the relationship between oral language and literacy development in languages exhibiting a mismatch relationship (see Saiegh-Haddad & Spolsky, Chap. 10). Such research would enhance our understanding of literacy development in general. Moreover, it is essential for determining appropriate evidence-based pedagogical practices in literacy assessment and literacy instruction in these speech communities in particular, which have so far been largely based on mainstream sociolinguistic situations in which a language-literacy match is assumed (for more on the Anglocentricism in reading research and practice, see Share 2008).

Most of the studies that do exist in this area focus on African American English (AAE) speaking students' reading development in Standard American English (SAE). The Black-White reading achievement gap is well documented in the literature and is reflected in several measures of school success (McDonald and Craig 2006). These achievement gaps often demonstrate a widening difference between a minority students' grade level and their corresponding reading level (Morrison et al. 2005). Sixty-one percent of African American children failed to achieve basic reading levels on the 2003 Fourth Grade National Assessment of Educational Progress compared to 26% of their white peers (U.S. Department of Education 2003). Research has investigated the source variables of the described achievement gaps. Early studies investigating the relationship between AAE speaking students and reading showed no relationship between literacy achievement in SAE and children's AAE abilities (Gemake 1981; Goodman and Buck 1973; Harber 1977; Hart et al. 1980; Melmed 1973; Rystrom 1973–1974; Seymour and Ralabate 1985; Simons and Johnson 1973; Steffensen et al. 1982 as cited in Craig and Washington 2006, p. 97). However, subsequent studies provide empirical evidence to support the idea that the use of some AAE constructions does correlate negatively with reading achievement for African American students learning to read in SAE written language (Adler 1992; Manning and Baruth 2000 as cited in Craig and Washington 2006, p. 97).

Three main hypotheses have been proposed to explain these latter results and to explain the achievement gap. The first hypothesis is the teacher bias hypothesis, in which teachers' negative perceptions of AAE speaking students results in provision of lower quality instruction, thus affecting achievement. The second hypothesis claims that linguistic mismatches between the home language and language of reading instruction results in possible confusion in the learning process. Finally, the third hypothesis attributes the achievement gap to a lack of linguistic awareness knowledge of both varieties and the relationship between them (Terry et al. 2010; Terry 2010). This knowledge has been referred to as dialect awareness ability (Charity et al. 2004), dialect shifting (Connor and Craig 2006; Craig and Washington 2004), or linguistic awareness flexibility (Scarborough et al. 2007).

Current research in language and literacy has been expanded to include non-mainstream American English (NMAE) dialects other than AAE such as Southern American English, Creole English, Appalachian English, and Latino English (Terry et al. 2010) and can be divided into four main areas of research. These include a focus on studying the development of oral language shift abilities in relation to reading achievement (e.g. Craig and Washington 2006), understanding metalinguistic awareness development in relation to reading development (e.g. Scarborough et al. 2007), developing non-discriminatory language and literacy evaluation procedures (e.g. Craig et al. 2005; Pearson et al. 2009) and ultimately, enhancing our understanding of the factors in predicting academic success for AAE-speaking students in academic contexts (e.g. Terry et al. 2010).

This review of studies of learning to read and write in oral-literacy mismatch situations underscores the importance of various aspects of the relationship between oral language skills and reading development in these contexts. For example, Craig and Washington (2006) argue that dialect shifting ability is necessary for conventional literacy development in AAE speakers learning to read and write in SAE. Moreover, a new focus on examining language awareness effects for the prediction of reading success in Arabic supports the effect of 'linguistic affiliation' (Saiegh-Haddad 2007), that is, whether a given linguistic structure if affiliated with the spoken vernacular or with the standard written language, on metalinguistic awareness in Arabic and points to the need to develop assessments that are sensitive enough to these differences in linguistic affiliation on the acquisition of basic literacy skills in Arabic. Assessment and evaluation of the linguistic affiliation effect in developing readers would enable earlier identification of reading deficiencies for populations with an oral-literacy mismatch (i.e., diglossia) such as vernacular Arabic speakers and non-mainstream English speakers.

### *13.1.1 Arabic Diglossia and Learning to Read and Write*

One of the markers of speech societies exhibiting diglossia is the restriction of access to formal schooling, along with a requirement on the part of formal institutions for knowledge of the 'high variety' language (for a cross-linguistic perspective, see Myhill, Chap. 9; Romaine 2000). The low literacy rate in the Arab world is widely reported in the literature (Maamouri 1998; UNDP 2003; Haeri 2003).[1] It is also reported in Haeri's (2003) fieldwork in Egypt, which observes that many people who had a college education or otherwise work in a literate setting (e.g., public librarians) report not liking to read in spite of their high proficiency in MSA. Participants in this study attributed their lack of interest in reading to their perception that written Arabic is very complex and difficult (Chap. 9, Myhill, for linguistic distance reasons, Rosenhouse, for pedagogical reasons and Saiegh-Haddad & Spolsky, for ideological and other reasons).

Arabic might be considered a transparent orthography (where direct relationships between the orthographic system and the phonological systems exist), if the fully vowelized script is employed. Maamouri (1998) claims that this relation, however, becomes opaque once vowelization is eliminated (for a description of Arabic language and orthography, see Saiegh-Haddad & Henkin-Roitfarb, Chap. 1). Many researchers have found that children achieve better spelling and oral reading when exposed to fully vowelized script and hence the use of fully vowelized scripts has been encouraged in schools (Azzam 1990; Abu-Rabia 2002). However, due to the diglossic situation between SA and MSA, a different opacity still exists in the literacy process for developing readers, due to the mismatch between the spoken and standard varieties (Saiegh-Haddad 2005). There is therefore a need to understand how typically-developing children develop their linguistic competence of these features. This understanding may inform our educational and clinical evaluation and intervention for children with learning difficulties or disabilities.

This chapter is focused on the early stages of learning to read and write in Arabic and children's diglossic knowledge and/or awareness development within the diglossic situation where they are taught to read and write in MSA and speak vernacular Arabic at home. This study was administered in Israel, where in comparison to the Arab world children have relatively limited exposure to Modern Standard Arabic. This is because Hebrew and English are the dominant languages in the state of Israel, and Arabic is the language of the indigenous minority (Spolsky 1997; Amara 2002). Hence, we assume an increase of the possible interactive effects of diglossia on literacy development in such a sociopolitical environment. Using language

[1] Forty percent of the total population of all Arab states over 15 years old is illiterate, with some variation across the Arab states and within each state (Maamouri 2003).

properly involves understanding the effect of context in choosing the appropriate language variety and the different linguistic rules for each variety. Since children are mainly exposed to MSA through formal instruction in the schooling system, we assume that increased exposure to MSA in schools amplifies the development of their diglossic knowledge (i.e. knowledge of the diglossic linguistic features of Arabic) and metadiglossic awareness (i.e. the awareness of the two language varieties of Arabic as such, and the interrelationships between them). The acquisition of diglossic knowledge and metadiglossic awareness is hypothesized to be positively correlated with literacy development, in much the same way that Non-mainstream American English speaking children with improved dialect awareness demonstrated improved SAE reading and writing abilities.

### *13.1.2 Diglossia in Arabic: Earlier Studies*

Khamis-Dakwar (2005) describes four main lines of research on Arabic diglossia. The first line is focused on describing the linguistic features of the two varieties and the relationship between them (e.g. Altoma 1969; Talmoudi 1984 as cited in Khamis-Dakwar 2005, p. 76), whereas a second line of research focuses on examining the effects of early exposure to literary Arabic texts on reading comprehension abilities in Arab pre-school children (e.g. Abu-Rabia 2000; Eviatar and Ibrahim 2000; Feitelson et al. 1993 as cited in Khamis-Dakwar 2005, p. 76). An expanded third line of research examines the development profiles of native Arabic-speaking children either linguistically (e.g. Abu-Rabia et al. 2003; Khamis-Dakwar et al. 2012; Saiegh-Haddad 2003, 2004, 2005), or in reading and spelling (e.g. Abu-Rabia 2002; Abu-Rabia and Taha 2004; Abu-Rabia and Shalhoub Awwad 2004; Abu-Rabia and Taha 2006). The last line of research focuses on teaching Arabic as a foreign language within the existent diglossic situation as cited in Khamis-Dakwar (2005). For the purpose of this chapter, we will describe only those studies addressing metalinguistic development in Arabic and Arabic language assessments.

#### The Development of Metalinguistic Awareness in a Diglossic Situation

Eviatar and Ibrahim (2000) studied the metalinguistic abilities of Palestinian children from Israel who had been exposed to both spoken and literary Arabic in comparison to the metalinguistic abilities of Russian-Hebrew bilinguals and monolingual Hebrew speakers. Arbitrariness ability (in which the child was asked to exchange one word for another in the same language), phonological awareness, and vocabulary size were evaluated in this study. The Palestinian children were tested in spoken Arabic whereas the Hebrew monolinguals and Russian-Hebrew bilinguals were tested in Hebrew. In the phonological tasks and the arbitrariness tasks, children in both the Arabic-speaking group and the Russian-Hebrew bilingual group achieved significantly higher scores than the Hebrew monolinguals. Interestingly, for the vocabulary task, the Arabic-speaking children had higher performance scores than the Russian-Hebrew bilinguals and their scores were closer to that of Hebrew monolinguals in kindergarten, but not in the 1st grade. Based on these findings, the authors conclude that Arabic-speaking children's exposure to literary Arabic is comparable in its effects on bilingual language analysis performance to that of children exposed to two languages (such as Hebrew and Russian). Based on the study results, the authors suggest that Arabic-speaking children in a diglossic situation perform similar language analyses to children in a bilingual situation. These behavioral findings were further supported by recent neurocognitive investigations in lexical diglossic code-switching in native Arabic-speaking adults. Here, Arabic speakers performed lexical code-switching between MSA and PSA which elicited a P600 event related potential (ERP) response, in much the same way another study elicited the same response from bilingual Spanish-English speakers performing a similar task. This comparison between MSA to PSA and Spanish to English code-switching points to two varieties being linguistically indexed in both situations as separate underlying neural lexicons, despite conceptual constructs of more greatly differing language categories (Moreno et al. 2002; Khamis-Dakwar et al. 2009; Khamis-Dakwar and Froud 2007).

The development of research into diglossia has more to consider in light of the aforementioned studies. Eviatar and Ibrahim's (2000) study examined metalinguistic awareness in only one Arabic language variety and did not control for overlapping and non-overlapping features in the two language varieties. Indeed, on the development of linguistic competence there are very few studies that account for the linguistic features that differentiate MSA and SA in either typically-developing children or in children with reading or learning disabilities. A series of studies by Saiegh-Haddad examined the influence of lexico-phonological distance (between the spoken and standard language varieties in Arabic) on the development of phonological awareness, word decoding, word repetition, and lexical retrieval in native Arabic-speaking children with typical development (Saiegh-Haddad 2003, 2004, 2005, 2007, 2011a, b, 2010; Saiegh-Haddad et al. 2011). Findings from these studies led Saiegh-Haddad (2007) to propose the "linguistic affiliation constraint" hypothesis, which suggests that the oral-written language phonological distance in Arabic dialects impacts the acquisition of basic language and literacy skills in MSA because it affects the development of high-quality phonological representations for MSA linguistic structures, and the accurate encoding of standard language phonological structure in long-term memory (Saiegh-Haddad et al. 2011).

Evidence of impacted morphosyntactic knowledge in developing diglossic Arabic speakers has also been documented (Khamis-Dakwar et al. 2012). Here, researchers examined the development of morphosyntactic knowledge of MSA and Palestinian vernacular Arabic (PSA) in 60 typically-developing Arabic-speaking children aged 6; 4–12; 4, from a school in Nazareth, using a forced-choice grammaticality judgment task. The results of the study revealed that these children's performance was significantly higher on items verbally presented in PSA, their spoken language, than in MSA, with the exception of constructions involving negation.[2] In addition to this language variety effect, children performed better on items when the two constructions were overlapping in both language varieties than when they did not overlap, thus supporting the 'linguistic affiliation constraint' (Saiegh-Haddad 2007).

Current language assessment tools do not address the findings revealed by the reviewed research examining language and literacy development in Arabic, which if administered, would provide educators and clinicians with a more representative and accurate account of a child's true linguistic abilities. Further in this chapter is an outline of the development of a test called ADAT, and preliminary findings from its pilot administration with typically-developing Arabic-speaking children in grades 1–5. The introduction of the test is preceded by a review of language and literacy testing in Arabic, with a focus on speech and language pathology assessment in Arabic.

### *13.1.3 Language and Literacy Testing in Arabic*

Very few studies report on language and literacy testing in Arabic. Most of the existing studies do not account systematically for the diglossic features which have been reported to significantly influence children's performances, neither in their design nor in their analysis of the results.

For instance, Abu-Rabia and Taha (2004) investigated the profile of spelling errors of native Palestinian Arabic-speaking 5th graders with dyslexia and compared it to that of typically-reading children matched for age and grade level, and also to typically-reading 2nd graders, which were matched for reading level. Children's spelling was examined in three contexts: spelling of texts, isolated words, and pseudowords. The results revealed that children with dyslexia exhibited no qualitatively different spelling errors in comparison to the children with typical reading development and that their spelling-error profile resembled that of the normal readers matched for reading level. Additionally, the most prominent error exhibited by the group of children with dyslexia and the reading level matched group (i.e., 2nd graders) were the morphological and semiphonetic errors, which arguably reflect the demands of Arabic orthography. On the other hand, children from the age-matched group (i.e., 5th graders) exhibited a high percentage of phonetic errors. The authors suggest that these errors are exhibited due to a limited orthographic lexicon and poor knowledge of spelling rules. The possible effect of diglossic features on these types of errors could not be identified within the study, due to the limitation of the coding paradigm, which does not account for diglossic-based error types.[3] This study was

[2] For further discussion of children's performances on negation structures refer to Khamis-Dakwar et al. (2012).

[3] Abu-Rabia and Taha (2004) classified children's oral reading errors into the following types of errors: non-semantic semiphonetic errors, semantic and non-morphological semiphonetic errors, semantic dysphonetic errors, non-semantic dysphonetic errors, morphological errors, addition of functional words, visual letter confusion, irregular pronunciation rules, semantic sentence

unique in that it was one of the first studies to examine spelling errors in light of the unique characteristics of Arabic orthography. Nonetheless, although the authors discuss the effect of diglossia on children's spelling and oral reading development and present a model of reading and spelling assumed to illustrate reading and spelling of Arabic in light of its specific sociolinguistic and orthographic features, there was no categorization of the diglossic-based errors which might manifest as a separate error type or as a sub-category of phonetic errors, as observed on phonological and decoding tasks (e.g., Saiegh-Haddad 2003).

Another study conducted by Abu-Rabia and Taha (2006) utilized the same spelling-error analysis paradigm (Abu-Rabia and Taha 2004) and examined word spelling[4] of 288 Palestinian students in the 1st through 9th grades who are native speakers of Arabic from Israel. As detailed and fundamental as this study is in its findings, it also does not address the effect of diglossia on children's spelling, either in its research design or in the data analysis.

Other studies have attempted to examine the predictive correlations between language and literacy skills in children with reading disabilities, in light of the specific features of Arabic, yet these too did not consider diglossia in their design, implementation, analysis or interpretation. This has resulted in studies using tasks that have randomly mixed the two varieties with the assumption that the same language is being elicited. For example, Abu-Rabia et al. (2003) investigated whether performance on tasks associated with basic cognitive processes, including working memory examined by memorizing digits, missing words in sentences, visual processing, morphological abilities tested by identifying two morphologically related words and producing words from same morphological family in 30 s, syntactic abilities tested by oral cloze test and grammaticality judgment of sentences in MSA, and phonological awareness tested by final phoneme deletion task in pseudowords and in MSA words, predicted word reading ability in three groups of children: 5th grade children with reading disability, age-matched typical readers also in the 5th grade and reading-level matched typical readers in the 3rd grade. Their results revealed deficiencies among the 5th grade children with reading disability in phonological decoding, morphology, working memory, and syntactic and visual processing. Phonological decoding was revealed as the most significant deficiency. On the other hand, orthographic processing was shown to be relatively strong in this group. This study was unique in its separate assessment of children's spoken Arabic and Standard Arabic language skills. However, language processing tasks did not systematically target linguistic features that differentiate MSA and PSA. Instead investigators used both MSA and PSA varieties depending on the modality of testing with the

guessing, semantic errors, and omitting functional words. Similarly, children's spelling errors were classified as phonetic errors, semiphonetic errors, dysphonetic errors, visual-letter confusion errors, irregular spelling errors, word omission, and functional word omissions.

[4] The authors do not declare the number of words used for testing children's spelling and they only note that the number of words for each list differed depending on the grade level.

result that the orally administered tasks were verbally presented in PSA and the written tasks in MSA.[5]

Another recent study by Mahfoudhi et al. (2010) examined the predictive relationships of phonological and morphological processing as well as reading fluency in 166 typically-developing Arabic-speaking children and 70 learning disabled (LD) Arabic-speaking children from the 3rd through 6th grade, matched on nonverbal ability. To address their query, Mahfoudhi et al. (2010) developed linguistic measurements specifically for this study. Mahfoudhi et al. (2010, p. 4) maintain that "Given the lack of standardized measures in the Arabic language, these measures were developed specifically for this work", based on measures typically used in the literature. The measures they used were unique in examining not only phonological processing (in spoken Arabic) but also morphological processing (of written stimuli in MSA). The results of the study showed a significant correlation between morphological processing performances and reading fluency performances in 5th–8th graders with LD (but not 3rd–6th graders LD). Differences in modality and in the language used in each mode of presentation to assess phonological processing and morphological processing might have led to the observed differences in the performances obtained and might, therefore, limit the generalizability of the results and the external validity of the conclusions with regard to the effect of phonological and morphological awareness skills on language comprehension and reading fluency in Arabic. Hence, there is a need to develop a valid test that incorporates the assessment of processing abilities of all language domains while also controlling for the diglossic features specifically related to the process of learning to read and write in Arabic. Such a test would be valuable not only for clinical and educational practices, but also for research use and for its potential to enhance our understanding of language and reading development in Arabic diglossia.

The reality is that clinical assessment (in Israel and most probably in other Arabic-speaking regions) mimics research in that it ignores diglossia as an important factor in language and reading development in Arabic. Clinical practice in Israel relies on a translation of tasks that were developed originally based on normative data for American or British English speaking children, and whose linguistic processing for reading and writing occurs in non-diglossic contexts with a high degree of linguistic matching between the oral language and the language of literacy. Hence, there is a need to develop an authentic linguistic tool for Arabic-speaking children that accounts for diglossia, where the difference in oral and written systems is systematically targeted. This would perhaps be more amenable to analysis by bilingual linguistic assessment procedures than by monolingual assessment paradigms.

[5] A similar dichotomy of assessing speaking and listening using vernacular Arabic, while using MSA when assessing writing and reading is reported in the assessment of the most common proficiency tests used for assessing students learning Arabic as a second language in the United States: the ACTFL & ILR tests (Eisels 2006).

## Speech Language Pathology Services in Arabic and Language Assessment in Arabic

Speech language pathology is a developing field in the Arab world. There is at present a limited number of certified Arabic-speaking speech language pathologists (SLPs) and academic and clinical resources are scarce (Khamis-Dakwar and Crowley 2005; Patel and Khamis-Dakwar 2005; Khamis-Dakwar and Froud 2012; Wilson 1996). For example, in Kuwait, there are only 42 Arabic-speaking SLPs (both Kuwaiti and non-Kuwaiti) (Al-Khaledi et al. 2008); and in Egypt, there are 125 phoniatricians and 250 logopedists (Kotby et al. 2010). Moreover, even though speech and language services in Israel are considered to be a “well established professional field” (Korenbrot et al. 2002, p. 72), there is a shortage of certified Arabic-speaking speech language pathologists in Israel, as compared to Hebrew speaking SLPs. A prominent non-governmental organization for human rights reported that in 2000, only 21 of the 1,185 speech therapists in Israel were Palestinian Arabs (Human Rights Watch 2001). Thereafter there were approximately 16 Arabic-speaking SLPs to administer evaluation and treatment for every million people in Kuwait in 2008, 5 Arabic-speaking SLPs per million people in Egypt in 2010, and 17 Arabic-speaking SLPs per million people in the Palestinian population in Israel in 2000. This is compared to the 388 SLPs per million people in the U.S and 224 Hebrew-speaking SLPs per million people in Israel.

The literature on language development and language testing for Arabic- speaking children in the Middle East is sparse, when compared to the field as a whole. Some intensive focus has been directed toward developing articulation norms and tests in Arabic (Amayreh 1994; Abou-Elsaad et al. 2009). In one of the rare studies on developing language screening tests for Arabic-speaking children, Wiig and El-Halees (2000) reported that, in Jordan, speech and language screening mainly employs subjective measures and that false negative identifications are numerous. Additionally, they reported that, “At times, English tests are translated literally and scores are interpreted against normative data developed from American or British-English speaking children” (Wiig and El-Halees 2000, p. 261). Similarly, Korenbrot et al. (2002), report that SLPs in Israel tend to translate and use tests from English with no appropriate standardization. They note the availability of only two standardized tests in Israel, both of which are designed for pre-school children (7 years and younger), and are standardized only for Hebrew-speaking children in Israel. Often, these tests are translated word by word when used with Arab children from Israel. Transliteration of testing items does not account for differences in linguistic structure or cultural bias. Additionally, translated language tests do not take into account the sociolinguistic situation of Arabic in which children’s knowledge of a language variety varies between the spoken and the written form and hence, between the two modalities of testing.

One of the responsibilities of speech language pathologists is to assess children’s readiness to read and write. This is due to the growing recognition of the relationship between reading disabilities and underlying linguistic deficits. In addition, several language skills, such as naming and oral language, have been found to be a strong predictor of success in reading, writing and spelling. Some evidence suggests early intervention might prevent the development of reading disability in later stages (Foster and Miller 2007). As per our review above, there is a need to develop an Arabic readiness test in which diglossic features are controlled for or systematically addressed. There is no Arabic test developed to examine children's diglossic knowledge and awareness in the two language varieties in Arabic, and across the different language domains (semantics, morphology, syntax, phonology, and pragmatics) with respect to features that differentiate MSA and PSA. Developing such a tool will enable a better understanding of the normative development of language and literacy in Arabic diglossia. This normative data is necessary for establishing a basis for distinguishing between children with reading difficulty triggered by the diglossic situation and children with a genuine neurologically based reading disability. In the following section, we will describe the development of ADAT (Arabic Diglossia Knowledge and Awareness Test) and describe preliminary results of children's development of relative competence in the two varieties of Arabic across the early elementary school (1st–5th) grades.

To end this section, it is imperative to note Labov's (2003) assertion that reading research has focused extensively on studying "the small percentage who fall far behind in reading because of a specific cognitive impairment" (pp. 128), and that "considerable progress had been made in defining the symptoms and typology of dyslexia, if not its etiology" (pp. 128). He addresses the need for a new direction in reading research which focuses on studying the failure of minority children to learn to read and write in a language that differs from their mother tongue. This situation involves a larger number of children (more than simply those with dyslexia) in the United States and in the world, and it has serious consequences when considering the limited opportunities these children have as a result of their failure to achieve literacy.

### *13.1.4 ADAT (Arabic Diglossic Knowledge and Awareness Test)*

The foregoing sections suggest that it should no longer be ethically acceptable to assess emergent literacy in Arabic-speaking children based on the examination of only one of their language varieties and without controlling for the effect of diglossic features (match vs. mismatch, or overlapping vs. non-overlapping/distinctive) on language tasks performance.

Emergent literacy assessment in a mismatch situation should be carried out with an instrument that is linguistically and culturally appropriate, so as to be able to identify areas in which differential impairment may be found at any level of linguistic structure (phonology, morphology, syntax, pragmatics, and lexicon).

The *Arabic Diglossic Knowledge and Awareness Test* (ADAT) is intended to be a comprehensive language test designed to test language-based skills found to predict success in reading, writing, and spelling in Arabic for kindergarten and 1st grade students. Each student is tested individually. The testing is multidimensional—testing various linguistic levels, across multiple tasks (e.g., comprehension, judgment, and production), and units (e.g., phonemes, words, and narrative).

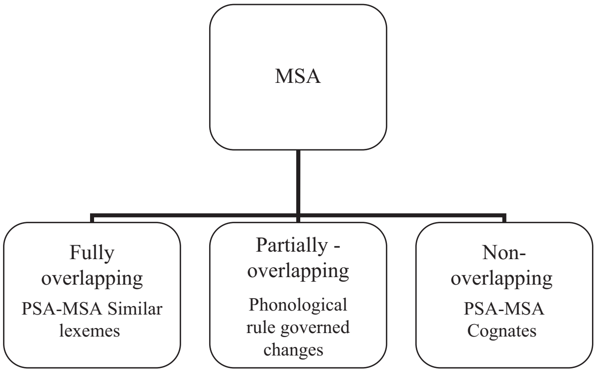


**Fig. 13.1** Type of lexemes presented in the receptive diglossic vocabulary assessment

To administer the ADAT, the examiner employs the stimulus book. At present, it is only available for testing Palestinian Spoken Arabic (PSA) in the north of Israel. We hope that future studies will develop or adapt the ADAT for other Arabic dialects in different sociolinguistic contexts. The test is comprised of four parts, including a receptive vocabulary assessment, a morphosyntactic knowledge assessment, an assessment of phonological awareness, a questionnaire regarding sociolinguistic knowledge of diglossia and finally, a narrative sample.

## Receptive Vocabulary Assessment

In this sub-test children are asked to identify 15 MSA words via point gesture, as represented by a picture in a field of four images. Five of the stimulus words are non-cognates which do not share phonological features with MSA (i.e., non-overlapping features), 5 are related by phonological features (i.e., partially overlapping features), and 5 are similar to MSA (e.g., overlapping features) lexemes as outlined in Fig. 13.1. For example, in testing receptive identification of non-cognates that do not share phonological features, children were asked to identify the MSA word for 'shoe', which is ħ*iða:*ʔ in MSA but/*kundara*/in PSA (see Fig. 13.2). Alternately, in examining children's receptive identification of words that are related phonologically, children are asked to identify the word *qalb* 'heart' in MSA, which has the phonological form ʔ*alib* in PSA, being that the classical Arabic phoneme/q/ becomes a glottal stop/ʔ/in PSA-northern dialect (see Fig. 13.3). An example of an item assessing the identification of PSA-MSA overlapping lexemes is exhibited in Fig. 13.4, where children are asked to identify the word *ba:b* 'door' spoken in the same way in both varieties.

## Morphosyntactic Knowledge Assessment

This sub-test is based on a morphosyntactic knowledge assessment developed by Khamis-Dakwar et al. (2012). A forced-choice grammaticality task is presented in

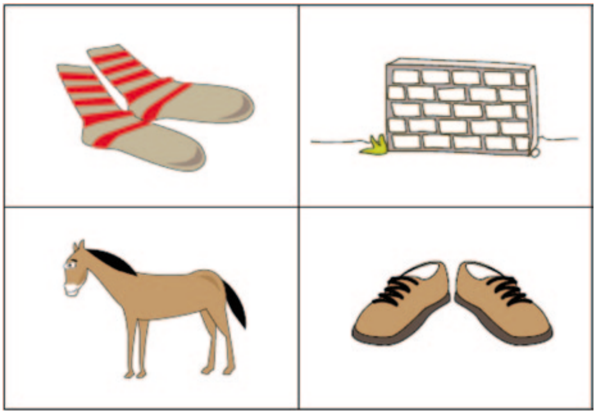

**Fig. 13.2** Receptive diglossic vocabulary item assessing identification of distinct lexemes. Children are asked to point to the ħiðaʔ 'shoe'. (Used with permission from Khamis-Dakwar and Makhoul (2009), *Arabic Diglossic Knowledge and Awareness Test*.1st edition)

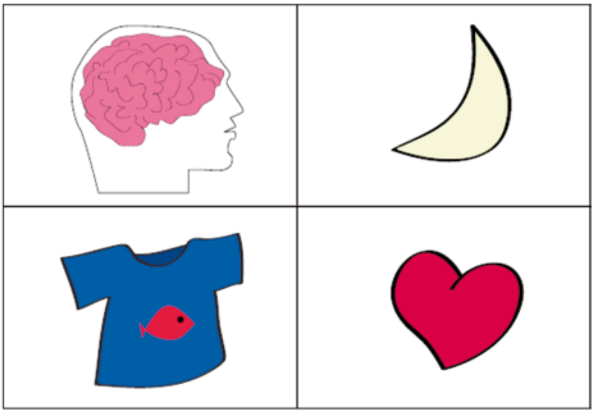

**Fig. 13.3** Receptive diglossic vocabulary item assessing phonologically related lexemes. Children are asked to point to the *qalb* 'heart'. (Used with permission from Khamis-Dakwar and Makhoul (2009), *Arabic Diglossic Knowledge and Awareness Test*.1st edition)

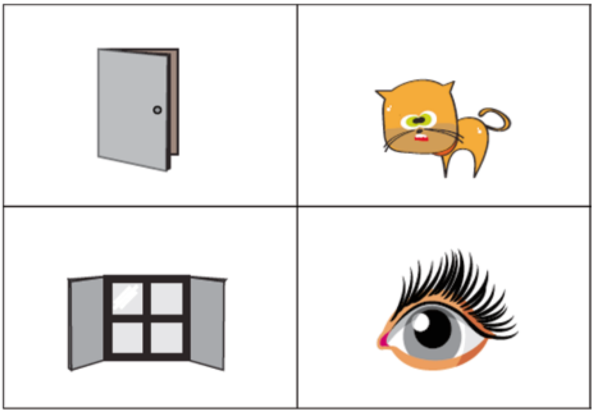

**Fig. 13.4** Receptive diglossic vocabulary item assessing similar/overlapping lexemes. Children are asked to point to *ba:b* 'door'. (Used with permission from Khamis-Dakwar and Makhoul (2009), *Arabic Diglossic Knowledge and Awareness Test*.1st edition)


**Fig. 13.5** Falafel seller prompt. (Used with permission from Khamis-Dakwar and Makhoul (2009), *Arabic Diglossic Knowledge and Awareness Test*.1st edition)

MSA, and in PSA. In both varieties, six morphosyntactic features that are non-overlapping in MSA and PSA, and four overlapping features in both language varieties are examined. The non-overlapping morphosyntactic features include dual-number marking, word order/agreement, negation, yes/no question formation, relative pronouns and passive formation. The overlapping features include sound plurals, adjective definiteness, wh- questions, and construct phrases. All target structures were selected based on the fact that they are structures explicitly targeted in the elementary school curriculum for teaching Arabic in Arab schools in Israel. For each morphological or syntactic feature there are four pairs of sentences. Each pair consists of a grammatical and an ungrammatical sentence. Accordingly, each of the MSA and PSA grammaticality judgment lists included 40 grammatical and 40 ungrammatical counterparts. Both grammatical and ungrammatical sentence pairs were similar in word number and sentence meaning except for the rule violation contained in the ungrammatical sentences and the minimal phonological and lexical adaptations to the different variety.

Sentences are presented in the context of two linguistic scenarios for each variety. PSA sentences are presented along with a picture of a falafel seller, a profession in which employees are likely to use PSA during work (see Fig. 13.5). Children are asked to listen to 40 pairs of sentences. For each pair, the child is asked to select which sentence sounds more acceptable by a falafel seller. Conversely, MSA sentences are presented along with a picture of television broadcaster, a profession in which employees are likely to use MSA during work (See Fig. 13.6) and children are asked to judge the most acceptable sentence in a pair of sentences spoken in MSA. These pictures are presented to prompt and cue the language variety called upon in these contexts and hence being tested. Two illustration trials for each sentence list are provided. These illustration trials do not relate to the test item conditions.

## Phonological Diglossic Awareness

This sub-test consists of 12 phonological awareness tasks. Similar to practices reported by studies on metaphonological awareness in diglossia situations (e.g.

**Fig. 13.6** Television broadcaster prompt. (Used with permission from Khamis-Dakwar and Makhoul (2009), *Arabic Diglossic Knowledge and Awareness Test*.1st edition)

Saiegh-Haddad 2003, 2004, 2005, 2007), target phonemes in each of the 12 tasks were manipulated to occur in MSA only (4 out of 8 items) and not in the Galilee dialect of PSA (such as /θ/, or /ð/), whereas the other 4 target phonemes are shared in both language varieties. In this section the following tasks are presented: rhyme identification, initial phoneme identification, medial phoneme identification, final phoneme identification, syllable deletion, initial phoneme deletion, initial phoneme substitution, medial phoneme substitution, final phoneme substitution, rhyming production, syllable blending, and phoneme blending.

### Sociolinguistic Knowledge of Diglossia

This section of the exam asks clinicians to administer a questionnaire in order to gather information regarding the child's understanding of the sociolinguistic context of Arabic. The questionnaire includes open-ended questions used to elicit information about the child's identification of diglossia (with and without prompting), their understanding of the different contexts of use for each of the two language varieties (i.e., when do we use each language variety and with who), their explicit knowledge of linguistic similarities and differences between MSA and PSA, their reading preferences, and cognitive processes involved in reading and writing in MSA, wherein a switch from PSA would occur (i.e., strategies used in enhancing their reading comprehension and writing in MSA).

### Narrative

In this portion of the exam, children are presented with two picture books with a simple narrative structure and no written text. They are prompted to tell a story in PSA and another story in MSA. During our pilot data collection, the order of presentation for these was counter-balanced across participants. The two picture books are illustrated in Figs. 13.7 and 13.8. The narratives produced are later analyzed at the macro level (for basic story grammar features) as well as at the micro level for detailed features of complexity of sentence type and lexical diversity).

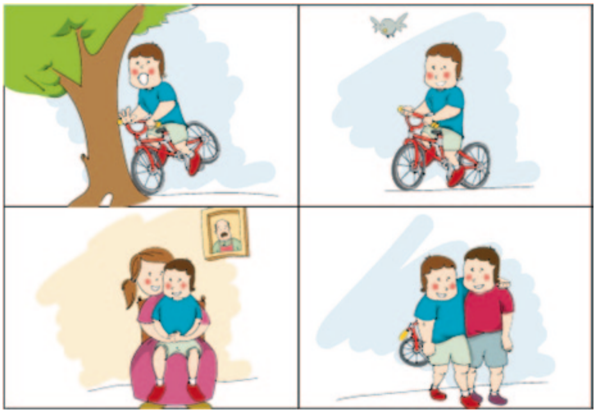

**Fig. 13.7** PCA narrative elicitation picture book. (Used with permission from Khamis-Dakwar and Makhoul (2009), *Arabic Diglossic Knowledge and Awareness Test*.1st edition)

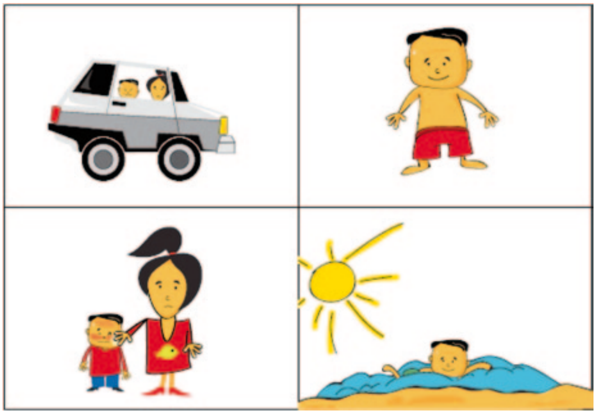

**Fig. 13.8** MSA narrative elicitation picture book. (Used with permission from Khamis-Dakwar and Makhoul (2009), *Arabic Diglossic Knowledge and Awareness Test*.1st edition)

## Sociolinguistic Diglossic Knowledge and Awareness in Arabic: Preliminary Results

The development of the ADAT is in its early stages. The stimulus items were determined based on the literature reviewed above, the two authors' experiences and the outlined aim of each of the test tasks. Pictured pages were constructed with the assistance of a Palestinian artist who was instructed to make illustrations that are colored, clear, child-friendly, and culturally appropriate.

The first field tests began in October 2010 wherein the *ADAT* was administered to 40 monolingual native Palestinian Arabic-speaking children, 20 males and 20 females, ages 6; 1–12; 6 years of age, raised in families of moderate-to-high socioeconomic status (based on teachers' reports). There were eight participants at each of the following grade levels; 1, 2, 3, 4, and 5. Per teachers' reports, all the children had typical language and literacy development, and no hearing, health, behavioral, developmental and/or reading difficulties. All children were exposed to Palestinian

Arabic of northern dialect at home and had their first intensive exposure to MSA upon entering the school.

This first pilot study aimed to examine how diglossic knowledge and awareness develops with age/grade level based on the performances on *ADAT* and how similarities/differences between MSA and PSA linguistic structures feature in children's performance on the ADAT items.

## Preliminary Descriptive Data

*Diglossic awareness:* The findings of the study reveal that by the 1st grade, all children can explicitly identify the context of use for the two language varieties, if given prompting (i.e. when prompted to tell when we use each of the language varieties), and without prompting by 5th grade (i.e., when asked to tell what he/she knows about the two language varieties). Moreover, children at the 1st and 2nd grade levels were able to explicitly think about similarities and differences between the two language varieties, but only in the phonological and lexical domains. Children in 3rd, 4th, and 5th grade group however, outlined morphosyntactic and pragmatic differences.

Lastly, when children were administered the sociolinguistic knowledge of diglossia sub-test and were asked whether they think in spoken Arabic or in MSA before they write down their thoughts and answers, no clear trend was found with regard to children's tendency to either think in spoken Arabic or MSA before writing about a topic in MSA. Further data is needed to elucidate this cognitive strategy. Interestingly, most children at the 3rd, 4th, and 5th grade levels reported to like speaking and writing in MSA. However, children in the 1st and 2nd grade groups reported liking to write in MSA but preferred PSA for speaking. Of note, the sample in this pilot was very small in each group (8 children per grade level).

*Morphosyntactic knowledge:* Similar to previous findings (Khamis-Dakwar et al. 2012), children at the 1st, 2nd, and 3rd grade level exhibited more accurate judgments of PSA presentations than MSA presentations and more accurate judgments on items composed of structures that are overlapping than structures that are distinct or non-overlapping.

*Receptive vocabulary:* Children's performances in the receptive vocabulary subtest demonstrated significant differences in performances depending on type of target lexical item but only at the 1st grade level, which revealed children had better identification percentages of words that are either similar (identical) or distinct lexemes, and lower performances in identifying items that held partial phonological overlap. No significant differences were found at later grade levels which might be related to a high ceiling effect.

*Metaphonological awareness:* Similar to those studies which reveal the effect of diglossic features on the development of children's metaphonological awareness (e.g. Saiegh-Haddad 2003, 2004, 2005, 2007), children's accuracy level for this sub-test at the 1st grade level was significantly lower for distinct MSA target phonemes than target phonemes shared in the two language varieties.

To summarize, these exploratory findings reveal significant diglossic features defining the typical development of children's literacy-based language skills. This effect was evident at different grade levels, and in all language domains as identified by their performances at the *ADAT*.

Future work in the development of the *ADAT* test is to standardize the assessment with a larger population so as to be a valid and reliable assessment tool in examining children's language abilities, as needed for literacy development for 5–9 year-old Palestinian Arabic-speaking children. The reported preliminary screening results are just the first step in this process. Based on these results, modifications to some items and coding are underway. Later, a reduplication of the pilot study with the modified test will be administered to a larger sample, in other Palestinian regions with varying dialects. The performance of children with speech and language disorders and/or learning disability will be also examined as part of the test validation process.

The data collected will be informative in understanding the language development at the pre-kindergarten level in Arabic and can be used to guide teaching approaches and clinical practices for SLPs. The data elicited from administering the test to children with language and/or learning disabilities will enhance our understanding of the nature of these disabilities and the interaction of diglossia in children's language and reading performances.

Future studies would focus on developing the ADAT for adolescents, in which more age appropriate tasks are utilized, such as assessment of translation abilities and interference effects in each language variety, lexical diglossic awareness, and narrative comprehension comparisons in spoken Arabic versus MSA narrative with different concentrations of overlapping and non-overlapping structures.

## 13.2 Conclusion

In this chapter, we introduced the development of a test based on recent research findings which aims to investigate children's diglossic knowledge and metalinguistic awareness in two language varieties. The ADAT examines diglossic knowledge and metalinguisic awareness, which has been increasingly demonstrated by Arabic linguistic research as impactful on typical language development. By testing a child's diglossic knowledge and metalinguistic awareness, clinicians can assess how much diglossic linguistic features of Arabic and the ability to think about and use these diglossic linguistic features as arbitrary linguistic code independent of meaning may play a part in a child's academic progress with regard to language and literacy skills. The test items for ADAT were developed and its content validity was examined. As part of this pilot research, researchers geared these items to answer two main questions: 1) What linguistic skills develop in children learning the two language varieties in Arabic diglossic speech communities? 2) What are the necessary skills for successfully learning to read and write in situations of mismatch relationships between oral language and literacy skills, such as Arabic? These questions could not be addressed comprehensively without the use of an appropriate tool, which addresses the specific language skills necessary for literacy and learning in the specific sociolinguistic situation of Arabic diglossia.

ADAT is an authentic language assessment tool developed while controlling for overlapping and non-overlapping features of PSA and MSA. This tool can be beneficial for better pedagogical and clinical practices, and may enhance research in this field. The shift between PSA and MSA during reading and writing in Arabic is acknowledged in the literature. Ferguson (1959, p. 329) pointed out that in all of the four languages he studied to define diglossia "it is typical behavior to have someone read aloud from a newspaper written in H and then proceed to discuss the contents in L". In this quote, Ferguson refers to MSA and SA as H for high language variety and L for low language variety respectively. On this point, Ferguson also notes that in the Arab world in secondary schools "often a considerable part of the teachers' time is taken up with explaining in L the meaning of material in H which has been presented in books or lectures" (Ferguson 1959, p. 329). Mainstream languages typically studied in the literature show that oral reading of a text can be relatively matched to the written parts of the text. Contrary to this, in Arabic, and other languages with mismatched home and school language varieties, children need to negotiate the idea that the written text may be either overlapping or distinct in all domains from the spoken mode representation. The development of this knowledge at elementary grade levels was assessed using ADAT and this task reveals a significant effect of overlap (i.e., match) versus non-overlap (i.e., mismatch) on children's performances. These results add to the debate on the need for authentic assessment of reading and learning disabilities in Arabic as well. We hope that this chapter lays the groundwork for an alternative method for the assessment of learning and reading disabilities for Arabic-speaking children.

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# Part V
# Arabic Emergent Literacy: Socio-Cultural Factors

# Chapter 14
# The Development of Young Children's Arabic Language and Literacy in the United Arab Emirates

**Sana Tibi and Lorraine McLeod**

**Abstract** In this chapter, we report on the current situation of emergent literacy and language in the emirate of Abu Dhabi in the United Arab Emirates (hereafter, UAE). In 2010, Abu Dhabi Education Council (hereafter, ADEC) announced a 10-year strategic plan aimed at improving the quality of education in the emirate of Abu Dhabi. A key feature of this plan is what is referred to as the "New School Model" which entails bilingual education (Arabic and English) from kindergarten through the years of compulsory schooling.This change has brought with it many intended and unintended consequences. The purpose of the present chapter is to examine issues relating to young children's emergent literacy, including bilingualism, diglossia, and writing in the context of the UAE under the current *New School Model*. Although there is very little literature on emergent literacy and language development in the UAE, we looked carefully into these important issues and their implications in light of the existing literature in both the UAE and internationally, and also in relation to the rapid societal changes being experienced in the UAE. Recommendations are made for all concerned parties; policy makers, strategic planners, caregivers and families so that reform can bring the optimal development of bilingualism for the young Emirati children while retaining their national identity and culture.

**Keywords** Bilingualism · Diglossia · Emergent literacy · Kindergarten · Policy · United Arab Emirates

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S. Tibi (✉)
Queen's University, Kingston, ON K7L 4N3, Canada
e-mail: s.tibi@queensu.ca

L. McLeod
UAE University, Al Ain, United Arab Emirates
e-mail: lorrainejim11@hotmail.com

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## 14.1 Introduction

In this chapter, the development of young children's Arabic language and literacy in the United Arab Emirates (UAE) is discussed in light of the current changes taking place in the educational system, and with reference to some specific research undertaken in the Abu Dhabi Emirate of the UAE, and elsewhere in the world.

The UAE, bounded by the shores of the Arabian Gulf to the west and the Indian Ocean to the east, is a country that has developed rapidly since the discovery of oil in the late 1950s. In 1971, traditional lifestyles altered remarkably. During the previous two decades, the oil discovered in the emirates brought wealth not previously seen and, in 1971, the seven Emirates formed a federation to manage it. Rapid changes occurred in all aspects of UAE lifestyle and society. As in most situations of rapid growth and change, many unforeseen and unplanned changes occurred as new policies and projects were introduced.

Major changes have been made to the education system, including a shift from a long-held oral Arabic language tradition to a recent desire to incorporate oral and written bilingualism (Arabic and English) into kindergarten, school and university curricula.

The trajectory of such rapid change is often uneven and is fraught with unplanned side effects, including societal changes and changes in as well as cultural attitudes and beliefs. This chapter describes some of the changes—planned and unplanned—that are taking place with regard to the oral Arabic language development of very young children in the UAE and to children's Arabic literacy. The changes and their consequences are discussed in light of the literature on language development in children, including issues of diglossia and bilingualism, and on the development of emergent literacy, including emergent writing opportunities and behaviors.

Recommendations are made for systemic interventions at government, Board of Education, Ministry of Education, kindergarten and family levels of Abu Dhabi's society to increase young children's exposure to Standard Arabic language and literacy. In order to be effective, these interventions should reflect strongly the UAE environment and socio-cultural heritage while taking into consideration the linguistic issues associated with the Arabic diglossic situation.

### *14.1.1 Education in the UAE: Then and Now*

A new comprehensive formal education system was introduced in the UAE in the 1970s. Prior to that period, a very small number of boys attended privately-owned schools, while education for other boys consisted of attendance at the local mosque and learning to memorize the Holy Quran under the tutelage of *Al Muta:wa*, the community's spiritual leader. Basic reading and mathematics were taught as tools for reading and understanding the Quran. Girls were mostly educated in domestic life skills in their homes by their mothers and female relatives.

In the 50 years since the first schools were opened to the general population, much has changed as the UAE's educational infrastructure has developed. Now, education facilities provide free education for Emirati boys and girls; public kindergartens are available for children aged from four to six years, and compulsory free education is provided for children from Grades 1–9. A range of secondary and higher education facilities is available too. Teacher education programs have proliferated, and changes to curricula and pedagogical requirements are frequent as attempts are made to improve educational outcomes for children.

Recent federal government policies under the 'Education 2020' strategic plan (World Data on Education, 2010) have prioritized the inclusion of English language in the curricula of kindergartens, schools and universities across the UAE. This focus has resulted in diverse attempts to strengthen English usage across the emirates. Since September, 2010, Abu Dhabi Council for Education (ADEC 2009) has recruited a native English-speaking teacher to co-teach with a native speaker of Arabic in every classroom from kindergarten to Grade 3. This full immersion model for the teaching of English is being used in teaching all subjects except for Arabic language and Islamic studies classes.

### *14.1.2 Language Development for Young Children*

According to Owens (1996, 2001) language is learned through conversations. From birth, parents and caregivers usually treat their child as a conversational partner and provide language models for their children. In an attempt to maximize the child's participation, parents continue to modify conversations as the child includes sounds and then words and sentences into his/her language repertoire. (For more on the impact of parents' language policies and attitudes on children's language and literacy skills, see Farran, Bingham, and Matthews, Chap. 16). Adults, acting as facilitators of communication, gradually increase children's opportunities to participate verbally in conversations. (For more on mother-child literacy activities and emergent-literacy in children, see Korat, Aram, Hassunha-Arafat, Hag-Yehiya Iraki and Saiegh-Haddad, Chap. 15). For example, Owens (2006, p. 43) describes a "turnabout" as "a comment or reply to the child's utterance, followed by a question that serves as a cue for the child to take his turn".

By the time the child enters kindergarten, it is estimated (Owens 1996) that s/he has learned 90 % of his/her language form/structure (syntax, morphology and phonology) and that new words continue to be added to the child's lexicon at the rate of two or three per day. More advances are made during the school years, particularly in the semantic and pragmatic aspects of language.

The child's linguistic growth develops further through the school years as metalinguistic skills develop. Metalinguistic skills are usually defined as one's ability to think about language. Metalinguistic competence becomes increasingly necessary, for example, as reading skills develop, and they lie at the heart of the child's transition from the "learning to read stage" to "reading to learn" (Chall 1983). Such linguistic development does not describe the development of language in diglossic Arabic.

### *14.1.3 Diglossia*

Diglossia (Ferguson 1959), a linguistic phenomenon characterizing the Arabic language, as well as other language communities (for a cross-linguistic perspective, see Myhill, Chap. 9) should be considered in any inquiry into Arabic language and reading development in children. (For assessment and clinical implications of this, see Khamis-Dakwar and Makhoul, Chap. 13). Diglossia refers to "the presence of a high and a low style or standard in a language, one for formal use in writing and some speech situations, and one for colloquial use" (cited in Harris and Hodges 1981, p. 88). In the Arabic language, Standard Arabic (also referred to in the literature as Literary Arabic or Classical Arabic) is used in writing and in formal communication whereas spoken Arabic, a linguistically related form, usually referred to as colloquial Arabic, is used in daily conversation. (For more on the structure of Arabic language and orthography, including diglossia and the difference between Classical Arabic, Literary Arabic, and Standard Arabic, see Saiegh-Haddad and Henkin-Roitfarb, Chap. 1). The linguistic distance between Standard Arabic and the spoken varieties (so-called dialects) has been documented in all linguistic domains and especially in the phonological domain. (See Laks and Berman, Chap. 11, for some of the distinctive linguistic features. Also, see Maamouri 1998; Saiegh-Haddad 2003). This diglossic context puts Arabic-speaking children in a situation where they are confronted with the task of learning a different form of the language upon beginning formal education (for the ideological basis of this, see Saiegh-Haddad and Spolsky, Chap. 10) as this is the language encoded in books. (See Rosenhouse, Chap. 12, for more on diglossia in textbooks). Some researchers argue that this diglossic situation interferes with the acquisition of basic literacyskills in Standard Arabic (Ayari 1996; Maamouri 1998; Saiegh-Haddad 2003, 2004, 2007, 2011, 2012; Saiegh-Haddad et al. 2011). Yet, Ayari (1996) argues that this hardship can be reduced through the early introduction of Standard Arabic to kindergarten children, and Feitelson et al. (1993) and Abu-Rabia (2000) report that children who were exposed to Standard Arabic performed better on language and comprehension tasks as a result of exposure to MSA.

In Emirati society, children grow up speaking their own Emirati dialect of Spoken Arabic(which may vary from one tribe to another) at home and usually start learning Standard Arabic in a more formal way as they go to school. While they may have some exposure to Standard Arabic during their pre-school years (for example in some TV programs), this exposure is likely to be minimal. As in any other Spoken Arabic dialect, the Emirati Spoken Arabic has its own distinguishable characteristics in all aspects of language. Some of these characteristics are at the phonological and semantic level. For example, the phoneme /*q*/ in standard Arabic is produced as /*g*/ in the Emirati dialect. (For more on linguistic differences between Standard and Spoken Arabic, see Saiegh-Haddad and Henkin-Roitfarb, Chap. 1).

In addition, most UAE children are exposed to the native languages of their Philippine or Indonesian housemaids, nannies, and drivers who speak very little (and often distorted) Arabic. Most of these employees also speak a Filipino variety of English (non-standard), so there is usually neither a strong Spoken Arabic (let alone Standard) nor a Standard English language model provided for children by the people with whom they spend a great deal of time.

Another issue is the polygamous nature of some UAE marriages, where children may have half-siblings from mothers who may be of different ethnic backgrounds and speak various languages (such as Indian, Persian, Tagalog, or other Spoken Arabic dialects, such as Moroccan or Egyptian Arabic) that are different from the Spoken Emirati dialects. All of these factors place the Emirati child at risk of acquiring language from a language model that does not reflect sound dialectal or cultural practices. In addition, with the new curricula for integrating English into kindergartens and schools, it is assumed that the child will receive formal instruction in Standard Arabic and English regardless of the socio-cultural background of the child.

In a study by Tibi et al. (2006) on the impact of housekeepers or nannies on Emirati children's reading and writing skills in the first grade, it was found that children of families who employ housekeepers or nannies performed significantly lower on tasks of letter recognition, word reading and spelling than children of families without housekeepers. The authors attributed this poor performance in the reading and writing skills of such Emirati children to their exposure to poor language models (housekeepers or nannies) in the early years of language acquisition prior to formal instruction in reading and writing. (For more on the impact of quality of language of caregivers/parents, see Farran, Bingham, and Mattews, Chap. 16).

In a longitudinal study undertaken by Tibi et al. (2013), it was reported by three Abu Dhabi kindergarten teachers that they were encouraged by ADEC to use Standard Arabic in the classroom. However, according to the observations the authors carried out in three different kindergartens for the purpose of that study, it was clear that only one of the three observed teachers used Standard Arabic frequently. The other two teachers used the Emirati Spoken dialect most of the time. In that study, children who were taught by the teacher who spoke Standard Arabic were observed to use Standard Arabic more. This finding suggests that young children are capable of using Standard Arabic if they are exposed to it.

### *14.1.4 Bilingualism*

There are various definitions of the term 'bilingualism'. One definition is that being bilingual means speaking two languages fluently (Hoff-Ginsberg 1997). In the UAE education system, the planned transition to bilingualism involves teaching both Standard Arabic and English from Kindergarten1 (four years old) throughout the years of formal schooling.

There are various approaches to fostering bilingualism in children: for example, bilingual education programs (Marsh et al. 2002) or full immersion programs (Cummins 2004). Because there are a variety of approaches, the rationale for any transition to bilingualism in a national education system should be clearly outlined to ensure that the desired outcome is explicit, and that subsequent policies can deliver the intended outcome. For example, macro-level impacts on society (e.g., effects on national identity (Nieto 1995), religious beliefs, and possible economic advantages) and micro-level changes to communities and individuals (e.g., ensuring expertise in teaching a second language, possible family or tribal resistance to a second language, difficulties in understanding academic concepts in a second language) should be considered.

Studies have shown clearly that it is important to maintain the native language because it is the medium through which cultural heritage and oral history can be sustained (see, for example, McCarty and Watahomigie's (1998) work with Native American groups). Children's native language is part of their sense of identity and who they are as people (Nieto 1995; Tatum 1997). In addition, their native language facilitates knowledge of subject matters, and promotes academic success (Igoa 1995). In several published studies by Cummins and colleagues (Cummins 1978a, b; Cummins and Gulutsan 1974; Cummins and Mulcahy 1978), the academic and cognitive gains from additive bilingualism as opposed to subtractive bilingualism were constantly underscored. Cummins (1994) makes a clear distinction between additive bilingualism in which the first language continues to be developed and the first culture valued while the second language is added; and subtractive bilingualism in which the second language is added at the expense of the first language and culture. Cummins (1984) argues that students' first language literacy skills clearly communicate to them the value of their culture and identity and, when incorporated in an instructional program, will contribute to students' academic engagement.

There is no doubt that being bilingual has clear personal, cultural, cognitive and academic advantages. For example, research has shown that bilingual children have greater phonological awareness which allows for a good start in learning to read (Chen et al. 2004). Being bilingual also facilitates achievement in other academic areas such as reading, vocabulary, and grammar (Diaz 1983; Reich 1986).

### *14.1.5 Issues to be Considered When a Bilingual Curriculum is Planned*

Cummins (1981, 1991) has stressed the importance of developing academically and conceptually in one's native language while learning another language and specifically warns against neglecting the native language while doing so. In fact, research indicates that giving up one's native language delays rather than expedites academic progress in English (Cummins 1991; Dolson 1985).

Cummins (1991) argues that the primary language (L1) constitutes a conceptual foundation for academic growth, and contributes to one's valuing of one's own culture. Further, Cummins' linguistic threshold hypothesis assumes that a minimum threshold of competence in L1 is required in order for a child to benefit from instruction in a second language (L2). Hence, if a certain threshold level in L1 has not been reached, the child may become "semi-lingual", which implies poor levels in both languages, and has detrimental effects on both academic and cognitive growth. In summary, the implication of the threshold hypothesis is that both languages (L1 and L2) must be given sufficient opportunities to develop in order to achieve long-term positive results. Research on bilingual reading development has supported this argument. For example, Saiegh-Haddad and Geva (2010) stated that concurrent acquisition of reading in multiple languages will have benefits at some point. Based on the research the authors reviewed on reading in two languages, Saiegh-Haddad and Geva concluded that a) there is a shared linguistic basis for reading, and b) the likelihood of cross-linguistic transfer does not necessarily mean it will happen automatically. This is due to the complexity of the conditions under which transfer occurs.

The linguistic interdependence hypothesis, proposed by Cummins (1984, 1991, 2000), assumes that language and literacy skills can be transferred from one language to another, presuming there is adequate exposure (either in school or the home environment) and adequate motivation in the second language. This possibility of transfer across languages, according to Cummins, is due to the "common underlying proficiency" (2000, p. 38) of concepts, skills and metalinguistic knowledge children acquire in the course of learning their own language (Cummins 1991, 2000). The issue of transfer across languages has also been reported in other studies. For example, some researchers have noted that bilingual students' difficulties in word decoding and spelling in L2 have their roots in their L1, regardless of the type of orthography involved (DaFontoura and Siegel 1995; Geva et al. 1993; and Ho and Fong 2005).

It follows from the above discussion that, within a bilingual program, instructional time can be invested in developing students' literacy skills in their native language without any adverse effects on the development of their literacy skills in a second language.

The past two decades have witnessed an increasing body of research examining the impact of linguistic skills in the first language on second language and literacy development (Saiegh-Haddad and Geva 2010). For example, Cisero and Royer (1995) noted that awareness of one's L1 phonology predicts one's ability in decoding and word identification in L1 and also in L2. In a study by Sparks (1995), the author suggested that skills such as phonology, orthography, syntax and semantics in writing and speech in L1 facilitate learning of L2. It was also reported that poor readers in L2 present with difficulties in syntax, phonology and working memory of their L1 (Abu-Rabia and Siegel 2003).

There is no doubt that in a multicultural and cosmopolitan society like the UAE, being competent in English has great benefits. However, if Emirati children continue to be taught mainly in English, their knowledge of Standard Arabic may suffer in the process. This is likely to happen due to two reasons: the diglossic situation of the Arabic language and the limited exposure that children have to Standard Arabic, the written language; and also due to the most recent changes in the curricula of Kindergarten 2 (5 years old) in Abu Dhabi that involves a reduction in the time allocated to the formal instruction of Arabic language and little or no time for access to Arabic language and literacy activities in the kindergarten library.

### *14.1.6 Literacy Development*

The importance of literacy development in today's world cannot be overestimated. It "is widely reckoned that, in modern societies, literacy skills are fundamental to informed decision-making, personal empowerment, active and passive participation in local and global social community" (Stromquist 2005, p. 12, cited in UNESCO (2006) p. 137).

In the new millennium, the definition of literacy has been expanded to include literacy in information and communication technologies (Cunningham 2000). Literacy is no longer exclusively defined as the ability to read and write alone. In fact, since Marie Clay introduced the term *emergent literacy* in 1966, a large body of research has demonstrated that literacy begins long before children begin formal instruction in school (Clay 1991; Hall and Moats 1999; Teale and Sulzby 1986). Furthermore, literacy encompasses other aspects of development such as language (including, in the UAE, aspects of diglossia and bilingualism, already discussed) and cognition (Ormrod 2008; Owens et al. 2007).

### *14.1.7 Emergent Literacy*

The term "emergent literacy" was coined by Marie Clay (1966) to describe the journey of literacy development that the child takes, beginning at birth. Roth and Baden (2001) believe emergent literacy is the vitally important period between birth and five years in which children become increasingly aware of the forms and functions of print, and develop attitudes about literacy. Ramsburg (1998) argues that emergent literacy is observed when young children use books and writing materials to imitate reading and writing activities, although they cannot yet read and write in the formal sense. Ramsburg further claims that these early activities form part of a continuum of development, rather than being just preparation for reading and writing.

Clay's later work (see, for example, Begg and Clay 1968; Butler and Clay 1979) elaborates on the importance of introducing literacy experiences into the lives of very young children, instead of waiting until children begin school and then using only memorization techniques to learn to read and write.

Whitehead (2004), like Clay (1975), claims that reading and writing have their genesis in oral language and all three develop from birth. Being a writer, Whitehead says, is "another means of enriching and extending children's existing communicative skills and satisfying their own felt needs for literacy" (p. 190). She also argues that reading and writing are cognitive tools "that transform our capacity for self-reflection, mental re-organization and evaluation" (p. 169). She strongly criticizes earlier claims about writing as being simply a technical skill and maintains that handwriting (or calligraphy) is a craft skill that is different from writing.

Whitehead's concept of emergent literacy is supported by Adams (1990) and Teale (1986) who indicate that the first five years are particularly important in a child's acquisition of literacy knowledge. They note that children who begin school with literacy knowledge have a considerable advantage in learning to read over children who come from literacy-deprived environments.

Research has clearly indicated that children with good language skills are likely to enjoy reading and begin to read earlier than their age-matched peers who have poor language skills (Anderson et al. 1985; Baker and Brown 1984). On the other hand, children with language impairments may also exhibit literacy impairments or at least be at risk of reading and writing difficulties (Owens et al. 2007; Stanovich 1986). Language deficits usually contribute to literacy problems in many ways; deficits in phonological processing and phonological awareness, impaired comprehension, and poor metalinguistic skills (Catts and Kamhi 2005; Hambly and Riddle 2002; Naremore 2001). In fact, it has been acknowledged that literacy problems have their roots in the years prior to formal school instruction in reading and writing (Anderson and Shames 2006).

The importance of emergent literacy processes to a child's cognitive development cannot be overestimated. Piaget (1959, 1966) used the term "symbolic thought" to describe the use of abstract concepts and symbols (most commonly words, but also numbers and gestures) that children aged eighteen months to two years develop to represent reality.

Vygotsky (1978) maintained that "internalization of complex thought processes comes only after children first use such processes in their verbal interactions with others" (cited in Ormrod 2008, p. 59). Hence, early literacy exposure allows for many opportunities of language and social interactions between children, their peers and the adults around them. Such interactions (formal and informal) provide the foundation for children to grow and develop cognitively and linguistically. In Vygotsky's view, when adults interact with children, they engage children in meaningful activities through which they share meanings for objects and events. Central to Vygotsky's theory is the emphasis on society and on culture in transmitting cognitive tools that facilitate children's learning and foster their thinking abilities. A very important cognitive tool is language (oral or written) through which children can acquire the unique concepts, ideas and beliefs of their culture.

### *14.1.8 Emergent Literacy at Home*

Literacy socialization for infants, toddlers and young children includes literacy artifacts, literacy events, and literacy knowledge (van Kleeck and Schuele 1987). Literacy artifacts are items children have around them in a literate environment (such as alphabet blocks, books on shelves and refrigerator art). Story reading, going to the library, and writing and reading menus are all examples of literacy events and activities. Literacy knowledge involves concepts about print such as knowing how to hold a book, what the title is for, who the author is, where to start reading, and how and when to turn the page. For young children, development of literacy and language go hand in hand.

Adams (1990) emphasizes the value of the literacy opportunities children receive at home prior to entering school. According to Adams, children who are exposed to fewer opportunities may lack the experiences of phonemic awareness, exposure to print, and thousands of school-like reading experiences. She underscores the importance of adults enjoying books with children while reading aloud to them and reflecting on the form and content of the book.

Baker (2003) has addressed the importance of involving families in helping their children develop reading and phonemic awareness skills. Baker suggests that family members can serve as role models in their literacy practices to show their children that reading can be enjoyable, informative and interesting.

### *14.1.9 Emergent Literacy in the UAE*

The heritage of oral language and memorization skills is arguably still prominent in the teaching of literacy in the UAE and many other Arab countries. It is also possible that the notion of "reading readiness" that became prevalent in western countries in the middle of the twentieth century may have also influenced the teaching of reading and writing in Arab countries. In the reading readiness model, aspects of literacy development are seen as sequential. Oral language development is believed to precede written language and it is held that writing can only be taught once reading has been mastered from the age of seven or eight, and in the form of technical calligraphy, or the copying of letters (Whitehead 2004). Teale and Sulzby (1986) explain that, in America, it was not until the 1970s that the traditional reading readiness model of literacy development (in the English language) was challenged.

However, in the Arab world, it was as recently as 2000 that Toaimah (2000) said that children could not write until they had learned to read and had developed fine motor skills or muscle control. Al Nashef (1996), too, states that children "must be able to hold/have a grip of the pencil, and be able to form a sequence of identifiable shapes and patterns" (p. 58) before beginning to write. Al Nashef underscores the development of fine motor skills as a precursor to reading and writing development rather than as one of many skills that develop in parallel as a child is exposed to literacy activities from a very early age.

### *14.1.10 Emerging Literacy in Some UAE Kindergartens*

Evidence of the influence of the argument described by Toaimah (2000) and Al Nashef (1996) was seen in the longitudinal study mentioned above by Tibi et al. (2013). The authors observed and analyzed the emergent writing behaviors of some Abu Dhabi four-year-old children at regular intervals over an eight-month period. Individual Emirati children were observed during their Arabic writing classes at specific times during their first eight months in three UAE public kindergartens, and their teachers and one of each of their parents were interviewed about writing opportunities at kindergarten and at home. Throughout the eight month observation period and at the interviews, the three teachers all strongly emphasized the need to provide activities and tools such as plastic or play dough and cutting with scissors. According to the interviewed teachers, children need to develop their fine motor skills in order to be able to write later on when they are in Grade 2 or 3 at school.

Tibi et al. (2013) found that few opportunities were provided for children in Kindergarten 1 to enhance their emergent literacy, particularly their emergent writing. Most children spent the scheduled classroom writing time in confusion as they attempted to write in many different ways on their worksheets what the teacher had previously modeled in only one way on the white board. The children were confused by the plethora of shapes on their worksheets made with a variety of writing tools and in a range of sizes and shapes, over which they were expected to trace, draw, join dots, or color. Children were also noted to have problems with directionality; right to left (Arabic) versus left to right (English). Teachers attributed this difficulty to confusions between the two languages, but the problem may have been due to the inappropriateness of the task for most four-year-olds.

While daily calligraphy lessons were being provided for the four year olds observed in the study by Tibi et al. (2013), no opportunities were offered for those children to link the technical calligraphic formation of letters to their own emergent writing practices or to other literacy experiences, apart from during the phonics practice led by the teacher at the beginning of each lesson. The children were not even asked to attempt to write their own names on worksheets. Interviews with the teachers and in-classroom observations confirmed that children were being drilled in mechanical aspects of writing letters in isolation, or calligraphy, instead of being encouraged to make any sense of their writing, or to write creatively.

Another phenomenon that was observed in the longitudinal study described above was that teachers and children constantly erased children's calligraphy attempts. One teacher reported that they "must erase children's work if it is not perfectly done so they (children) do not get used to the habit of making mistakes when writing the letters". Another teacher, who not only erased but corrected the children's attempts in her own handwriting, indicated that parents did not like to see imperfect work on children's worksheets. This comment was further supported by the third teacher in the study, who discussed some parents' angry behavior—directed at both teachers and their own children—if letters were not correctly formed on worksheets completed in kindergarten classes.

Although little research is available on early childhood education in the UAE, it seems the above findings by Tibi et al.'s longitudinal study support findings from an earlier study by Momani et al. (2008). In their study, Momani et al. (2008) investigated 44 kindergarten teachers' views of the curriculum, instruction, and assessment. The authors employed an open-ended questionnaire, interviews, and observations. Momani et al.'s results revealed that some teachers believe that the official curriculum is not developmentally appropriate, as it focuses more on academic instruction rather than on child development. The authors also found that teachers' instructional and assessment practices emphasize teaching academic skills, using a direct instructional approach whereby the teacher is considered the center of the teaching and learning process rather than the student. Momani et al. found that academic tasks and textbooks mandated by the Ministry of Education form the core of the learning process for the kindergarten age group rather than teachers being able to provide children with a learning environment and materials that are developmentally appropriate for children's cognitive, social and emotional well being.

### *14.1.11 Emergent Literacy Practices in Some UAE Homes*

During their longitudinal study of emergent writing of four-year-olds in some UAE Kindergarten and homes, Tibi et al. (2013) arranged for one parent of each of the six four year olds in the study to be interviewed about their provision of literacy practices in their homes. Six mothers agreed to be interviewed, and provided information about their own and their husbands' literacy practices with the children included in the study. The results of the study showed that parents rarely, if at all, read with or to their child. Few parents read books themselves; three of the five literate mothers said that they read magazines only, while one read books in addition to magazines, and one read the Quran as well. All the mothers reported that the children saw their fathers reading magazines and newspapers, with one also reading the Quranand another reading from the internet.

The mothers said that their children sometimes drew faces, shapes, flowers, cars, the beach and the sea. Some also colored pictures and traced over alphabet worksheets. One parent reported that her child sometimes attempted to write her name.

Only one mother indicated that she valued her child's work and communicated this to him by displaying his work, saying "we hang his work in the playroom". In general, most other mothers indicated that they did little with children's attempts to write or draw. One said "we trash them" while another said "we just leave them in his school bag if he draws at kindergarten".

Three mothers often provided their children with literacy materials such as paper, writing tools and books. Two provided these items sometimes, while one mother never provided them. Two children were reported to often ask a parent to write for them, two sometimes did, and two never did. Four children, the mothers claimed, never tried to read print, while two often did. Three mothers claimed that they and two fathers often read to the children in the standard language, while parents made some explanations in their own dialects whenever they needed to help their children understand what they read; the remaining seven parents (three mothers and four fathers) never did so.

The analysis of parent interviews in Tibi et al. indicated that, in general, the number and quality of literacy events in the households of families in the sample was minimal. Little awareness was expressed by parents about the importance of parent-child interactions and the provision of literacy-rich, responsive and stimulating early home environments for their young children.

### 14.1.12 Implications for Future Directions: Research and Policy

In planning for future directions for the UAE's educational system, there are some cautions that need to be considered. First, more research is needed and warranted before any generalizations can be made to the Arabic language which is different from other languages.

Second, while a few research projects undertaken in the UAE have been referred to above, they have been small in scale, and usually restricted by funding and time. There has been no strategically-designed large study designed to answer questions about the effects of introducing English in kindergartens and schools, or about the most appropriate approach to use. Similarly, there have been no major studies about emergent Arabic literacy in the UAE.

Whether a full immersion program or any other bilingual programs for the teaching of English in the UAE are favored, a further area of caution is noted for decision makers, who must be vigilant about the appropriateness of the instructional program of choice in terms of their own student population. Issues of diglossia, for example, should be carefully considered and planned for (see also in this collection, Khamis-Dakwar and Machul for assessment issues; Laks and Berman for linguistic differences; Rosenhouse for reflections in textbooks; and Saiegh-Haddad and Spolsky for ideological and policy issues).

It is also important that the provision of teaching and professional support is tailored to meet the individual needs of students. In particular, more support at instructional, assessment, and intervention levels should be given to students who are at risk of reading and writing difficulties in their first language.

Finally, it is clear that no reforms can be made without strategic planning and policy decisions by government, the Ministry of Education, and each Education Zone. In general, decisions need to be made about paying much more attention to the early development of children's Arabic language and emergent literacy than has previously been thought necessary.

With these cautions in mind, the following recommendations are made for parent education and support, teacher education and professional development, and policy development.

### 14.1.13 Parent Support and Education

Today's parents and grandparents of young children in the UAE experienced a very different school system (or none at all) from the one that their children and grandchildren face. It is therefore difficult for some adults to understand or follow their children's educational journeys when the adults themselves have not been exposed to current concepts of teaching and learning, the impact of technology, and different curriculum requirements. As a result, they require strong support in the form of parent education programs and campaigns backed by governmental policy to help them understand how they can assist their children's language development and emergent literacy during the early years. Some of the features of such programs should include helping parents to:

- stimulate infants', toddlers' and young children's oral Arabic language at home through a positive language model;
- learn about the role of home Arabic literacy and the positive impact it has on children's future literacy development; and to
- understand that the concept of emergent Arabic literacy is a continuum of development that builds on knowledge already established, needs constant practice, and positive parental encouragement.

### *14.1.14 Teacher Education and Professional Development*

A strategic, long-term plan for improving the development of young children's Arabic language and literacy should include education programs and professional development for potential and current kindergarten and school teachers so that they understand:

- the importance of maximizing Standard Arabic through meaningful, culturally appropriate activities;
- the value of emergent Arabic reading and writing and how both should be encouraged and valued from birth instead of being considered to begin when a child goes to school;
- how to promote awareness of Arabic print amongst kindergarten children by increasing and utilizing classroom and school displays, reading and discussing Arabic stories;
- the importance of encouraging children to take many opportunities to write (e.g., cards, lists, stories, captions, speech, cartoons), using scribbles, creative spelling and imperfectly formed letters as their skills develop, and to praise them for what they attempt rather than to chide them for their lack of perfection;
- that children should use their native language and be encouraged to feel proud about it;
- how to conduct early observational assessments to determine which children are at risk of failing to learn to read in their native language;
- how to monitor children's literacy progress in L1 and L2; and
- strategies for developing parent education programs that improve and support the knowledge of parents, families, and nannies about ways in which language and emergent literacy can be developed at home.

### 14.1.15 Policy Development

In order that kindergarten teachers are able to make classroom changes that will support improved language and emergent literacy development, there are a number of policy issues that kindergarten and school zones, ADEC, and the Ministry of Education, should consider. They include:

- increasing the amount of time allocated for teaching the Arabic language;
- increasing curriculum opportunities for the exposure of Emirati kindergarten children to more literacy activities in Standard Arabic inside the classroom;
- removal of the scheduled daily calligraphy lessons (at least in Kindergarten 1), which are inappropriate for four year olds;
- the inclusion of more meaningful Arabic language and emergent literacy experience activities in class (for example, discussions, telling stories, writing down children's oral language, children's assisted attempts to write their own stories);
- encouraging a change of teachers' attitude towards children's approximations of reading and writing by helping teachers to understand that encouragement and praise for what children attempt to read and write promotes literacy development far more than criticizing their efforts;
- time and encouragement for engaging children in activities that are culturally meaningful through Arabic story reading and other literacy activities;
- allocation of time for visiting the library to support Arabic literacy development;
- policies that encourage children to borrow Arabic story books from kindergarten and school libraries to take home and read with their families.

## 14.2 Conclusion

In the Abu Dhabi emirate of the UAE, the complexities of very young children's emerging Arabic literacy are exacerbated when the need to use Standard Arabic, and a second language (English) that is typologically different from the native L1, are added to the mix. There is no doubt that maintaining one's native language has its gains at all levels. Findings from research carried out by Fitzgerald (1995) have indicated clearly that native-language development can enhance reading in English as a second language. Therefore, within any bilingual program, instructional time must be allocated to developing students' literacy skills in their primary language.

There is also no doubt that, in a global community, being proficient in more than one language is an asset to the individual and his/her country. However, with many influences from the socio-cultural UAE context and the current educational regime of constant change, one or more of these languages may be sacrificed as children grapple to learn them. The key issue is how to raise a generation of bilinguals or trilinguals (fluent in Standard Arabic, Spoken Arabic and English) in the UAE whilst preserving the native language which is so important to the retention of national and individual identity, cognitive and metalinguistic ability, and, ultimately, the preservation of a culture.

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# Chapter 15
# Mother-Child Literacy Activities and Early Literacy in the Israeli Arab Family

**Ofra Korat, Dorit Aram, Safieh Hassunha-Arafat, Himat Hag-Yehiya Iraki and Elinor Saiegh-Haddad**

**Abstract** Our chapter focuses on the language and literacy development of Israeli Arabic-speaking kindergarten children within the context of their family. We researched two different literacy activities: storybook reading and joint word writing. The chapter presents results of the contribution of these activities, as well as socio-economic status (hereafter, SES) and home literacy environment (hereafter, HLE), to children's literacy level in kindergarten among Israeli Arabic-speaking families. A total of 109 kindergarten children and their mothers participated in the study. Children's literacy level was assessed in kindergarten.

Mothers and children were videotaped at home during a book reading activity and in a word writing activity, and demographic and HLE data were gathered from the mothers. Mothers showed low to medium levels of mediation in the bookreading activity by focusing mainly on paraphrasing, and in the writing activity by mainly naming the letters and providing a model for copying. However, while the results from the writing activity followed Bronfenbrenner's three-layered ecological model (SES, HLE and parental mediation) as expected, reading showed a contribution only from the two first layers, SES and HLE.

We conclude that the linguistic gap between the spoken and the language of literacy, Standard Arabic (or Literary Arabic) poses difficulties and may be confusing for the mothers in mediating the written language across literacy activities, reading and writing. Our study points to the importance of the family's HLE and SES for children's early literacy. Future studies should emphasize how to best design family intervention programs so as to maximize children's literacy growth within the Arabic-speaking family.

**Keywords** Arabic · Diglossia · Literacy activities · Home literacy environment · Socio-economic status · Storybook reading · Joint word writing

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O. Korat (✉) · S. Hassunha-Arafat · H. Hag-Yehiya Iraki
School of Education, Bar-Ilan University, 52900 Ramat Gan, Israel
e-mail: korato@mail.biu.ac.il

D. Aram
Tel Aviv University, Tel Aviv, Israel

E. Saiegh-Haddad
English Linguistics and Literature Department,
Bar-Ilan University, 52900 Ramat Gan, Israel

E. Saiegh-Haddad, R. M. Joshi (eds.), *Handbook of Arabic Literacy,* Literacy Studies 9,
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## 15.1 Introduction

This chapter focuses on the family literacy context in which Israeli Arab kindergarten children live, and its relation to their literacy skills. Literacy acquisition seems to be a singular and interesting process for young Arabic-speaking children, due to the distinctiveness and complexity of this language (Holes 1995). This assumption is grounded in the socio-linguistic phenomenon of diglossia, and the subsequent linguistic distance that exists between the spoken and the standard written language variety. (For more on diglossia see, in this collection, Khamis-Dakwar & Makhoul, for assessment; Myhill, for a cross-linguistic perspective; Saiegh-Haddad & Spolsky, for ideologies and implications for language instruction; Rosenhouse, for manifestations in textbooks).

Written texts in all languages differ to some extent from the everyday spoken language. However, Arabic diglossia manifests itself in great differences between the standard language (called "Fusħa" 'eloquent language') and the spoken language (called "ʕa:mmiyya" 'colloquial language') (Ferguson 1971 [1962]). (For a discussion of some of the linguistic differences, see in this collection, Laks & Berman and Saiegh-Haddad & Henkin-Roitfarb). Unlike Spoken Arabic (hereafter, SpA) which is used for daily communication, Standard Arabic (hereafter, StA) is reserved for formal communication and is studied mainly in school (Meesls 1979; Somah 1980). While parents in various cultures and languages are reported to serve as facilitators in bridging the orality-literacy gapfor their children, Arab Israeli parents have been reported as seldom exposing their young children to StA (Feitelson et al. 1993). This may be due to the structural complexity of StA and subsequently parental belief that early exposure to literary Arabic could be a burden for young children (Abu-Rabia 2004). The reported limited exposure to StA texts might be responsible for the difficulties of Arabic-speaking children in listening comprehension (Feitelson et al. 1993; Ministry of Education 2001), acquisition of basic reading skills (Eviater and Ibrahim, Chap. 4; Saiegh-Haddad 2003, 2004; Saiegh-Haddad et al. 2011) and later on in reading comprehension (Abu-Rabia 2000).

Besides the linguistic distance between the spoken and the written varieties of Arabic, the Arabic orthography itself is also complex (Ibrahim et al. 2002) and consists of a dual system of letters and diacritics. Further, Arabic script is cursive with 22 of the 28 letters having four different shapes depending on their position within the word and on the nature of the preceding letter. Further, many letters share one identical basic shape and are distinguished only by the number and location of dots. This latter characteristic reflects the historical evolution of the Arabic orthographic system. (For a detailed description of Arabic language and orthography, see Saiegh-Haddad & Henkin-Roitfarb, Chap. 1). These orthographic features have been argued to make orthographic processing in Arabic difficult. (For more on the impact of Arabic orthography on letter processing and reading, see Eviatar & Ibrahim, Chap. 4).

The theoretical framework of the research presented in this chapter is socio-cultural and is based on the premise that culture shapes the mind (Rogoff 1990; Vygotsky 1978; Wertsch 1985). In other words, the individual's mental activity is external and social, and is internalized by the individual in the course of joint activity with more experienced others. More specifically, the study is grounded in Bronfenbrenner's (1979) model, according to which various layers of context affect the individual's development. In his model, Bronfenbrenner refers to macrosystems such as cultural, social, or ethnic groups; mesosystems including close groups such as family or peers; and microsystems, or proximal processes—the actual interactions between children and significant others. In this study, we examined a model of three contextual layers reflecting the three depicted above and their relationship to Arabic-speaking kindergartners' early literacy: SES, children's literacy environment at home, and the nature of maternal literacy mediation: storybook reading and joint writing. (For more on environmental factors and literacy development, see Farran, Bingham, & Matthews and Tibi & McLeod, in this collection).

Reading and writing are essential tools in modern cultures, and success in these areas is central to academic achievement and beyond (Cunningham and Stanovich 1998). The literacy code is a creation of culture and society and is passed from generation to generation (Olson 1984) and parents usually play an important role in this process. Parental mediation, through which children are introduced to this code in their environment, constitutes a central factor in literacy development (Korat 2011; Aram and Levin 2011; McBride-Chang et al. 2010; van Kleeck and Stahl 2003).

Researchers have reported differences in the quality of maternal mediation in literacy events such as bookreading (Korat et al. 2007; Baker et al. 2001; Heath 1983; Leseman and de Jong 1998; Ninio 1980) and mutual writing (Korat and Levin 2002; Aram and Levin 2011) between families oflow and middle socio-economic statuses (hereafter, SES), favoring the latter. In the bookreading activity, mothers from low SES (hereafter, LSES) were reported to ask fewer questions and to rarely encourage their children to participate in the event (Ninio 1980). Moreover, mothers from LSES tend to relate more to illustrations in the book than to language and to paraphrase the text to their children (considered a low level of cognitive mediation), whereas mothers from middle SES (hereafter, MSES) are reported to discuss the story content with their children, to use rich vocabulary and complex language and to relate to the properties of the written text (reflecting a high level of cognitive mediation) (Korat et al. 2007). In writing, Hebrew-speaking mothers from MSES were found to communicate the steps in the encoding process to their children and to encourage them to carry out those steps during parent-child writing activities. They were also found to give their children more autonomy than mothers from LSES in printing the letters and to refer to the Hebrew orthography more often during joint writing (Aram and Levin 2001).

Children's literacy development is not related to parental mediation only but also to more general factors, such as family SES and the home literacy environment (hereafter, HLE). The relation between SES level and children's achievements in oral language and literacy skills is well documented (Aram and Levin 2001; Korat et al. 2007; Korat and Levin 2002; Walker et al. 1994). Children from MSES present better language and early literacy skills than children from LSES (Bowey 1995; Lonigan and Whitehurst 1998; Ninio 1980; Raz and Bryant 1990).There are also reports on the connection between HLE measured by the amount of literary artifacts (books, journals for adults and children, writing materials, etc.) and by the frequency of literacy activities at home (prevalence of reading books to children, visits to the library, etc.) (Heath 1983; Wells 1985)and children's language and literacy achievements (Evans et al. 2000; Hecht et al. 2000). A literacy environment that includes many artifacts predicts children's early literacy in kindergarten (reading, writing, phonological and orthographic awareness) (Aram and Levin 2001; Purcell-Gates 1996; Stuart et al. 1998). Other studies report that a literacy environment rich in artifacts (e.g., paper, pens, books, newspapers, and computers) contributes to later achievement in reading comprehension (Caretti et al. 2009; Catts 2009; Cunningam 2010; Hirsch 2003).

It is important to note that a search in the published literature on the relationship between SES, HLE and children's early literacy did not reveal any such research among Arabic-speaking families. We did not find any published research that documents the nature of parental storybook reading or writing interactions with young Arabic-speaking children. In the present chapter we present a pioneering study addressing variables and the relationships among them. We aimed to learn how family SES, HLE and maternal mediation in a bookreading event and in a collaborative writing activity contribute to Arabic-speaking kindergartners' language and early literacy. This investigation is highly warranted, given the diglossic context of Arabic on the one hand, and the low literacy achievements of Arabic-speaking children in Israel, on the other (Zuzovsky 2011).

It should be noted that our research project focused on a large number of families and incorporated two projects aiming at two different activities—book reading and word writing. Data analysis was insured by the specific aims of each project.

### *15.1.1 Method*

**Participants**

One hundred and nine 5 to 6-year old children and their mothers took part in this study. The families were from four communities located in the center or north of Israel and represent different types of settlements in which Arabs currently live in Israel: (a) Muslim Arab village in the north, (b) Mixed Christian and Muslim Arab city in the north, (c) Muslim Arab neighborhood in a mixed Jewish and Arab city in the center of Israel and (d) Muslim city in the center of Israel. All children came from homes in which Arabic was the principal language. In the kindergarten, book reading took place once a week, letters were presented on the walls, and the teachers used work sheets for teaching letters once a week. The children at kindergarten were exposed to television programs broadcast in StA, without the teachers' guidance, 2 to 3 times a week.

## Procedure

Data were collected in four sessions. In the first session, the children's early literacy (hereafter, EL) was assessed individually within their kindergarten setting towards the end of the school year, from May to June. Two individual meetings (between 20–30 min each) were held with each child participating in the study. In the second session, mother-child dyads participated in a joint story bookreading activity in their homes. The mothers were given an unfamiliar storybook and were asked to read it to their children as they deemed fit. This activity was videotaped and later analyzed. In the third session, 3 to 4 days after the bookreading activity, we asked the mothers to help their children write six words. This activity was also videotaped and analyzed. The mothers and their children received six cards, each of which displayed a drawing of an object. The mothers were asked to help their children write the words to the best of their ability, without any further directions. Demographic and HLE information was gathered at home in the fourth session, two to three days later.

## Research Instruments

### Maternal Mediation in Bookreading

We used the children's book *Arrogant Little Rabbit* by Abdo Muhammad (no year of publication is provided) in the mother-child bookreading activity. The book was not familiar to the parents or the teachers in the Arabic-speaking communities that participated in our study. The book contains 10 pages, each of which includes 1–2 lines and a matching colorful line drawing of the scene. The narrative includes elements of exposition, problem and solution and tells about an arrogant little rabbit that refuses to play with a turtle, a lamb and another rabbit. One day a fox comes to attack the rabbit and eat it. All the animals that the rabbit refused to play with hurry to help it. The rabbit apologizes to all the animals, thanks them for their kindness and offers to become friends with them.

The mother-child interaction was segmented into verbal units. A verbal unit constitutes the smallest unit. A few verbal units (3 to 5) usually constitute a topic unit. A topic unit was coded only when a new content was added to the previous discourse. Each topic unit was coded into only one of five categories. In the few cases in which a topic unit referred to more than one category, a discussion and decision was made by the two raters as to the category to which it seemed to fit better. This coding system was based on work carried out by Bus et al. (2000) and was modified for the purposes of the current study. Inter-judge reliabilities for segmenting the interaction into content units were computed based on a random selection of 10% of the dyads. Reliability measured by Cohen's Kappa was 0.80, $p<0.001$.

The topic units were classified into five levels, from low (1) to high (5), as follows: (1) relating to illustrations in the book (e.g., naming characters and objects in the illustrations, referring to the relationship between the text and the illustrations, or naming details in the illustrations that were not mentioned in the story); (2) narrating the story in spoken Arabic (the mother reads the story silently, then tells the story in spoken Arabic); (3) reading and paraphrasing (the mother reads the story aloud, then paraphrases the text—this includes word explanations and sentence completion); (4) promoting text comprehension via "distancing" (e.g., relating to the child's own relevant experiences to further text comprehension or making connections beyond the text, including instructions, recollection and reconstruction); (5) relating to the written text—the orthography and the decoding/reading process. The hierarchy of the levels was determined by "moving from concrete immediately available information" (De Temple and Snow 1996, p. 54) to higher cognitive or abstraction processes, termed by Sigel (1982) as "distancing". Each content unit that could be classified into the five categories was given a score ranging from 1 = low (naming of characters and objects) to 5 = high (relating to the orthographic system that appears in the book). Inter-judge reliabilities for sorting content units were computed based on a random selection of 10 % of the dyads. The reliability for maternal mediation levels was $K$ = 0.79.

## Maternal Mediation in Joint Writing

The mothers helped their children write six mundane words that are part of children's spoken vocabulary. The mothers and children received six cards, each of which displayed a drawing of an object that is referred to using a different word in SpA and StA. The objects were: glass (StA *kaʔs*—كأس, SpA*kubba:y*—كباي/; bed (StA *sari:r*–سرير, SpA *taxit*—تخت); telephone (StA *ha:tif*—هاتف, SpA *talifo:n*—تلفون; shoe (*StA ħiða:ʔ*—حذاء, SpA *kundara*—كندره; bag (StA *ħaqi:ba*—حقيبه, SpA shanta—شنته); and cat (StA *qiṭṭa*—قطه, SpA *bissi*—بسة). The mothers were asked to help their children write the words as best as they could, without any further instruction. Videotapes of the dyadic interactions were transcribed verbatim and the transcripts were used to code the interactions. Two measures were coded: grapho-phonemic mapping and printing mediation.

Grapho-phonemic mediation is the degree to which the mother guides her child through the process of segmenting each word into its sounds and retrieving the required letter for each sound when attempting to represent a word in writing. The encoding of each letter was assessed on a 7-point scale. We demonstrate the scale's range for the word 'bed'StA *sarir* - سرير: (1) The mother refers to the word as a whole: "Write *sarir*". (2) The mother utters the sequence of sounds that create the word, for example: "Write *sa—ri- r*". (3) The mother refers to each letter separately—dictates a letter name, for example: "Write Sin" [the letter name for S]. (4) The mother retrieves the target phoneme or CV phonological unit and immediately dictates the required letter name, for example: "*sa*—Sin" [the sound *sa* and the letter Sin]. (5) The mother retrieves the phonological unit and encourages the child to link it with a letter name, for example: "It starts with *sa* so which letter is it?" (6) The mother encourages the child to retrieve the phonological unit and link it with a letter name (either Spoken or Standard), for example: "*sa-ri-r* so what do you hear at the beginning, which letter is it?"; and (7) the mother encourages the child to go through the whole process independently while supporting the child along the way when help is needed. The average scores across the letters yielded the grapho-phonemic mediation score (Cronbach's alpha reliability coefficient across the letters was $\alpha = 0.96$).

Printing mediation captures the autonomy allowed or encouraged by the parent in printing each letter. The printing of each letter was assessed on an 8-point scale: (1) the mother writes the letter; (2) the mother writes the letter holding the child's hand; (3) the mother writes the letter as a sequence of dots for the child to follow; (4) the mother writes the letter for the child to copy; (5) the mother virtually demonstrates the letter's shape in the air or on the table; (6) the mother describes the letter's shape (e.g., "it's like a square with two dots"); (7) the mother scaffolds the child by using the child's previous knowledge, for example tells the child in which familiar word the letter appears; and (8) the child writes the letter independently, encouraged and monitored by the mother. The mean score across the letters yielded the printing mediation score (Cronbach's alpha reliability coefficient across letters was $\alpha = 0.97$).

### Demographic Information

The mothers were asked for demographic information including data about the present SES of the family. The children's age (in months) was $M = 68.74$, $SD = 4.99$, their mothers' mean age (years) was $M = 30.80$, $SD = 3.54$, and their fathers' mean age was $M = 32.30$, $SD = 4.24$. The families have $M = 3.6$, $SD = 1.47$ children, with $M = 5.65$, $SD = 1.46$ people living in $M = 4.03$, $SD = 1.18$ rooms.

A seven-factor index was used to calculate the families' SES levels and took the educational and occupational levels of the fathers and mothers, including the family income level into account. The mean of the SES variable was 2.80 ($SD = 1.17$) (range 1–5; $\alpha = .92$). The data showed that the mothers' educational level is higher than that of the fathers ($t\ (108) = 2.17$, $p < .05$), whereas the fathers' occupational level is higher than that of the mothers ($t\ (108) = 5.08$, $p < .001$). The mean income level of the families ($M = 2.58$, $SD = 1.27$) was found to be below the reported average of the Israeli Jewish population ($M = 3.19$, $SD = .90$, see Gallili 2006) and is similar to that of the Jewishlow SES population ($M = 2.76$, $SD = .92$).

### Home Literacy Environment

The mothers were asked to give information about the Home Literacy Environment(HLE) of their families. The questionnaire included aspects such as the number of adult and children's books in the home, frequency of parental reading of books to the child, newspaper subscription (children and adults), number of videos and DVDs, mother's reading pleasure, and the number of children's educational games in the home ($\alpha = 0.76$). According our findings, Arab families' homes in our sample had on average one computer, very few educational games for reading

($M=6.09$, $SD=5.46$) and arithmetic ($M=3.56$, $SD=4.04$), some computer games ($M=6.90$, $SD=0.63$), and video cassettes and DVDs ($M=14.11$, $SD=12.95$). We counted (on average) only 30 children's books and 29 adult books in these homes. About one third of the families reported that they had a subscription to an adult newspaper. The mothers reported reading to their children on average every three days (about 11 days a month), while fathers' reading to their children was reportedly only once a month. The average age of beginning reading to children was reported as one year and 6 months. Most variables, including the existence of literacy tools: computers ($r=0.34, p<0.001$), computer games ($r=0.28, p<0.001$), videos, DVDs ($r=0.58$, $p<0.001$), educational games in arithmetic ($r=.44$, $p<0.001$)and reading ($r=0.30$, $p<0.001$)were correlated positively and significantly with the families' SES. Reading frequency to the child as reported by the mother was not found to correlate with the family's SES.

## Children's Emergent Literacy Level

The children's emergent literacy (EL) level was assessed using two categories: written language and spoken language skills. Written language included nine parameters: letter knowledge (letter names, letter-sound knowledge and letter writing ability), concept of print, phonological awareness, orthographic awareness, literary word writing and word recognition**.** Spoken language ability included six parameters: expressive vocabulary knowledge of onsite words (Spoken and Standard Arabic), receptive knowledge, and listening comprehension of written sentences and a story.

## Written Language Tasks

*Letter naming* The children were presented with 29 letters (including final non-connected letter shapes) of the Arabic script. Each letter was written on a card. With the card facing down, the child was asked to randomly pick a letter and say its name. This was repeated 14 times, such that 14 letters were picked. The scale was: 0= incorrect, 1= using the letter name used in SpA (إبـ), 2= correct, StA letter name (باء). The reliability coefficient of this tool was $\alpha=0.90$.

*Letter sound knowledge* The cards used for letter names were given to the children following the same procedure, except that this time they were asked to say the letter sound. The scale range for this task was: 0 = incorrect, 1 = the child said the letter sound embedded within a CV phonological unit (e.g., for the letter N (نْ) the child said na), 2 = correct, providing only the phoneme that the letter represents; $\alpha = .93$.

*Letter writing* The researcher randomly chose 14 letters. She named each letter and asked the child to write it on a card. The researcher used the first letter from the child children were presented s name for an example with feedback. The children's responses were scored on a 3-point scale: (0) wrong—no answer or wrong answer; (1) partial answer—writing a letter that is similar in shape (e.g., for the letter "ب" (B) writing ت, ن, ث) (see, Abu-Rabia and Taha 2006); (2) correct answer. Cronbach's alpha reliability coefficient across the letters was $\alpha = 0.90$.

*Print concepts* An adaptation of Shatil's Hebrew Concept Abut Print (CAP) test (2001), following Clay (1979, 1989), was developed and used for Arabic. The children were presented with the book *A Surprise for Yara* and were asked to answer 16 questions about it. The questions were about concepts such as page, lines, print, drawing including text handling (e.g., where one begins and ends reading a book) and directionality (in Arabic from right to left). Answers were scored as incorrect(or "I don't know") (=0) or correct (=1) and the range of scores was from 0 to 16, $\alpha = 0.84$.In all the research tests, "I don't know" answers were followed by the researcher's encouragements to the child to make an effort and give an answer.

*Phonological awareness* Two phonological awareness tests were developed for the study and administered on two separate days: initial and final phoneme isolation. Each task included 17 one syllable words, all of which were nouns familiar to children. The researcher said each word out loud, and then asked the child to say the initial or final phoneme in each word. The scale range for phonological awareness was: 0= incorrect; 1= partially correct—the child said the initial/final phoneme within a CV unit (for rationale and evidential basis, see Saiegh-Haddad 2007); 2= correct phoneme. The alpha reliability coefficient was.96 for the initial phoneme and.97 for the final phoneme isolation task. The mean score across the two tasks served as the phonological awareness score ($\alpha = 0.84$).

*Orthographic Awareness* The Arabic script contains 28 letters, with, as mentioned before, 3–4 different forms each: beginning of the word connected to the left only; beginning of the word (ﺑ -b), connected to the left and to the right; middle of the word (ﺒ -b), connected to the right only (ﺐ- b); and not connected (ب -b). The children were presented with 16 pairs of StA word stimuli. Each pair consisted of a StA word on one card and a string of signs that do not represent the StA script on another card. The signs comprised letters and numerals in Arabic, Hebrew and English, signs repeated several times resulting in excessively long strings, or wrongly connected words. The researcher presented the two cards to the child and asked her or him to choose the card that represents an Arabic word. Incorrect or "I don't know" answers were scored =0 and correct answers were scored =1. Cronbach's alpha reliability coefficient for this test was 0.82.

*Word recognition* This test aimed to examine the children's ability to recognize StA words. We used three pairs of words, which were familiar to the children: elephant-turtle (فيل – سلحفاة*fi:l – sulħafa*:h; FYL-SLĦFAÖ); bear-butterfly (دب - فراشة, *dub-fara:Šah,* DB- FRAŠÖ); giraffe-ox (زرافة - ثور/*zara:fah-θawr*, ZRAFÖ-θWR). These words were chosen because they represented about half of the Arabic letters and include long vowels, represented in Arabic orthography through compulsory letters, and short vowels, represented through a system of optional diacritics. (For more on the structure of Arabic orthography, see Saiegh-Haddad & Henkin-Roitfarb, Chap. 1). Furthermore, two cards presented a pair of words where the longer sounding word denoted a smaller referent (e.g., elephant-turtle (سلحفاة – فيل *fi:l – sulħafa*:h; FYL-SLĦFAḦ) and one pair presented a pair of words where the two referents were similar in their size but one word was longer phonologically and orthographically than the other (giraffe- ox (زرافة – ثور/*zara:fah-θawr*, ZRAFḦ-θWR). The rationale for including this contrast is found in the literature indicating that before they become aware of the alphabetic principle, young children tend to use a referential strategy where more letters are used for bigger referents (Levin and Korat 1993). Each word was written on a separate card and its matching drawing appeared on another card. The researcher put the two cards with the two words and the two cards with the matching drawings in front of the child and said, for example: "Here are two pictures for a butterfly and a bear, and also two cards for the two words 'butterfly' and 'bear'. Please put the word 'butterfly' under the picture of the butterfly and the word 'bear' under the picture of the bear." The scale for this task was: incorrect or "I don't know" = 0 or correct = 1, $\alpha$ = 0.62. After giving their answer, the children were asked to explain their judgments. The children's reasoning was classified into five levels, from low (1) to high (5) (Levin and Korat 1993), as follows: 1 = egocentric argument, 2 = semantic argument, 3 = phonological argument, 4 = argument based on letters, 5 = argument based on reading (the child read the word). Cronbach's alpha reliability coefficient for this test was $\alpha$ = 0.91.

*Word writing* The children were asked to write the same words used in the word recognition task (described above). The words were different from the words the children had been asked to write at home with the help of their mothers. Three cards displaying drawings of two nouns were presented randomly, with a blank card for writing each pair's names. The oral instructions for each card were, for example: "Write the word 'turtle' and then the word 'elephant'". Each word was scored on a 10-point scale adapted from Levin, Share, and Shatil (1996), ranging from pseudo letters through random letters, basic consonantal spellings, partial consonantal spellings, to formal writing. Higher scores indicated a higher, more formal level of writing. The mean score across the eight words served as the *word writing* score. Cronbach's reliability coefficient across words was $\alpha$ = 0.97.

### Spoken Language Tasks

*Expressive Vocabulary* We used the antonyms sub-test from Kaufman's *Battery for Children* (K-ABC) (1983) test in order to assess the children's vocabulary in SpA and StA. This test assesses the children's productive vocabulary by asking them to provide the opposite word to the word presented to them. Eighteen words from the K-ABC were translated into Arabic to test productive vocabulary (antonyms) for each test (a) in SpA and (b) in StA. The test was administered on two days. On the first day the researcher said the word in SpA and asked the child to give the opposite of this word. On the second day, the experimenter said the word in StA and asked the child to say the opposite of this word. The scale range was 0 = incorrect, 1 = correct.

Cronbach's reliability coefficient across words was ($\alpha=0.85$) for literary Arabic words and ($\alpha=0.89$) for spoken Arabic words.

*Receptive vocabulary (an adapted translation of PPVT—Peabody Picture Vocabulary Test)* The children's vocabulary was evaluated using an adapted translation of the *PPVT* test (Dunn and Dunn 1981). This test measures receptive vocabulary knowledge of children aged 2 to adulthood. Adaptation to Arabic following the Hebrew version (Nevo and Oren 1979) was performed by a group of Arab researchers, educators, and linguists and used both SpA and StA words. Based on a preliminary pilot, we used the first 40 items. In each item the child was shown 4 pictures and was asked to indicate the drawing that matched the word said by the researcher. The scale range was 0= incorrect, 1= correct. Cronbach's alpha reliability coefficient for this test was $\alpha=0.85$.

*Story comprehension* A translation of the story *Kamil and Lassie Dog* (Shatil 2001) from Hebrew into Arabic was used for this test. After the researcher read the story twice to the children, she presented them with 12 true/false questions about the story. The scale range was 0= correct, 1= incorrect. Cronbach's alpha reliability coefficient for this test was $\alpha=0.65$.

*Sentence comprehension* Shatil and Nevos' sentence comprehension test (2007) was translated from Hebrew into Arabic in order to evaluate the children's sentence comprehension. The children were asked to indicate which of the drawings best matched the sentence read to them by the researcher (e.g., the researcher said: "My mother said: take the book and bring it to the library". Which of the pictures that you see here (out of four) represents this sentence?).The distractors were syntactic manipulations of the target sentence. The scale was incorrect (or "I don't know") =0, correct =1. Cronbach's alpha reliability coefficient for this test was $\alpha=0.70$.

### *15.1.2 Results*

#### Children's Emergent Literacy

The mean and SD of the children's literacy level in kindergarten in Spoken and Standard Arabic and correlations with SES and HLE are presented in Table 15.1. Children's scores are presented as percentage.

According to Table 15.1, Arabic-speaking kindergarten children present a low level of literacy skills across most variables and large standard deviations that demonstrate great diversity among them. The children's knowledge of the concept about print ($M=68.63$, $SD=23.78$) was the highest among the written skills tested, whereas letter-sound knowledge ($M=33.20$, $SD=33.00$) was the lowest. This in part reflects the children's frequent use of the spoken letter names rather than the Standard Arabic letter names, and also difficulties in retrieving the letter sound, especially in the case of some letters such as those representing stop phonemes (plosives) or diglossic phonemes which do not exist in the children's spoken

**Table 15.1** Mean in percentage and (SD) of children's EL in kindergarten and correlations with SES, HLM and maternal mediation level

| Variable | *M* % | *SD* | SES | HLE |
|---|---|---|---|---|
| Written language | | | | |
| Letter names | 40.00 | 28.80 | 0.33*** | 0.39*** |
| Letter sounds | 33.20 | 33.00 | 0.30*** | 0.44*** |
| Letter writing | 54.61 | 32.04 | 0.38*** | 0.31** |
| Orthographic awareness | 66.10 | 24.55 | 0.37*** | 0.38*** |
| Concepts about print | 68.63 | 23.78 | 0.41*** | 0.48*** |
| Phonological awareness (initial phoneme) | 52.63 | 32.06 | 0.31** | 0.39*** |
| Phonological awareness (final phoneme) | 41.28 | 39.50 | 0.37*** | 0.35*** |
| Word recognition (judgment) | 66.06 | 35.42 | 0.20* | 0.24* |
| Word recognition (reasoning) | 44.72 | 32.49 | 0.41*** | 0.41*** |
| Word writing | 37.60 | 23.74 | 0.31** | 0.28** |
| Spoken language | | | | |
| Expressive vocabulary (spoken) | 24.70 | 23.03 | 0.26** | 0.38*** |
| Expressive vocabulary (literary) | 10.87 | 16.01 | 0.37*** | 0.46*** |
| Receptive vocabulary (PPVT) | 61.76 | 17.01 | 0.19* | 0.18 |
| Listening comprehension (sentences) | 66.33 | 23.36 | 0.06 | 0.06 |
| Listening comprehension (story) | 65.36 | 23.73 | −0.02 | 0.27** |

$^*p<0.05$; $^{**}\ p<0.01$; $^{***}\ p<0.001$

vernacular (Saiegh-Haddad 2003, 2007). When they succeeded in this task, they usually retrieved a syllable/sub-syllabic unit (CV) and not a phoneme. We are aware that, in some cases, as in the case of stops, it is impossible to retrieve the sound without a following vowel, a CV, while in other cases, as in the case of fricatives, this is possible. This distinction is recommended in future research in order to elucidate this process. In addition, using the spoken names of letters might sometimes imply knowledge of the sound; children might resort to SpA names because they cannot articulate the individual sound. With reference to *letter writing*, the children seemed to be familiar with the general appearance of most of the letters. The mean score on *word writing*($M=37.60$, $SD=23.74$) appears to be quite low and reflects the children's frequent use of random letters and basic consonantal representations (using one correct letter from the word accompanied by random letters) when trying to write a word.

The mean score in *word recognition*($M=44.72$, $SD=32.49$) was somewhat higher than letter writing, but was nonetheless low, and showed that when trying to explain their recognition of words, the children tended to use semantic explanations which referred to the object's features (e.g., "because the turtle is small"), or phonological arguments which referred to the phonological length of words (e.g., "because ox is a short word").

The children in our sample exhibited some knowledge about print and on average correctly answered 2/3 of the 16 questions that were asked in the CAP test. In phonological awareness, the children succeeded significantly better in retrieving the first phoneme of the word ($M=52.63$, $SD=32.06$) than the last one ($M=41.28$, $SD=39.50$) ($t=14.77$, $p=.000$). While this contradicts earlier findings

(Saiegh-Haddad 2003, 2004, 2007), such contradiction may be attributed to the fact that the current scoring rubric gave credit to CV responses.

As to their spoken language, the children scored very low on the expressive vocabulary test in both its SpA and StA versions. On average, they correctly drew the opposites of only 10 % and 23 % of the 18 words in StA and SpA, respectively. In contradistinction, low SES Hebrew-speaking children showed a success rate of $M=47\,\%$ in this task (Levin and Aram 2012). However, the variance on these measures was large. Some children did not know even one word while others correctly wrote 80–90 % of the words. The children performed better on the receptive vocabulary ($M=61.76\,\%$) than on the expressive SpA vocabulary ($\mathrm{M}=24.70\,\%$) ($t=21.30$; $p<0.001$) and expressive StA vocabulary ($M=10.87$) ($t=30.13$; $p<0.001$). Children's expressive SpA vocabulary was significantly higher than their expressive StA vocabulary ($t=7.88$; $p<0.001$). Most measures of children's literacy were positively and significantly correlated with SES (except listening comprehension—sentences and story) and HLE (except PPVT and listening comprehension of sentences).

### Maternal Mediation in Bookreading

An analysis of maternal mediation in the bookreading activity showed that the most prevailing maternal mediation behavior was reading the written text from the book and afterwards paraphrasing it in the spoken language ($M=65.75\,\%$, $SD=22.30$). This behavior was followed by story discussion which was remarkably less frequent ($M=22.37\,\%$, $SD=14.90$). All other mediation behaviors related to reference to the illustrations ($M=8.11\,\%$, $SD=12.10$), or narrating the story in spoken language—without any oral reading of the story in StA ($M=3.06\,\%$, $SD=12.10$), as well as relating to the orthographic representation of words ($M=0.70\,\%$, $SD=2.47$) which appeared to a much lesser extent.

### SES, HLE and Bookreading Mediation as Predicting Children's literacy

We created one score for all SpA language measures (Cronbach's alpha reliability coefficient for this test was $\alpha=0.89$) and one score for all StA language measures (Cronbach's alpha reliability coefficient for this test was $\alpha=0.72$). The general mean score of literacy level (spoken and written language) was $M=51$, $SD=17.00$ (Cronbach's alpha reliability coefficient for this test was $\alpha=0.87$). The results showed that SES was positively and significantly correlated with HLE ($r=0.60$, $p<0.001$) and with the children's general literacy level ($r=0.48$. $p<0.001$). Furthermore, HLE was correlated with the children's general literacy level ($r=0.54$. $p<0.001$). No significant correlations were found between any of the variables tested and maternal bookreading mediation behavior except one. Interestingly, the maternal behavior of relating to the orthographic representation of words was the only one that correlated significantly with SES ($r=0.26, p<0.1$). Higher SES mothers tended to relate to the orthographic representation of words in the book while reading to the child and also had children with higher literacy skills.

Given the overall moderately high correlation between SES and HLE levels, which might indicate a multi-colinearity effect of these two variables, we executed a step-wise regression analysis entering SES as the first predictor, HLE as the second, and maternal mediation as the third, in order to test their possible contribution to the variance in the children's general literacy score as well as in the written Arabic score and the spoken language score. Regarding the general score, the data show that SES entered in the first step accounted for 19 % of the variance, while HLE entered in the second step accounted for 39 % of the variance, adding 20 % unique variance above SES. Regarding the written language skills, SES contributed 27 % to this score and HLE contributed another unique 8 %. Regarding the spoken language skills, SES contributed 5 % in the first step, and HLE contributed an additional 6 %. Maternal mediation level made no significant contribution to any of the dependent scores tested beyond SES and HLE.

## Maternal Mediation in Joint Writing

First we checked what linguistic version of the word (the spoken or the Standard) the mothers chose to use when they mediated word writing to their children. We found that when engaged in the task of word writing, the mothers opted more for the StA form of the word than for the SpA form. About 70 % of the written outcomes were in StA. However, surprisingly, and despite the fact that Spoken Arabic is used only for oral conversation and not for writing in Arabic, 30 % of the writing that mothers asked their children to attempt was in Spoken Arabic. For example, 19 % of the mothers helped their children write the SpA form of the word word بسة instead of the StA word قطه when shown a picture of a 'cat', 33 % chose the SpA word تخت for 'bed' instead of the StA word سرير and 31 % wrote down the SpA word شنطه for 'bag' instead of the conventional StA word حقيبه. This might reflect lack of knowledge about the word's linguistic affiliation, or an attempt on the part of the mother to make the writing activity more meaningful to the child by using the version of the word that the child is familiar with.

Next, in order to study the mothers' general Arabic-writing mediation strategies, we analyzed the frequency of maternal use of each writing mediation category. The words that the mothers were asked to write with their children included in all a maximum of 26 letters (in StA or SpA). We scored the mediation of each letter separately, since mothers sometimes used different strategies for different letters in mediating one word. In general, the mothers were found to refer to words as wholes (21 %) or as sequences of sounds (26 %). The most frequent strategy used by mothers was dictation of letters (33 %). The mothers seldom connected between sounds and letters (5 %), isolated a sound and encouraged their children to connect it to a letter (5 %), encouraged their children to isolate a sound and connect it to a letter (6 %) or monitored their children during the grapho-phonemic process (5 %). With reference to the level of autonomy that the mothers allowed their children in the print mediation of the letters, we found that they frequently wrote the letters for their children and asked them to just copy (56 %). It is noteworthy that the large standard deviations across all measures reveal the diversity among the mothers and their attitudes toward a joint writing activity with their children.

SES, HLE and joint writing mediation as predicting children's written language

There is evidence that writing mediation is related to children's written language skills but not to their general language ability or listening comprehension (e.g., Aram and Levin 2002; Aram et al. 2006). In the present chapter we focused on the relations between mothers' writing mediation and a variety of early written skills that we targeted: letter knowledge (letter naming, letter sound knowledge and letter writing), word writing, word recognition, phonological awareness (initial and final phoneme isolation), concept about print and orthographic awareness. The mean score of initial and final phoneme isolation tasks served as the *phonological awareness* score *(*$\alpha=0.97$) and the mean score across the three letter measures served as the *letter knowledge* score *(*$\alpha=0.85$).

Hierarchical regression analyses were conducted in order to examine the unique link between each of the socio-cultural layers targeted (SES and HLE) to the children's literacy skills, and assess the contribution of maternal writing mediation (grapho-phonemic mediation and printing mediation) to children's early literacy beyond the effects of SES and HLE. The mean score between maternal grapho-phonemic and printing mediation served as the *writing mediation* score ($\alpha=0.95$). Six separate 3-step fixed-order hierarchical regressions were conducted with SES in the first step, HLE in the second and maternal writing mediation measure entered in the third step (see Table 15.2). The criterion variables were each of the six early literacy measures.

SES (step 1) contributed significant amounts of variance to all early literacy measures: *letter knowledge* (15 %), *word writing* (10 %), *word recognition* (25 %), *concept about print (CAP)* (20 %), *phonological awareness* (21 %) and *orthographic awareness* (21 %). After partialling out SES, the availability of literacy artifacts at home (HLE) (step 2) added significant amounts of variance to *word recognition* (4 %), *concept about print* (4 %), *and phonological awareness* (4 %). After partialling out SES and HLE, maternal *writing mediation* (step 3) added significant amounts of variance to *letter knowledge* (29 %), *word writing* (18 %), *word recognition* (11 %), *concept about print* (15 %) and *phonological awareness* (11 %).

At the third step, maternal writing mediation made a significant contribution to all early literacy measures (except orthographic awareness). Together, the three socio-cultural layers that were assessed in the present study explain a considerable amount of the variance. SES, HLE and maternal writing mediation explained 46 % of the variance in *letter knowledge skills*, 29 % in *word writing*, 39 % in *word recognition*,40 % in *concept about print*, 37 % in *phonological awareness* and 23 % of the variance in *orthographic awareness.* Overall, SES, HLE and maternal writing mediation explained between 23 % and 46 % of the differences in the children's early literacy.

**Table 15.2** Summary of hierarchical regression analysis for socio-cultural measures (SES, Home Literacy Environment and Writing Mediation) Predicting the written literacy measures ($N = 89$)

| | Letter knowledge | | | Word writing | | | Word recognition | | | Concept about print | | | Phonological awareness | | | Orthographic awareness | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | SE B | β | B | SE B | β | B | SE B | β | B | SE B | β | B | SE B | β | B | SE B | β |
| Step 1 | | | | | | | | | | | | | | | | | | |
| SES | 0.13 | 0.03 | 0.39*** | 0.84 | 0.27 | 0.31** | 0.79 | 0.15 | 0.50*** | 13.30 | 2.81 | 0.45*** | 0.19 | 0.04 | 0.46*** | 13.47 | 2.84 | 0.45*** |
| Step 2 | | | | | | | | | | | | | | | | | | |
| SES | 0.08 | 0.04 | 0.24 | 0.60 | 0.38 | 0.22 | 0.51 | 0.20 | 0.33* | 7.45 | 3.79 | 0.25* | 0.11 | 0.05 | 0.27* | 11.70 | 3.93 | 0.39** |
| HLE | 0.08 | 0.05 | 0.22 | 0.41 | 0.43 | 0.13 | 0.47 | 0.23 | 0.26* | 9.81 | 4.36 | 0.29* | 0.13 | 0.06 | 0.28* | 2.98 | 4.52 | 0.09 |
| Step 3 | | | | | | | | | | | | | | | | | | |
| SES | 0.07 | 0.04 | 0.22* | 0.57 | 0.34 | 0.21 | 0.50 | 0.18 | 0.32** | 7.17 | 3.40 | 0.24* | 0.11 | 0.05 | 0.26* | 11.59 | 3.89 | 0.39** |
| HLE | 0.08 | 0.04 | 0.20 | 0.37 | 0.39 | 0.12 | 0.45 | 0.21 | 0.25* | 9.43 | 3.92 | 0.28* | 0.13 | 0.06 | 0.27* | 2.82 | 4.48 | 0.08 |
| Writing mediation | 0.13 | 0.02 | 0.54*** | 0.86 | 0.19 | 0.42*** | 0.39 | 0.10 | 0.33** | 8.73 | 1.88 | 0.39** | 0.11 | 0.03 | 0.34*** | 3.45 | 2.15 | 0.15 |

*$p<0.05$; **$p<0.01$; ***$p<0.001$
It should be noted that only 89 mothers of the larger sample (described above) participated in this part of the study

## Discussion

This pioneering study on the literacy context and mediation in the Arabic-speaking family presents important results on the literacy environment in which Israeli Arabic-speaking children grow up and its relation to children's early literacy development. It is clear that although our sample included different families living in different areas and a variety of geographical and cultural settings, they all turned out to be low-income families and their SES profile was similar to that of low SES families in the Israeli Jewish Hebrew-speaking population. We found that the Arabic-speaking children in these communities live in an environment that is impoverished in literacy artifacts and activities. Their homes have on average one computer, very few educational games for reading and arithmetic, some computer games, video cassettes and DVDs. We counted an average of 30 children's books and 29 adult books in these homes.

As reported in previous studies which focused on Hebrew-speaking children (Korat et al. 2007), the availability of literacy artifacts and the age of starting to read to the child is correlated positively and significantly with the SES of the families. However, in this study, no correlation was found between the reported frequency of book reading to the children and SES. Mothers reported reading to their children on average every three days and reported on fathers' reading to the children once a month. A possible explanation for this lack of correlation with SES could be an increasing awareness on the part of parents of the importance of the bookreading activity to young children's literacy development following promotion of this topic by the education system and the media (Bus et al. 1995; Badsh-Landow 2006). An alternative explanation is social desirability regarding parental report on the frequency of reading across all social groups. An indirect measure for parental bookreading to their children, such as the "Title Recognition Test" (TRT) (Stanovich and West 1989; see also Sénéchal et al. 1998( may have been a more valid and reliable measure of book reading. It is also possible that Arabic-speaking parents read relatively less frequently to their children, regardless of SES (compared to Israeli Hebrew-speaking parents who report reading to their children 2–3 times a week, see Korat et al. 2007) because of the diglossic context. It is recommended to test this assumption in future research.

The study also revealed low (out of the maximum grade for each measure) and highly varied knowledge of both the spoken and the written language skills among children. The general low SES level of the participants and the correlations with HLE and with the children's literacy appear to go hand in hand (Korat et al. 2003).

### Bookreading Activity

Three important findings are related to the bookreading activity. First, mothers mainly used the behavior of reading the text aloud to the child and then paraphrasing it to him or her. Second, the only behavior that correlated significantly with SES was discussing the writing orthography in the book. Third, the best contributor to children's literacy level was HLE, followed by SES. One might ask why Arabic-speaking mothers tend to read the text to the children and then paraphrase it to them during most of the reading event (65 % of their behavior) and why they discuss the story (which involves higher cognitive processing) to a much lesser extent (22 %). Israeli Jewish low SES Hebrew-speaking mothers (Korat et al. 2007) exhibit paraphrasing in only 32 % of their behavior, and in the middle SES this happens in only 22 % of the cases. Discussion beyond the text appeared in 41 % of the behavior of Israeli Jewish low SES Hebrew-speaking mothers and in 50 % of the middle SES. The behavior of the Arabic-speaking mothers may be related to the diglossic nature of the Arabic language. Since their children are not familiar with the written language, StA (as this language is not acquired naturally but is rather limited to literacy related activities and to some TV programs and religious sermons), mothers mediate the written text to their children by telling the story in SpA, the everyday familiar language. They might feel that in this manner they are bypassing the language's obstacles to story comprehension: unknown words (lexicon), different morphology and syntax. Arabic-speaking mothers work mainly on the linguistic "translation" of the book to their young children and leave much less time for higher cognitive and abstract discussion of content that goes beyond the text (22 %).

In line with Bronfenbrenner's ecological model, we view development as embedded in the socio-cultural context. When studying the impact of reading mediation, we elaborated a model of three contextual layers related to kindergartners' early literacy: SES, HLE, and the quality of maternal mediation. According to this model, our findings show that the contribution of HLE to children's literacy level is more significant than SES and goes beyond the family's SES. Such a relationship between HLE and children's EL levels converges with previous findings from other languages: Hebrew (Korat et al. 2007) and English (Burgess et al. 2002; Sonnenschien and Munsterman 2002). Our study expands on the existing database by showing that the same relations exist within the Israeli Arabic-speaking family. The findings may have a positive implication, since although most Arabic-speaking families have a low SES level, HLE and the availability of literacy artifacts and activities within this generally poor society makes a more significant contribution to the children's literacy level than parental education, profession or income. Thus, literacy material and activities with young children in the Arabic-speaking society in Israel impacts the children's Spoken and Standard language knowledge before formal learning to read and write at school begins.

However, our findings did not show a significant contribution of maternal mediation in bookreading to the child's literacy level, as expected by Bronfenbrenner's ecological model. Mothers' mdiation mostly took the form of paraphrasing, making no contribution to the children's language and literacy knowledge in kindergarten. We assume that a greater contribution to the children's literacy level might have been found had mothers used more discussion beyond the text, expanding story comprehension by focusing on integration of different parts of the text and relating the story meaning to the children's life, including print-related and written language orthographic discussions.

### Joint Writing Interaction

All children in our study failed to spell all of the dictated words autonomously. As in the case of studies in Hebrew (Aram and Levin 2001) and English (DeBaryshe et al. 1996), all the mothers in our study helped their children produce readable spellings. Interestingly, in spite of the fact that there is no conventional way of representing Spoken Arabic in writing, and even though this variety is used for oral speech only, about 31 % of the mothers chose to help their children write the words in Spoken Arabic. There is informal evidence from observations in kindergartens and homes of young children that teachers and parents expose children to the standard and spoken forms of the letter names (Levin et al. 2008). Moreover, our conversations with teachers and parents reveal that they are not sure whether they should write with their young children in Standard Arabic or whether it is better to use the words that the children use in everyday life and write the phonological form of the words as they sound in Spoken Arabic. Some of them told us in private talks that when they write with the children it may be better to focus on the grapho-phonemic process and the printing of the letters and skip the differences between the Spoken and the Standard Arabic vocabulary.

Writing involves several steps: segmentation of the word into phonological units, retrieval of the required letter names and sounds, recruiting the letter shapes, and printing the letters (Treiman 1993). Mothers must become aware of these steps in order to scaffold writing. Many mothers in our sample did not know how to help their children segment the word into its sounds and treated the word as a whole or as a sequence of sounds (levels 1 and 2 in the grapho-phonemic mediation scale). When it came to printing the words, they felt more competent. However, they did not ask their children to write. Neither did they write for them. They gave the children a model to copy.

Low level mediation, such as merely providing a model for copying a word, may stem from limited awareness and knowledge of the encoding process. Alternatively, mothers may be unaware of their children's writing level and therefore underestimate their children's actual level of development. Children's writing level varied, yet mothers in our study tended to scaffold on a low level. In line with Vygotsky's (1978) development model, adults should scaffold their children within their Zone of Proximal Development, beyond their actual level, pulling them toward their potential development level in order to support the children's development. We conceive mother-child interactions as a two-way street where both parties shape the interaction mutually and interactively. However, the mother, as the expert, has the leading role (Vygotsky 1978). Her interaction style is molded by her previous experiences with her children, but just as much by cultural beliefs and norms of behavior related to parenting (Lightfoot and Valsiner 1992).

We claim that a significant maternal role comprises an ongoing phenomenon affecting the trajectory of child literacy development. Mothers who mediate literacy at a higher level, from the child's early age onward, learn about the child's competencies and use this knowledge to shape their future interactions. Consistently high quality mediation is likely to promote children's literacy. This may be a central explanation for the substantial contribution of mediation quality to the prediction of children's literacy levels (e.g., Aram and Levin 2004).

In line with Bronfenbrenner's ecological model, we expected that all the layers in the children's environment would contribute to their literacy development (see Farran, Bingham, and Matthews, Chap. 16). Nevertheless, we expected that the layer closest to the child (maternal writing mediation) would contribute to the child's early literacy beyond the contribution of HLE and SES, an expectation that was largely supported. SES, the furthest layer, is related to the child's general life context. It contributed in the first step of the regression to all of the early literacy measures. The home literacy environment represents a layer closer to the child. It reflects the materials that are present in the child's environment, the tools with which the child can play and learn literacy. HLE added a significant amount of variance to word recognition, concept about print and phonological awareness beyond the contribution of SES. Maternal writing mediation, the layer closest to the child, that represents the nature of the actual writing interactions between the mother and the child predicted the child's early literacy beyond SES and HLE.

There is a body of research that connects parent-child literacy interactions to early literacy and acknowledges the importance of these experiences to children's literacy development (e.g., Wasik and Herrmann 2004). The results of the present study show that writing interactions comprise contexts where parents can teach their children about the Arabic written system. It seems that Arabic-speaking mothers of young children are frequently confused and ambivalent about the way to mediate writing. We inspire educators of young Arabic-speaking children to encourage parents to write with their children and help the parents learn appropriate ways to mediate writing according their children's ability and understanding. Mothers can learn to mediate writing on a higher level. Levin and Aram (2011) showed, in an intervention study, that mothers' writing mediation can be enhanced via direct coaching and that promoting mothers' writing mediation increased their children's early literacy.

The results of the present study are consistent with previous studies among children from different countries, in showing a significant relationship between maternal mediation and children's literacy skills (e.g., Aram 2007; Worzalla et al. 2009). At the same time, the study reveals some unique aspects of the socio-cultural context in which Arabic literacy development is embedded and the effect of that on mothers' behavior and their children's development.

## 15.2 Conclusion

In the present study, the mothers showed medium to low levels of mediation by focusing mainly on paraphrasing in the bookreading activity, and by mainly naming the letters and providing a model for copying in the writing activity. However, while the writing activity followed Bronfenbrenner's three-layered ecological model (SES, HLE and parental mediation) as expected, the reading activity showed a contribution only of the two first layers, SES and HLE. This might be explained by the more direct relationship between the writing activity and the children's literacy measures than between bookreading activity and literacy development. The nature of the mother-child word writing activity was directly related to the alphabetic tasks given to the children in their individual test. To mediate word writing the mother helped her child in phonological awareness, letter naming and letter-sound connection, and indeed these alphabetic skills are highly related to word writing mediation. In the story-reading activity, which is more complex, we did not assess the children's vocabulary from the story that their mothers read/narrated to them or their comprehension of the story. If the vocabulary of the book that the mothers read to their children had been used to assess vocabulary knowledge, we might have found that story bookreading makes a significant contribution to children's vocabulary beyond SES and HLE.

In general, it seems that diglossia, and specifically the linguistic gap between the spoken and the literary language poses difficulties and may be confusing for the mothers in mediating the written language across literacy activities, reading and writing. We view this research as a first step in learning how this context in the Arabic-speaking family is related to children's literacy development. In order to learn more about parental behavior, a study of Arabic-speaking parents' beliefs and attitudes regarding diglossia is warranted. Research is also needed into the effect of such beliefs and attitudes on language practice in the Arabic-speaking home and on the literacy exposure, training, and mediation.

It should be noted that the design of this study precludes inferences about causality regarding the relationships between the variables in question. That said, intervention studies are needed in order to learn more about these relationships. For example, Levin and Aram (2011) showed that enhancing maternal writing mediation (in Hebrew) promotes a wide variety of children's alphabetic skills. To the best of our knowledge, such an intervention program has not yet been conducted in Arabic. Second, including maternal reports on the extent to which they engage their children in print activities, such as teaching their children to print letters or words, could afford greater insight into the home literacy activities and might better explain children's measured literacy levels (Sénéchal et al. 1998). Third, the maternal mediation levels which emerged in the current research were based on a single observation of mothers reading a storybook to their children or writing with them. Data based on multiple observations could provide stronger evidence of typical parental mediation levels.

Our pedagogical implications point to the importance of the family's HLE and SES for the children's EL level. (For more on environmental factors and literacy development, see Farran, Bingham, & Matthews and Tibi & McLeod, in this collection). Future studies should emphasize how to best design family intervention programs so as to maximize children's literacy growth. Considering the lack of contribution of maternal mediation in bookreading to children's EL in the Arabic-speaking community, and the clear contribution of it to the writing activity, we suggest that future intervention efforts incorporate different parental meditational supports in different literacy activities. This might include discussion beyond the text, integrating different parts of the text to elaborate story compression as well as using alphabetic and rhyming intervention programs to encourage discussion of the orthography and aspects of the written register.

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# Part VI
# Arabic Literacy Development in Special Populations

# Chapter 16
# Environmental Contributions to Language and Literacy Outcomes in Bilingual English-Arabic Children in the U.S.

**Lama K. Farran, Gary E. Bingham and Mona W. Matthews**

**Abstract** Recent research supports the potent role of the environment in the development of language and literacy. While substantiated in research addressing language and literacy of many young children from various cultural and linguistic backgrounds, the role of the environment has received scant attention in research focusing on children who learn Arabic, a Semitic language characterized by diglossia. This chapter examines the role of environmental variables (parent education, beliefs, and home language use and literacy practices) in language and literacy outcomes of 64 bilingual English-Arabic children in the US. Results reveal a strong relationship between parent home language use and participants' Arabic word reading, morphological awareness, and vocabulary skills; and between Arabic home literacy practices and Arabic reading comprehension skills. These findings corroborate previous cross-linguistic research and point to the importance of experience, namely parent language use and literacy practices, in predicting language and literacy outcomes in bilingual children. Implications for research, instruction, early intervention, and prevention of language and reading disorders in children acquiring Arabic are highlighted.

**Keywords** Arabic · Bilingual · Cognitive advantage · Diglossia · Home literacy environment · Language · Literacy · Parent language use · Parent beliefs · Statistical learning

L. K. Farran (✉) · G. E. Bingham · M. W. Matthews
The College of Education, Georgia State University, 30 Pryor Street, Suite 550, Atlanta, Georgia 30303, USA
e-mail: lama_farran@bellsouth.net

G. E. Bingham
e-mail: gbingham@gsu.edu

M. W. Matthews
e-mail: rmatthews@gsu.edu

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## 16.1 Introduction

In his seminal book *The Symbolic Species*, Terrence Deacon wrote "Language is a social phenomenon… The source of information that is used to 'grow' a language lies neither in the corpus of texts and corrections presented to the child, nor in the child's brain to begin with. It is highly distributed across myriad interactions between children's learning and the evolution of a language community"(Deacon 1997, p. 115). Researchers since have echoed similar (though not identical) views to characterize early literacy development as emerging from the interactions between children's cognition and the social environment in which children live (McBride-Chang et al. 2010). When considering environmental variables, extant research has established the contribution of the home environment and parental input in promoting language and literacy in monolingual (Hoff 2006; Snow et al. 1998; Whitehurst and Lonigan 1998) and bilingual children (Davison et al. 2011; Genesee and Geva 2006; Goldenberg et al. 2006; Gonzalez et al. 2010; Hammer et al. 2003; Paez et al. 2007). Moreover, reports from the National Institute of Child Health and Development Early Child Care Research Network (2005), the National Center for Education Statistics Early Childhood Longitudinal Study (ECLS-K 2011), and the National Early Longitudinal Study of 1988 (NELS 1988) indicate similar findings (Boyle et al. 2007; Hao and Bonstead- Bruns 1998; Kennedy and Park 1994; Yeung et al. 2000). Collectively, these studies provide robust evidence for the pivotal role environmental (home, parental) contributions play in the developmental outcomes of young children from diverse socioeconomic and linguistic backgrounds.

This chapter contributes to the growing evidence by presenting results of a study that examined relations among home language and literacy practices, parental beliefs, and language and literacy outcomes of bilingual children in the US who learn English as their first language and Arabic as their second language. The chapter is organized into four sections. First, we begin by reviewing research studies that examine these relations in monolingual and bilingual children. Second, we present a brief background of the Arabic language with focus on its unique characteristics such as diglossia and dual transparency. Third, we provide a comparison between reading in Arabic and reading in English to highlight potential sources of language and reading difficulties bilingual children might encounter in the process of learning Arabic as a second language. Finally, we describe the study and discuss implications of its findings for early assessment, instruction, intervention, and future research directions with bilingual children.

### *16.1.1 Theoretical Framework*

This study is grounded in two developmental theories. The first is the bioecological theory of human development, as conceptualized in the Process-Person-Context-Time (PPCT) model (Bronfenbrenner and Ceci 1994; Bronfenbrenner and Morris 1998, 2006), which underscores the role of multiple circles of influence, contextual factors, and proximal processes in children's developmental outcomes. Accordingly, development unfolds as a dynamic process through reciprocal interactions that occur over time between an active child and the individuals, objects, and symbols in the child's immediate environment. (For another study based in this framework, see Korat et al., Chap. 15). The second is a Vygotskian perspective on development, which highlights the central role adults (e.g., parents and teachers) play in children's language and literacy learning. According to Vygotsky's (1962, 1978) zone of proximal development (ZPD), adults promote children's learning via instruction and scaffolding as they support children's participation in routine events. Such assistance provides a key means by which to transmit cultural knowledge. Children, by collaborating with adults and other more knowledgeable individuals, can participate in events that otherwise would be beyond their ability to perform on their own.

## Home Language and Literacy Experiences

As articulated in the theories above, parents and the home language and literacy environment influence are important predictors of children's literacy and language skills. As the place where language and literacy are first encountered (Strickland 1990), the home provides children with multiple opportunities for literacy related social interactions, such as joint book reading, parent language stimulation, writing activities, and, when children get older, assistance with school related tasks (e.g., homework, tutoring) that directly contribute to children's developing language and literacy skills (Bus et al. 1995; Hoover-Dempsey et al. 2001; Klesius and Griffith 1996; Levin and Aram 2012; Rodriguez and Tamis-LeMonda 2011). According to Sénéchal (2006), the home serves as a place where young children develop two types of traditional literacy skills through two important routines: (a) exposure to storybooks and (b) parent instruction of literacy skills. (For more on parent-child literacy interactions: book reading and joint writing, see Korat et al., Chap. 15). Each routine has been linked differentially to children's literacy and language development (Sénéchal et al. 1998).

As a socially mediated, interactive activity (Sulzby and Teale 1991), parent-child book reading offers children emotionally salient language interactions that build children's language and literacy skills (Bus and van IJzendoorn 1997). Research demonstrates, however, that parents vary considerably in the quality of their interactions with children. For example, variability in the instructional nature of parent-child joint book reading, often measured by the amount and type of talk that parents share with their children in book reading interactions, is linked to differences in children's development of early language and literacy skills (DeTemple 2001; Klesius and Griffith 1996; Neuman 1996; Sénéchal et al. 1998; Whitehurst et al. 1994). A recent meta-analysis by Mol, Bus, de Jong, and Smeets (2008) demonstrates that dialogic parent-child book reading contributes positively to children's language scores with a moderate effect size, but is more impactful on young children's vocabulary development (i.e., 4 years-old and younger) than that of older children (i.e., 5 or 6 years-old).

Research indicates that the language and literacy that parents engage in with their children have a differential impact on children's developmental outcomes. For example, Sénéchal and colleagues (1998) found that parent-child book reading was linked to children's vocabulary development. However, parent-child literacy instruction was related to children's reading and writing skills. Specifically, it was parents' formalized teaching about reading (e.g., teaching their children to print and read words) that related to children's development of written language skills such as concepts about print, alphabet knowledge, invented spelling, and decoding. In a similar vein, Aram and Levin (2001, 2004) found that the quality of mothers' mediation of their children's writing in kindergarten (e.g., how mothers helped their children navigate writing words) was related to concurrent measures of kindergarten children's writing and word level skills, and longitudinally predictive of children's spelling production and reading comprehension in second grade. This effect was maintained even when parents' socioeconomic backgrounds and children's literacy skills in kindergarten were controlled.

As children get older, the nature of parents' language and literacy activities in the home changes. In the school years (i.e., primary grades), parents appear to utilize multiple reading strategies and other home related practices (e.g., help with homework) that impact children's language and literacy development. For example, Sénéchal and Young's (2008) meta-analytic review of 16 family literacy interventions from kindergarten through third grade reveals that it is more important to listen to children read and to read with them, than to read "to" children. In addition, research links other home literacy routines or parent involvement activities, beyond reading with children, to children's academic achievement. Many of the studies that examine the home environments of school aged children often conceptualize home literacy activities and routines as one aspect of "parental involvement." Although considerable variability exists in definitions of parental involvement activities (see Gwynne et al. 2000), for this study, we are interested in some common elements among definitions that include any direct involvement of parents with their child's school work, such as assisting with homework (Hoover-Dempsey et al. 2001), tutoring of the child in a specific area (i.e., reading and writing), or providing the child with access to books or other literacy related materials.

A final source of influence from the home environment on children's development of language and literacy skills are parents' social cognitions, often termed parents' expectations and beliefs (Okagaki and Bingham 2006). Related to the present study, parents' literacy beliefs are an important source of influence on parents' home literacy behaviors and children's literacy development (Curenton and Justice 2008; Weigel et al. 2006). Research demonstrates a link between parents' beliefs and parents' home literacy behaviors, and suggests that the way parents conceptualize the acquisition of early literacy skills influences the literacy activities they provide for their children (Machida et al. 2002; Sonnenschein et al. 1997). Although the differing literacy views that parents possess can be described in a number of ways (see Lynch et al. 2006; Weigel et al. 2006), a common thread among these conceptualizations is the importance of parents' educational backgrounds to the formation of belief systems.

When examining parents' beliefs, it is important to consider how the belief is manifested in the parenting behaviors (Bingham 2007; Sigel 1992). Bingham (2007) found that studying parents' beliefs in terms of parents' subsequent behaviors is easier when both beliefs and behaviors fall within the same domain. For example, in his study, mothers' beliefs about effective joint book reading were related to the quality of book reading interactions but not to mothers' participation in other home literacy practices. Likewise, mothers' beliefs regarding the ways in which the home environment can promote literacy among their children were related to mothers' home literacy practices, such as the frequency with which mothers engaged their children in literacy activities. Hence, it appears that parents' beliefs and expectations may, to some extent, be domain specific. Such specificity may have considerable influence on the strength of the connection between parents' literacy beliefs and home literacy behaviors and, as a result, on children's literacy and language development.

While the majority of research reviewed here on parents' home literacy practices and children's language and literacy development has been collected on English-speaking monolingual children and their parents, connections between the home literacy environment and children's language and literacy skills has been documented among families from various language backgrounds including Spanish (Farver et al. 2006; Hammer et al. 2003; Reese et al. 2000), Dutch (van Steensel 2006), French (Sénéchal 2006), and Greek (Manolitsis et al. 2011) speaking families. However, few studies have examined relations between home literacy environments and children's language and reading skills in Arabic. One exception is a recent study by Midraj and Midraj (2011) who found a positive association between parents' provision of home literacy resources (books and games to improve reading) and Emirati fourth graders' Arabic reading comprehension. Marginal effects were found between home literacy activities (reading to the child) and Arabic reading fluency. Given the relative lack of research examining relations among home literacy environments and children's development in Arabic, especially in the context of second language learning, additional research is needed. Before we introduce the present study, we provide a brief background on the Arabic language and highlight differences between reading in Arabic and reading in English.

## *16.1.2 The Arabic Language*

**Arabic: The Role of Transparency**

The Arabic language is a Semitic descendant largely spoken in the Middle East and North Africa. Arabic, the fifth most spoken language in the world, constitutes the official language of over 22 countries worldwide (Holes 2004). Arabic is written from right to left. It is an*abjad,* which is an alphabetic orthography that represents vowels only partially. This property plays a major role in the transparency of Arabic. (For a detailed description of the Arabic language and orthography, see Saiegh-Haddad and Henkin-Roitfarb, Chap. 1).

Transparency refers to the extent to which the orthography (writing system) of a language and the phonology (sound system) of a language (e.g., grapheme-to-phoneme correspondence) map or align (Share 2008; Zielger and Goswami 2005). The degree of this correspondence has implications for the ease with which children learn to read in that language (Frost 2006) and, by consequence, recognize words (Wimmer and Goswami 1994). To illustrate, learning to read in a transparent language like German, which has a one-to-one grapheme-to-phoneme correspondence, results in the rapid mastery of reading-related phonological processing skills (Wimmer and Goswami 1994). In contrast, learning to read in a non-transparent language such as English with a one-to-many grapheme-to-phoneme correspondence, often results in slow mastery of phonological recoding, which can affect word reading development (Ziegler and Goswami 2005). Unlike most languages that are characterized by low transparency levels or high transparency levels, Arabic presents a challenge: it can be more transparent or less transparent depending upon whether or not diacritics are used. Arabic is more transparent when vowelized (with diacritics) (e.g., كَتَبَ 'he wrote'), and less transparent when unvowelized (without diacritics) (e.g., كتب 'he wrote', 'books' and also 'was written' and 'made someone write'). (For other linguistic challenges in reading Arabic, see Eviatar and Ibrahim, Chap. 4). Such low transparency in Arabic is challenging for children in the process of learning to read because of the absence of phonological information. However, mitigating this challenge, is that low-transparent Arabic words possess a root and a pattern structure, or an internal morphological structure, which increases the consistency of the spelling-sound relationship (for more on the role of morphology in word representation and processing in Arabic, see Boudelaa, Chap. 2. Also, see Hansen, Chap. 3, for a morphology-based model of Arabic word reading). This enables readers of Arabic to use the morphological pattern as an aid to infer the missing phonological information (Frost 2006) and for word processing in general (Saiegh-Haddad in press). Another challenge to learning Arabic is related to the diglossic nature of Arabic. How diglossia manifests itself in Arabic and its implications for learning to read are discussed in the next section.

## Arabic: A Case of Diglossia

Diglossia is a phenomenon where two varieties of the same language coexist, with each variety occupying a distinct sociolinguistic function, and each used for a mutually exclusive set of purposes (Ferguson 1959). Arabic diglossia manifests itself in two forms: Spoken Arabic Vernacular (hereafter SAV), acquired via informal interactions, and used when communicating at home and in informal ordinary conversation; and Modern Standard Arabic (hereafter, MSA), acquired via formal education and used in formal speeches, media, and for various written purposes. (For more on diglossia as well as structural properties of Arabic language and orthography, see Saiegh-Haddad and Henkin-Roitfarb, Chap. 1). This differential use of SAV and MSA across communicative contexts and purposes results in a social-functional complementarity (Ferguson 1959). Typically, the use of one form (e.g., SAV) means the absence of use of the other (e.g., MSA). Moreover, one characteristic of Arabic diglossia is a linguistic distance between the SAV and MSA forms (Saiegh-Haddad 2003), which cuts across all components of language, including phonology, morphology, and vocabulary (see Laks and Berman, Chap. 11, for a study of some of the linguistic differences between the two language varieties). As a result, children's development of highly specified linguistic (e.g., phonological) representations (Saiegh-Haddad et al. 2011) and word reading (Saiegh-Haddad 2003) may be compromised, potentially reducing their reading comprehension (Farran et al. 2011). (For more on diglossia, see in this collection, linguistic differences between spoken and written texts produced by native Jordanian speakers, Laks and Berman; manifestations of diglossia in textbooks, Rosenhouse; ideological factors affecting instruction, Saiegh-Haddad and Spolsky; implications for assessment, Khamis-Dakwar and Makhoul.)

The linguistic distance between MSA and SAV is not invariant, however. Differences exist based upon the dialect(s) used. While a number of spoken versions (SAVs) exist, only one conventional written version (MSA) is used predominantly for formal spoken and written purposes. In this study, children were exposed to SAVs that differed from each other at least lexically, idiomatically, and phonologically, in addition to differing from MSA. Further, the differences in reading English versus Arabic renders more complex the notion of linguistic distance between MSA and SAV. We discuss those differences next.

### *16.1.3 Children's Experiences With Reading in Arabic and Reading in English*

The children in this study were emerging bilingual children in the United States who learned English as their first language and Arabic as their second language. The term "bilingual" is used because the sample consists of children who are exposed to Arabic on a consistent basis and in addition to English as the primary language (a similar qualification was used in Saiegh-Haddad and Geva 2008). The challenges these children faced can be explained by considering the differences between the two languages—Arabic and English—along four areas relevant to the study: structure, frequency of use, context of use, and presence of diglossia.

*Structure* While in English the spoken and the written varieties coincide to a high degree, in Arabic there is only limited overlap between the spoken (SAV) and the written (MSA) form of language. (For a description of linguistic differences, see Saiegh-Haddad and Henkin-Roitfarb, Chap. 1; for an empirical study of the differences as reflected in text production in the two varieties and modalities, see Laks and Berman, Chap. 11).

*Frequency* The frequency with which the children used English and Arabic differed. In this study, English was the children's first language and, as such, was more frequently used. Children received the majority of instruction (i.e., math, science, social studies) in English. With respect to Arabic, although Arabic classroom instruction occurred in MSA predominantly, Arabic teachers often infused their SAVs naturally during their interactions with students.

*Communicative context* Another source of difference between learning to read in English and learning to read in Arabic was in the contexts in which the two languages were used. English, the mainstream, societal language and the language of instruction of all academic content (except Arabic) was used in multiple settings, including informal and formal settings, as well as beyond the classroom. The contexts for Arabic use, on the other hand, were confined to the school (four times per week for 40 min a day) and the home for a subset of the sample. As discussed in the methods section, the majority of children (except 19 % of the sample) were not exposed to spoken Arabic in their home environments.

*Diglossia* Finally, diglossia is characteristic of Arabic but not English. Therefore, the overwhelming majority of reading interactions and other home literacy practices that took place between the children and their caregivers occurred around English books (or in some cases another home language). When they occurred in Arabic, both MSA and SAV were used. Because MSA is never naturally acquired as a mother tongue (Saiegh-Haddad 2012), parents tend to read less to their children, and when they do, they read in MSA first and then paraphrase using SAV (Iraqi 1990 as cited in Feitleson et al. 1993). (For more on book reading in Arabic-speaking homes and impact on literacy, see Korat et al., Chap. 15).

To summarize, in addition to English, the bilingual children in the present study were exposed to at least two variants of Arabic, MSA (predominant variant of Arabic used by the Arabic teacher) and SAV (sometimes used by the Arabic teacher in the classroom along with MSA). Moreover, Arabic is characterized by dual transparency. As children learn to read in MSA, they are exposed to vowelized and unvowelized words and texts, and have to map different written forms of MSA (vowelized Arabic and unvowelized Arabic) onto different forms of oral language (SAV and MSA). When phonologically transparent (vowelized Arabic), a one-to-one correspondence exists between graphemes and phonemes, whereby each diacritic mark denotes a single speech sound. When phonologically opaque (unvowelized Arabic), a one-to-many correspondence exists between graphemes and phonemes. Combined, these factors contribute to the complexity of learning to read in Arabic. (For more, see Eviatar and Ibrahim, Chap. 4).

This study was designed to examine associations among parents' educational attainment, literacy beliefs, home language and literacy practices, and children's Arabic language and literacy skills. We sought answers to two research questions:

1. What is the relation among parents' educational attainment, parents' Arabic literacy beliefs, parents' Arabic home language use and children's Arabic reading skills (vowelized word reading, unvowelized word reading, and reading comprehension)?

2. What is the relation among parents' educational attainment, parents' Arabic literacy beliefs, home language and literacy experiences, and children's Arabic language skills (phonological awareness, morphological awareness, and vocabulary)?

### *16.1.4 Method*

#### Study Context

This study was conducted in a charter school, which is a public school that does not follow the same rules and regulations as other public schools and is attended by choice with no cost to the family. Located in a suburb of a major city in the southeastern portion of the United States, this charter school is the only one in the state that emphasizes teaching Arabic as a second language for 40 min a day in the elementary grades, and espouses an expeditionary learning model with a focus on hands-on activities and projects as a means for learning. For Arabic instruction, the Arabic teachers primarily emphasize daily oral language use, although writing and spelling activities and the reading of simple paragraphs or stories occur. When texts are read, teachers often provide children with simple paragraphs or stories that are accompanied by pictorial stimuli to aid children's comprehension of text. As mentioned previously, teachers predominantly use MSA for instruction but also code-switch to SAV (two teachers speak Egyptian Arabic, one teacher speaks Algerian Arabic, and one teacher speaks Lebanese Arabic) in the course of interaction with students in the classroom.

#### Participants and Procedures

Participants were 64 emerging bilingual English-Arabic speaking children in third, fourth, and fifth grades (26 males and 38 females). As seen in Table 16.1, children were distributed across the three grades and were ethnically diverse. Home language surveys reveal that parents reported that the majority of students came from Asian and White backgrounds (36 % and 34 %, respectively). Children were included as participants in this study if they met the following criteria: (a) children's parents signed a consent form and filled out a questionnaire about their home literacy and language experiences, (b) children had attended the school for at least three consecutive years, and (c) children had received formal Arabic instruction for 40 min per day, four days per week. All children, whose parents consented to participate in this research project, gave their assent before being tested.

As indicated by school demographic data and parent survey (see Table 16.2), despite a range of socioeconomic circumstances and variability in parental education, the majority of parents possessed at least a college degree. This level of educational attainment held for both mothers and fathers. The home language survey also revealed considerable variability in children's home language experiences.

**Table 16.1** Demographic characteristics of the children in the study

| Variable | M (SD) or Frequency (Percentage) |
|---|---|
| Grade | |
| 3 | 25 (39%) |
| 4 | 23 (36%) |
| 5 | 16 (25%) |
| Age in years | 10 (0.96) |
| Gender | |
| Female | 38 (59%) |
| Male | 26 (41%) |
| Ethnicity | |
| Asian | 23 (36%) |
| Black | 11 (17%) |
| Hispanic | 1 (2%) |
| Mixed | 7 (11%) |
| White | 22 (34%) |

While 19% of parents reported speaking Arabic in the home, 62% reported only English language use in the home. Slightly more than 20% of households reported speaking a language "other" than English or Arabic at home, including: Urdu (2%), Turkish (4%), Tamil (4%), or French (2%). All children were provided with bilingual homework in English and Arabic to assist non-Arabic speaking parents as they helped their children with Arabic literacy support in the home.

## Data Collection

All Arabic assessments, which consisted of both individual and group tests (see measures), were administered in the spring of the school year. Children were administered one-on-one Arabic assessments (i.e., word reading, phonological awareness, and morphological awareness) by the first author and tasks were counterbalanced to maximize random distribution of measurement error and to

**Table 16.2** Family background variables: arent and partner education and home language use

| Variable | Frequency (Percentage) | Variable | Frequency (Percentage) |
|---|---|---|---|
| Parent education | | Partner education | |
| Elementary | 0 (0%) | Elementary | 1 (2%) |
| High school or equivalent | 5 (8%) | High school or equivalent | 7 (11%) |
| Community college | 4 (6%) | Community college | 7 (11%) |
| 4-year college | 32 (50%) | 4-year college | 24 (37%) |
| Graduate school | 23 (36%) | Graduate school | 25 (39%) |
| Mother home language use | | Partner home language use | |
| Arabic | 12 (19%) | Arabic | 11 (18%) |
| English | 39 (60%) | English | 38 (59%) |
| Other | 14 (22%) | Other | 15 (23%) |

ensure that the order of administration of the measures did not influence student performance. Student verbal responses were audio-recorded to ensure the accuracy of manual scoring. Administration of the individual assessments took place in a quiet room inside the school and near children's classrooms. Children were given breaks during the testing session as needed. Group assessments of vocabulary and reading comprehension skills took place in children's classrooms and consisted of testing children in groups of 10 to 20 students.

### Measures

This study used several measures that assess parents' beliefs, home literacy experiences and children's Arabic language and literacy skills. These include a parent survey and five experimental measures. Because of the lack of norm-referenced tests in Arabic, one experimental measure, created by the first author (see Farran et al. 2011) and four other measures, adapted for this study from work conducted by Saiegh-Haddad and Taha (m.s.) and Saiegh-Haddad and Geva (2008), were used. These four adapted measures were administered individually, with each administration lasting approximately 45 min per child. The fifth measure, created for a previous study, consisted of vocabulary and reading comprehension items and was administered to the children in groups. Each group administration took approximately 50 min. A brief description of each measure follows.

### Family Survey

The survey was developed as part of a larger study that examined the relationship between language and reading in bilingual English-Arabic children (Farran 2010). One parent from each family completed an online survey, which collected demographic information on the family and documented the family's Arabic home literacy and language practices. To provide clarity, we refer to all three home language and literacy variables (i.e., parents' Arabic home language use, parents' beliefs about the importance of learning Arabic, and Arabic home literacy experiences) collectively as *Arabic home experiences*.

*Demographic Information* Parents supplied information about their family ethnic background, and the educational background of both parents. Responses for parent education included the following categories: elementary, junior high/middle school, high school, community college/vocational school, 4 year college degree, professional or graduate degree. A composite parent education variable, namely an average of both parents' educational attainment, was used for all analyses.

*Parental Arabic language use* Parents were asked to estimate the amount of Arabic their child heard in the home environment. Parents' indicated the degree to which they spoke Arabic with their children on a four-point scale that ranged from "less than 25 % of the time" to "100 % of the time".

*Parents' beliefs about the importance of learning Arabic* Parents were asked to respond to four questions regarding the importance of their child learning Arabic. Each question was answered on a 5-point Likert scale ranging from "strongly agree" to "strongly disagree". Sample questions include: "Studying Arabic is important for my child because it will enable him/her to better understand and appreciate Arabic culture" and "Studying Arabic is important for my child's future career". Items from this scale evidenced strong internal consistency ($\alpha = 0.80$).

*Arabic home literacy experiences* The Arabic home literacy scale assessed the degree to which parents promote children's exposure to Arabic literacy activities in the home environment. Items included assessed: (1) the provision of Arabic literacy resources in the home (e.g., "How many Arabic books do you have at home?"), and (2) how often the parent and child engage in Arabic literacy activities (e.g., "How often do you or another family member read Arabic books with your child?" and "How often do you or another family member help your child with Arabic homework?"). Although response items for each question were completed on a 5-point Likert type scale, answers from each item were converted to z scores, to ensure that variables with greater variance did not have undue weight, and then were summed to form a composite score. For this sample, items that make up this scale demonstrated acceptable internal consistency ($\alpha = 0.73$).

## Arabic Language and Literacy Assessments

*Arabic phonological awareness* Blending and Elision sub-tests were used to create a phonological awareness composite measure. The Blending subtest assessed the child's ability to blend individual phonemes. The stimuli for the Blending sub-test, adapted from a segmentation task developed by Saiegh-Haddad and Taha (ms.), consisted of two practice items and 20 target items that progressed in length and phonological complexity. The examiner orally presented each set of individual phonemes and asked the child to blend the speech sounds to make syllables or words. A score of 0 was given for incorrect or partially correct responses (such as using CV units instead of phonemes) and a 1 for correct responses.

The Elision subtest assessed the child's ability to delete phonological units from within verbally presented words. The stimuli for this sub-test, adapted from Saiegh-Haddad and Geva (2008), consisted of two practice items and 40 target items that progressed in phonological complexity (i.e., progressed from using larger phonological units to smaller phonological units). The examiner orally presented each target word and the child repeated the target word and then omitted the specified phonological unit, such as a phoneme or a syllable. Because Blending and Elision sub-tests were moderately correlated ($r = 0.49$) and as a form of data reduction, these scales were standardized and combined to form a phonological awareness composite score.

*Arabic Morphological Awareness* This measure, developed by Saiegh-Haddad and Geva (2008), assesses children's implicit Morphological Awareness knowledge by presenting children with 20 pairs of phonologically transparent words. Frequent in stem and derived forms, these words consisted of two morphemes that had four different patterns: agentive (e.g., *Ka:TeB* 'writer'), passive adjective (e.g., *MaKTu:B* 'written'), place adverbial (e.g., *MaKTaB* 'office') and reciprocal verbal (e.g., *Ka:TaBa*'corresponded') (Saiegh-Haddad and Geva 2008, p. 488). The child was given the following instructions: "You will hear pairs of words. Listen carefully and tell me whether the words that I say are from the same family or not". The child responded *yes* if the word pair was morphologically related, and *no* if the word pair was morphologically unrelated. Three pairs of high-frequency words, of each stem and derived form, were presented as practice items. Phonologically (but not morphologically) related buffers were used.

*Arabic Word Reading* Developed by Saiegh-Haddad and Taha (ms.), this measure presents children with a list of 40 vowelized and 40 unvowelized words that progress in length and complexity. The vowelized Arabic word list consists of words without inflectional endings. The child reads words presented in six rows on one page. For unvowelized word reading, the examiner presents the child with an unvowelized Arabic word list of 40 words without inflectional endings.

*Arabic Vocabulary and Reading Comprehension* As presented in Farran et al. (2011), an adaptation of the *Gates-MacGinitie Reading Test, Fourth Edition, Level 2* (GMRT; MacGinitie et al. 2000) was used to assess children's Arabic vocabulary and reading comprehension. The GMRT was selected because it is more sensitive to oral language proficiency as compared to other reading measures (Cutting and Scarborough 2006). Level 2 of the GMRT was selected for translation into Arabic because it includes sentences and short paragraphs along with pictures guiding the child as s/he is reading. This reliance on pictures as a source for extracting meaning parallels the instruction received at school. The examiner provided the children with a response form in MSA with multiple choice questions. Vocabulary was assessed using 64 vocabulary items. Each item included a pictorial stimulus with four word choices. The child circled the word that the picture depicted from a multiple-choice array.

Reading comprehension was assessed using cloze tests. Each cloze test consisted of 28 items. For each item, one or two sentences were presented along with three pictorial stimuli. The child circled the picture that best represented the meaning of the sentence. A score of 0 was given for incorrect (e.g., did not mark the target word) or partially correct responses (e.g., marked two responses including the target word) and 1 for correct responses. Raw scores were computed based on correct responses on all sub-tests.

## Data Analysis

Data screening and analyses were conducted in SPSS 18. First, to search for out-of-range values, we generated descriptive statistics and examined the plausibility of means and standard deviations. We also graphed the data to visually inspect each child and parent variable. In addition, screening involved evaluating missing data,

**Table 16.3** Variable mean and standard deviation scores

| Variable | Mean | SD | Range |
|---|---|---|---|
| Family literacy and language measures | | | |
| Combined parent education | 5.07 | 0.73 | 1–6 |
| Arabic beliefs | 2.32 | 0.83 | 1–5 |
| Parents' home Arabic use | 2.32 | 1.58 | 1–5 |
| Arabic home literacy | 0.00 | 0.76 | −0.84–1.99 |
| Arabic language measures | | | |
| Elision | 22.63 | 6.76 | 5–37 |
| Blending | 14.17 | 3.53 | 3–20 |
| Morphological awareness | 14.89 | 3.55 | 6–20 |
| Vocabulary | 0.00 | 1.76 | −3.43–6.85 |
| Arabic reading measures | | | |
| Vowelized reading accuracy | 20.15 | 11.47 | 0–38 |
| Unvowelized reading accuracy | 21.19 | 11.52 | 0–37 |
| Reading comprehension | 0.00 | 1.00 | −2.42–2.91 |

checking plots for non-linearity and heteroscedasticity, identifying skewness and kurtosis, transforming variables as warranted, and evaluating variables for multicollinearity and singularity (Tabachnick and Fidell 2007). To answer the research questions, we conducted series of hierarchical linear regressions. These analyses allowed us to examine which Arabic home experience variables were most related to children's Arabic language and reading scores.

## Results

Table 16.3 presents descriptive statistics for children's performance on the Arabic language and literacy measures and the quality of Arabic home experiences. Results reveal that parents did not particularly hold strong beliefs about the importance of their child learning Arabic ($M=2.32$, $SD=0.83$), but they provided their child with access to Arabic books, and, when possible, assisted their child with Arabic homework. Finally, as evidenced by the large standard deviation, considerable variability was observed in parental reports of children's home language exposure to Arabic ($M=2.32$, $SD=1.58$).

To address the first and second research questions, a series of hierarchical regression analyses were generated. Each of these analyses contained a set of independent variables (IVs) that were entered in different steps or blocks into the equations. Child age was entered first into each equation to account for variability in children's scores that could be attributed to differences in children's ages. Parent education was entered in block two to account for contributions of parents' educational backgrounds that may influence children's reading and language scores. The third set of IVs entered in the last block included: parents' beliefs about the importance of learning Arabic, parents' Arabic home use, and Arabic home experiences. As multiple regression estimates the relations among multiple independent variables (IVs) to one dependent

**Table 16.4** Summary of hierarchical regression analysis of Arabic home experiences on vowelized word reading ($N=64$)

| | Model 1 | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | *B* | *SE B* | β | *B* | *SE B* | β | *B* | *SE B* | β |
| Child age | 0.50 | 1.47 | 0.04 | 0.77 | 1.52 | 0.07 | 0.82 | 1.47 | 0.07 |
| Parent education | | | | −1.47 | 1.98 | −0.01 | −1.12 | 1.93 | −0.10 |
| Importance of learning Arabic | | | | | | | 2.25 | 1.70 | 0.17 |
| Parents' home Arabic use | | | | | | | 0.11 | 1.12 | 0.06 |
| Arabic home literacy | | | | | | | 5.04 | 2.30 | 0.34* |
| $R^2$ | | 0.01 | | | 0.01 | | | 0.14 | |
| $F$ for change in $R^2$ | | 0.12 | | | 0.55 | | | 2.93 | |

$+p<0.1$; $*p<0.05$; $**p<0.01$

variable (DV), the following reading and language skills were entered in separate equations: unvowelized word reading, vowelized word reading, reading comprehension, phonological awareness, morphological awareness, and vocabulary.

To examine associations between children's Arabic home experiences and their vowelized and unvowelized word reading, we generated two separate hierarchical multiple regressions. As indicated in Tables 16.4 and 16.5, step 1 and step 2, containing child age and parent education, did not significantly contribute to children's vowelized or unvowelized word reading. Adding Arabic home experience variables in block 3 predicted 13 % variance of Arabic vowelized word reading $F\,(5, 58)=2.93$, $p<0.05$. The significant relation between Arabic home experiences and Arabic vowelized word reading was accounted for by the quality of children's Arabic home literacy experiences, which includes Arabic reading opportunities and exposure to Arabic books ($\beta=0.34$, $p<0.05$). A similar set of findings was found for the associations between children's home literacy experiences and unvowelized word reading. Although child age and parent education did not predict children's unvowelized word reading, entering block 3, containing Arabic home experiences into the equation produced a significant result, $F\,(5, 58)=3.21$, $p<0.05$. However, an examination of associations among the IVs and Arabic unvowelized word reading revealed that Arabic home literacy experiences only marginally related to children's unvowelized reading ($\beta=0.27$, $p=0.069$).

A similar pattern emerged when examining the relation among child age, parent education, Arabic home experiences, and children's Arabic reading comprehension. Entering child age and parent education did not contribute significantly to children's Arabic reading comprehension scores (see Table 16.6). Arabic home experience variables entered in block 3, however, added 11 % to the variance of the model, but this effect was not significant at the multivariate level ($F$ (5, 58)$=2.47$, $p=0.07$). An examination of individual contributions to reading comprehension demonstrates that the only variable making a marginal contribution to comprehension was parents' Arabic home language use ($\beta=0.30$, $p<0.064$).

**Table 16.5** Summary of hierarchical regression analysis of Arabic home experiences on Arabic unvowelized word reading (*N*=64)

| | Model 1 | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | *B* | *SE B* | β | *B* | *SE B* | β | *B* | *SE B* | β |
| Child age | 1.47 | 1.48 | 0.13 | 1.62 | 1.54 | 0.14 | 1.62 | 1.49 | 0.14 |
| Parent education | | | | −0.75 | 2.01 | −0.05 | −0.08 | 1.95 | −0.01 |
| Importance of learning Arabic | | | | | | | 1.17 | 1.72 | 0.09 |
| Parents' home Arabic use | | | | | | | 1.07 | 1.12 | 0.15 |
| Arabic home literacy | | | | | | | 4.08 | 2.32 | 0.27+ |
| $R^2$ | | 0.02 | | | 0.02 | | | 0.09 | |
| *F* for change in $R^2$ | | 0.99 | | | 0.14 | | | 3.21 | |

+$p<0.1$; *$p<0.05$; **$p<0.01$

**Table 16.6** Summary of hierarchical regression analysis of Arabic home experiences on Arabic reading comprehension (*N*=64)

| | Model 1 | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | *B* | *SE B* | β | *B* | *SE B* | β | *B* | *SE B* | β |
| Child age | 0.43 | 0.41 | 1.32 | 0.47 | 0.43 | 0.15 | 0.52 | 0.42 | 0.16 |
| Parent education | | | | −0.22 | 0.56 | −0.05 | −0.07 | 0.55 | −0.02 |
| Importance of learning Arabic | | | | | | | 0.22 | 0.48 | 0.06 |
| Parents' home Arabic use | | | | | | | 0.60 | 0.32 | 0.30+ |
| Arabic home literacy | | | | | | | 0.26 | 0.65 | 0.06 |
| $R^2$ | | 0.02 | | | 0.02 | | | 0.13 | |
| *F* for change in $R^2$ | | 1.10 | | | 0.16 | | | 2.47 | |

+$p<0.1$; *$p<0.05$; **$p<0.01$

An examination of the three multiple hierarchical regressions generated to assess relations among Arabic home experiences and children's phonological awareness, morphological awareness, and vocabulary reveals that home language and learning experiences were not related to children's Arabic phonological awareness (see Table 16.7). In contrast, for morphological awareness, entering the block of Arabic home experience variables into the equation contributed 17% of variance to the model ($F$ (5, 58)=4.10, $p<0.05$). An examination of individual variables reveals that Arabic home literacy was positively related to children's Arabic morphological awareness skills ($\beta=0.35$, $p<0.05$) (Table 16.8).

In the final analysis examining the relation between Arabic home experiences and children's Arabic vocabulary, results reveal that in block 1, child age had only a marginal contribution, $F$ (1, 62)=, $p<0.079$. Although parent education at step 2 did not make a significant contribution to Arabic vocabulary, entering the Arabic home experience block of variables in step 3 contributed an additional 36% of the variance in children's vocabulary scores, $F$ (5, 58)=7.90, $p<0.001$. Of the Arabic home experience variables, only parents' Arabic home language use significantly

**Table 16.7** Summary of hierarchical regression analysis of Arabic home experiences on phonological awareness ($N=64$)

| | Model 1 | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | *B* | *SE B* | β | *B* | *SE B* | β | *B* | *SE B* | β |
| Child age | 0.07 | 0.11 | 0.08 | 0.06 | 0.12 | 0.07 | 0.06 | 0.12 | 0.07 |
| Parent education | | | | 0.05 | 0.15 | 0.05 | 0.09 | 0.15 | 0.08 |
| Importance of learning Arabic | | | | | | | 0.04 | 0.13 | 0.04 |
| Parents' home Arabic use | | | | | | | 0.10 | 0.09 | 0.19 |
| Arabic home experiences | | | | | | | 0.10 | 0.18 | 0.09 |
| $R^2$ | | 0.01 | | | 0.01 | | | 0.07 | |
| $F$ for change in $R^2$ | | 0.37 | | | 0.12 | | | 1.28 | |

**Table 16.8** Summary of hierarchical regression analysis of Arabic home experiences on Arabic morphological awareness ($N=64$)

| | Model 1 | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | *B* | *SE B* | β | *B* | *SE B* | β | *B* | *SE B* | β |
| Child age | 0.29 | 0.46 | 0.08 | 0.27 | 0.46 | 0.08 | 0.15 | 0.44 | 0.04 |
| Parent education | | | | 0.17 | 0.60 | 0.04 | 0.51 | 0.57 | 0.11 |
| Importance of learning Arabic | | | | | | | −0.38 | 0.51 | −0.10 |
| Parents' home Arabic use | | | | | | | 0.14 | 0.33 | 0.07 |
| Arabic home experiences | | | | | | | 1.55 | 0.68 | 35* |
| $R^2$ | | 0.00 | | | 0.01 | | | 0.18 | |
| $F$ for change in $R^2$ | | 0.45 | | | 0.07 | | | 4.10 | |

$p<0.1$; *$p<0.05$; **$p<0.01$

contributed to Arabic vocabulary ($\beta=0.55$, $p<0.001$), with all three blocks together explaining 41 % of the variance in children's scores (see Table 16.9).

## Discussion

The aim of the present study was to examine associations among bilingual English-Arabic children's home language and literacy environments and their Arabic language and literacy outcomes. The results reveal that Arabic home experiences are related to children's language and reading outcomes, thus lending support to the bioecological theory as proposed by Bronfenbrenner and Ceci (1994). As this theory posits, children develop language and literacy through dynamic interactions with proximal processes (their parents in the context of Arabic home experiences). Moreover, the results are in line with Vygotskian theories of human development, which underscore the role of adults (parents, caregivers, and teachers) in supporting

**Table 16.9** Summary of hierarchical regression analysis of Arabic home experiences on Arabic vocabulary ($N$=64)

| | Model 1 | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | *B* | *SE B* | | *B* | *SE B* | | *B* | *SE B* | |
| Child age | 1.85 | 1.04 | 0.22+ | 1.83 | 1.08 | 0.22+ | 1.90 | 0.89 | 0.23* |
| Parent education | | | | 0.09 | 1.40 | 0.01 | 0.97 | 1.16 | 0.09 |
| Importance of learning Arabic | | | | | | | 0.09 | 1.02 | 0.01 |
| Parents' home Arabic use | | | | | | | 2.58 | 0.67 | 0.51*** |
| Arabic home experiences | | | | | | | 1.43 | 1.38 | 0.14 |
| $R^2$ | | 0.05 | | | 0.00 | | | 0.36 | |
| $F$ for change in $R^2$ | | 3.18 | | | 0.00 | | | 11.57 | |

+$p$<0.1; *$p$<0.05; **$p$<0.01; ***$p$<0.01

children's language and cognitive development by providing tasks and experiences that enable them to function within their zone of proximal development (ZPD).

The first research question examined the relationship between home language and literacy experiences and children's reading skills. Controlling for child age and parent education, we found significant associations between Arabic home literacy experiences (e.g., reading interactions, homework support, and providing access to Arabic books) and children's vowelized word reading, but only marginal associations between Arabic home experiences and children's unvowelized word reading accuracy. One interpretation of this discrepancy could be related to the differential frequency of the use of vowelized Arabic compared to unvowelized Arabic across school and home contexts. In school, the teaching practices children experienced placed equal emphasis on reading using both vowelized and unvowelized words; whereas at home, as parent-child dyads engaged in Arabic home literacy experiences, children's exposure to vowelized Arabic likely was higher than that of unvowelized Arabic. This is probably due to children's books in the home environment being written in vowelized Arabic, the Arabic variant used predominantly in children's literature.

Parents' home Arabic use was related marginally to reading comprehension. This finding was not surprising given the diglossic nature of Arabic and the linguistic distance between the spoken and written variants (Saiegh-Haddad 2003; Saiegh-Haddad et al. 2011). First, parents' home Arabic use occurred in SAV, whereas reading comprehension was in MSA. Thus, the linguistic distance between these two variants possibly accounts for the lack of association we observed. Second, children in this sample had limited exposure to reading (Stanovich 1986), because Arabic instruction relied more heavily on oral language compared to written language (the medium in which reading comprehension is measured), which presumably affected their performance on reading comprehension measures. A third interpretation is related to the visual and orthographic factors that characterize reading in Arabic (Abu-Rabia et al. 2003; Abu-Rabia and Taha 2004; Mohamed et al. 2011; Tahan et al. 2011). These include orthographic density, whereby each visual slot is occupied by a consonant and a short vowel or diacritic; visual similarity between the letters, the result of which is that many Arabic letter dyads and triads look identical except for placement and number of the dots; right-to-left directionality; cursive writing; and the multiple shapes each letter can take depending on its position in the word.

The second research question investigated whether Arabic home experience variables predicted children's language outcomes. We found no relationship between Arabic home experiences and Arabic phonological awareness skills. Two factors could be at play. One, Arabic home experiences do not typically focus on phonological awareness. Parents likely engage their children in contextualized and decontextualized language experiences that are rich and culturally meaningful. Therefore, it is unlikely that parents would focus their interactions on teaching their children about the constituent parts of the spoken language (i.e., sound units and their manipulations), even though limited evidence suggests that some parents may focus on phonological awareness tasks when interacting with their children (Manolitsis et al. 2009; Chow and McBride-Chang 2003). For this, parent-child joint writing interactions may be particularly relevant (see Korat et al., Chap. 15). Two, the lack of association between Arabic home experiences and phonological awareness could be attributed to the diglossic nature of Arabic (Saiegh-Haddad 2003) and the resulting fuzzy phonological representations children might have as they engage in language and literacy practices in MSA (Saiegh-Haddad et al. 2011).

In contrast to phonological awareness, Arabic home experiences predicted morphological awareness. Perhaps this finding can be explained by the vocabulary that parents use in the course of interacting with their children, which draws attention to the morphological patterns in words. Generally, research supporting this connection between home experiences and morphological awareness is tenuous as compared to the relatively robust research linking morphological awareness to children's experience with reading, particularly in morphologically rich Semitic languages like Arabic (Abu-Rabia and Taha 2004; Saiegh-Haddad in press; Saiegh-Haddad and Geva 2008) and Hebrew (Ravid 2006). An exception is Aram (2006) who found that maternal literacy (assessed by mothers' vocabulary ability and knowledge of children's book titles) and the presence of home literacy tools (i.e., reading materials, games, writing materials) were positively related to children's oral, but not written, Hebrew morphological awareness skills. In our study, we tested morphological awareness using a morphological relatedness task where children were presented with pairs of words orally and asked to judge whether or not the pairs of words were related. Given the positive association between morphological awareness and Arabic home experiences in this study, we conjecture, similar to Aram (2006), that this association may have been mediated by children's oral vocabulary, which is intertwined with morphological awareness. This finding is substantiated further in research studies pointing to the bootstrapping effect morphological awareness plays in language and reading (Carlisle 1995; McBride-Chang et al. 2005) and in extracting meaning from the context in which language occurs (Frost 2006; Katz and Frost 1992).

Examination of the link between the home environment and vocabulary revealed that parents' Arabic home use was related to children's vocabulary knowledge. This finding lends support to previous studies highlighting early experiences in the home environment as a main source of differences in children's language and literacy outcomes (Foorman et al. 2002; Hoff 2006) and the importance of oral input, including the frequency with which children are exposed to the statistical regularities in the language (s) in which they are immersed (Saffran et al. 1996; Werker and Byers-Heinlein 2008). Further, this finding may be due to the linguistic relatedness between SAV (oral medium in which vocabulary was presented) and MSA (written medium in which vocabulary was assessed in school) across the language components such as vocabulary and morphology. Interestingly, despite the variability in the degree to which SAV and MSA overlap or are linguistically related to each other in terms of similarities across language components, frequency mattered and perhaps contributed to children's highly specified linguistic representations. Similar conclusions are drawn from studies with Spanish-English bilingual children. Hammer et al. (2009) reported that maternal usage of Spanish was necessary for the growth of children's Spanish vocabulary. While considerable research has documented the importance of home literacy activities in children's oral language skills (see Mol et al. 2008), the present findings indicate that parent language use mattered more than home literacy activities for children's Arabic vocabulary knowledge. These findings, along with those of the present study, attest to the need to embrace children's home language and provide more Arabic language opportunities in the home to further promote favorable language and literacy outcomes in bilingual English-Arabic children.

One interesting finding related to the lack of an association between parents' beliefs about the importance of learning Arabic variable and children's Arabic language and literacy skills deserves mentioning. While the absence of a significant relationship between parents' beliefs and children's outcomes might be surprising, especially given the available evidence attesting to this connection (DeBaryshe 1995; Storch and Whitehurst 2002; Weigel et al. 2006), previous research demonstrates that parental beliefs often operate through the manifestation of certain parental behaviors (e.g., how often parents read books or what types of activities parents provide for their children) rather than directly impacting children's development (see Okagaki and Bingham 2006). An additional explanation for this null finding is that the parents in this study may not have "held" strongly enough their beliefs in the importance of their child learning Arabic. The average score on this measure indicated that parents, in general, neither agreed nor disagreed with statements regarding the benefits or importance of learning Arabic. As argued by Sigel and McGillicuddy-De Lisi (2002), parents may need to strongly hold a belief for it to impact their parenting behavior and their child's development. As a final note, although for the parents in this study becoming bilingual was clearly important, as evidenced by their children's enrollment in a bilingual school, we may not have captured the importance of their language learning beliefs. This may have impacted our ability to find an association between parents' beliefs and their children's language and literacy skills.

## 16.2 Conclusion

The present findings support the views put forward by "early literacy models", namely Scarborough (2001) and the home literacy model of Sénéchal and LeFevre (2002). These models suggest that young children rely, in the process of learning language and literacy, on different sources of information that differentially relate to future language and reading outcomes. Specifically, Scarborough (2001) posits that learning to read entails weaving together separate strands of language and literacy skills, such as vocabulary and decoding. Similarly, Sénéchal and LeFevre (2002) identify distinct paths for early literacy experiences, namely informal and formal aspects of the home literacy environment. As such, informal reading experiences, such as exposure to storybooks, as well as formal reading experiences, exemplified in parental reports of explicit teaching, enhance early literacy skills and work in concert to help children in the process of learning to read. Consistent with these models, this study found that Arabic home literacy practices were important to children's Arabic reading skills, and that home language exposure was important to children's Arabic vocabulary skills.

Although the above early literacy models provide a compelling case for the role of the home environment, they fall short of delineating the mechanisms of language and literacy outcomes for the bilingual children we observed in this study because they were inspired by research on monolingual children. Even though we refer to such models and derive from them empirical support to make sense of the data, we remain cognizant that approximately 80% of the children in our sample are becoming bilingual, meaning they are not two monolinguals put together. Rather, they possess general cognitive skills, including language and reading shaped by fundamentally different experiences than those of monolinguals. Therefore, their suite of skills embodies a history of numerous interactions between their cognition and the environment in which they live (Deacon 1997). Various lines of research support the skills that bilingual children bring to language and literacy learning and highlight the importance of bilingual children's background knowledge. These constructs have been coined differently by various researchers in terms such as cognitive reserve (Bialystok 2007; Bialystok et al. 2009), cultural and linguistic capital (Bourdieu and Passeron 1990), and funds of knowledge (Gonzalez et al. 2005). Such constructs are an important starting point and must be extended to inform family and community practices regarding their pivotal role in the development of language and literacy of bilingual children (Carreon et al. 2005).

*Implications* The findings of this study have several implications for assessment, prevention, intervention, and instruction with bilingual children, as well as the professional development of educators. As the research shows (Bialystok 2007), bilingual children's strengths and weaknesses are distributed across both languages (in this case, English and Arabic). Therefore, assessment of environmental contributions in first- and second-language in the home and school would be important to capture children's overall language and literacy outcomes across language contexts. This would entail developing reliable and valid Arabic measures of language and literacy that assess parental beliefs, patterns of language use, and child outcomes, which are currently lacking.

In terms of prevention, the evidence is limited regarding what variant of Arabic, SAV or MSA, is best for parents to use with their children and how early language and literacy must be introduced and assessed in childhood to reduce the risk of future reading failure. Nonetheless, accumulating support for the role of early experience in the development of language, which originates from research on infants, demonstrates how monolingual and bilingual infants learn through statistical regularities in the input they are exposed to (Saffran et al. 1996; Werker and Byers-Heinlein 2008). Thus, the earlier children are immersed in and the more frequently they are exposed to the languages and language variants of their community (in the case of Arabic, both MSA and SAV), the better they are equipped to learn to read and write at an early age.

As for early intervention, while the debate regarding which Arabic variant (MSA or SAV) should be used as a medium for instruction is ongoing, the available evidence indicates the benefits of early intervention using with monolingual Arabic-speaking children (Abu-Rabia 2000; Feitelson et al. 1993; Levin et al. 2008). For bilingual children who are learning Arabic, it would be essential to understand the nature of bilingual children's language and literacy learning through longitudinal investigations that track the development of oral and written language components to build the case for intervention research in the future. Equally important would be to assess the influence of a single language component (e.g., phonology) versus the influence of a combination of language components (e.g., phonology and morphology) in the development of language and literacy in Arabic, especially given the evidence from other Semitic languages such as Hebrew regarding the pivotal role of oral language in the development of morphology long before children begin formal schooling (Aram 2006). Future studies might benefit from investigating how various aspects of vocabulary (Branum-Martin et al. 2009) and morphology (Ramirez et al. 2010) differentially influence outcomes across languages in bilingual children.

With respect to instruction, findings point to the need to view bilingual children's cognitive and social-cultural resources as the foundation for literacy teaching. Thus, evaluating strengths and weaknesses entails looking at potential risk factors at multiple levels, including the individual child, family, community, and school. Accumulating research evidence indicates that home language maintenance does not have a negative effect on children learning English (Hammer et al. 2009; Bialystock 2007), thereby supporting bilingual education in U.S. classrooms, with explicit teaching of rich language (e.g., vocabulary, narrative discourse, morphology, and phonology) and frequent exposure to books as requisites. Simultaneously, partnering with parents and caregivers to provide comparable language input at home is paramount. This latter recommendation could prove challenging, however, considering the high variability in literacy levels that characterizes language minority communities in the U.S. (Hammer et al. 2003). To address these challenges, instructional practices aimed at (a) respecting the home language (Yeung et al. 2000) and (b) providing differentiated literacy instruction in terms of reading resources and explicit teaching strategies are needed to maximize positive developmental outcomes for bilingual children and their families.

Lastly, the findings have implications for the professional development of speech-language pathologists, pre-service teachers, and in-service teachers. Given the magnitude and multiple layers of risk that surround bilingual children's language and literacy learning, it would be best to design intensive mentoring programs that permit professional learning of new skills while addressing the cognitive and affective needs of linguistically and culturally diverse students. Central to these programs is a focus on long-term training that permits professional learning of skills that positively influence child and family outcomes, which in turn induces changes in the beliefs and attitudes of speech-language pathologists (Hammer et al. 2004) and teachers (Rueda and Garcia 1996) related to working with bilingual children.

*Future Directions* Throughout this chapter, we have argued that children's environments are paramount in shaping children's developmental outcomes. This study and the research reviewed point to two important conclusions: (a) language input to children matters and is associated with children's language and literacy outcomes. This holds true across languages (first- and second-language learning) and modalities (oral and written). Therefore, exposing young children to the statistical regularities of the language (s) of their community (Werker and Byers-Heinlein 2008) likely would result in cognitive advantage (Bialystok 2007); and (b) although bilingual children benefit from participating in home literacy practices and having books read to them frequently, they may also benefit more from explicit, systematic reading instruction. The difference in how robust language skills seem to be compared to reading skills is likely attributed to the long evolutionary history of human language, which makes it less vulnerable to environmental events. In contrast, the evolutionary history of reading is relatively new, rendering it highly susceptible to environmental factors (Immordino-Yang and Deacon 2007), including poor parental input, less-than-optimal home and community literacy practices, and poverty.

Future studies aimed at examining the earliest connections young bilingual children make with significant others in their environment and following bilingual children and their families over time would help elucidate the mechanisms underlying the emergence of language and literacy and identify risk and protective factors necessary for designing prevention and early intervention. Studies should also examine relations among the timing of older children's exposure to reading, as was the case for students in this sample, and home and school factors that lead to optimal outcomes in bilingual children's language and literacy development.

*Limitations* This study has several limitations. First, children's language and literacy experiences were captured via a self-report parent questionnaire. Because parents' answers may be biased, as they are susceptible to social desirability and lack of specificity in characterizing parental behavior, caution should be exercised when generalizing the results from this sample to other samples. Second, our sample size was small and our study was correlational in nature, thereby limiting the analytical approaches we used and the inferences we are able to make regarding relations between home environments and children's language and literacy outcomes. Third, although 80% of our sample consists of children who are emerging into bilingual English-Arabic speakers, we only used Arabic, experimental measures that targeted a restricted set of skills. Thus, we were unable to make cross-linguistic linkages that are paramount to capture fully the various strengths and weaknesses of children in our sample. Finally, our measurement of parental language and literacy practicesdid not address the style of interaction (e.g., bookreading) parents used with their children. There is ample evidence pointing to the importance of parental style in children's literacy outcomes in English (Bingham 2007; Whitehurst et al. 1994), Spanish (Landry et al. 2011), Chinese (McBride-Chang 2004), Arabic (Iraqi 1990 as cited in Feitelson et al. 1993), and Hebrew (Aram and Levin 2004; Levin and Aram 2012).

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# Chapter 17
# The Development of Grapho-Phonemic Representations among Native Hebrew Speakers Learning Arabic as a Foreign Language

**Susie Russak and Alon Fragman**

**Abstract** This chapter addresses the development of grapho-phonemic representations in Arabic as a foreign language (AFL) among native Hebrew-speaking pupils (HL1) based on two studies. The first study employed both quantitative and qualitative analyses of spelling errors among 8th graders during the second year of formal exposure to Standard Arabic. Findings indicated that pupils made errors in 80% of the words they spelled. Qualitative analyses showed that orthographic representation of novel phonemes, of phonemes with similarly sounding neighbors, and of phonemes with allographic variants proved to be the most challenging. These difficulties were argued to be attributed, *inter alia*, to the linguistic distance between HL1 and AFL. The second study examined the developmental trajectory of grapho-phonemic knowledge among 8th, 9th, and 10th grade HL1 pupils by targeting novel phonemes. Findings showed that there was no significant improvement in spelling accuracy over time. Possible causes for such slow growth in spelling accuracy despite increased exposure over the years and the transparent nature of the voweled orthography of Arabic are discussed.

**Keywords** Arabic · Arabic as a foreign language (AFL) · grapho-phonemic knowledge · Hebrew · Letters · Novel phoneme spelling

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S. Russak (✉) · A. Fragman
Beit Berl Academic College, Kfar Saba, Israel
e-mail: susie.russak@gmail.com

A. Fragman
Ben Gurion University, Be'er Sheva, Israel
e-mail: fragman.alon@gmail.com

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## 17.1 Introduction

Arabic is the second and only official language of Israel, besides Hebrew (Spolsky and Shohamy 1999). Yet, the study of Arabic as a foreign language (AFL) in Hebrew-speaking schools is only obligatory from seventh to tenth grades (Ministry of Education Bulletin 1997). In practice, however, only 75 % of native Hebrew speaking study AFL in junior high school, and only 20 % in the tenth grades (Lustigman 2008). Among these pupils, less than 4 % go on to take the Arabic language matriculation examination in the twelfth grade. The remaining school pupils change take to study French instead, which the Ministry of Education offers as a possible option. The teaching of Arabic is optional in Hebrew-speaking elementary schools, i.e. it is not part of the core curriculum. Despite these patterns, Israel has the largest number of non-native speakers learning Arabic in schools as an integral part of the academic curriculum (Fragman 1999). To date, the majority of AFL research in Israel has focused on attitudes towards the learning experience (Brosh 1988; Donitsa-Schmidt et al. 2004). No study has yet focused on the linguistic processes involved in the acquisition of the Arabic language. The present chapter focuses on some of these basic linguistic processes.

### *17.1.1 Hebrew and Arabic: Two Similar yet Different Semitic Orthographies*

Hebrew and Arabic are both Semitic languages, sharing many commonalities, yet still maintaining unique signatures of their own. Orthographically, both languages are written from right to left. Also, both languages have two written forms: pointed/vocalized and unpointed/unvocalized. The pointed/vocalized versions are mostly used for initial literacy instruction and for literary and sacred script. From the third grade on, children are exposed to the unpointed/unvocalized scripts. In addition, within each language, there are orthographic differences between the printed and the handwritten form of the script. Morphologically, both languages use non-linear root and word pattern derivational procedures to derive content words (verbs and nouns). As a result of this, Semitic orthography (*abjad*) represents mainly the consonants of words, and the written forms of words consist primarily of the three/four consonantal root letters which are differently affixed and voweled, mainly through the use of diacritics, to represent the different words of the lexicon (Berman 1978; Ravid and Schiff 2006). The combination of roots and phonological patterns is the basis of both the Hebrew and the Arabic lexicon. (For more on the structure of Arabic language and orthography see Saiegh-Haddad and Henkin-Roitfarb, Chap. 1).

In addition to the above commonalities, Arabic and Hebrew share other characteristics that are distributed differently in the two languages, and which might affect the acquisition of Arabic by native Hebrew speakers. For instance, in both Hebrew and Arabic, dots occur as diacritics to mark short vowels and other phonological information. In the unpointed Hebrew script these dots are not marked, which makes some letters homophonic (e.g. פ which may represent /*p*/ and /*f*/). Yet, in Arabic, dots are an integral and obligatory part of fifteen of the letters and are not omitted even when the script is unvoweled. In Arabic, these letters might share a very similar and sometimes even identical basic shape so they are only distinguished on the basis of the existence, location and number of dots, e.g. the Arabic letter graphemes representing /*t*/ and /*n*/ (ت ,ن) become the graphemes representing /θ/ and /*b*/ (ث,ب) by adding or changing the number or location of dots. In addition to the obligatory letter dots, there are diacritical marks that contribute phonological information to the Arabic written word such as those representing short vowels. Whereas in both orthographies there are letters that have multiple shapes or allographs, according to their position in the word, this phenomenon is much less widespread in Hebrew than in Arabic. In Hebrew, only five letters change their shape and only when they occur word finally: מ-ם, נ-ן, צ-ץ, פ-ף, כ-ך. In contrast, in Arabic, 22 of the 28 letters change their shape, according to their position in the word: beginning, middle, final (Azzam 1984). In addition, 22 of the 28 letters in Arabic are written connected to the following letters, as opposed to the Hebrew script where no letters are written connected to neighboring letters. Recognition of these letters and their diverse writing rules in different positions, including the different letter dots and diacritic markings is critical for accurate word identification and spelling in Arabic and might require considerable cognitive effort, especially on the part of a beginning reader (Abu-Rabia 2001).

Evidence for the cognitive complexity of the Arabic orthography comes from cross-linguistic research revealing that native Arabic-Hebrew adolescent bilinguals process Hebrew letters faster and more accurately than Arabic letters, arguably as a result of the complexity of the additional orthographic information that is packed into each graphemic representation in Arabic (Azzam 1993; Ibrahim et al. 2002). In skilled readers, it was found that reaction time for visual recognition of Arabic words by native Arabic speakers is longer than reaction time for Hebrew words by native Hebrew speakers (Bentin and Ibrahim 1996), English words by native English speakers, and Serbo-Croatian words by native Serbo-Croatian speakers (Frost et al. 1987). Researchers have claimed that these finding attest to the complexity of the Arabic orthography as compared with other orthographies, such as the Hebrew orthography (Eviatar et al. 2004).

Research into word processing has not taken into account another important feature of Arabic, and one that has important implications for word processing. This is the diglossic nature of Arabic (Myhill, Chap.; Ferguson 1959). Arabic diglossia, and the linguistic distance between the Spoken and the Standard written varieties of the language, compounded with the rigid separation in the social function of the two language forms impacts exposure, experience, and processing of Arabic words. (See Chap. 13, Khamis-Dakwar and Makhoul for language assessment in diglossia; Laks and Berman for linguistic distance between Spoken and Standard Arabic; Rosenhouse for manifestation of diglossia in Arabic teaching textbooks; and Saiegh-Haddad and Spolsky for problematic aspects of vernacular literacy in diglossia.) Research has demonstrated the strong impact of linguistic distance on phonological processing in Arabic words as well as on word decoding, word spelling and lexical representation. For instance, in a direct examination of the impact of linguistic distance, Saiegh-Haddad (2003, 2004, 2005, 2007) examined phonological processing and decoding for phonemes and syllabic structures that are within a local dialect of Spoken (Palestinian) Arabic in Israel as against those that exist only in Standard Arabic, among kindergarten and first grade children, and found that children's phonological processing and word decoding skills were directly affected by the linguistic affiliation of the target phonological unit (Standard versus Spoken). Children in these studies found novel phonological structures that are only available in Standard Arabic significantly more difficult to process both orally and in reading than those structures familiar to them from their spoken vernacular.

Based on these findings, the *linguistic affiliation constraint hypothesis* was proposed, which predicts that novel phonological units that are not available to children from their spoken language will harder to process than those available to them from their L1, even in the presence of accurate articulation (Saiegh-Haddad 2007). Evidence for the validity of the *linguistic affiliation constraint hypothesis* has been demonstrated among normally developing readers and reading disabled native Hebrew-speaking adults learning English as a foreign language (Russak and Saiegh-Haddad 2011). These difficulties were attributed to low quality phonological representations (Elbro 1996; Elbro and Pallesen 2002; Perfetti 2007) for these novel phonemes, due to limited exposure and practice with English as a foreign language even among college students. Whereas phonological processing among native Hebrew speakers learning Standard Arabic is not expected to be impacted by the linguistic distance between Spoken and Standard Arabic because Arabic foreign language learners in Israel are taught Standard Arabic to the exclusion of Spoken Arabic, given earlier research (Russak and Saiegh-Haddad 2011) it is predicted that they will experience difficulties with the processing of novel phonemes that are not available in Hebrew, their native language.

## Spelling Acquisition

According to Gillis and Ravid (2006), the acquisition of spelling in L1 is a process of conceptual as well as linguistic learning that provides a window on what individuals know about words. "It consists of knowledge about the nature of the particular orthography as a notational system in a number of dimensions, integrating grapho-phonemic links, orthographic-internal consistencies, and aspects of morphological units encoded in the system" (Gillis and Ravid 2006, p. 623). Therefore, studying the types of spelling errors that beginning spellers make can shed light on the content and quality of their linguistic knowledge.

Abu-Rabia and Taha (2004, 2006) examined the types of spelling errors made by native Arabic-speaking pupils in Israel in the first through the ninth grade in order to understand the effect of Arabic orthography on different levels of Arabic spelling skills at different age levels. Based on a categorical analysis of errors, their findings indicated that the most prominent type of error across grade levels was phonetic, representing 50% of all errors. Further, Abu-Rabia and Siegel's (1995) study of spelling in trilingual native Arabic-speaking eighth graders reported confusion between short vowels and long vowels; errors in writing words that combined two similar sounds /*s*/ and /*ṣ*/ or /*t*/ and /*ṭ*/; errors in writing words as a result of homophones; and errors in writing four-syllable words.

## The Complexities of Grapheme-Phoneme Correspondences in AFL for Native Hebrew Speakers

As mentioned earlier, the acquisition of novel sounds in the target language that do not exist in the phonemic inventory of the L1 may be problematic (Saiegh-Haddad 2003, 2007; Russak and Saiegh-Haddad 2011). With regards to foreign language learning, the *Speech Learning Model* (Flege 1992, 1995) accounts for these difficulties in relation to phonetic proximity. According to Flege, "the perceived phonetic dissimilarity of an L2 sound from the closest L1 sound is a determinant of whether a new phonetic category will or will not be established for an L2 sound" (2007, p. 367). In the case of the relationship between Hebrew (L1) and Arabic (FL), there are four Arabic phonemes that are distinguished from familiar Hebrew phonemes based on one phonetic feature alone that does not exist in Modern Hebrew, namely pharyngealization (Amayreh and Dyson 1998): /*t* - *ṭ* /ت - ط , /d - ḍ/ د - ض, /*ð* - *ð̣*/ ذ - ظ, and /*s* - *ṣ*/ س - ص . There are three phonemes that are distinguished by place of articulation from their close Hebrew neighbors (/*ʔ*-*ʕ*/ أ - ع ,/*ħ* - *χ*/ ح - خ , /*k* - *q*/ ,ك -ق); and two additional novel phonemes /*r*- *ɣ*/ (ر-غ), which are similar phonologically, both resembling a close Hebrew neighbor (ר). Therefore, the phonetic proximity of novel (FL) and familiar (L1) phonemes could be a deterrent in the establishment of accurate and stable phonetic categories for native Hebrew speakers learning AFL.

The effect of orthographic complexity on the acquisition of the written form of Arabic has been discussed earlier in this chapter with regards to native Arabic speakers. For the native Hebrew speaker learning AFL, however, there is an additional cognitive burden. This is the fact that some Arabic letters are not only orthographically similar to other Arabic letters but also phonetically similar to other phonemes that exist in both Arabic and Hebrew. For example, the sound of the letter ض/ḍ/ phonetically resembles the sound /*d*/ that exists both in Arabic and Hebrew, while at the same time being orthographically similar to the Arabic letter ص (different only by the dot) which makes the sound /*ṣ*/. This multi-faceted complexity might lead to confusion and difficulty with the establishment of accurate grapho-phonemic representations for the foreign language learner. In addition, it can present cognitive challenges for a beginning Hebrew-speaking AFL learner who is still trying to establish grapho-phonemic relationships between letters and sounds. Figure 17.1 illustrates this complexity.

In what follows we will present findings from two studies that explored the effect of this multi-faceted complexity, among other phonological and orthographic factors, on spelling accuracy of AFL among native Hebrew-speaking pupils.

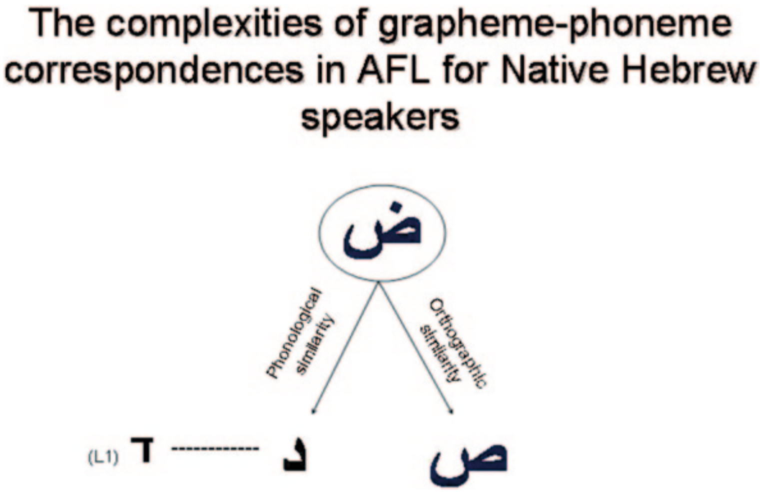


**Fig. 17.1** An example of the complexities of grapheme-phoneme correspondences in AFL for native Hebrew speakers

## *17.1.2 The First Study*

*Method*. In the first study we examined the grapho-phonemic knowledge of Hebrew (L1) learners of AFL during the second year of exposure to Standard Arabic, the written form of the language. We analyzed the spelling errors of a sample of 34 middle class eighth graders (mean age 14.0) who studied in a regional school in the center of Israel, where AFL is studied twice a week for 55 min per lesson. The Arabic teachers in this school were all native Hebrew speakers. It was hypothesized that native Hebrew-speaking pupils would have difficulty spelling sounds that are novel and do not exist in Hebrew, such as /ḍ/ض. We also predicted spelling to be difficult for similar sounds in Arabic, such as /s/ س and /ṣ/ ص. As the distinction between short and long vowels is not common in modern day Hebrew, it was also hypothesized that Hebrew-speaking pupils would have difficulty representing this phonemic contrast in their spelling of Arabic words. Difficulties were also expected for infrequent letter -phoneme correspondences, as in the case of the letter /ð̣/ ظ, as pupils would have had little exposure to these correspondences. Given that some researchers have attributed difficulties with accurate phono-orthographic representations among native Arabic speakers to the complex nature of the Arabic orthography (Abu-Rabia and Taha 2004, 2006), it was hypothesized that native Hebrew-speaking pupils would also have difficulty mastering the orthography itself and especially the different shapes of Arabic letters.

A dictation task was developed for the study which comprised twenty words that were selected from the first year textbook *From Language to Culture* (Velstra 2000) used for the teaching of Arabic in the seventh grade. All words were judged by four senior Arabic teachers to be familiar to the pupils. Words were chosen based

**Table 17.1** Frequency of errors on letters representing novel phonemes

| Phoneme | /ɣ/ | /ḍ/ | /q/ | /ð/ | /ħ/ | /ṭ/ | /θ/ | /ṣ/ |
|---|---|---|---|---|---|---|---|---|
| Score in % | 85 | 62 | 44 | 41 | 32 | 32 | 26.5 | 24 |

on phonological and orthographic considerations. The phonological category included sounds that are novel and do not exist in Hebrew, short and long vowels, and sounds that are phonetically similar to each other in Arabic. The orthographic category included similar looking letters within the Arabic language, ج -ح- خ (ت - ن - ب , غ- ع , ع – ح, and letters that have different shapes (allographic variants) according to their position within a word (ج , ح, خ, ه ,ع , غ , م , ص , ض), as well as letters which occur rather infrequently (ظ). Data collection took place during the Arabic lesson. Data was collected by classroom teachers under the supervision of the researchers. The words for the dictation were recorded and the recording was played for the pupils in their classes so that all the pupils heard the same words pronounced in an identical manner.

*Results.* The results of the dictation task were analyzed quantitatively and qualitatively. In the quantitative analysis, a frequency count of errors was carried out by counting the number of words that were spelled accurately out of the total number of words. The frequency count of the number of errors showed that the total number of correct spellings from the entire sample was 139 out of a total of 680 test items (20 %). There were different types of spelling errors in the remaining 541 words (80 % of the total pool of words). The average number of words that were spelled inaccurately per student was 14 (S.D 3.21) out of 20.

A qualitative analysis was carried out on the inaccurately spelled 541 words (80 %). The qualitative analysis was based on coding the errors according to phonological and orthographic categories. We found that phonological errors made up 53 % of the total spelling errors and included difficulties representing novel consonantal phonemes and distinguishing between long and short vowel sounds. A frequency count of the percentage of errors within each category indicated that many more errors occurred with the representation of the novel phonemes / ɣ / (85 %) and /ḍ/ (62 %) which in addition to being novel, also occur infrequently in the language (Madi 2010). Table 17.1 shows the frequency of errors for all letters representing the novel phonemes targeted. The errors are reported as percentage scores out of the total number of occurrences of the target letter.

A more fine-grained analysis suggests that in some cases pupils might have perceived the phoneme accurately but had difficulties with its orthographic representation. For example: some pupils wrote بسعل *basʕal* instead of بصل *baṣal* 'onion' and كعرية *kʕarya* instead of قرية *qarya* 'village'. These examples show that the pupils somehow perceived a velarized novel sound but produced instead a familiar pharyngeal sound /ʕ/ from Hebrew (L1) instead to emphasize the novel feature.

Less predominant than the phonological errors (53 %) were the orthographic errors which made up only 24 % of the total number of spelling errors. These errors mainly reflected difficulty discriminating between orthographically similar letters which are distinguished by the number and placement of dots, and difficulties representing letters with multiple allographic variants, such as failing to choose the right letter shape in a given word context (Fragman and Russak 2010).

*Discussion.* The findings from the first study reveal that during the second year of exposure to the written form of Arabic, native Hebrew-speaking pupils spell words that should be familiar to them from their language study program with only 20 % accuracy rate. These findings are in line with data from the Foreign Service Institute of the U.S. Department of State (Jackson and Kaplan 1999), which indicates that in order to reach a high level of proficiency in foreign languages that share similar structural and orthographic features, a minimum of 575–600 class hours in small group settings is necessary. In light of the fact that by their second year of study, native Hebrew-speaking pupils have received approximately 100–120 h of instruction, these scores are compatible with the expected scores of pupils at a beginning proficiency level.

Within the remaining 80 % of the words that were spelled inaccurately, the qualitative analysis indicates that approximately 50 % of the spelling errors were phonological and were characterized by misrepresentation of novel sounds. These findings support and extend the *linguistic affiliation constraint hypothesis* (Saiegh-Haddad 2007) to include Hebrew speakers learning AFL. From the qualitative analysis of errors, it may be seen that the pupils were struggling primarily with the letter encoding of the phonemes that do not exist in Hebrew. Their errors suggest that they heard a novel yet indistinct sound and hence failed to find the right orthographic representation for it, so they sometimes had to resort to writing the letters of two familiar sounds that they thought might approximate the novel sound, or alternatively to over-representing the novel feature. Difficulties with the representation of specific novel phonemes and hence their orthographic representation could be explained by the complex nature of the grapheme-phoneme correspondences in AFL for native Hebrew speakers. However, it is not clear from these findings if the cause of these difficulties inheres in the novel nature of the linguistic material being learned or in the relatively brief amount of exposure and practice that beginning learners have with the target language. Therefore, the second study examined the effect of different degrees of exposure to the language on the development of grapho-phonemic correspondence knowledge in AFL among native Hebrew speakers by comparing the performance of eighth, ninth, and tenth graders. For this study we chose to focus on four novel phonemes that could be characterized by the complex nature of the relationship between their phonological and orthographic representations: /*t* - *ṭ*/ - ت - ط /*d* -*ḍ*/ - د -ض, /*ð* - *ð̣*/ - ذ - ظ, and /*s*-*ṣ*/ س - ص (for full explanation see section *The complexities of grapheme-phoneme correspondences in AFL for native Hebrew speakers* above).

### *17.1.3 The Second Study*

*Method*. The second study included 335 native Hebrew-speaking pupils learning AFL in the eighth ($N$ = 119), ninth ($N$ = 125), and tenth ($N$ = 91) grades. This sample was randomly selected from six different middle socio-economic schools in the center of Israel. Pupils with learning disabilities of any kind were excluded from the sample. A dictation task was created which was comprised of 20 words that

**Table 17.2** Percentage scores for word accuracy and novel phonemes in the word dictation task

| | 8th grade M (SD) | 9th grade M (SD) | 10th grade M (SD) |
|---|---|---|---|
| Whole word accuracy | 19.11 (1.77) | 18.97 (1.75) | 25.67 (1.93) |
| Novel phoneme accuracy | 55.29 (2.30) | 56.82 (2.28) | 59.88 (2.51) |

included the four target novel phonemes. The words were chosen from curricular materials that the pupils were familiar with from their seventh grade textbook and were recorded by a native Arabic speaker. Words were chosen based on specific target phonological and orthographic characteristics and included a combination of one or more of the linguistic characteristics targeted. The same task was administered to all participants in all grade levels.

*Results.* In order to examine the effect of length of exposure (grade level) on the development of grapho-phonemic representations for the four novel phonemes targeted, the task was scored twice: once for whole word spelling accuracy out of the total number of words (word accuracy) and once for accuracy of representation of the novel phonemes (novel phoneme accuracy). Table 17.2 provides descriptive statistics of scores for word accuracy and novel phoneme accuracy. The scores below are reported as percentage scores.

In order to explore the development of word spelling accuracy across grades, repeated measure ANOVA analysis was conducted with word spelling accuracy as the within-subject factor and grade as the between-subject factor. Results of this analysis showed a main effect of grade $F\ (2{,}354) = 4.14$, $p < 0.01$. Bonferroni pairwise comparisons showed significantly higher scores in the tenth grade than in the eighth or the ninth grades. However, no significant differences were found between the eighth and the ninth grade scores on word spelling accuracy. At the eighth and ninth grade levels, approximately 19 % accuracy rates were found. By tenth grade, accuracy scores for word spelling reached a level of 25.67 %.

In order to address the development of spelling accuracy for novel phonemes across grades, two repeated measure ANOVA analyses were conducted to analyze the performance of participants in eighth, ninth, and tenth grades. In the first analysis novel sounds were the within-subject factor and grade was the between-subject factor. Results of this ANOVA showed no main effect of grade and scores ranged between 55 and 60 % accuracy. In other words, the grapho-phonemic representation knowledge for novel phonemes that pupils acquire during the first year of exposure to Arabic in school, does not improve significantly during the course of the additional three years of language study.

The next ANOVA was performed with novel phonemes as the within-subject factor and grade as the between-subject factor. Table 17.3 provides descriptive statistics of the grapho-phonemic representations of the target novel sounds across grades. Scores are reported as percentage scores.

Results of this analysis showed a main effect of novel phoneme, $F\ (2{,}354) = 93.28$, $p < 0.001$. Bonferroni pairwise comparisons showed significant differences between the accuracy scores obtained on the four different novel phonemes. Differences between scores for each phoneme were significant. In other words, the highest scoring letter ac-

**Table 17.3** Descriptive statistics of the grapho-phonemic representations for phonemes across grades reported as percentage scores

| | 8th grade M (SD) | 9th grade M (SD) | 10th grade M (SD) |
|---|---|---|---|
| ħ | 58.60 (38.57) | 58.73 (36.13) | 67.94 (35.65) |
| q | 43.54 (37.02) | 43.05 (32.19) | 47.11 (33.65) |
| ṣ | 37.09 (38.45) | 37.10 (32.67) | 42.78 (37.95) |
| ʕ | 67.60 (31.75) | 65.87 (34.43) | 66.98 (33.81) |

curacy was for the phoneme ʕ followed by ħ, which in turn scored significantly higher than q and then ṣ with the lowest score. Again, no main effect of grade was found.

In order to better understand the quality of the spelling errors across the three grades tested, a more fine-grained qualitative analysis was performed on a small random sample of errors from all of the grades targeted. We were interested in testing whether there were any qualitative differences in errors over time with increased practice and exposure to the standard form of the language. We found that for each of the four novel phonemes examined, and for each of the three grades examined, there were both phonologically and orthographically motivated errors. Furthermore, similar errors were found across grades. In other words, additional exposure to the written form of the language did not seem to have affected the type of errors that native Hebrew speakers made.

Phonological errors were characterized primarily by one type of error that repeated itself across grades, namely choice of letters that represent sounds that are phonetically similar to the target sound in Arabic but exist in the Hebrew L1 inventory (for example كلب *kalb* 'dog' instead of قلب *qalb*. 'heart'). These findings replicated the findings of the first study.

In addition, several patterns of orthographic errors were found. However, it should be noted that because of the small sample, the frequency of orthographic versus phonological errors was not recorded. In the case of the letters ع /ʕ/ and ح /ħ/ where each letter has four different shapes, we observed examples of writing the wrong shape of the letter in a specific position. An additional error pattern observed involved errors with letters that are visually similar to other letters in Arabic; for example exchanging between final ح and ع in both directions, صباع *ṣaba:ʕ* instead of صباح *ṣaba:ħ* 'morning' سمح *samiħa* instead of سمع *samiʕa* 'he heard'. As opposed to the letters ح /ħ/ and ع /ʕ/ which have four different shapes, in the case of ق /q/ and ص /ṣ/, which have 2 distinct shapes each (excluding the ligature), a different pattern of errors was observed. In the case of /q/ق., the errors involved omission of the dot thereby representing a different phoneme altogether (for example فلب *falb* 'non-word' instead of قلب *qalb* 'heart'), while in the case of ص, there was no incidence of orthographic errors, despite the fact that this letter does have an orthographically similar letter form (ض /ḍ/). This might be due to the fact that the latter is much less frequent in Arabic and therefore pupils are less exposed and less familiar with this alternative letter option.

*Discussion.* Based on earlier research on the role of input exposure to language and reading development (Cummins 1991; Koda 2007), it was expected that with more hours of practice and exposure, the spelling skills of native Hebrew-speaking pupils learning AFL would improve. Findings of the second study replicated the findings of the first study with regards to the eighth grade pupils who spelled words with a low 20% accuracy rate. The impact of additional exposure and practice with the written form of the language was only significant in the tenth grade, and even then, word accuracy spelling levels showed an increase of just 6%. In addition, accuracy levels for the grapho-phonemic representation of novel phonemes did not change significantly over time. All this implies that exposure and practice with AFL for native Hebrew speakers had no impact on the development of accurate or stable representations for novel phonemes. These findings suggest a state of stagnation in the development of language knowledge in this group. This stagnation can be explained by the multi-faceted complex nature of AFL for native Hebrew speakers, where letters which are orthographically similar to other letters in Arabic are simultaneously phonetically similar to other phonemes that exist both in Arabic and in Hebrew and which might present both a phonological and an orthographic linguistic burden. This burden impedes the establishment of accurate grapho-phonemic representations for the native Hebrew-speaking AFL learner. An alternative complementary explanation that requires further research might relate to the quality of the exposure that these FL learners obtain, especially given the fact that they are taught by Hebrew L1 teachers, not by native speakers of Arabic, and especially given the poor linguistic proficiency of those teachers in Arabic (Landau-Tasseron et al. 2012).

Within the category of novel phonemes, /ʕ/ and /ħ/ were represented with more accuracy than the novel phonemes /*q*/ and /*ṣ*/. This might be explained by the fact that these phonemes do exist to some degree in the Hebrew linguistic landscape in dialects from Eastern Jewish cultures (Schwartzwald 1985). However, it is important to note that even in the case of these phonemes, added practice and exposure did not affect accuracy levels across grades.

## 17.2 Conclusion

The results from the two studies reported in this chapter show that despite the shared etymological background, differences in the availability and frequency of certain linguistic features have serious repercussions for the acquisition of language and spelling skills among native Hebrew speakers learning AFL. Even after four years of exposure and practice with the written form of Arabic, native Hebrew speakers still struggle with the letter encoding of both novel and non-novel phonemes. In accordance with research on spelling in Arabic as L1, the current findings show that the acquisition of spelling in Arabic is challenged by both orthographic and phonological factors. These significant and prolonged difficulties with the acquisition of the written form of AFL among native Hebrew speakers indicate the need for a reexamination of educational goals and language instructional programs, so that a pupil who completes four years of mandatory AFL learning will achieve a level of accuracy that is commensurate with the amount of time and effort that has been invested in the language learning process by all stake holders.

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# Chapter 18
# Braille Reading in Blind and Sighted Individuals: Educational Considerations and Experimental Evidence

**Waleed Jarjoura and Avi Karni**

**Abstract** Braille reading is a crucial literacy skill for blind individuals and an important model to study non-visual modes of communication. Many studies have addressed Braille reading in English, but no previous study targeted Arabic Braille reading. Here we report our findings on Braille reading accuracy and speed in three different age-groups of Arab participants in Israel: 10(±2.5) year-olds attending elementary schools ($N$=20), 16(±1.7) year-old high-school students ($N$=13) and young adults (23±2.6 years) ($N$=24). All participants read vowelized and unvowelized word lists and vowelized and unvowelized texts printed in Arabic Braille. The results showed that as in studies of English Braille reading, Braille reading rates in Arabic improve as a function of the readers' age. However, Arabic Braille readers were consistently slower compared to English Braille readers. In addition, Arabic Braille readers were prone to read less accurately, with participants of all age-groups committing more phonetic reading errors in the unvowelized word lists and texts compared to the vowelized reading tasks. On the other hand, the older participants did not commit mirror-image errors or letter-skipping errors, which were noted in the younger participants. We discuss the results in the light of the specific characteristics of Arabic, especially diglossia and the homography of unvowelized Arabic.

**Keywords** Arabic · Blindness · Braille reading · Braille template · Tactile discrimination · Reading proficiency · Reading speed and accuracy · Visual impairment

W. Jarjoura (✉) · A. Karni
The Edmond J. Safra Brain Research Center for the Study of Learning Disabilities,
University of Haifa, 31905 Haifa, Israel
e-mail: jwaleed10@hotmail.com

W. Jarjoura
The "Convent of Nazareth" school for the blind, Nazareth, Israel

A. Karni
The Sagol Department of Neurobiology, University of Haifa, 31905 Haifa, Israel
e-mail: avi.karni@yahoo.com

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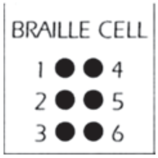
**Fig. 18.1** The structure of the basic Braille cell matrix (template)




## 18.1 Introduction

Reading is an ability acquired in childhood that becomes a lifetime skill necessary for various occupations, including formal education, communication and leisure activity (Snow-Russel 2001). Individuals with severe visual impairments or total blindness use an adapted, standardized reading system called the Braille code which is based on tactile discrimination skills rather than on vision.

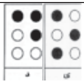
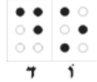
A basic Braille template (cell) is a tactile configuration of six raised (embossed) dots, organized in a matrix of 2 × 3 dots each. Various combinations of 5 dots, or any smaller number of dots, represent an alphabetical letter, a consonant, a vowel, a number, a diacritical mark or an abbreviated suffix. For example, the full six dot pattern represents an abbreviation of the word ‘for’ in English or the letter ظ ð̣ in Arabic Braille (Jarjoura 2004). The convention is that each raised dot has its own corresponding number starting with dot #1 in the left upper corner and continuing downwards on the vertical left axis of the matrix and then transferring to the upper right dot #4 and continuing downwards on the right vertical axis of the matrix (see Fig. 18.1).

In Arabic Braille, the discrimination between Braille vowels and Braille consonants is considered a prerequisite for proficient reading. The Braille vowels are actually standard Braille templates that represent diacritics in visual Arabic. These templates in Arabic Braille have totally different phonological representations in other languages (see Fig. 18.2).

Some Braille templates in one language have no parallel representation in another language and in other cases the template for a consonant in one language serves as a vowel in a different language. For instance, the Arabic letter ***ḍ*** ض representing the phoneme /***ḍ***/ and the Hebrew letter צ/*ts*/ and the English Braille abbreviation for ‘*the*’ share the same template (see Fig. 18.3). Another example is the representation of the letter Y ي (representing the consonant/*y*/ and the long vowel/i:/) in Arabic, ‘iy’ in English and ‘Yod-Hirik’- יוֹד חיריק in Hebrew by the same template (see Fig. 18.3b).

Braille ‘writing’ is by necessity performed using a machine, i.e., it is a typing-related skill based, unlike handwriting, on an accurate timing of both hands. For non-electronic media, letters are printed by a Perkins-Brailler, a standard mechanical hand-used Braille ‘typewriter’. This generates the various spatially-organized patterns as small raised dots on a surface of the printed page. Braille letters are printed from left to right in all languages, including Arabic and Hebrew (Jarjoura 2004). In recent years various software programs and hardware devices have become available for converting the standard computer keyboard for Braille printing and on-line Braille reading.

**Fig. 18.2** Examples for Braille letters representing different phonological units in three languages

| Arabic* Braille | English Braille | Hebrew* Braille |
|---|---|---|
|  |   |  |

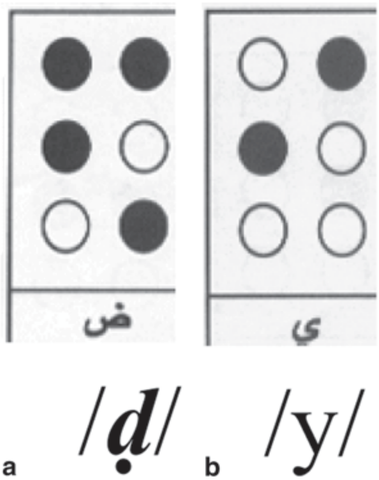



**Fig. 18.3** Braille template representing **a** ض, and **b** ي in Arabic

## 18.2 Tactile Discrimination for Braille

Tactile perception is served by a sensory system that is quite different from the visual one. However, as in visual reading (in which part of the skill relates to acquired eye-movement abilities) Braille reading requires the establishment of a motor component—the tactile scanning of the text—as a necessary aspect of the Braille reading skill. Thus, the specific structure and characteristics of the tactile sensory system as well as the generation of effective motor tactile scanning routines pose specific challenges for the acquisition of Braille reading skills. The skin surface (i.e. the finger-pads) includes three types of mechano-receptors: slowly-adapting (SA), rapidly-adapting (RA) and Pacinian fibers. The first respond to stationary or slow contact of the finger-pads with embossed tactile surfaces, whereas the other two types respond to dynamic, active tactile scanning by light-touch movements of the finger-pads across surfaces of tactile stimuli. All mechano-receptors are connected to the corresponding spinal cord segments. In Braille reading with the finger-pads, these fibers run into the dorsal spinal root in segments C4–C5 and then through the antero-lateral tract (pain, discriminative light touch and temperature) and the dorsal-column tract (proprioception, vibration and sense of graph-aesthesia) to the thalamus in the contra-lateral hemisphere. Thalamo-cortical tracts continue to the cerebral parietal cortex where wide-range neural representations of the sensory facets of the tactile stimuli are consciously and volitionally processed (Johansson and Vallbo 1979).

There is good evidence in support of the notion that the physical aspects of the Braille letters are matched and named on the basis of tactile physical features; i.e., that Braille reading skills are highly specific to the template that is consistently used for printing. Studies (Millar 1986; Grant et al. 2000) have shown that proficient Braille readers (English) are not universally more effective in terms of tactile performance than sighted readers and that if sufficient training and practice is afforded for the sighted non-Braille reader participants, their discriminative performance for Braille letters improves. On the other hand, multiple studies (Grant et al. 2000; Van Boven et al. 2000; Kauffman et al. 2002; Goldreich and Kanics 2003, 2006; Jehoel et al. 2009) have shown that blind adults significantly out-performed sighted adults in various tactile discrimination tasks throughout the lifespan. One should keep in mind however, that blindfolded, sighted participants may perform significantly better than sighted participants in tactile discrimination tasks (Kauffman et al. 2002).

Millar (1977) tested 12 proficient Braille readers (mean age, 10.2 years). They were asked to discriminate and name English Braille letters presented in pairs. The letters were of two sizes: standard and enlarged. Only two of the faster (most fluent Braille readers) subjects were able to name the enlarged letters without mistakes; four participants were able to correctly name the enlarged letters after a single training session. The slower Braille readers needed an average of 8.2 training sessions before they succeeded in correctly naming the enlarged letter pairs in the two test trials. All participants took longer to name the enlarged letters compared to the standard letters, and the response speed differences were larger for the slower participants compared to the faster participants.

## 18.3 Experimental Studies in Sighted Naïve participants

Tactile discrimination and matching of Braille letters was also tested in sighted individuals (e.g., Loomis 1981; Heller 1989; Grant et al. 2000; Goldreich and Kanics 2003). These studies lend support to the notion that Braille letter discrimination can be enhanced by intensive tactile experience, even in sighted adults; this discrimination learning, however, is contingent on the participants being blindfolded during the tactile training experience. For example, Kauffman et al. (2002) compared the performance of 24 healthy, sighted subjects (mean age: 25 years) on a Braille character discrimination task. Participants were randomized into one of four sub-groups: blindfolded with intensive tactile stimulation, blindfolded and non-stimulated, sighted with intensive tactile stimulation and sighted, non-stimulated. Subjects in the blindfolded groups (stimulated and non-stimulated) were completely visually deprived for 5 consecutive days using a specially designed blindfold. The tactile 'stimulated' groups (sighted and blindfolded) took part in an intensive tactile stimulation program for at least 6 h per day (4 h of Braille learning and 2 h of playing tactile games). These participants were told to use predominantly their right index finger. The non-stimulated groups were given 6 h of free time without specific instructions. All participants were tested using a computerized Braille character recognition task on days one, three and five of the experiment. All participants were blindfolded during the Braille testing session, in which consecutive bilateral presentations of Braille letter templates were raised in opposition to both the right and the left index finger-pads, simultaneously. Participants were asked to judge whether the Braille letter pair was of the same formation or of a different formation. Results showed that blindfolded subjects performed better than sighted subjects in the Braille discrimination task. Furthermore, the stimulated sub-groups showed significantly more improvement in Braille recognition ability compared to non-stimulated sub-groups. Thus, there is good support for the notion that Braille letter discrimination can be considered as a perceptual or perceptual-motor skill and as such Braille letter discrimination learning would be subject to the advantages and constraints imposed on procedural skill learning and procedural memory consolidation in other sensory and sensory-motor domains (Karni et al. 1994; Karni 1996; Karni and Bertini 1997; Bitan and Karni 2004; Goldreich and Kanics 2006; Censor et al. 2006).

According to an accepted neurobiological and cognitive model, long-term memory can be divided into declarative ('what') memory and procedural ('how to') memory (Squire and Zola 1996). According to this dichotomy, the first is considered a more cognitive and flexible system for the explicit recollection of events and factual information. The second is perceived as a memory system that serves the retention of performance gains acquired implicitly during the actual execution of given tasks (Karni 1996). Declarative knowledge (of facts and events) is typically distinguished from procedural knowledge by being accessible to awareness, being often acquired through a single experience and involving cortico-limbic brain systems. Procedural skill learning, on the other hand, is evident by improvement of the performance of a given task; it is not necessarily conscious, requires multiple repetitions and is subserved by different cortical areas (Karni 1996; Squire and Zola 1996). Both declarative and procedural knowledge can be acquired either by explicit or by implicit learning instructions.

Jarjoura (2012) investigated the efficiency of a newly developed standardized intervention approach for initial Braille learning for naïve sighted, blindfolded subjects ($n=31$, mean age 27.2 (SD ± 4.6), 8 males and 23 females). Participants of both groups (intervention and control) were native speakers of Arabic. Sighted, blindfolded naïve young adults with no prior experience with Braille were assigned randomly into two groups. In the first session, both groups were trained in 6 blocks of 16 trials each, with paired, standard Braille letters (S-S format) that were presented for palpation only to their right index finger. Immediately after the training phase, the control group had 20 min of free break while the study group (intervention group) underwent 20 min of explicit instruction, by the researcher, on the spatial structure of the Braille template and other specific features of the Braille code, such as enumeration and various dot-combinations. Immediately after, both groups continued training in four blocks of the S-S format Braille letter pairs. Tactile discrimination time and verbal responses were recorded for speed and accuracy after a 24 h interval, on the following day, as well as after a 3 month interval. Both groups showed robust within-session and between-session learning effects, including the expression of delayed gains (Karni 1996) and very effective long-term retention.

However, after the 3 month interval, while both groups showed additional gains in trained Braille letter discrimination compared to the performance at 24 h post-training, the participants were slightly slower in discrimination of Braille in an enlarged format compared to their achievements 3 months previously. But, the intervention group was better in this transfer condition indicating that the intervention may afford a better opportunity for generalization of the skill to Braille letters of different sizes. In a follow-up test 6-months post-training, both groups maintained their previous (3 months) speed and accuracy achievements to a similar degree.

## 18.4 Pre-literacy Educational Approaches for Young Blind Children

Various pre-literacy educational approaches (Wormsley and D'Andrea 1997; Pena and Zapata 2002) have been developed and implemented in children with blindness or severe visual impairments. These programs are skill-oriented and, thus, focus on improving specific skills such as fine motor abilities, tactile discrimination (of various materials rather than the Braille dots), fine-motor coordination, muscle strength, general language abilities, age-related play skills and precision and accuracy in motor performance. Work towards improving auditory memory and naming abilities in verbal tasks is often included. Later, in the literate stage, young blind children are explicitly instructed in various cognitive-lingual skills for text decoding, e.g. Braille letter naming and Braille letter numeration (i.e., repeated training on the child's ability to explicitly report the 6-dot matrix for various letters, numerals and symbols). There is also emphasis on tactile-motor training for Braille discrimination and recognition, e.g. general tactile investigation of the raised dots in Braille code, tactile discrimination of a specific Braille cell's configuration, the ability to maintain a coherent spatial orientation of lines and columns and printing skills using bilateral hand coordination (Perkins Brailler 1996). Practice on letter naming and dot enumeration and tactile motor training are the two major instructional methods assumed to enhance Braille reading ability and to improve Braille reading accuracy and speed. However, numerous studies have found that reading speed and accuracy are also affected by contextual constraints, hand usage, and age (Mousty and Bertelson 1985; Knowlton and Wetzel 1996; Trent and Truan 1997).

In Israel, a standardized preparatory program for Braille learning is administered in all educational programs for children with severe visual impairments or total blindness (Kadmon 1998). The program details 9 different fields of developmental function that are specifically targeted: (1) palpation skills (2) games for acquiring basic language concepts (3) games for enhancing word familiarity (4) affordance of basic familiarity with books, including Braille books, and reading behaviors (5) listening skills and auditory differentiation ability (6) hand movement skills relevant to Braille reading (7) perceptual differentiation between 'similar', 'equivalent' and different' (8) tactile differentiation of Braille code without naming, and later with naming (9) familiarity with the Perkins-Brailler and producing Braille-dot printing.

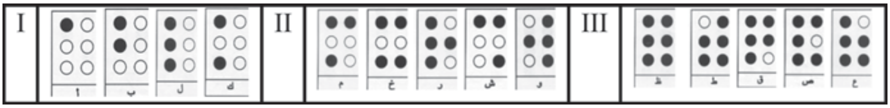



**Fig. 18.4** Examples of Braille letters introduced in the different 'phases' (*I–III*) of Braille teaching in the Arabic language

This graded program offers direct training in tactile discrimination and matching skills of Braille cells.

In elementary school, blind Israeli students are taught the same curricular program as their sighted peers. Curricular textbooks are printed in Braille and assignments are printed but similar academic achievements are expected from blind students and sighted students in order to prepare the blind children for high school level and university studies. Adaptations of educational and teaching methods (e.g., detailed oral descriptions; tactile exploration) are usually implemented when required on an individual basis.

## 18.5 Teaching Approaches for Braille

Lowenfeld, Abel and Kedris (1969), as cited in Harley and Rawls (1970) found that two-thirds of the teachers in residential and day school programs implement the word or sentence method for Braille teaching, whereas a third of the teachers surveyed began Braille instruction with the sequential introduction of the Braille alphabet, printing, tactile-discrimination and recognition of single letters (Grade 1 Braille). Most current conventional programs for teaching Braille are initiated by a sequential, single Braille character introductory program. Next, two-character words, followed by short word presentation, longer words and then short sentences are gradually introduced with abbreviations and contractions (Grade 2 Braille). Once short texts have been introduced, children are encouraged to implement and acquire reading habits such as fast reading and two hand usage in tactile discrimination.

Steinman et al. (2006) compared the development of print and Braille reading in children in relation to Chall's stage model (Chall 1983) of reading development which includes a pre-reading stage (stage 0) and five succeeding stages. On the basis of the comparison, the authors concluded that readers of both print (visual) and Braille (tactile) text formats may progress through similar acquisition stages. Currently, there is no developmental model that directly addresses the issue of Braille literacy and Braille reading development.

In Israel, for both Hebrew and Arabic native speakers, primary school children with severe visual impairments or blindness begin Braille learning with a focus on the letters a, b, l and k which are constituted of raised dots on the left axis of the basic Braille template (see Figure 18.4). The logic is that these "simpler" letters are made of a minimal dot quantity of 1–3 and are arranged only in a vertical, serial spatial configuration. In this phase (I) letter printing, tactile discrimination and recognition (naming and enumeration) are taught. In phase II instruction continues with printing, tactile discrimination and recognition (naming and enumeration) of letters with one or two dots on the right vertical axis (such as the letters M /*m*/, Š/š/ and R /*r*/, in Arabic) and a few basic vowels that are constituted of an additional single raised dot on the right axis of the basic Braille template.

Later, in the 1st grade, more complex and high density dot configurations (e.g., the Braille letters corresponding to the Arabic letters T /*t*/ or Q /*q*/) are taught (phase III). These letters are followed by word and short sentence Braille reading, Braille printing exercises and training on simple reading comprehension skills. (Fig. 18.4: phase I, phase II, phase III.) One should note that diglossia (see Myhill, Chap. 9) is also a factor in Arabic Braille teaching (Abu-Rabia 2000; Saiegh-Haddad 2004, 2005, 2007, 2012; Leikin et al. 2009; Ibrahim 2009); the words and sentences used in Braille reading instruction are identical (at phase III onwards) to the standard Arabic school materials for sighted students.

Even when diglossia is not an issue, as in English and Italian, within the first school year and throughout the elementary school years, Braille reading children fare lower on basic phonological, semantic and orthographic skills than sighted peers on both speed and accuracy measures (Packer 1989; Legge et. al. 1985, 1989; Greaney and Reason 1999; Wetzel and Knowlton 2000). Many of the gaps in academic achievements between blind and sighted school children are usually met through individual support administered by teachers with special education training in the mainstream elementary and high-school systems as well as in elementary school special education programs.

## 18.6 Fluency and Accuracy Measures in English Braille Readers

Nolan and Kedris (1969) reviewed nine studies and summarized them by focusing on the effects of multiple factors that may affect English Braille reading. The review addressed the effect of aspects such as word length, familiarity, Braille specific orthography (the influence of the numbers and position of dots, and influence of Braille contractions) and context on recognition thresholds for words. The contribution of these factors to Braille word reading at the elementary school level as well as in low-intelligence readers was assessed. The reviewers also addressed the effect of character recognition training on Braille reading. Data relevant to the current review is presented in Table 18.1.

The data presented by Nolan and Kedris (1969) clearly reveals a consistent advantage for regular readers in mainstream schools compared to both visually impaired and blind readers in regard to their reading rates using a word-per-minute measure (Table 18.1). Large print readers attained, barely, half the reading rates of the regular readers. The reading rates of the Braille readers, while closing, at high-school level, the gap vis-à-vis the large print readers, were nevertheless more than twice as much lower than those of the regular readers.

**Table 18.1** Reading rates (in words-per-minute, wpm) in the 6th grade and high-school level in regular readers, large print readers and English Braille readers (based on the Nolan and Kedris (1969) review)

| Readers' groups | 6th grade | High-school |
|---|---|---|
| Regular readers | Average 6th grade reader, 179 wpm | Average high school reader, 215 wpm |
| Large print readers | Large print 6th grade reader, 79 wpm | Large print high school reader, 95 wpm |
| Braille readers | Braille 6th grade reader, 59 wpm | Braille high school reader, 83 wpm |

Knowlton and Wetzel (1996) investigated the effects of various reading tasks on the reading performance of expert adult Braille readers. The reading rates of their sample of expert adult English Braille readers varied greatly. Many of the subjects read at rates that were significantly faster than the average of 90 wpm often reported in the literature on Braille reading, with some individuals attaining reading rates of 240 words per minute in studying a test text. However, the authors argue that any measure of the reading rate for Braille reading must take into consideration more than a perceptual process of word recognition because reading constitutes much more than the recognition of words *per se*. For example, oral reading was 30 % slower compared to silent reading (Knowlton and Wetzel 1996).

The Texas School for the Blind and Visually Impaired (TSBVI-1997; http://www.tsbvi.edu/instructional-resources/1020-assessment-kit#Contents) developed an assessment kit for various individual Braille reading related skills for the blind or visually impaired. This source provides some additional information regarding the average Braille reading rates in English. The average reading rates for 3rd graders are reported as 51 wpm and this rate increases very moderately to 67 wpm by the 6th grade; these rates are consistent with the average reading rate (90 wpm—Grades 5–12) that were reviewed by Nolan and Kedris (1969) 30 years earlier. College students were found to read Braille at a rate twice as fast as 5th graders (115 wpm).

Students of different age-groups with a visual impairment generally read at a much slower rate than students without a visual impairment due to the slower non-visual (tactile) reading modality (Packer 1989; Legge et. al. 1985, 1989; Wetzel and Knowlton 2000). Not only does the reading of Braille, and large print of standard texts, generally require more time than reading regular print by vision, but the time needed to explore and interpret various pictorial information presented as tactile or enlarged graphics can be a tedious and time-consuming process. Therefore, extended time seems to be an obvious accommodation for this population of visually impaired students. Researchers have suggested that time extensions (based on classroom experience or research data) on the order of 1.5–2 times the standard (sighted) time allotted for print reading is appropriate for students with low vision reading large print (Gompel et al. 2004; Morris 1974; Packer 1989; Spungin 2002). Similarly, for Braille readers, a time extension on the order of 2–2.5 times the normal print reading time was suggested (Kedris et al. 1967; Morris 1974). Recently, a 5-fold increase in the allotted reading time was suggested for experienced adult Braille readers (Wetzel and Knowlton 2000).

**Table 18.2** Reading rates (*in words per minute-wpm*) for two Arabic reading tasks in elementary, high school and young adults, blind participants. Note that the unvowelized text included almost twice as many more words than the vowelized text

| Texts: Age-groups | Vowelized, Arabic text (*70 words/541 letters*) | Unvowelized, Arabic text (*134 words/667 letters*) |
|---|---|---|
| Adults ($N$=24) | 46 wpm | 57 wpm |
| High-school students ($N$=13) | 35 wpm | 44 wpm |
| Elementary school children ($N$=16) | 25 wpm | 37 wpm[a] |

[a] Only three children were able to perform the task

## 18.7 Performance in Arabic Braille Readers

Jarjoura (2012) investigated Braille reading proficiency speed and accuracy in three age-groups of Arab participants in the northern district of Israel: adults, mean age 23.3 (±2.55) ($N$=24), high-school students, mean age 16.4 (±1.7) ($N$=13) and elementary school children, mean age 10.3 (±2.8) ($N$=16). Participants were asked to read aloud two different texts in Arabic in two conditions: with and without vowels. The unvowelized texts were simplified and adapted from news websites while the vowelized text was based on elementary school level texts in Arabic. Reading rates (in words per minute) in the two reading tasks are summarized in Table 18.2.

The Braille reading rates measures presented in Table 18.2 show that adult blind participants consistently achieved higher Braille reading rates compared to the younger age-groups of blind participants in both Arabic reading conditions. Nevertheless, the between-group differences were significant only for the vowelized Arabic reading speed ($F_{(2, 38)}=7.6$, $p<0.01$); no significant difference was found in the non-vowelized Arabic reading rates, ($F_{(2, 35)}=0.32$, $p$=n.s.) possibly because only very high performers from the youngest age-group were able to complete the text and were included in the statistical analysis. One should note that the switch to unvoweled text reading occurs in Braille teaching, as in print teaching for sighted children, during the 5th grade; the young participants in the current study were recruited from the 5th and the 6th grades.

In the same study (Jarjoura 2012) reading errors were also analyzed. The errors committed were sorted into five types according to whether tactile-perceptual or linguistic aspects were focused on: substitution of mirror-reversed letters (such as p and q or b and d in printed English) (Millar 1985, 1997); one dot discrimination errors (Millar 1997; Nolan and Kedris 1969); missing letters; phonetic errors in vowels (Saiegh-Haddad 2004, 2007; Abu-Rabia and Taha 2006; Abu-Rabia 2007); lexical violation (Ibrahim et al. 2002; Saiegh-Haddad 2004; Abu-Rabia and Taha 2006).

The results showed that in the vowelized Arabic Braille text, the youngest age-group tended to commit the greatest number of errors, while adults were more accurate. Adults showed errorless performance in the mirror-image inversion and missing letter categories. Phonetic errors in vowels and one dot discrimination errors were the most common type of errors encountered in adults. The high-school students self-corrected significantly more than the adults, while the youngest age-group's reading was characterized by an intermediate number of self-corrections.

In the unvowelized Braille text reading task, no significant differences were found between the three age-groups in any of the six error types; in other words, all error types were found to be distributed evenly across age levels. The most common error type in both Arabic Braille reading task types was the phonetic error (vowel switching). This may reflect a characteristic of Semitic orthography, where ‘real’ letters representing consonants and vowels are inferred from the context. A similar finding was reported by previous studies with sighted, native Arabic readers (Abu-Rabia and Taha 2006; Abu-Rabia 2007). However, in the Arabic Braille reading tasks, for the vowel switching errors, there was a significant group (reading experience) effect in the *vowelized* Arabic Braille text reading condition but not in the *unvowelized* Arabic Braille text reading condition. The findings suggest that tactile skill related errors in unvowelized Arabic Braille reading shows no significant reading experience differences from 5th grade and up to young adulthood, but lexical and phonologic errors decrease with reading experience.

Another interesting finding was revealed in relation to the mirror-error type. The blind adult readers committed some mirror-errors while reading unvowelized Braille text but no such errors were present in the reading of the vowelized Braille text. On the other hand, the elementary school and high school participants made some mirror-errors in the vowelized Braille text reading task but not in reading the unvowelized Braille text. In addition, the one-dot error type was found in both Arabic Braille reading tasks in all age-groups. Both error types (mirror-image error and one-dot error) are considered tactile-based errors. Note that in Braille about half the alphabet is a mirror-image of the other half (compared to the p–q and b–d in English).

## 18.8 Conclusion

There is good support for the notion that Braille letter discrimination can be considered as a perceptual or perceptual-motor skill and as such Braille letter discrimination learning would be subject to the advantages and constraints imposed on procedural skill learning and procedural memory consolidation in other sensory and sensory-motor domains (Karni 1996; Karni and Bertini 1997; Bitan and Karni 2004; Goldreich and Kanics 2003, 2006). Although skilled reading requires multiple language and pragmatic skills, one should note that one dot discrimination errors in Braille letter reading persist into adulthood, even in the context of a text (Nolan and Kedris 1969; Millar 1997; Jarjoura 2012).

There is significant variance between the different studies on Braille reading rates and reading accuracy as a function of Braille reading experience. Moreover, the measurement methods for obtaining these assessments differ from response times (speed) in Braille letter discrimination to text reading (Millar 1977, 1997; Grant et al. 2000; Van Boven et al. 2000; Kauffman et al. 2002; Jarjoura 2012). Most studies, moreover, are concerned with Braille reading of English and very little is known about Braille reading in other languages. New data (Jarjoura 2012) regarding Arabic Braille reading proficiency and tactile discrimination speed and accuracy suggests that the contributions of Braille reading experience are not of a simple nature. Braille reading and especially Braille reading error rates in Arabic seem to be differentially affected by factors such as vowelized vs. unvoweled text reading. Moreover, diglossia and tactile-perceptual aspects may exert their effect on speed and accuracy of Braille reading in a differential manner.

Some limitations of the reading proficiency measurements in the various studies might be related to the heterogeneous study groups of blind or visually impaired participants and the relatively small number of subjects in each study compared to numerous studies rconducted with larger numbers of sighted print readers. Consequently, both limitations must be addressed and controlled in future studies in order to achieve more consistent measures of Braille reading proficiency in order to study and improve Braille reading instruction in blind and visually impaired individuals.

A significant issue is the unique features of the Arabic Braille orthography. The vowelized Arabic text is significantly longer and more complex for reading than the unvowelized Arabic text due to the necessity for activating more serial phonological abilities in order to read, thus affecting reading speed as well as accuracy. Another issue that needs to be directly addressed is that the majority of the older blind participants in the Arabic community in Israel are actually multi-lingual individuals because they are formally involved in the learning of Arabic, Hebrew and English Braille reading in the different Israeli educational institutes in respect to their age and educational level. Consequently, Braille consonants and vowels of the different languages (all of which use the very same Braille template) may actually have consolidated into multiple phonological representations in memory serving the different languages. Therefore, interference phenomena may affect reading fluency and accuracy in each specific language.

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