Chapter 2
Learning to Spell in Brazilian Portuguese: Children's Patterns of Spelling Errors and Unconventional Word Segmentation

Jane Correa

2.1 Introduction

In the school context, written language is the instrument par excellence for learning the different subjects that form the syllabus. In this way, difficulties in learning written language have a great impact on the school trajectory of any learner, imposing serious obstacles to the cognitive and socio-emotional development of children and young people of school age.

Writing is a very complex skill, as it involves several other linguistic-cognitive skills, including reading, as well as different types of knowledge, including the reader's knowledge of word and the world. In the study on the written production of the text, Pontecorvo (1997) distinguishes two levels of analysis: written language and language writing. At the level of written language, attention is focused on understanding the skills and knowledge related to text composition. From the perspective of language writing, the focus is on the own writing process and on the linguistic materiality of the text, which includes the domain of spelling, the object of this chapter.

There are several aspects involved in the learning of spelling by the learner, which comprises the linguistic, cognitive, and socio-affective domains. Initially, it is important to make some considerations about the socio-affective aspects involved in the domain of spelling, since writing leaves marks, not only on the surface on which it is made but also on who writes.

On the one hand, writing according to the conventions of spelling norm confers social prestige to those who master them. On the other hand, success in school learning is associated with the intelligence, discipline, interest, and effort of the learner (Correa & MacLean, 1999; Correa, 2015). The presence of spelling errors in writing exposes to others how far the child is from the qualities attributed to school

J. Correa (✉)
Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil

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success and how close to unflattering attributes that harm the construction of self-esteem. Numerous spelling errors are visible marks of what is not known, often being attributed to people with learning difficulties, the labels of undisciplined, unmotivated, disinterested, or lazy. Often, children with difficulties in school learning consider themselves to be unintelligent and underestimate their own abilities. This negatively impacts the construction of their self-esteem and their bond with learning (Gomes et al., 2018), harming the relationships they establish with the teacher and their peers in the classroom.

To avoid exposure, the child then starts to avoid writing or to write very little, generally, elaborating short and disconnected sentences from the use of words whose spelling are already known. Understanding the linguistic-cognitive aspects involved in the domain of spelling is essential for planning a learning path that leads the child to feel confident when writing.

Considering the writer-text-reader interaction, the care with the spelling in the text expresses the consideration the writer, by paying attention to spelling, gives to the reader (Koch & Elias, 2009). Spelling according to the conventions of the written standard makes the text understandable, facilitating communication between the writer and the reader. By paying attention to spelling, the writer helps the reader to go beyond the linguistic surface of the text without major difficulties, so that reading can become more fluid. This is possible since, with the practice of reading, the brain starts to quickly recognize words, relating the conventional spelling of the word (orthographic processing), its meaning (semantic processing), and pronunciation (phonological processing) (Ashby & Rayner, 2012). Thus, the sight of the written word immediately activates the information referring to the word, in an automated way and without conscious effort on the part of the reader, who can thus expend cognitive resources to understand the text. Therefore, being careful with spelling is a strategy the writer uses to facilitate communication with the reader and favor the sharing of their ideas.

The ease with which the child can carry out the writing activity depends on the internalization and consequent automaticity of the writing conventions (Limpo et al., 2020). The delay, or even the impossibility, in writing the words on paper during the writing activity can even lead the child to forget the subsequent ideas of their text, thus compromising the elaboration of sentences and their organization. The lack or partial knowledge of conventions of the writing system gives an idiosyncratic character to writing, resulting in a text understandable only with the help of the own child in the exact context of its production. After some time, this same text no longer makes sense, even for the child who wrote it.

In the production of the text, the writer must coordinate the flow of ideas with the act of writing, whether on paper or on digital devices. Thus, the precision and speed with which the writing is carried out allows the writer to maintain the continuity of the theme and the development of ideas in text elaboration. Difficulties in the domain of spelling compromise the fluency of writing, bringing damage both in terms of quantity and quality of written production (Gregg & Mather, 2002; Limpo et al., 2020). Omissions of words or even sentences are frequent; the delay, or even the impossibility, in writing the words on paper during the writing activity can lead

the child to forget about subsequent ideas, thus compromising the elaboration of sentences and their organization in the text. This ends up compromising the textual progression, negatively impacting the construction of text coherence by the writer.

Learners with poor writing skills tend to spend a lot of time spelling words (Gregg & Mather, 2002). The fact that many cognitive resources are focused on how to spell words hinders the performance of more complex cognitive operations required by the text composition process (Berninger et al., 2002; Graham & Harris, 2000; McCutchen, 2000). In short, a well-developed orthographic processing is fundamental for the elaboration of the written text, as it ensures that the writer does not face frequent interruptions to the flow of selection, organization, and development of ideas, thus contributing to the implementation of monitoring processes and the regulation of activity in terms of composition.

2.2 Learning to Spell

Learning is a transitive verb: whoever learns, learns something. In this way, we have two basic elements for understanding the learning process: the subject who learns and the learning object (Vergnaud, 1985). Thus, in the investigation of spelling learning, it is important, on the one hand, to describe which skills contribute to this learning and how such skills, as well as the learner's knowledge, are transformed throughout this process. On the other hand, it is important to consider the constitution of the learning object, in this case the spelling, which by nature imposes epistemological obstacles to the subject who learns. Thus, learning spelling will require the development of specific cognitive skills, which will differ from other objects of knowledge (Vergnaud, 1985). In this way, investigating the learning of spelling means considering the following: (a) the skills that, from the subject's point of view, enable them to write according to the norm and (b) the nature of the spelling system. The language in which the subject learns will influence the learning process itself, as well as the cognitive resources the learner uses to appropriate spelling knowledge.

2.2.1 The Object of Learning: Spelling

The way spelling should be learned is still a matter of debate. On the one hand, there are those who advocate that such learning should be carried out in a natural and informal way, using self-instruction. On the other hand, there are those who defend that spelling knowledge should be an object of explicit and systematic teaching. From the perspective of self-instruction learning, the development of spelling skills would result from the experience with reading, since when reading, the learner would be exposed to the conventional spelling of words. This practice is in line with the perspective that learning to read and write should occur naturally through

children's participation in different literacy contexts, that is, from their participation in activities requiring the use of reading and of writing.

In fact, the practice of reading contributes to develop spelling knowledge, but less effectively than through explicit teaching. Although reading and writing both involve mastering the conventions of the writing system, the distinction between spelling irregularities and regularities may vary, depending on the perspective of the reader or the writer. There would be "reading spelling regularities" and "writing spelling regularities" (Morais, 2005), since, from the graphophonic point of view, there is greater consistency of letter-sound relationships in reading than in the phonographic correspondence in writing. In cases of multiple correspondence between letters and sounds, irregularities are experienced both in reading and writing, when a grapheme represents several phonemes. Nevertheless, in cases where a phoneme is represented by different graphemes, the reader does not experience any ambiguity in converting the grapheme into a phoneme. However, in writing, the doubt about the appropriate representation for the phoneme in spelling remains. In this way, the child has a greater number of regularities when reading the words in the text than in their writing.

Although children can, depending on their experience, learn certain spelling patterns without being formally educated, pedagogical practices for spelling mastery based only on natural learning, that is, carried out in an incidental and informal way, have shown limited reach for children with typical development (Bruck et al., 1998; Treiman, 2018). Those practices also prove to be unproductive for children with learning difficulties (Graham, 2000). Natural learning has shown limited contribution when compared to systematic teaching of spelling conventions in various performance measures.

Teaching spelling does not mean advocating a return to the traditional method of giving children lists of words for them to memorize but rather leading the learner to understand the alphabetic writing system and spelling rules. In this sense, the systematic teaching of spelling should be organized with the principle of offering opportunities for the child to observe, compare, analyze, discuss, and explain their knowledge about spelling (Meireles & Correa, 2006; Morais, 1998) as well as to develop skills and metacognitive strategies that contribute to spelling progress (Cordewener et al., 2016; Cordewener et al., 2018).

Despite the greater effectiveness of explicit teaching for spelling mastery (Graham & Santangelo, 2014), both forms of learning, implicit and explicit, present singularities that make them important in their way to promote the development of children's writing skills. The association of systematic teaching of spelling conventions with incidental learning practices may even prove to be more effective than either of these approaches alone (Graham, 2000). Thus, for the learning of spelling knowledge by the child, it is important to organize the explicit teaching of spelling in a systematic and meaningful way, associated with self-instruction learning, depending on the child's participation in different literacy contexts. With this, the child is provided with the opportunity to participate in more natural writing activities in which the spelling knowledge learned can be applied.

2.2.2 *The Nature of the Spelling in Which One Learns to Write*

If the alphabetic orthographies were totally transparent, that is, if there was absolute regularity in the relationship between the sound pattern and the graphic pattern, the knowledge of the correspondence between sounds and letters would be enough for the development of spelling skills. That is, in a totally transparent writing system, the spellings of words would be predictable, resorting to phonographic correspondences, since a phoneme would be represented by a letter (or group of letters), and this same letter (or group of letters) would only represent a single phoneme. Irregularities from the phonographic point of view (sound for letters) in alphabetic orthographies imply the existence of multiple representations for a given phoneme, as in the possibility that a grapheme represents different phonemes, generating plausible spellings for certain words, although not sanctioned by the spelling conventions.

Seymour et al. (2003) compared several alphabet-based European languages regarding their complexity, adopting as one of the criteria the degree of regularity of correspondence between sounds and letters in the spelling of words. The different orthographies were organized in a continuum from the absolute regularity of phoneme-grapheme correspondences (maximum transparency) to the extreme in terms of opacity or irregularity of such correspondences. In this way, spelling would be so much more opaque, the more irregularities observed in the phonographic correspondences in the spelling of the words. In the comparative analysis of European languages carried out by Seymour et al. (2003), according to the regularity-irregularity axis of phonographic correspondences, we would have the following sequence, comparing the following Latin orthographies: Italian, Spanish, European Portuguese (at a central point of the continuum), and French.

The unpredictability in the spelling of words at the phonographic level does not nullify the possibility of predicting the spelling of such words at another level of language, such as morphology. In this case, consistency in spelling of morphemes makes it possible to spell words correctly, the subject's morphological knowledge will significantly contribute to the development of spelling skills (McCutchen & Stull, 2015). The contribution of morphology to spelling is more expressively documented in opaque languages, such as English and French (Levesque et al., 2021; Mussar et al., 2020). The importance of morphology for the writing of school-age children has also been investigated in regular orthographies. There is empirical evidence suggesting the contribution of morphological awareness to the development of writing skills also in transparent orthography, as in Italian (Angelelli et al., 2014) and Spanish (Defior et al., 2008), or even in relatively transparent orthographies, such as Brazilian Portuguese (Cardoso et al., 2008; Guimarães et al., 2014; Guimarães & Mota, 2018; Mota, 2012).

In addition to the importance of morphology for learning different orthographies, it is questioned in which period the independent contribution of morphological awareness would impact learning. There is empirical evidence that the use of

morphology would be carried out late (Nunes et al., 1997). Children would be slow to use morphological knowledge in writing. There is also evidence that points to the significant contribution of morphology in the early years of learning to write (Breadmore & Deacon, 2019). In this way, morphological processing would have a specific and independent contribution from that observed for phonological processing from an early age to children's writing (Zhang & Treiman, 2020). In both cases, the empirical evidence comes, for the most part, from investigations in English (Deacon, 2008). From a phonological point of view, English is a very irregular language (Seymour et al., 2003), which greatly limits the use of phonological strategies in writing.

In short, to write according to the orthographic norm, the child integrates diverse knowledge and skills. Orthographic writing requires the understanding of regularities related to different levels of linguistic analysis and therefore cannot be performed immediately by mastering the alphabetic writing system in the initial years of formal education. In this way, mastering spelling will involve knowledge and skills to be learned throughout schooling.

2.3 The Development of Children's Spelling Skills in Brazilian Portuguese

Historically, the spelling of Brazilian Portuguese, like other alphabetic languages, was not organized solely guided by the phonographic principle. Other linguistic levels, such as etymology and morphology, are present in its constitution. Therefore, other levels of linguistic information, and other strategies, besides phonology, are necessary to be able to write according to the orthographic norms of Brazilian Portuguese. Despite the relative transparency of Brazilian Portuguese, it is not possible to predict the spelling of certain words just by knowing the regularity of correspondences between letters and sounds. In some cases, it is necessary to relativize the principle of letter-sound regularity, considering the position in which the representation of a phoneme is determined by phonemes or letters that are close to it in the word. Such regularities are called context regularities, and they continue to have as a reference the phonological level of analysis of the language.

As a Romance language, Brazilian Portuguese is an inflected language. Nouns and adjectives are modified in number or gender, while verbs are modified in tense, aspect, and person. Brazilian Portuguese also includes morphologically complex words; most affixes (prefixes and suffixes) come from Latin or Greek. To write according to orthographic norms, children need to develop morphological processing skills, since there are cases in Brazilian Portuguese in which the spellings of words follow regularities of a morphological nature, related to the class to which the words belong and the spelling of morphemes that constitute them.

Describing the development of spelling skills in Brazilian Portuguese allows to understand, in this process, the constitutive role of a language with a median

position in the regularity-irregularity continuum regarding phonographic correspondences (Seymour et al., 2003). Brazilian Portuguese is even considered more transparent than European Portuguese (Fernandes et al., 2008). Thus, empirical evidence obtained for European Portuguese cannot be generalized to Brazilian Portuguese and vice versa.

2.3.1 Context-Sensitive and Morphological Regularities in Brazilian Portuguese Spelling

To examine the relative difficulty of spelling regularities of frequent use in Brazilian Portuguese, according to their level of linguistic organization, we asked children from the 3rd to the 5th year of elementary school to write words whose spellings were predicted by spelling conventions of a context-sensitive and morphological nature. Morphological regularities were separated into those of inflectional nature, in which morphemes express certain grammatical information (number, tense, person, etc.), and those of derivational nature, in which new words are formed by the addition of affixes. The regularities evaluated are listed in Table 2.1.

Words were randomly assigned to four different dictation lists among other words, so that children could not find a writing pattern that could be repeated. The dictation sheet contained, in each item, a sentence with a blank space for writing the dictated word. The word was said once in isolation and repeated in the reading of the sentence contained in the child's dictation protocol. It was repeated once more in isolation so that the student could fill in the blank space in the sentence with the dictated word. The dictation was performed in the classroom, with the help of the class teacher, as part of routine activities. The examination of writing in critical contexts, that is, in the correct spelling of the evaluated endings, was analyzed by using cluster analysis. This allow to examine individual differences in children's

Table 2.1 Cluster profiles for context-sensitive and morphological regularities

Phoneme	Grapheme	Critical context	Examples
Context-sensitive regularities			
/R/	Rr	Intervocalic	Corrida (race); birra (tantrum)
/r/	R	Intervocalic	Cara (face); parada (stop)
Inflectional morphological regularities			
/ãw/	Ão	Simple future indicative	Falarão (they will speak; cantarão (they will sing)
	M	Present tense of verbs in ar	Falam (they speak); cantam they sing)
Derivational morphological regularities			
/z/	S	esa suffix	Marquesa (marchioness); princesa (princess)
	Z	eza suffix	Beleza (beauty); pobreza (poverty)

spelling skills, which we would not obtain if the data were treated dichotomously, in terms of the presence or absence of errors. Children were distributed into groups according to the spellings produced, respectively, for context regularities (Table 2.2) and morphological regularities of inflectional (Table 2.3) and derivational nature (Table 2.4).

Context-Sensitive Rules

The letter *r* at the beginning of a word represents the phoneme /R/, as rua (street). When between vowels, it represents the phoneme /r/. For the representation of the phoneme /R/ when between vowels, it is necessary to use two letters *r*, forming the digraph *rr*, as in *carro* (car).

In the first group, children are moderately skilled at spelling words with phoneme /r/. Children in the second group are skilled at spelling those words. In the third group, children are skilled at spelling words in all critical contexts.

Examination of spellings throughout schooling reveals a pattern of development in which the child becomes more skilled, initially, in one of the critical contexts, before becoming competent in both. The representation in which the child is most skillful is the one which is also presented in high-frequency words. In year 5, most children are able to perform well in representing both critical contexts.

Inflectional Morphological Rules

The ending /ãw/ is written as *ão*, when it comes to representing the future tense of verbs for the third person plural – *eles partirão* (they will depart). When representing the present tense of verbs ending in *ar*, write the ending with *am*. The child could only spell words with such endings according to spelling conventions through the use of their morphological knowledge in solving the ambiguity presented in the writing of such endings.

In the first group (skilled at *-ão* ending), children represent the ending /aw/ using the ending *ão*. It is important to say that nouns very familiar to children ending in /aw/ are represented by *ão*.

Table 2.2 Cluster profiles for context-sensitive rules

		Moderately skilled phoneme /r/	Skilled phoneme /r/	Skilled all critical contexts
		(*n* = 15)	(*n* = 40)	(*n* = 88)
Phoneme /R/	M	.39	.41	.93
	SD	.27	.21	.09
Phoneme /r/	M	.57	1.00	.99
	SD	.27	.00	.04
3rd year	*n*	10	20	23
	%	19	38	43
4th year	*n*	1	12	20
	%	3	36	61
5th year	*n*	4	8	45
	%	7	14	79

Table 2.3 Cluster profiles for inflectional morphological rules

		-ão/ -am endings		
		Skilled -ão ending	Skilled -am ending	Skilled all critical contexts
		(*n* = 48)	(*n* = 46)	(*n* = 42)
-am ending	M	.19	.71	.92
	SD	.20	.27	.12
-rão ending	M	.90	.29	.93
	SD	.12	.23	.09
3rd year	*n*	12	8	4
	%	50	33	17
4th year	*n*	19	19	7
	%	42	42	16
5th year	*n*	17	19	31
	%	25	28	46

Table 2.4 Cluster profiles for derivational morphological rule

		Skilled eza suffix	Skilled esa suffix	Skilled all critical contexts
		(*n* = 25)	(*n* = 72)	(*n* = 41)
Suffix esa	M	.10	.90	.76
	SD	.13	.18	.18
Suffix eza	M	.60	.21	.73
	SD	.31	.20	.19
3rd year	*n*	19	23	8
	%	38	46	16
4th year	*n*	5	33	16
	%	9	61	30
5th year	*n*	1	16	17
	%	3	47	50

For children in the second group (skilled at -am ending), the preferred way of representing the ending sound is made by the ending *am*. Such an ending designates the present tense of verbs. Narratives of children in the early years make a lot of use of the present tense.

In the third group (skilled at all critical contexts), the number of correct spellings in writing the ending /aw/ is significantly higher than expected due to the indistinct use of both endings. Children in this group are not exclusively attached to a particular representation for spelling verbs with /aw/ ending, making appropriate use of morphological information.

The percentage of children classified in each of the spelling patterns indicates a qualitative change in the child's use of morphological information throughout schooling. The percentages of children who generalize the use of one or another

ending in the writing of the ending /aw/ are very close both in 4th and 5th years. With respect to the frequency distribution, it is initially expected the predominance of the form *ão* in writing. This is followed by alternation in the use of one or another graphic form, before the mastery of the appropriate spelling. The percentages of children who generalize the use of one or another ending in the writing of the ending /aw/ are very close both in 4th and 5th years that would be able to consistently spell /aw/ endings was 46%.

Derivational Morphological Rules

The ending /eza/ is written *eza*, when in a derivational morpheme that forms abstract nouns (*beleza,* beauty; *pobreza*, poverty) or *esa*, when in a morpheme used in the generation of a feminine form, such as in *duquesa* (duchess) and *norueguesa* (Norwegian woman). Again, to resolve the ambiguity in the writing of this ending, the child will have to use their morphological analysis skills.

The first group includes children who represented the phoneme /z/ preferably by the letter *z*. This indicates that these children were based on the alphabetical hypothesis that the letter *z* is the representation par excellence of the phoneme in question. Therefore, they spell only the morpheme *eza* in a conventional way.

For children in the second group (skilled at *esa* suffix), the preferred way of representing the phoneme /z/ is made by the letter *s*. Children, still guided by their sensitivity to phonology and understanding of the change in the sound value of the letter, according to their position in the word, recognize the legitimacy of the letter *s* in the representation of the phoneme /z/ as well as its higher frequency of use in these cases. In this way, words formed by the morpheme *esa* are written in a conventional way.

In the third group (skilled at all critical contexts), the number of correct spellings in writing both morphemes was significantly higher than expected due to the indistinct use of the letters *s* and *z* for spelling the phoneme. Children in this group are not exclusively attached to a particular phonological representation for word spelling, making appropriate use of morphological information.

The percentage of children classified in each of the spelling patterns varied considerably according to schooling, indicating a qualitative change in the use made of morphological information in writing during their development, the endings /eza/. Although the mastery of such orthographic regularities varies significantly according to children's schooling, the percentage of children in the 5th year that would be able to consistently spell /eza/ endings was 45%.

The analysis of the frequency of correct answers in the evaluated critical context regularities suggests that Brazilian children tend to master context regularity more easily when compared with morphological regularities, which corroborates Meireles and Correa's (2005) previous findings. The use of morphology by children to resolve ambiguities in writing is late, as also observed by Correa et al. (2016). Thus, there would be a progression in the domain of the different orthographic regularities in Brazilian Portuguese, starting with the writing of phonographic regularities, followed by the regularity of context, to the regularity of morphological nature. A similar sequence was also observed in more regular orthographies such as Spanish (Ford

et al., 2018) and Italian (Notarnicola et al., 2012). Finally, it is important to note that regularity of inflectional nature did not prove to be easier than that of derivational nature.

2.3.2 *Children's Spelling Errors in Brazilian Portuguese Writing*

Just as important as examining the pattern of correct spelling in critical contexts for understanding the development of children's spelling skills is to consider the pattern of errors made by them, particularly at their early schooling years. Error analysis can provide relevant information about their linguistic knowledge and the strategies used to write. In fact, much of our understanding of spelling development comes from analyzing children's mistakes and invented writing.

Spelling errors are not random but reflect the level of knowledge or skill that children have (Limpo et al., 2021). Thus, the analysis of these errors allows to observe in which orthographic context the child makes such errors and at what point in their school trajectory. Based on the nature and frequency of spelling errors, it is possible to establish a hierarchy between the different types of spelling rules and their mastery by children, thus examining the existence of a pattern in the development of spelling skills.

The use of dictation allows the evaluation of the child's spelling performance through the systematic control of orthographic syllabic patterns of dictated words, as well as the spelling regularities or irregularities to be examined. Text writing also offers a valuable corpus of analysis to assess spelling errors, as children are more likely to spell words as they normally do in their spontaneous writing. Furthermore, analysis on the production of written texts does not limit the nature of the errors to be found. Thus, through the analysis of spelling errors found in written texts, we can examine the nature and frequency of these in words that children chose to write.

Correa and Dockrell (2010) examined orthographic patterns present in the stories written by Brazilian children attending the 1st to 3rd years. The types of mistakes frequently found in these texts were:

(a) String of letters – writing sequences of letters that do not represent any existing word in the language. It is a typical prephonological spelling.
(b) Phonologically acceptable errors – use of a letter or group of letters that, although not the conventional representation for that word, are possible transcriptions for the phoneme. For example, the child writes *caza* instead of *casa* (house). Although the choice of the letter *z* is not appropriate to represent the phoneme /z/ in the word *casa*, this letter represents the phoneme in other words, such as *prazer* (pleasure) or *fazer* (to do)
(c) Illegal letter errors: there is the use of a letter that does not represent the target phoneme in any context of the language – *cato* instead of *gato* (cat). Generally, the child's choice is for a letter that would represent a phoneme analogous to the

target phoneme and that differs from it solely by the presence or absence of the voicing feature.

(d) Letter omission errors: omission of the representation of a phoneme presents in the enunciation of the word – *lina* instead of *linda* (beautiful).

(e) Illegal letter order errors – phonemes of the word are represented, but the letters of some are in the wrong order – *predeu* instead of *perdeu* [she/he lost]. This type of error occurs in complex syllabic patterns such as CCV or CVC.

(f) Morpheme omissions errors: *vai canta* instead of *vai cantar* (going to sing).

(g) Morpheme substitution errors: *beberão* (simple future) instead of *beberam* (past tense – drinked).

(h) Morpheme addition errors: *uma presente* instead of *um presente* (a present).

The frequency of each type of error is presented in Table 2.5. The phonologically acceptable errors were the most frequent, occurring in the writing of almost all the children participating in the study.

For analysis, Correa and Dockrell (2010) considered the errors made by more than 50% children (Table 2.5): phonologically acceptable errors, substitution of letters, omission of letters, and omission of morphemes. As expected, schooling contributed to decrease the frequency of spelling errors that express difficulties in phonological analysis and/or inappropriate phonographic correspondence (Table 2.6).

The proportion of phonologically acceptable errors throughout schooling reveals the importance that phonological processing has overexposure to print for writing development in Brazilian Portuguese. It is to be expected that with the increase in schooling, there would also be an increase in exposure to written material, at the same time that phonologically acceptable errors would decrease, which would indicate the relevance of the lexical strategy for writing. However, the proportion of phonologically acceptable errors in the 2nd and 3rd years suggests the importance of phonological processing for the construction of the orthographic lexicon in Brazilian Portuguese.

At all ages, children omitted letters and morphemes, suggesting that the production of fluent text demands information processing resources, which may contribute

Table 2.5 Error types produced by children in their written stories

Error type	Percentage of children producing error type	Range in numbers of errors per child
Morpheme substitutions	5	0–1
Illegal letter order	10	0–5
String of letters	16	0–5
Morpheme addition	22	0–4
Morpheme omission	54	0–8
Letter omissions	58	0–10
Illegal letter representation	69	0–28
Phonologically acceptable errors	93	0–43

Table 2.6 Patterns of error according to schooling

	Letter omission errors	Illegal letter representations	Morpheme omission errors	Phonologically acceptable errors
1st year	.13	.19	.08	.42
2nd year	.08	.15	.11	.62
3rd year	.09	.11	.14	.59

to omissions in writing. The frequency of illegal letters errors in writing was more common than omissions, suggesting that children were trying to spell the phonological sequence of words without mastering the appropriate representations to do so. Either through errors in phonologically acceptable representations or even through the presence of illegal letters errors, it can be seen that children were trying to represent the phonological sequence of the target words in their texts. However, these were not the only mistakes made. In the case of omission of morphemes, children are exclusively relaying on their speech for their writing. In speech, there is, for example, the omission of some verb endings (e.g., as in the verb phrase *vamos viajar* (let's travel), in which the phoneme /r/ is not pronounced). The success observed in spelling words determined by orthographic regularities of morphological nature is related to the development of morphological processing skills.

Examining the correlations between the types of errors allows to infer differences or similarities between them. Phonologically acceptable errors have a negative and statistically significant relationship with all other types of errors. On the other hand, illegal letter errors and letter omissions are positively correlated, which reiterates the fact that they are typical errors of children with phonological analysis difficulties and who lack the necessary knowledge of phonographic correspondence for a more accurate representation of words in writing.

2.3.3 Unconventional Lexical Segmentation in Brazilian Portuguese Writing

Correa and Dockrell (2007) analyzed the production of stories by Brazilian children in elementary school (1st to 3rd years) and showed the occurrence of unconventional segmentations in the writing of texts. Defining the limits of words in writing a text is not a simple task, even for children who have mastered graphophonemic correspondences. The existence of blank spaces in writing results in information the writer and reader must process in order to understand the text (Ferreiro & Pontecorvo, 1996). In children's writing, unconventional word segmentation has been observed in a variety of languages and contexts with more occurrences of hyposegmentation (failure to separate two or more written words with a space) than hypersegmentation (written words are divided into more than one segment). In Brazilian Portuguese,

there is a tendency for articles or prepositions not to be separated by blank spaces from the closest lexical words (nouns and verbs) in hyposegmentation (*omenino* instead of *o menino* – the boy). The occurrences of hypersegmentation also refer to the same word classes involved in hyposegmentation.

Correa and Dockrell (2007) examined the frequency of unconventional lexical segmentation in Brazilian Portuguese in the early years of schooling, as well as the relationship of such segmentations with children's orthographic development. Hyposegmentations are significantly more frequent than hypersegmentations in children's texts. The relative frequency of nonconventional segmentations decreases significantly until the 3rd year. Children showing a greater number of unconventional segmentations in their narratives, whether in the form of hyposegmentation or hypersegmentation, produced relatively more spelling errors related to the string of letters and illegal letter representations. The latter, related to substitutions of voiced and unvoiced consonants representations, as in the spelling of *cato* by *gato* (cat). In turn, spelling errors with lesser occurrences of unconventional segmentations in writing were, for the most part, phonologically acceptable. In this sense, the occurrence of hyposegmentations and hypersegmentations in children's texts is related to the presence of spelling errors that express difficulties in phonological analysis on the part of children.

2.4 Cognitive Skills for Learning to Spell in Brazilian Portuguese

Understanding spelling learning as a knowledge construction process involves understanding both the nature of the object of knowledge and the knowing subject. In this sense, it is important to examine, from the point of view of the knowing subject, how children's writing reveals the cognitive processes related to the development of spelling.

In order to match speech, which is continuous, to letters, which are discrete units, it is necessary to segment speech into discrete units so that this correspondence can be carried out. The ability that enables this segmentation to be performed is phonological awareness, that is, the ability to operate on the phonological constituents of speech. Spellings that can be predicted by employing the analysis of sublexical units that involve meaning and grammatical information will require the learner to employ their morphological processing skills. Knowledge about the sequences of letters allowed by the writing system, as well as the memorization of spellings of irregular words, is part of the set of skills and knowledge for progress in spelling.

In Brazilian Portuguese, Correa and Dockrell (2010) analyzed the relationship between the occurrence of spelling errors most frequently found in children's writing (phonologically acceptable errors, illegal letter representations, letter omission, and morpheme omission) and verbal and nonverbal skills, working memory, vocabulary, morphological awareness, and reading. Phonologically acceptable errors

were positively correlated with all assessed skills, with the exception of nonverbal skills. Except for the nonverbal skill, illegal letter representation showed a negative and statistically significant correlation with all other linguistic-cognitive skills. There were no statistically significant correlations between letter omissions and any of the skills assessed. However, a negative trend was found between letter omissions and reading. There was a statistically significant positive correlation between morpheme omission and the morphological awareness task. It was also observed a positive trend between morpheme omission errors and working memory.

Acceptable phonological errors indicate the importance of phonological processing in the construction of an orthographic lexicon by Brazilian children. Illegal representation of letters and the omission of letters suggested that children were struggling with phonological analysis and phoneme-grapheme correspondence. However, illegal letter was also related to broader difficulties children have with other cognitive and linguistic abilities, such as verbal ability, reading, working memory, and morphological awareness.

According to Correa and Dockrell (2007), no significant differences were detected in nonverbal skills or working memory resources according to the greater or lesser occurrence of nonconventional segmentations in stories produced by children. The higher frequency of hyposegmentation in the written text of Brazilian children would be related to lower performances in verbal skills, vocabulary, and reading accuracy. In turn, a higher occurrence of hypersegmentation was related to poor reading accuracy. In this sense, occurrences of hyposegmentation in writing seem to reflect more general linguistic difficulties than the occurrence of hypersegmentation. The occurrence of hyposegmentation would be related to the child's linguistic conceptions, based on oral language and the learning of writing conventions. In turn, hypersegmentation appears to be of a later occurrence when compared to hyposegmentation. Hypersegmentation is more specifically related to learning to read and write and to the hypotheses the child builds about the concept of word based on the formal instruction they receive.

Not all words have meanings that can be taken as a unit of meaning independent of the linguistic universe. Prepositions, articles, and conjunctions, for example, are eminently related to the context of the language itself, modifying the meaning of other words to establish grammatical relationships between the words in the sentence and between the sentences themselves (Monteiro, 2002; Rosa, 2006). The meaning of such words is therefore grammatical in nature. These are the so-called function words (Bisol, 2004) or grammatical words (Monteiro, 2002; Rosa, 2006). The hypothesis about a minimum number of letters for writing a word is contradicted by the fact that there are words written with only one or two letters, such as articles, which have no lexical meaning but only grammatical meaning. According to Correa et al. (2014), Brazilian children start to hypersegment words in which they highlight syllables corresponding to such words (*a gora* instead of *agora* – right now).

The child's verbal skills, in particular their level of vocabulary, significantly contribute to the understanding of the limits of the word in writing. This is because vocabulary knowledge is correlated with a better phonological representation of the word,

as argued by Dockrell and Messer (2004). According to them, vocabulary also influences the child's spelling development via morphology and semantics, which would also help to explain the correlation obtained between the lower frequency of unconventional segmentation in writing and morphological awareness, that is, the ability to deal with the morphological constituents of words, thus allowing to identify, understand, and mentally operate with morphemes (Nunes et al., 1997). Younger children find it easier to properly delimit nouns, verbs, and adjectives in writing (Ferreiro & Pontecorvo, 1996; Tolchinsky & Cintas, 2001). Such word classes represent ideas (Monteiro, 2002) or objects of thought (Tamba-Mecz, 2006). Such words are called lexical words (Bisol, 2004) or content words (Rosa, 2006). In these cases, children could use their semantic knowledge and sensitivity to grammar, particularly differences between word classes, to decide the boundary between words in writing.

Finally, the correlation between reading accuracy and the lower frequency of unconventional segmentation in writing indicates that the ability to establish limits between words in Brazilian Portuguese would be related to: (a) greater ability in phonological analysis and (b) the knowledge the child has of graphophonemic correspondences. This hypothesis gains strength with reference to correlations between the frequency of unconventional segmentation and orthographic knowledge presented in the previous section.

2.5 Final Remarks

To understand the learning process, it is important to look inside the relationship established between subject and object of knowledge. Thus, it becomes relevant to discuss what is learned and what makes learning possible. Regarding the object of knowledge, in this case spelling, it is important to consider the nature of regularities from which the spellings of words can be predicted, the relative difficulty between different regularities, as well as which regularities are learned before the others. From the perspective of the subject, it is necessary to describe the linguistic-cognitive skills contributing to the mastery of spelling conventions, explaining how and when they influence the development of writing.

In the case of Brazilian Portuguese, a set of characteristics at the phonological level of language organization makes phonological processing a fundamental skill for learning spelling. Such findings reiterate the relative transparency of Brazilian Portuguese, bringing it closer to transparent Latin spelling, such as Spanish, for example. Given the morphological complexity of Brazilian Portuguese, how can one explain that morphological processing does not contribute to the same extent as phonological processing to the orthographic knowledge of Brazilian children since the early years of schooling? The answer to this question needs to go beyond the existence of a relative regularity of phonographic correspondences. It must be considered that Brazilian Portuguese shows, in prosodic terms, a relatively high degree of syllable-timing (Barbosa, 2000; Bisol, 2000). This makes the syllable a sublexical unit of great importance for the phonological analysis of the word in writing (Correa et al., 2007).

The prominence given to the syllable in Brazilian Portuguese tends to impair the salience of the morphic constituents of the words. The spelling of some affixes corresponds to a single syllable. Others would have their identity diluted, being part of two different syllables. Thus, the relative regularity of phonographic correspondences, the predominance of simpler syllabic patterns, such as the prominence of the syllable as a sublexical unit of references, favor the development of phonological processing, contributing to delay the process of morphic analysis of words as a strategy to be used in writing of Brazilian children. In short, compared to the development of phonological awareness, the contribution of morphology for the mastery of spelling in Brazilian Portuguese would be more specific (Correa, 2022; Soares, 2016), as well as its explicit use in writing would be later, as revealed by the analysis of spellings of Brazilian children's spellings, whether through dictations or through writing texts.

Finally, the set of investigations on the development of spelling skills in Brazilian children have interesting implications regarding the understanding of the development of spelling skills. The first is that the contribution of morphology to learn to spell in Brazilian Portuguese, compared to that of phonological awareness, is more specific. Also, the explicit use of morphological information occurs later in children's development of spelling skills. In addition to contributions of phonology, orthography, and morphology as described by the Triple Word Form Theory of spelling development (Bahr et al., 2012), in Brazilian Portuguese, prosodic aspects, such as rhythm and the contribution of semantics-syntax, should be highlighted. In this way, the interaction of lexical and sublexical units of analysis is encompassed to understand how Brazilian children develop their basic writing skills.

Language is both an object of knowledge and an object of thought, and as such it must be learned as well as taught. In this sense, the study of language is fundamental so that language can also be used for the study. Investigations about the acquisition of spelling knowledge bring relevant educational implications to be considered for the creation of learning contexts for the study of writing in the early school years. In the specific case of Brazilian Portuguese as a teaching object, it is important to consider children's linguistic intuition about the syllable-spelling pattern of words and the prominence of the syllable as a sublexical unit of analysis. Phonological processing is of fundamental importance for success in learning to spell in Brazilian Portuguese. Errors that impair the learning of writing are those reflecting the difficulty in performing the phonological analysis on the part of the child. Finally, it is essential to understand that writing leaves marks on children, in the form of stories of success or failure to learn. We expect that, from the children's point of view, learning contexts allow the writing of stories in which learners can live their trajectories as knowing subjects happily ever after.

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