# 12 Typical Phonological Development in Ugandan Language: A Case of Rukiga – A Pilot Study

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## Introduction

Uganda is a diverse country linguistically with 41 living languages, Rukiga included (Lewis, 2009). Rukiga is relatively under-researched, and there have been no previous studies on speech development in Rukiga. Speech–language therapy (SLT) is a new profession in Uganda whose pioneers qualified in 2010 and no study has been conducted on the speech development either of Rukiga or other Ugandan languages. Speech–language therapists (SLTs) working in Uganda face a major challenge in diagnosing speech difficulties in children given the lack of normative data upon which to base such clinical judgments. According to Miccio and Scarpino (2011), an effective phonological assessment requires knowledge of typical phonological development. Therefore, a study on Rukiga would not only contribute to an understanding of typical speech development in Rukiga-speaking children but also to that of the sister languages in Uganda, including Runyankole, Runyoro, Rutooro and the other related languages of Nyambo, Zinza, Haya, and Kerewe in Tanzania (Lewis, 2009). This preliminary study establishing speech developmental norms would also contribute greatly to professionals working in Uganda.

## Theoretical Background

### Rukiga Language

Rukiga /ruʧiga/, also referred to as Chiga, is one of the interlacustrine Bantu languages classified by the Guthrie classification of Bantu languages as E.14 (Lewis, 2009). Bantu is a tribal group classified as originating in sub-Saharan Africa, whose members speak more than 500 languages, Rukiga inclusive, with related linguistic features (Guthrie 1948 as cited in Lewis, 2009).

Rukiga is spoken in southwestern Uganda in the districts of Kabale, Kanungu, Rukungiri, north Kisoro, Ntungamo, and Kibaale (see Fig. 12.1). It is part of a language group known as Runyakitara, which according to an analysis by Bernsten (1998) is spoken by the largest group of Uganda's population (more than 20%). According to the Uganda Bureau of Statistics (2014), Uganda has a population of 34.9 million people. Runyakitara consists of four languages, namely: Rukiga, Runyankole, Runyoro, and Rutooro, which are mutually intelligible (Lagefoged et al. 1972 as cited in Bernsten, 1998). The four languages have a lexical similarity between 68% and 94% such that Runyankole–Rukiga use the same standard of orthography and so do Runyoro–Rutoro. Rukiga has four dialects, as indicated by Lewis (2009): Ruhimba, Runyaifwe-Hororo, Runyangyezi, and Rusigi.

## Phonology of Rukiga

### Consonant System

Twenty-one consonant phonemes have been identified for this study from an inventory of Runyakitara phonemes listed by Ndoleriire and Oriikiriza (1996): /p, b, m, f, v, t, d, n, r, s, z, ʒ, ʃ, ʧ, ʤ, k, g, ŋg, j, w, h/. The phoneme /ŋg/ was added for purposes of assessing velar-nasal sound acquisition considering that Rukiga does not contain the phoneme /ŋ/. However, Rukiga also contains sound combinations such as /n/: nt, nd, ns, nz, nʒ, nʧ; /m/: mb, mp; /ŋ/: ŋk, ŋg; /w/: bw, tw, nw, ʃw, kw, gw, mbw, ntw, nʃw, ŋkw, ŋgw; and /j/: sj, zy, tj, dj, which are treated as individual sounds since they function as single phonemes and when combined with other phonemes they form words.

### Vowel System

Conventionally, Rukiga has been treated as having a five-vowel system, where each short vowel is paired with a long vowel of similar quality (Ndoleriire & Oriikiriza, 1996). The vowels are /a, e, i, o, u/ and have qualities close to the cardinal vowels. The distinctive feature of vowel length leads to change in the meaning of a word (e.g., *okutuma* [to send] versus *okutuuma* [to heap up]). However, this distinction raises the question of whether or not short versus long vowels should be treated as separate phonemes such that instead of five vowels the vowel inventory would comprise ten vowels. Rukiga also has three diphthongs /ai, ei, oi/. In Rukiga orthography, the long vowels are indicated as double letters and short vowels as single letters. In this discussion, short vowels will

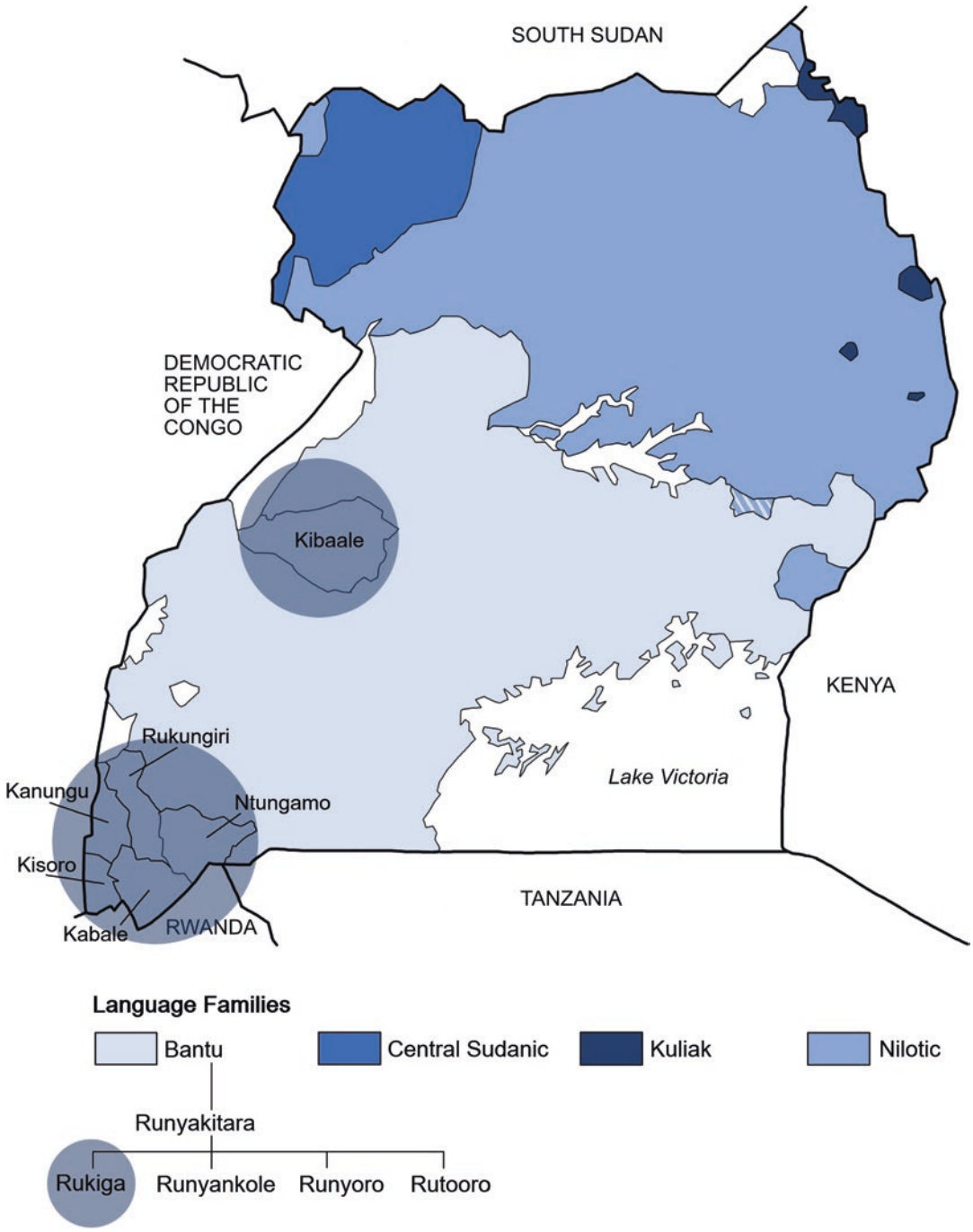


**Fig. 12.1** Map showing language families and the distribution of Rukiga language in Uganda. (Based on Bernsten, 1998; Eberhard et al., 2020; Lewis, 2009)

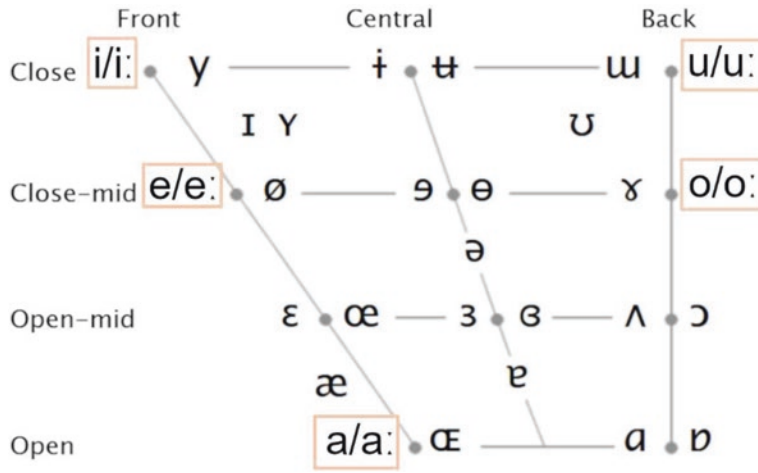


**Fig. 12.2** Rukiga vowel chart. (Adopted from Ndoleriire & Oriikiriza, 1996)

be indicated by a single letter (e.g., /a/) and long vowels will be indicated using the International Phonetic Alphabet (IPA) symbol /ː/ (e.g., /aː/) (Fig. 12.2).

### Syllable Structure

Rukiga has polysyllabic words that can take on the syllable shape of VCVCV (*vowel–consonant–vowel–consonant–vowel*) or CVCVCV (*consonant–vowel–consonant–vowel–consonant–vowel*). All words in Rukiga end in a vowel; thus, no consonants exist in word-final position. A syllable can consist of a single vowel and most Rukiga words have a vowel in word-initial position. A cluster of two or three consonants with a vowel is also considered as a syllable, e.g., *ente* (cow) = {e*(V)*nte*(CCV)*}; omwana (child) = {o*(V)*mwa*(CCV)*na*(CV)*}; *embwa* (dog) = {e*(V)*mbwa*(CCCV)*}; and *engwe* (leopard) = {e*(V)*ngwe*(CCCV)*}. The shortest word has two syllables and longer words have six or more syllables. There are no monosyllabic words in Rukiga.

### Tones

Rukiga makes use of lexical tones but the tonal system appears to be in a state of change, with young speakers using a different system from that of old speakers (Ndoleriire & Oriikiriza, 1996). The current phonological study will focus on sound segments and not on tones.

## Speech Development Including Phonological Development

### General Overview

In the process of speech development, children learn to recognize and use the distinctive features of the speech sound segments in their native language. In addition, they learn how to combine the speech segments into well-formed linguistic units to convey meaning. A review of the literature indicates that speech development follows a gradual progression (Stackhouse & Wells, 1997; Stoel-Gammon & Vogel Sosa, 2007). Stoel-Gammon and Vogel Sosa (2007) indicate that from birth, children are using non-speech-like expressions such as cries, coughs, wheezes, burps, and at around 2–3 months, speech-like sounds emerge which are vowel-like vocalizations. At around 6–7 months, children start to use non-meaningful consonant-vowel (CV) productions that resemble adult-like syllables. Stackhouse and Wells (1997) note that by 9 months, children's babble includes a greater range of CV sequences that have characteristics of their native language. At around 12 months, they start to say their first meaningful words, and this is followed by a period of rapid expansion in vocabulary, sound repertoire, and syllable shapes. Stoel-Gammon and Vogel Sosa (2007) indicate that at around 18 months, they start to use two-word utterances and multi-word utter-

ances emerge at around 24 months. Syllable structures also develop from simple or shorter syllabic structures to longer or more complex syllabic structures. Development continues in later years until they have acquired all distinctive speech segments of their native language in an adult-like manner (Stoel-Gammon & Vogel Sosa, 2007). Studies on vowel development indicate that most vowel quality development takes place before 3 years of age (Donegan, 2013).

English has been the most researched language in speech development (including several cross-sectional studies on English-speaking children) (see Table 12.1). Relatively fewer studies have been done on other languages of the world. Such studies include those on Arabic, Cantonese, Dutch, Filipino, Finnish, French, German, Greek, Hebrew, Hungarian, Israel, Japanese, Korean, Maltese, Norwegian, Portuguese, Putonghua, Sesotho, Spanish, Thai, Turkish, Vietnamese, and Welsh (McLeod, 2007).

Regarding English, differences in the age of acquisition of sounds have been reported by different authors. For example, Prather et al. (1975) found an earlier age of acquisition compared to other studies. However, similarities are also noted: For example, children acquire /m, n, p, b, w/ earlier than other sounds while /θ, ð, z, ʒ, ʤ/ are among the last sounds to be acquired.

Several studies have described phonological processes in English-speaking children (e.g., Dodd et al., 2003) and relatively fewer in other languages. As cited in Hua and Dodd (2006), such studies include those focusing on Arabic (Ammar & Morsi, 2006), Maltese (Grech, 2006), Putonghua (Hua, 2006), and German (Fox, 2006). Although some patterns are similar across the languages of the world, some are different. For example, the sound /r/ has different replacement patterns in the languages analyzed by Hua and Dodd (2006): in English, /r/→[w/ʊ], in Putonghua /r/→[j], in Turkish /r/→[j/vowel], in Maltese and Arabic, /r/→[l], and in Welsh, /r/→[ð/ɪ]. Phonological patterns in English typical speech acquisition include gliding, de-affrication, cluster reduction, fronting, weak syllable deletion, and stopping (Dodd et al., 2003).

The literature regarding the acquisition of phonological structures in languages whose majority words are multisyllabic, such as Finnish and French, suggests that children attempt to use multisyllabic words as early as in their first 50 words

**Table 12.1** Overview of studies on phoneme acquisition in English

| Author | Sample size | Age range | Word position[a] | % of age group[b] | Speech[c] | Sounds acquired first (age) | Sounds acquired last (age) |
|---|---|---|---|---|---|---|---|
| Wellman et al. (1931) | 204 | 2;0–6;0 | I, M, F | 75% | S and I | m, n, b, f, w, h (3;0) | ŋ, θ, ð, ʒ, ʤ (6;0) |
| Poole (1934) | 65 | 2;6–8;6 | I, M, F | 100% | S and I | m, p, b, w, h (3;6) | θ, s, z, ɹ (7;6) |
| Templin (1957) | 480 | 3;0–8;0 | I, M, F | 75% | S | m, n, ŋ, p, f, w, b, h (3;0) | ð, z, ʒ, ʤ (6;0) |
| Olmsted (1971) | 100 | 1;3–4;6 | I, M, F | 50% | S | p, b, n, k, g, z, f (3;0) | ŋ, ð, ʒ, ʧ, ʤ (>4;0) |
| Prather et al. (1975) | 147 | 2;0–4;0 | I, F | 75% | S | m, n, ŋ, p, h (2;0) | v, θ, z, ʤ (>4;0) |
| Arlt and Goodban (1976) | 240 | 3;0–6;0 | I, M, F | 75% | I | p, b, t, d, k, g, m, n, f, v (3;0) | z, θ, ð, ɹ (>6;0) |
| Smit et al. (1990) | 997 | 3;0–9;0 | I, F | 75% | S | m, n, p, b, d, w (3;0) | ŋ, s, z, ɹ (>7;0) |
| Dodd et al. (2003) | 684 | 3;0–6;11 | I, F | 90% | S and I | p, b, t, d, k, g, m, n, ŋ, f, v, s, z, h (3;5) | θ, ð, ɹ (>6;0) |

[a]I, M, F refer to word-initial, word-medial, and word-final positions
[b]Minimum percentage of an age group required in deciding acquisition of a phoneme
[c]S and I refer to spontaneous production or imitation

(MacLeod et al., 2011; Saaristo-Helin et al., 2011). Phonological patterns reported in Finnish-speaking children include syllable reduction, initial consonant deletion, and vowel harmony (Saaristo-Helin et al., 2011). Finnish has some linguistic features that are similar to Rukiga, such as sharing features of open syllables, longer words, and a phonological contrastive feature of vowel length (every short vowel is paired with a long vowel).

For languages that use vowel length as a contrast feature (with little associated quality difference), such as Japanese and Swedish, other studies indicate that children learn to distinguish short and long vowels by 2 years of age (Donegan, 2013). Thus, it can be predicted that similar patterns may be observed in Rukiga. However, different patterns may also arise due to language-specific variations.

## Speech Development (Including Phonology) in Bantu-Speaking Children

No speech development study has been conducted on any of the languages in Uganda, Rukiga included. The studies that have been conducted have focused on syntax and morphology in Runyakitara (Katushemererwe & Hanneforth, 2010a, b).

SLTs working in Uganda tend to compare the phonological development of Ugandan children to norms applicable to English children because there are no normative data for native speakers of the local languages. Yet it is known that different languages differ in terms of segmental and suprasegmental features and developmental patterns. Reilly et al. (2004) argue that SLT practice should be linked to research. Hence, establishing the phonological development norms of Ugandan languages, Rukiga included, will inform evidence-based practice in identifying speech sound disorders.

Although research on other Bantu languages is growing (Pascoe et al., 2018), relatively few studies have investigated phonological development, most of which have been on South African languages, such as Sesotho, Setswana, Xhosa, and Zulu (see Pascoe & Norman, 2011, and Mahura & Pascoe, 2016 for an overview). Only one study has been conducted on one of the East-African languages (Swahili; Gangji et al., 2014).

### Swahili

Gangji et al.'s (2014) study on Swahili speech development focused on 24 children acquiring Swahili as a first language between the ages of 3;0 and 5;11 years. In a cross-sectional design, children were divided into six age groups of four children each, with a difference of 6 months between groups. Each child produced 48 target words in a picture-naming task designed to elicit a specific range of consonant and vowel phonemes in Swahili. A phoneme was considered acquired if 75% of children in an age group produced it correctly. Results indicated that vowel acquisition was complete by 3 years. The order of consonant acquisition followed a gradual progression starting with plosives, nasals, laterals, approximants, affricates, fricatives, and finally trills. Most consonants were acquired by 3 years except the fricatives /s, z, h/ which were acquired at 4 years and the trills /θ, r/ at 5;11 years. Phonological patterns found included cluster reduction, weak syllable deletion, lateralization, sound preference substitution, initial consonant deletion, and metathesis. However, the population size was quite small, and determining whether a sound had been acquired was based on only three children (75% of the sample of four children in each age group). This may have resulted in variability in the developmental trends reported: for example, children in the group 4;6–4;11 performed below the youngest group (3;0–3;5) on percentage of consonants correct (PCC) scores. The investigators argued that two children in the age group 4;6–4;11 had inconsistencies that dragged down the group mean.

### Zulu

Naidoo et al. (2005) investigated the speech development of 18 Zulu-speaking children between the ages of 3;0 and 6;2 years, divided into three age groups (3;0–4;0, 4;1–5;1, 5;2–6;2). Each child's speech sample of 100 words was elicited from spontaneous conversation. Data were transcribed

and the study utilized the software packages of UBINET and the Phonetic Calculator Program (PCP) in the analysis. A speech sound was considered present in an age group if at least five to six children produced it correctly at least once in their speech. Findings indicated that vowels and most consonants were acquired by 3 years although the speech sound system was not complete by 6;2 years. Nasals, plosives, approximants, and fricatives developed earlier than affricates, clicks, and prenasalized consonants. In addition, shorter syllable structures developed earlier than longer syllable structures. For example, children in the age group 5;2–6;2 years were the only ones who could manage to produce six to seven-syllable words.

**Xhosa**

Several studies have been carried out to investigate isiXhosa speech development (Pascoe & Smouse, 2012). A longitudinal study by Tuomi et al. (2001) investigated speech development in ten Xhosa-speaking children between the ages of 1;0–3;0 years. Children's spontaneous productions were recorded and analyzed. A phoneme was considered fully emerged if 75% of children in the age group produced it correctly at a criterion frequency of 66.6%. Results indicated that all vowels were acquired by the age of 1;6 and most consonants by 3 years. Nasals, stops, and the glide /j/ were among the earliest to be acquired whereas fricatives and liquids were acquired last. It is also noted that the sibilant fricatives /s, z/ were acquired from the ages of 1;6–2;0. However, some findings from this study contradicted those from an earlier study by Mowrer and Burger (1991) in which the fricatives /s, z/ were acquired from the ages of 3;0–3;5. The investigators in this study argued that the difference in findings could have resulted from the different criterion measurements used in the two studies.

This earlier study on Xhosa, by Mowrer and Burger (1991), investigated the phonological development of 70 Xhosa-speaking children from the ages of 2;6–6;0 years, divided into seven groups of ten children each. The aim of this study was to compare the Xhosa phonological development with that of English-speaking children. Further, they matched the Xhosa-speaking children with 70 English-speaking children. A picture-naming test was used to elicit 41 target words. Mastery of a sound was considered complete if 80% of the children produced the sound correctly in word-medial position. Results indicated that 80% of the phonemes were acquired by 3 years in Xhosa-speaking children while only 48% of phonemes were acquired by 3 years in English-speaking children. Plosives, nasals, and clicks were the earliest to develop in Xhosa. Sounds acquired late in English were also found to be the last ones to be acquired in Xhosa-speaking children, namely /s, z, ʃ, r, tʃ/. The investigators also compared 20 consonants in the two languages that were similar. Results indicated that on sounds that Xhosa shares with English, English-speaking children made twice the number of errors that the Xhosa-speaking children made.

**Sesotho**

Finally, an analysis of Sesotho speech acquisition (Demuth 1992 as cited in Demuth, 2007) indicates that most consonants are acquired by the age of 2;6 years and attributes the early acquisition to the simple syllable structure of the language. Nasals and plosives are acquired earliest while the trill, lateral affricates, and clicks are the last sounds to be acquired. However, the findings on the development of clicks in Sesotho contrast with those in Xhosa, where clicks are among the earliest sounds to be acquired (Mowrer & Burger, 1991). This is attributed to the higher frequency of clicks in Xhosa than in Sesotho (Gxilishe 2004 as cited in Demuth, 2007).

**Summary**

Comparing these studies, it is clear that there are some similarities in the speech sound acquisition reported in Bantu languages; for example, vowels are acquired before the age of 3 years and children have acquired most consonants by this age, including nasals and plosives. However, discrepancies are also noted; for example, Swahili-speaking children acquire affricates earlier than in South African languages. Also, clicks are acquired earlier in Xhosa than in Sesotho. Hence, such a discrepancy in language variation in the age of acquisition of sounds is in contrast with the phonological universals. Although the Bantu-language groups are categorized by origin, they

vary in terms of the phonological system and in the frequency of sound use across different languages: for example, South African languages have clicks, ejectives, and prenasalized consonants, which are not present in Rukiga. Thus, every language needs to be considered independently when studying speech development.

## Speech Assessments Including Phonological Development

There are several formal speech sound assessments designed for assessing monolingual English-speaking children (McLeod & Threats, 2008). These include standardized assessments and word lists, which may or may not be standardized. However, the majority of speech assessments are in English or other majority languages and there are few in minority languages (McLeod & Goldstein, 2012).

In terms of each of the Bantu languages, van der Merwe and le Roux (2014) and Van Biljon et al. (2015) note that articulation assessment protocols need to be developed. Writing about sub-Saharan Africa, Alcock et al. (2015, p. 764) note that "the current lack of appropriate tools is associated with a dearth of systematic studies of typical development." There are no formal or published speech assessments in Rukiga and this has challenged SLTs in Uganda working with this group of children. McLeod and Goldstein (2012) highlight the unavailability of assessment tools in a language as a major challenge and urge SLTs to be cautious in using standardized speech assessments outside their original context due to several factors such as cultural and linguistic differences. They further note that the assessment of children in their native language is best practice and recommend creating an assessment tool if none are available.

However, when creating an assessment tool, some guidelines need to be followed (Van Biljon et al., 2015; Van der Merwe & Le Roux, 2014). McLeod (2012) provides some general considerations to note when creating an assessment tool and specific guidelines on how to develop a single-word test of consonants, which the current study utilized in the creation of the assessment tool.

### Independent Analysis

An independent analysis allows one to investigate consonants, vowels, syllable shapes, and patterns in a child's speech regardless of accuracy and relationship to the adult target. For phonological acquisition, several criterion measures are used. A frequently used criterion in cross-sectional studies is that proposed by Sander (1972 as cited in Amayreh & Dyson, 1998), categorizing children's speech acquisition into customary, acquired, or mastered levels. Consonants are defined as: (a) *customary* if they are correctly produced in a minimum of two-word positions by at least 50% of children in a given age group; (b) *acquired* if they are correctly produced in all word positions by at least 75% of children in a given age group; and (c) *mastered* if they are correctly produced in all word positions by at least 90% of children in a given age group. However, although independent analysis has its strengths, the current study will adopt more of a relational approach as highlighted below.

### Relational Analysis

In contrast to an independent analysis, a relational analysis allows comparison of a child's productions to the adult target when investigating speech development. A phonological process analysis is one commonly used in identifying patterns in children's speech (Miccio & Scarpino, 2011).

Other commonly used quantitative metrics in assessing children's phonological performance are the percentage of consonants correct (PCC) and percentage of vowels correct (PVC) (Pascoe et al., 2018; Shriberg et al., 1997). PCC is scored based on the number of consonants correct against the total number of consonants in the sample. PVC is scored similarly based on the number of vowels correct against the total number of vowels in the sample. Although these metrics have been useful for demonstrating the accuracy of speech production, they have also

been criticized for lacking standardization measures (for example, they are not adjusted for differences in age or gender).

## Research Questions

Taking the problem background and the current state of research into consideration, the study aimed to address the following research questions:

1. At what age do Rukiga-speaking children acquire the different speech sounds of Rukiga phonology?
2. Do Rukiga-speaking children develop speech sounds similarly to children acquiring other languages more commonly reported in the speech development literature or differently?
3. What phonological patterns are identifiable in Rukiga-speaking children's speech?
4. At what age do Rukiga-speaking children exhibit specific developmental phonological patterns?

## Methods

### Research Design

The study employed a descriptive cross-sectional design to identify patterns in children's speech development. A cross-sectional design enables a picture of children's speech to be captured at one point in time. The study was carried out in a rural nursery school located in Kikenkye, Bukinda subcounty in Kabale district, southwestern Uganda. It is located approximately 420 kilometers from Kampala, the capital city of Uganda.

### Participants

The study involved ten typically developing monolingual Rukiga-speaking children between the ages of 2;4 years and 4;1 years. The sample consisted of seven girls and three boys. Children were selected if they met the inclusion criteria and were recruited if their parents consented to their participation in the study (see sections "Selection Criteria" and "Ethical Considerations").

In addition, two adult native Rukiga speakers who were both teachers were recruited to name the pictures used in the analysis to compare children's productions with the adult target.

### Selection Criteria

The study included typically developing children who were native Rukiga speakers, aged between 2;0 years and 4;6 years attending the nursery school. The study excluded children who spoke Rukiga as a second language, children suspected of delayed or disordered speech development, and children with a medical diagnosis of a disorder such as autism, hearing impairment, visual impairment, or any kind of disability. One teacher at the school and two research assistants who are native Rukiga speakers were recruited for the purposes of identifying the children and collecting the speech data.

### Ethical Considerations

The approval to conduct the study was obtained from the University of Sheffield Ethics Review Panel and the study adhered to the requirements of the panel. Informed consent was obtained from the headteacher of the nursery school, the children's parents, and the adult participants to participate in the study. The headteacher was given an information sheet explaining the purpose and giving information about the study and a consent form to indicate the school's approval to participate in the study. The parents of identified children were invited to school and given an information sheet and a consent form to indicate their children's approval to participate in the study. To ensure informed consent, the information sheet and consent form were written in Rukiga and all explanations were given in Rukiga. The adult participants were given an

information sheet and a consent form to indicate their approval for participation in the study. To ensure confidentiality of the participants, pseudo Rukiga names were used in the report.

## Procedure

### Stimuli

A picture-naming task was used to elicit the target words. The single-word test was devised by the researcher following guidelines by McLeod (2012). A list of 98 words was generated from Rukiga vocabulary, from which 42 words were selected. These were selected considering whether they would be highly frequent and familiar to children, culturally appropriate for a rural setting, and picturable (McLeod, 2012). The final word list consisted of 42 target words that represented all consonants and vowels of Rukiga and a few clusters, in two-word positions: syllable initial word medial (SIWM) and syllable initial word final (SIWF) (see Table 12.2). The two-word positions were selected because the majority of Rukiga words contain vowels in word-initial and final positions. There was only one target word /wakame/ that contained a consonant in the syllable initial word-initial position (SIWI). The target words varied in length from three syllables to six syllables. The words were nouns that could be represented with a picture. Colored pictures of real objects were used considering they would be easier for

**Table 12.2** Word list of Rukiga words used in the assessment

| No. | Phoneme | SIWM[a] and SIWI[b] | SIWF[c] |
|---|---|---|---|
| 1 | /p/ | *ball* **omupiira** /omupiːra/ | *cup* **ekikopo** /ɛʧikopo/ |
| 2 | /b/ | *basin* **ebafu** /ebafu/ | *chair* **entebe** /entebe̤/ |
| 3 | /m/ | *key* **ekishumuruzo** /ɛʧiʃumuruzo/ | *sheep* **entaama** /entaːma/ |
| 4 | /f/ | *hoe* **efuka** /efuka/ | *basin* **ebafu** /ebafu/ |
| 5 | /v/ | *avocado* **ovakedo** /ovakedo/ | *earthworm* **omuhova** /omuhova/ |
| 6 | /t/ | *car* **emotoka** /emotoka/ | *tree* **omuti** /omuti/ |
| 7 | /d/ | *window* **edirisa** /edirisa/ | *bell* **ekide** /ɛʧide/ |
| 8 | /n/ | *kettle* **ebinika** /ebinika/ | *child/baby* **omwana** /omwana/ |
| 9 | /r/ | *pencil* **ekaraamu** /ekaraːmu/ | *egg* **eihuri** /ihuri/ |
| 10 | /s/ | *plate* **esohaani** /esohaːni/ | *pineapple* **enanaasi** /enanaːsi/ |
| 11 | /z/ | *water spring* **eiziba** /iziḇa/ | *table* **emeeza** /emeːza/ |
| 12 | /ʒ/ | *smearing vaseline* **amajuta** /amaʒuta/ | *boy* **omwojo** /omwoʒo/ |
| 13 | /ʃ/ | *watch* **eshaaha** /eʃaːha/ | *eye* **eriisho** /eriːʃo/ |
| 14 | /ʧ/ | *bottle* **ecupa** /ɛʧupa/ | *banana* **ekitookye** /ɛʧitoːʧe/ |
| 15 | /dʒ/ | *spoon* **ekigiiko** /ɛʧidʒiːko/ | *door* **orwigi** /ogwidʒi/ |
| 16 | /k/ | *pencil* **ekaraamu** /ekaraːmu/ | *hen* **enkoko** /eŋkoko/ |
| 17 | /g/ | *bicycle* **egaari** /egaːri/ | *jug* **ejaaga** /edʒaːga/ |
| 18 | /ŋg/ | *shoes* **engaito** /eŋgito/ | *pot* **enyungu** /enjuŋgu/ |
| 19 | /w/ | *rabbit* **wakame** /wakame/ | *green ibis* **enyawaawa** /enjawaːwa/ |
| 20 | /j/ | *mango* **omuyembe** /omujembe/ | *dress* **ekiteteeya** /ɛʧitetːja/ |
| 21 | /h/ | *panga* **omuhoro** /omuhoro/ | *bag* **eshaho** /eʃaho/ |

Words are indicated first by the English name in *italics*, followed by the orthographic Rukiga version in **bold** and the phonemic transcription in slant brackets //

[a]Syllable initial word medial

[b]Syllable initial word initial

[c]Syllable initial word final

children to identify, and these were compiled into a picture booklet. There were two pictures per page each of 15 × 10 cm in size.

### Task Administration

The nursery teacher who was familiar with the children and a native Rukiga speaker assessed each child individually in a quiet room. The assessor first established rapport and informed the child of what was required of him/her, before the test was administered. The assessor and the child were seated side by side with a book placed at a table appropriate for the child's height. The research assistant sat at the opposite side of the table in order to be able to clearly capture the child's speech production and video-recorded the speech productions of children and adult participants using a Canon VIXIA HF G10 HD recorder.

The administration procedure was the following:

1. The child was shown the picture and asked to name it. An appropriate prompt was given to elicit the response, whereby the assessor pointed to the picture and asked the child "*Eki'nenki?*" (What is this?).
2. If the child did not produce the correct target word or did not respond, the assessor gave another prompt in which the name of the picture was given and the child was asked to name it again: "*Ekibarakyeta ekikopo, barakyeta' ki?*" (This is a cup, what is it?).
3. Imitation was allowed to increase the data set, especially for the youngest age group of 2;4–3;4 years.

   However, allowing imitation poses theoretical implications, considering that imitation and spontaneous speech use different speech processing mechanisms from a psycholinguistic perspective (Stackhouse & Wells, 1997); for example, unlike spontaneous productions from a picture-naming task, imitation does not require a child to access their own representations of the word.

## Data Analysis

The video recordings were transferred to an encrypted memory stick, which was sent to the researcher at the University of Sheffield through the post for analysis. Based on the video recordings, the children's productions were transcribed by the researcher, who is a Rukiga native speaker and an experienced SLT, using phonetic transcription. To ensure validity and reliability, video recordings were listened to several times. The researcher sought a second opinion from a second researcher (an experienced SLT) where there were concerns in transcription. Due to the lack of a second Rukiga speaker at the University of Sheffield where the data were analyzed, inter-rater reliability was not possible.

Analysis of each child's speech took into consideration which sounds existed in the child's repertoire at the given age and the phonological patterns exhibited. A phoneme was considered acquired if 80% of the children (at least four out of five children) in an age group produced the sound correctly in two-word positions: syllable initial word medial (SIWM) and syllable initial word final (SIWF), regardless of whether the response was spontaneous or following a model. To profile phonological development, children were divided into two age groups consisting of five children in each group: the younger age group (2;4–3;4) and the older group (3;7–4;1). To ensure proper data management, data forms adopted from the Phonological Assessment of Child Speech (PACS) were used (Grunwell, 1985). The percentage of consonants correct (PCC) was calculated using the following formula (according to Shriberg 1997 and Pascoe et al., 2018)[1]:

[1]The study also intended to identify the percentage of vowels correct (PVC) but due to a pattern observed in all children regarding vowel production, it rendered PVC calculation challenging. This will be discussed in the next sections.

**Table 12.3** PCC scores for the younger age group (2;4–3;4)

| Pseudo name | Age (years) | Sex | PCC scores (%) |
|---|---|---|---|
| Byamugisha | 3;4 | M | 88.14 |
| Rukundo | 2;11 | F | 46.61 |
| Natukunda | 2;10 | F | 53.39 |
| Abaasa | 2;9 | F | 46.61 |
| Ariho | 2;4 | F | 83.05 |

**Table 12.4** PCC scores for the older age group (3;7–4;1)

| Pseudo name | Age (years) | Sex | PCC scores (%) |
|---|---|---|---|
| Tumuheki | 4;1 | F | 97.46 |
| Abeneitwe | 4;0 | F | 94.92 |
| Kyomuhendo | 3;7 | F | 97.46 |
| Tumwesigye | 3;7 | M | 99.17 |
| Musinguzi | 3;7 | M | 96.61 |

$$\frac{\#\,C'\text{scorrect}}{\#\,C'\text{stargeted}} \times 100$$

A phoneme was considered acquired if 80% of children (at least four out of five children) in an age group produced the sound correctly in two-word positions, syllable initial word medial (SIWM) or syllable initial word initial (SIWI) and syllable initial word final (SIWF), regardless of whether the response was spontaneous or following a model. The 80% criterion was used for this study as compared to Sander's 1972 (as cited in Amayreh & Dyson, 1998) 75% criterion, which is frequently used in cross-sectional studies because there was an uneven number of children in each age group (five children) which meant that it was not possible to meet the 75% criterion. A phonological pattern was considered present if it affected a class or a set of sounds with features in common (e.g., fricatives, alveolars, approximants, voiced sounds, etc.), rather than a single sound. Superscript letters […]$^{S\ or\ M}$ are used to indicate spontaneous production (S) or a production following a model (M), respectively (see e.g. Table 12.7). The majority of children in the younger age group required a model for their productions.

## Results: Phonological System-Segmental

The results presented are from ten children who participated in the study. The results will be presented for two age groups: the younger group of children (2;4–3;4) and the older group (3;7–4;1). The results in each age group will be presented in three categories: (1) phonological system-segmental, (2) phonological structure, and (3) variation, starting with the younger group and followed by the older group.

### Consonant Production

#### Younger Age Group (2;4–3;4 Years)

Children in this age group had a range of consonant accuracy between 46.61% and 88.14%. Table 12.3 shows the accuracy of consonant production as measured by the PCC.

#### Older Age Group (3;7–4;1 Years)

Children in this age group had a range of consonant accuracy between 94.92% and 99.17%. Table 12.4 shows the accuracy of consonant production as measured by the PCC.

### Phoneme Acquisition

#### Younger Age Group (2;4–3;4 Years)

In this age group, children had acquired 62% of consonants including nasals, stops, glides, fricatives, and affricates, as indicated in Table 12.5.

One child Byamugisha (3;4 years) had acquired all the consonants except /ŋg/, which is categorized as a cluster in Rukiga.

80% of the children in this age group did not produce a consonant in syllable initial word-initial position.

#### Older Age Group (3;7–4;1 Years)

In this age group, children had acquired all the consonants of Rukiga phonology, as indicated in Table 12.6.

**Table 12.5** Phoneme acquisition for the younger age group (2;4–3;4)

| Manner | Nasals | Stops/plosives | Glides | Fricatives | Affricates |
|---|---|---|---|---|---|
| Phonemes | /m, n/ | /p, b, t, k/ | /j, w/ | /v, h/ | /ʧ/ |

**Table 12.6** Phoneme acquisition for the older age group

| Manner | Nasals | Stops/plosives | Glides | Fricatives | Affricates | Liquid |
|---|---|---|---|---|---|---|
| Phonemes | /m, n, ŋg/ | /p, b, t, d, k, g/ | /j, w/ | /f, v, s, z, ʃ, ʒ, h/ | /ʧ, dʒ/ | /r/ |

**Table 12.7** Patterns and processes for the younger age group (2;4–3;4)

| Consonant production | | Vowel production |
|---|---|---|
| **Phonological system-segmental** | **Phonological structure** | |
| Context-sensitive voicing, e.g., /b/; /ebafu/→[epafu]$^{M}$ | Consonant/syllable addition, e.g., /enjuŋgu/→[edʒijindu]$^{S}$ | Vowel deletion, e.g., /efuka/→[fuka]$^{S}$ |
| Assimilation/reduplication/con-sonant harmony, e.g., /emotoka/→[emototа]$^{S}$ | Initial consonant deletion, e.g., /wakame/→[akame]$^{M}$ | Vowel harmony, e.g., /ekaraːmu/→[ataja:mu]$^{S}$ |
| Affrication of fricatives, e.g., /z/; /emeːza/→[emeːdʒa]$^{M}$ | Weak syllable deletion, e.g., /eʧikopo/→[kopo]$^{M}$ | Vowel substitution, e.g., /iziβa/→[eduβa]$^{M}$ |
| Deaffrication, e.g., /ʧ,dʒ/; /eʧidʒːiko/→[eʃiʒiːko]$^{S}$ | Cluster reduction, e.g., /entaːma/→[etaːma]$^{M}$ | Vowel reduction, e.g., /ekaraːmu/→[kəhəːm] |
| Gliding, e.g., /r/; /ekaraːmu/→[ataja:mu]$^{S}$ | | |
| Backing, e.g., /n/; /omwana/→[oŋaŋa]$^{M}$ | | |
| Stopping, e.g., /z/; /emeːza/→[emeːta]$^{M}$ | | |
| Fronting, e.g., /k/; /efuka/→[efuta]$^{S}$ | | |
| Glottal substitutions, e.g., /n/; /enanaːsi/→[enahaːʧi]$^{M}$ | | |
| Glottal reinforcement, e.g., /eʧiʃumuruzo/→[ʔŋʔŋjudʒo]$^{M}$ | | |
| Lack of alveolar and post-alveolar sound contrast, e.g., /enanaːsi/→[enanaːʃ]$^{M}$ | | |

## Patterns and Processes

### Younger Age Group (2;4–3;4 Years)

Table 12.7 shows patterns and processes for both consonant and vowel production for the younger age group children.

### Older Age Group (3;7–4;1 Years)

Table 12.8 shows patterns and processes for both consonant and vowel production for the older age group children.

## Variation

### Younger Age Group (2;4–3;4 Years)

There was inter-speaker variation, where different children varied in the production of the same word. There was also intra-speaker variation, where the same child varied in their production of the same word. However, not all children were variable in their own production.

A model was required in this age group for more than 60% of their productions. The number

**Table 12.8** Patterns and processes for the older age group (3;7–4;1)

| Consonant production | | Vowel production |
|---|---|---|
| **Phonological system-segmental** | **Phonological structure** | |
| Gliding, e.g., /eʧitete:ja/→[eʧitete:ra]$^{S}$ | Consonant deletion, e.g., /eʧiʃumuruzo/→[eʃ:umuruzo]$^{M}$ | Vowel deletion, e.g., /emotoka/→[em:tka]$^{S}$ |
| Lack of alveolar and post-alveolar sound contrast, e.g., /amaʒuta/→[amazuta]$^{S}$ | Consonant addition, e.g., /omupi:ra/→[omufpi:ra]$^{S}$ | Vowel reduction, e.g., efuka→[efukə]$^{S}$ |
| Affrication of fricatives, e.g., /omwoʒo/→[omwodʒo]$^{S}$ | Cluster reduction, e.g., /omwoʒo/→[uwoʒo]$^{M}$ | Vowel substitution, e.g., /eʧito:ʧe/→[eʧito:ʧi]$^{S}$ |
| Backing, e.g., /n/→/ŋ/; /omwana/→[oŋaŋa]$^{M}$ | | |

of models reduced with age and the number of words produced was 100% for all age groups.

### Older Age Group (3;7–4;1 Years)

There was inter-speaker variation, where different children varied in the production of the same word. There was also intra-speaker variation where the same child varied in their production of the same word. However, variation was not common in this age group.

## Discussion and Conclusions

The discussion of findings will focus on three aspects: first, the developmental trajectory of speech; second, the cross-linguistic similarities and differences; and finally, the word structure of Rukiga.

### Developmental Trajectory

It was hypothesized that Rukiga-speaking children would develop their phonological skills with age as reported in the literature regarding speech development (Stackhouse & Wells, 1997; Stoel-Gammon & Vogel Sosa, 2007). The data obtained from the children in this study indicate a clear developmental trajectory with increasing age. This is demonstrated by the huge difference of observations in the younger age group (2;4–3;4) compared to the older age group (3;7–4;1). Children in the younger age group had acquired few consonants (52%) while children in the older age group had acquired all consonants of Rukiga phonology. The first consonants to be acquired before 3;4 years were /m, n, p, b, t, v, h, k, ʧ, w, j, h/ and the last sounds to be acquired before 4;1 years were /d, g, ŋg, f, s, z, ʃ, ʒ, dʒ, r/. The fact that nasals, glides, and stops are acquired before fricatives by Rukiga-speaking children is consistent with more recent research (e.g., Dodd et al., 2003 and the "phonological universals" by Jakobson, 1941/1968). However, the affricate /ʧ/ is acquired before fricatives.

The age of acquisition of some phonemes is similar to other languages: for example, some of the sounds acquired early are the same as in English. However, variation is also apparent, which will be discussed in the next section on cross-linguistic issues. For example, the phoneme /ʧ/ is acquired from the ages of 4;0–4;5 years in English-speaking children (Dodd et al., 2003), but it is acquired from the ages of 2;4–3;4 years in Rukiga. This finding is supported by reports of Swahili-speaking children who acquire /ʧ/ by 3;0 years (Gangji et al., 2014). Furthermore, some sounds that English-speaking children acquire early (3;0–3;5), for instance, /d, g, f, s, z/ (Dodd et al., 2003), have been found to be acquired after 3;4 years in Rukiga. Also, /h/ is acquired before 3;4 years in Rukiga as compared to Swahili where it is acquired after 4;0 years and /r/ is acquired by 4;1 years yet is acquired at 5:11 years in Swahili. Most of these variations could be attributed to the frequency of phoneme distribution in Rukiga: for example, /ʧ/ is highly distributed and frequent in most Rukiga words (appearing in most Rukiga words and commonly used words).

Older children had more accurate productions as indicated by the PCC measures ranging from

94.92% to 99.17% compared to the younger children with PCC measures ranging from 46.61% to 88.17%. Children in the younger age group exhibited more variability in their speech production (both intra-speaker and inter-speaker variability) compared to the older group of children. Variability has been reported in young typically developing children (Stoel-Gammon, 2007, for English-speaking children). As cited in Stoel-Gammon (2007), children still exhibited high rates of inter-speaker variability in CVC productions until 30–33 months.

Children in the younger age group also had a significant number of patterns in their speech production, including context-sensitive voicing, reduplication/assimilation, affrication of fricatives, deaffrication, gliding, backing, stopping, fronting, glottal substitutions, lack of alveolar and post-alveolar sound contrast. The younger children also had shorter syllabic structures due to several patterns that affected the word structure, including consonant/vowel/whole syllable deletions and cluster reductions. In contrast, the older children had few error patterns in their speech and these occurred occasionally. The older children were most of the time able to produce longer and appropriate word structures up to the six-syllable word /eʧiʃumuruzo/ as assessed in the study unlike the younger children, where only two (40%) managed to produce the five-syllable word /eʧitete:ja/. However, most of the younger children's productions followed a model. It is uncertain whether similar or different findings could be obtained from spontaneous productions since imitation and spontaneous speech use different speech processing mechanisms (Stackhouse & Wells, 1997).

This finding of a clear developmental trajectory is similar to what has been found in other studies of English (e.g., Dodd et al., 2003, Swahili; Gangji et al., 2014, Zulu, Sesotho, Xhosa, French, Finnish, and other languages of the world).

## Cross-Linguistic Similarities and Differences

Some of the patterns found in Rukiga-speaking children are similar to what has been reported in other languages such as English (Dodd et al., 2003) and Putonghua (Hua & Dodd, 2000): for example, assimilation, consonant/syllable deletion, backing, stopping, and gliding. Although there were similarities with the mentioned languages and other Bantu languages such as Swahili (Gangji et al., 2014), cross-linguistic differences in the use of patterns were observed in this study, as will be discussed below (see the summary in Tables 12.9 and 12.10).

### Context-Sensitive Voicing

Context-sensitive voicing, a pattern that has been reported in English-speaking children, was also found in Rukiga-speaking children although the pattern found was different from that occurring in English. Whereas in English, a voiceless sound preceding a vowel would become voiced, in Rukiga, voiced sounds preceding vowels become voiceless (e.g., the word *kettle* /ebinika/→[epinika] or *basin* /ebafu/→[epafu]). The pattern in Rukiga is similar to the examples reported in Maltese-speaking children where /b/→[p] (Grech, 2006). This pattern has not been reported in Swahili (Gangji et al., 2014). Hence, this finding suggests that this pattern may be a language-specific one to Rukiga. Alternatively, it could be that it was not found in the Swahili-speaking children because they had resolved it, since the study included children above 3 years unlike the current study which included younger children.

### Gliding Pattern

The gliding pattern found in Rukiga was similar to that found in Putonghua (Hua & Dodd, 2000), where the liquid /r/ was replaced with the glide /j/: for example, the word *pencil* /ekara:mu/→[ataja:mu]. However, in Rukiga, the reverse pattern also occurred where /j/ was replaced with /r/ (e.g., the word *dress* /eʧitete:ja/→[eʧitete:ra]). There were no examples of /r/→[w], a pattern which is common in English (Dodd et al., 2003). Furthermore, the pattern in Rukiga is different to that found in Swahili (Gangji et al., 2014), whereby /r/ was lateralized to /l/. The reason for the difference is attributed to the fact that Rukiga has only one liquid /r/. Hence, this is a clear indication that although the two languages are linked by a common

**Table 12.9** Summary of the cross-linguistic comparisons in phonological patterns

| Phonological pattern | Similarities | Differences |
|---|---|---|
| Context-sensitive voicing | Similar to findings in Maltese-speaking children /b/→[p] (Grech, 2006). | In Rukiga, voiced sounds preceding vowels become voiceless.<br>In contrast to English where a voiceless sound preceding a vowel would become voiced. |
| Gliding | Similar to findings in Putonghua /r/→[j] (Hua & Dodd, 2000). | In Rukiga, the reverse also occurred /j/→[r].<br>No examples of /r/→[w] as common in English (Dodd et al., 2003).<br>Different to Swahili (Gangji et al., 2014) where /r/→[l]. |
| Backing and fronting | Similar to findings in Putonghua where the alveolar sounds are replaced by post-alveolar sounds, e.g., /s, z/→[ʃ] (Hua & Dodd, 2000).<br>Similar findings reported in Swahili; backing of alveolar fricatives to post-alveolar /s, z/→[ʃ, ʒ] (Gangji et al., 2014) | In Rukiga, the reverse also occurred where post-alveolar sounds were realized as alveolar sounds, e.g., /ʒ/→[z].<br>Also backing of nasal /n/ to velar-nasal [ŋ]<br>No findings of backing of alveolar stops /t, d/→/k, g/ as in English-speaking children.<br>In Rukiga, fronting was not common, only observed in one child; fronting of /k/→[t] and /g/→[d]. |
| Initial consonant deletion | It was a common pattern. This is similar to what has been reported in Swahili (Gangji et al., 2014), Finnish (Saaristo-Helin et al., 2011), and in Maltese (Grech, 2006) as a common process. | In Rukiga, initial consonant deletion was common, in contrast to English where it is not a common pattern (Grunwell, 1987). |
| Vowel and syllable deletion | In Rukiga, weak syllable deletion was common. This is similar to what has been reported in most languages, as a common process, e.g., English, Maltese, Putonghua, Swahili. | Vowels in SIWI positions were deleted; this has not been reported in other languages. |
| Assimilation/ reduplication | In Rukiga, the pattern was common in the younger age group (2;4–3;4 years). Similar to what has been reported in English-speaking children. | In Rukiga, there is a delay in resolving the pattern as compared to English-speaking children who resolve the process at approximately 2;0–2;6 years (Grunwell, 1987). |
| Affrication and deaffrication | Affrication was a common pattern in Rukiga, also reported in English-speaking children.<br>Deaffrication was also a common pattern. Similar patterns have been reported in English /ʧ/→[ʃ]. | In Rukiga, it affects fricatives /s, z, ʃ, ʒ/<br>In contrast to English where it affects stops (Dodd et al., 2003).<br>Other examples of deaffrication found in Rukiga, /ʧ/→[t, tj].<br>In contrast to English where /dʒ/→ /dz./, in Rukiga, it is realized as [ʒ]. |
| Cluster reduction | A common pattern, as reported in English.<br>Similar findings to what has been reported in Swahili; a cluster of a nasal + an approximant→nasal, e.g., /mw/→[m]<br>Early acquisition of homorganic clusters, similar to what has been reported in Finnish. | In clusters that had a stop and a nasal sound /nt, gw, ŋk, mb/, children retained a stop, e.g., /ŋk/→[k]. |
| Vowel development | Children could maintain a distinction between the target short vowels and target long vowels. This is similar to reports from other languages that use vowel length as a contrastive feature. e.g., Japanese, Swedish (Donegan, 2013).<br>Patterns included vowel reduction, vowel harmony, and vowel deletion. Similar patterns have been reported in Finnish (Saaristo-Helin et al., 2011). | Rukiga-speaking children have not developed the adult vowel quality by the age of 3 years (vowels were produced with a more centralized quality).<br>In contrast to reports from English and other Bantu languages that most vowel development is complete by the age of 3 years. |

**Table 12.10** Summary of cross-linguistic comparison in word structure patterns

| Word structure | |
|---|---|
| Similarities | Differences |
| • Younger children (2;4–3;4 years) used shorter syllabic structures. This is similar to what has been reported in Zulu-speaking children (Naidoo et al., 2005).<br>• Rukiga-speaking children exhibited a variety of patterns, e.g., deleting whole syllables, or individual consonants or vowels.<br>• Saaristo-Helin (2009) as cited in Saaristo-Helin et al. (2011) reports similar findings of children truncating polysyllabic words in Finnish.<br>• The younger children also used compensatory lengthening of consonants to realize the vowel in the syllable: for example, /ebafu/→[ebaf:]$^{S}$. This is similar to what has been reported in Finnish-speaking children (Saaristo-Helin et al., 2011). | • Rukiga is very different to lots of western European languages.<br>• It contains a high number of polysyllabic words. Shortest words have two syllables and are very rare.<br>• Structure for words that have no clusters contains a variety of CV syllable shapes that pose different challenges to those reported in other common languages.<br>• Children use glottalization as a reinforcement for the sounds at the beginning of very long words, e.g., /eʧiʃumuruzo/→[ʔŋʔŋjudʒo]$^{M}$. |

origin (Bantu), they are different languages that need to be addressed independently in studies of speech development.

### The Backing and Fronting Pattern

The backing pattern found in Rukiga was also similar to that reported in Putonghua (Hua & Dodd, 2000) where the alveolar sounds are replaced by post-alveolar sounds (e.g., /s, z/ were realized as [ʃ], as in the word *pineapple* /enanaːsi/→[enanaːʃ]). However, in Rukiga, the reverse pattern also occurred where post-alveolar sounds were realized as alveolar sounds (e.g., the word *boy* /omwoʒo/→[mozo]). There was also backing of the alveolar nasal /n/ to velar-nasal [ŋ] (e.g., the word *baby* /omwana/→[oŋaŋa]). Unlike in English-speaking children, where the alveolar stops /t, d/ would also be backed to /k, g/, this was not observed in Rukiga-speaking children. Instead, what was observed was fronting of /k/→[t] and /g/→[d] and this was observed in only one child (Rukundo, 2;11) in the younger age group.

Fronting of velar sounds to alveolar was also found in a small number of children in Putonghua. Hence, fronting is not a common process in Rukiga unlike the reports for English. Backing of alveolar fricatives to post-alveolar position has been reported in Swahili using the term "palatalization" where /s, z/→[ʃ, ʒ] (Gangji et al., 2014). It, therefore, seems a common process in Bantu languages. Fronting is not reported in Swahili, suggesting it may not be a common process in Bantu languages.

### Initial Consonant Deletion

As reported in the English literature, initial consonant deletion is not a common pattern in English-speaking children (Grunwell, 1987); in contrast, it was found to be common in the younger age group of Rukiga-speaking children. This could be attributed to the fact that most words in Rukiga have vowels in SIWI word position. Words with a consonant in SIWI position are not frequent words that children would use, such as names of places and some people's names. Hence, it is not surprising that only one word /wakame/ (*rabbit*) appeared on the test with a consonant in SIWI position and was realized without a consonant by 60% of children in the younger age group (e.g., [atame]). Initial consonant deletion has also been reported in Swahili (Gangji et al., 2014), Finnish (Saaristo-Helin et al., 2011), and in Maltese (Grech, 2006) as a common process.

### Vowel and Syllable Deletion

Similar to the above finding, vowels in SIWI positions were also deleted, and this was common in the younger age group (e.g., the word *hoe* /efuka/→[fuka]). This pattern has not been

reported in other languages, possibly because most languages have a consonant in SIWI position; hence, this is a language-specific variation.

Weak syllable deletion, a pattern that has been reported in most languages including English, Maltese, Putonghua, and Swahili, was also common in Rukiga-speaking children (e.g., the word *cup* /eʧikopo/→[kopo]). This pattern was only observed in the younger age group, suggesting that it resolves before 3;7 years, earlier than expected in English. In English, this process may occur up to approximately 3;6–4;0 years (Grunwell, 1987).

### Assimilation/Reduplication

Assimilation/reduplication was another pattern common in the younger age group of Rukiga-speaking children similar to that reported in English-speaking children (e.g., the word *car* /emotoka/→[emotota]). Since the pattern was not observed in the older age group, it is presumed that it resolved before 3;7 years. However, Rukiga-speaking children seem to delay resolving the pattern compared to English-speaking children who resolve the process at approximately 2;0–2;6 years (Grunwell, 1987); the younger age group in the current study was 2;4–3;4 years.

### Affrication of Fricatives

Another common pattern in Rukiga-speaking children was affrication of fricatives. Affrication has been reported in English-speaking children although it affects stops (Dodd et al., 2003), while in Rukiga it affected the fricatives /s, z, ʃ, ʒ/ (e.g., the word *table* /eme:za/→[eme:dʒa]). Deaffrication was also common in Rukiga-speaking children and similar patterns have been reported in English /ʧ/→[ʃ] (e.g., the word *bottle* /eʧupa/→[eʃupa] and in other cases, the affricate /ʧ/→[t, tj]). However, unlike English-speaking children who realized /dʒ/→/dz./, in Rukiga, children realized it as [ʒ]. Hence, such findings suggest cross-linguistic variation.

### Cluster Reduction

Cluster reduction, commonly reported in English, was also apparent in Rukiga and the patterns observed are language specific due to the Rukiga-specific clusters. However, for clusters that are common with Swahili as reported in a recent study by Gangji et al. (2014), when a cluster has a nasal and an approximant (e.g., /mw/), a nasal /m/ remains. In the other clusters examined which had a stop and a nasal sound /nt, gw, ŋk, mb/, children retained the stop (e.g., the word *hen* /eŋkoko/→[koko]). An important finding in the current study is that out of the seven clusters examined, all children in the older age group realized six (86%) correctly except /mw/. Early acquisition of homorganic clusters (clusters in which the place of articulation of both consonants is the same such as /nt, ŋk, ŋg/) has been reported in Finnish.

### Vowel Development

Finally, despite reports in the literature from many languages such as English and other Bantu languages that most vowel development is complete by the age of 3 years, Rukiga-speaking children have not developed the adult vowel quality by 4;1 years of age. In the current study, it was found that all children produced vowels with a more centralized quality (e.g., the word *ball* /omupi:ra/→[om:pi:rə]). However, all children could maintain a distinction between the target short vowels and target long vowels. This finding is similar to reports from other languages that use vowel length as a contrastive feature such as Swedish and Japanese, where children were found to acquire this distinction by 2 years of age (Donegan, 2013). The majority of vowels affected by the reduction pattern were those in word-medial and final positions, suggesting that children possess appropriate vowels for Rukiga phonology at 2;4 but because there are so many vowels in words, they stand a high chance of being reduced as a compensatory strategy. The vowel–consonant ratio is higher for vowels than consonants in most Rukiga words. For example, in the current study, the test used contained 141 vowels (54.4%) compared to 118 consonants (45%). The other vowel patterns included vowel harmony and deletion, although vowel harmony was only found in the younger age group. Similar patterns in vowel production have been reported in Finnish (Saaristo-Helin et al., 2011).

This suggests that word length is an important factor to consider for such vowel patterns commonly found in languages with long words, as discussed in the section below.

## Word Structure

Rukiga is very different to lots of western European languages because of the high number of polysyllabic words that it contains; the shortest words in Rukiga have two syllables, although there are very few words of this length. Examples include *mother* /mama/ and *father* /tata/. Hence, it is not surprising that the shortest words examined in the current study were three syllables long. Rukiga seems to have a simple structure for words that have no clusters. There are a variety of CV syllable shapes but because there are quite a lot in a word, it poses different challenges from what has been reported in many of the most common languages in the speech development literature.

As found in the current study, children in the younger age group could produce mostly three- to four-syllable words and only two children (40%) produced the five-syllable word. Children in the older age group could produce up to six syllables: for example, the word *key* /eʧiʃumuruzo/ with a structure VCVCVCVCVCV. This finding of younger children using shorter syllabic structures is supported by findings from Zulu-speaking children (Naidoo et al., 2005).

However, in contrast to what was found in Zulu-speaking children where the six-syllable VCVCVCVCVCV structure occurred with a frequency of 0.33% in the group of children ranging 3;0–4;0 years, 80% of Rukiga-speaking children in the older age group (3;7–4;1) produced the six-syllable word with the same syllable shapes.

This comparison needs to be treated with caution since the two studies used different methods: the study by Naidoo et al. (2005) elicited speech samples from spontaneous conversation, unlike the current study that used picture naming. Findings from Rukiga-speaking children are supported by reports from Finnish which utilizes polysyllabic words by Saaristo-Helin (2009) as cited in Saaristo-Helin et al. (2011), who noted that children stop truncating long words by the age of 3;0–3;6 years.

To cope with polysyllabic words, Rukiga-speaking children seem to be employing a variety of patterns as discussed in the previous section, such as deleting whole syllables, or individual consonants or vowels. The sounds that were mostly prone to deletion were those occurring in the word-medial position: for example, Rukundo (2;11) realized the word *cup* /eʧikopo/→[epu]$^{S}$.

The younger children also used compensatory lengthening of consonants to realize the vowel in the syllable (e.g., /ebafu/→[ebaf:]$^{S}$). Compensatory lengthening has been reported as one of the patterns in Finnish-speaking children (Saaristo-Helin et al., 2011). Also, glottalization was used as a reinforcement for the sounds at the beginning of very long words (e.g., /eʧiʃumuruzo/→[ʔŋʔŋjudʒo]$^{M}$).

## Impact of this Study

The study, being the first one to research children's speech development in Uganda, serves as a basis for future research in studies of speech development and should be repeated with a higher number of participants. Furthermore, results from this study will help SLTs working in Uganda in assessing and diagnosing phonological difficulties of Rukiga-speaking children and children speaking related languages in Uganda such as Runyankole, Runyoro, Rutoro, and the other related languages of Nyambo, Zinza, Haya, and Kerewe in Tanzania.

## Considerations for Future Work and Research

Future studies should focus on establishing the typical phonological development of the native speakers of other languages of Uganda and other countries in sub-Saharan Africa considering the cross-linguistic differences between these languages. It will also be paramount to establish standardized phonological assessment tools for SLTs to use for the effective assessment of children with speech difficulties.

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