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Substitution phonological patterns in the English speech of Ghanaian children

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A B S T R A C T

When children find the production of a speech sound difficult, they tend to substitute it with another easier one, a phenomenon described as Substitution Phonological Pattern (SPP). This study investigated SPP in Ghanaian preschoolers, who spoke their individual Ghanaian languages like Akan and Ga as their first languages (L1) but were learning to speak English as a second language, to understand and document how these children pronounced English speech sounds. Thirty preschoolers in a privately-owned basic school in Kumasi were selected and voice recorded as they mentioned twenty English lexical items from their textbooks after their teacher. Both the participants' and their teacher's productions of the stimulus words were transcribed according to the International Phonetic Alphabet. The data was analysed using both qualitative and quantitative research approaches and within the framework of Natural Phonology Theory. Findings indicated that the children exhibited Fronting, Backing, and Stopping. The participants' L1 and age among other factors were observed to be responsible for the processes identified: English sounds that were absent in the L1 of the children were difficult to produce for some of the children, while older children exhibited fewer cases of substitution. This study might serve as a documented material and a reference point for future researchers and Ministry of Education of the Republic of Ghana on Ghanaian children phonological experiences as regards the speaking of English.

1. Introduction

The researchers of this current study have observed that when children, whether monolingual or bilingual, reach a certain age and still exhibit characteristics of speech sound distortions, they are said to suffer speech difficulties. Children are therefore expected to overcome inconsistencies and abnormalities in sound articulation with time indicating that age is one factor that may play a role in the success of a child's articulation of speech sounds. Fringi et al. (2016:10), for instance, reported that "normative research suggests that the majority of children will have ceased to exhibit all of these phenomena by the age of six (Dodd et al., 2003)". The "phenomena" in this context refers to the various distortions in children's speech. The above argument was also partly presented in the proposition of Fabus (2011:149) that "it is not a coincidence that the final suppression of phonological processes occurs simultaneously at the age at which a child becomes intelligible to strangers." In this current study, the researchers clearly emphasized that the child's ability to use two or more languages in different domains irrespective of the speech errors the child exhibits makes the child

multilingual or bilingual. It could be added in this study that multilingual children acquire their first languages (L1) usually before the second language which usually occurs in the school setting. The researchers of this present study again have noticed that the unusual ways or distortions in speech or simplifications of speech perhaps owing to rapid speech, undeveloped articulatory organs, physiological challenges among other things were considered as phonological patterns by phonologists.

1.1. Forms of phonological patterns in the speech of children

As this current study was concerned about bilingual children's speech pattern, the researchers of this current study emphasized how bilingual children may grapple with or be influenced by their first languages in an attempt to learn to speak the second language. This was mirrored in the report of Goldstein and Swasey Washington (2001) as that bilingual children were observed to show slower, low intelligibility rating and other uncommon errors than monolingual children. In this study, Ghanaian children learning to speak English may therefore

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exhibit some difficulties as their first languages may have effect on their English speech. Phonological patterns are basically the easy but unusual way of producing speech sounds usually by a child. Phonological patterns are categorised into three major types which are syllable structure process, phoneme substitution and assimilation process (Leung & Brice, 2012, p. 43).

Substitution phonological pattern is explained as where "one class of sounds affects another sound class in which the phonemes are altered by changing the place or manner of production (Bernthal & Bankson, 2004)" cited in Fabus (2011:149). Example of substitution phonological pattern is where a word like *pig* /pɪg/ is pronounced by the child as *big* /bɪg/. The first phoneme /p/ of the word *pig* which is a voiceless labial stop, is replaced with a voiced labial stop /b/. Subtypes of the substitution phonological pattern are gliding, fronting, backing, stopping among others.

1.2. Language of assessment

Although the policy of Education in Ghana since 2007 stipulates the use of English as a medium of instruction from basic stage three (Ansah & Agyemang, 2015), it is apparent that most Ghanaian private-owned basic schools have English as the medium of instruction from Kindergarten to the Junior High School. Even in Ghanaian public schools, some poems are taught in English and English letters are also taught to pupils below basic stage three. Apart from the fact that children in Ghanaian private-owned schools are taught in English, the teachers sometimes communicate with the children in English outside of the classroom setting. This is meant to ensure the children gain interest and fluency in the use of the language. Again, outside of the classroom setting, teachers prepare their children for formal occasions where the children are engaged in academic exercises like recitation of poems, performance of drama among others. These reasons among others give Ghanaian teachers an overriding concern to introduce their pupils to the study of English at an early stage of their speech development. It must be stated categorically, here, that Ghanaian children's way of speaking English after overcoming all existing developmental speech sound disorders is a direct reflection of how their teachers, parents and peers speak the English language.

1.3. Rationale for the study

Li et al. (2011:999) have contended that "children's early productions frequently demonstrate omission and substitution errors relative to the adult forms. Many of these errors appear to be fairly consistent across children and across languages". This literature by Li et al. (2011) provided much impetus to understand Ghanaian children's English speech pattern, as the literature implied that Ghanaian children, like all other children learning to speak a second language, would exhibit phonological patterns like omission and substitution. Because of the position and relevance of English to Ghanaians in addition to English being the medium of instruction in Ghanaian schools, it was necessary to study the challenges Ghanaian children encounter in their speaking of English in their language development. In this present study, the researchers decided to study the phonological patterns of Ghanaian children learning to speak English to understand some of the challenges the Ghanaian children encounter. By focusing on these phonological patterns in the speech of preschoolers, findings from this current study may inform Ghanaian parents, teachers and curriculum developers of some of the existing errors or challenges Ghanaian preschoolers face in pronouncing certain English speech sounds. Another group of people to whom this study would be beneficial are Ghanaian speech therapists who as of now still depend on thresholds of children with English as their first language in other countries to diagnose speech problems of Ghanaian second language speakers of English.

This current study was guided by two major objectives. That is, the study investigated the types of substitution phonological patterns in the English speech of Ghanaian children. It also sought to find some of the probable reasons or causes of the identified phonological patterns in the speech of the children from existing literature.

2. Method

2.1. Participants

A total of thirty Ghanaian preschoolers at a private basic school in Kumasi, Ghana, who spoke both English and their individual Ghanaian languages at home and at school at the time of the study were considered for this study. In relation to the Ghanaian languages spoken by the participants, twenty-five of them were Akan native speakers, two of them were Ga native speakers and only one was an Ewe native speaker. Akan is a generic name for three different dialects: Asante, Fante and Akuapem. The three dialects remain the mother tongues of people living in parts of southern Ghana. Akan is the indigenous language with the most speakers (about 70% of the population of Ghana), both as L1 and an indigenous lingua franca for education, trade and media (Adomako, 2015, p. 4).

Hudu (2010:1) also narrates that

Dagbani is spoken mainly in the northeastern part of Ghana, but migrants from that region send their language wherever they go. The language belongs to the Oti-Volta subgroup of languages, which are a branch of the Niger-Congo language family; and is spoken by about 16.5 per cent of the population of Ghana.

Two of the participants speak Dagbani as their first language.

Ga is the language of the people of the Greater Accra Region of Ghana. According to Campbell (2017:1), it "is a language of the Niger-Congo family, the largest language phylum in the world with 1436 languages (Williamson & Blench, 2000, p. 11). It belongs to the Kwa sub-branch, which is the predominant branch in West Africa." Two of the participants spoke Ga as their L1.

To achieve uniformity in the selection of participants for the study, ten (10) children each of the ages 3, 4 and 5 were chosen for the study without a recourse to gender. Tables 1, 2 and 3 at Appendix B show the age, sex and native language distribution of the participants.

The researchers enquired about children within the age range of 3, 4 and 5 years from their teachers. The researchers together with the class teacher, randomly selected participants for the pronunciation task. With the help of the participants' teachers, the children were engaged in a recitation of the first five English letters. This was aimed at identifying participants who had a loss of tooth or teeth. Participants with an obvious dental problem like loss of a tooth or teeth were not considered participants since such a dental problem could adversely affect how such children orally produced the English speech sounds.

2.2. Data collection process

The participants in this study were made to mention each word once after their teacher. This approach in collecting the speech of the participants was motivated by a proposition by Kirk and Vigeland (2015:21) that "there is currently no research indicating what constitutes a sufficient number of opportunities for concluding that a child's speech displays a particular phonological error pattern". It is again supported by Sumner et al.'s (2013:1) assertion that "as listeners, we face a speech signal that is riddled with variation, with countless acoustic realizations of any given word". It therefore suggested that there was a tendency to have each of the several attempts (pronunciations of a word) different from the other. Since according to their teacher, some of the participants were usually not able to mention all the words without assistance, one of the teachers was made to pronounce the words for the participants to follow suit. This was also partly motivated by Byun's (2012:1056) assertion that "children may produce speech sound targets more accurately in imitation or drills than in

spontaneous speech". The reason for using one of the teachers of the participants was to achieve uniformity of the pronunciation of the words to the participants. The researchers also understood that while some of the participants were taught by the said teacher, the rest of the participants had been taught by the same teacher before, and therefore were familiar with the pronunciation patterns of the said teacher. Again, the decision to engage the participants' own teacher was to avoid biases where the researchers might have the temptation to mention words in a way to achieve expected results.

For privacy concerns and protection of the participant's identity, each participant was represented by a code. Each of the participants' pronunciations was coded according to a particular age group for ease of differentiation and classification. That was in the order of precedence: each of the ten participants of a particular age group was assigned a corresponding English letter serving as their code. For example, the first participant at 3 was assigned the English letter A which resulted in the code 3A and the second participant at 3 was assigned the letter B resulting in 3B. This process of coding applied to the other two groups of the participants at 4 and 5. The entire study was carried out within a nine-month period which began from April 2020 and ended in December 2020. The participants' data was stored on the recording device which was used for recording the participants' speech and kept far from the reach of any individual who did not matter in the transcription process of the data. Phoneticians who engaged in the transcription process did not have the participants' data on their private devices for security reasons. After the transcription of the data, the researchers of this study only had access to the data for the sake of reference.

A Sony ICDUX560BLK Digital Voice Recorder was used to record the participants' pronunciations of the words. This recorder allowed individual sounds to be played back with ease. It could also be connected to electronic devices like TV, computer, cassette player or woofer which allowed recorded sound to be played aloud and thus ensured accurate transcription of the recorded pronunciations of the participants. The recorder was positioned on a table on which the list of words was placed. From there, every participant mentioned the words after the teacher. The researchers themselves stood further away so as not to interfere especially since some participants might be shy or feel timid when reading in the presence of strangers.

2.3. Ethical clearance

A consent form obtained from the ethics committee of the university in which the researchers were affiliated to was given to the manager and the headteacher of the school to confirm their signatory to the exercise. Consent forms were also given to teachers and parents of the chosen participants to sign as evidence of their willingness and approval of their pupils and children partaking in this study. The school administration was also contacted for the bio-data on the children selected for the study. The researchers obtained ethical clearance from the ethics committee of the university of which they were part of its academic community. As a proof of ethical clearance, *ECH 014/20–21* was the code given to the researchers by the ethics committee of the university signifying the committee's satisfaction of the study.

2.4. Elicitation materials

A list of twenty (20) English words were randomly taken from the textbooks of the pupils. The choice of the words with different number of syllables was because such words had a tendency to elicit existing phonological patterns in the children's speech. The words included compound words in hopes of revealing how Ghanaian preschoolers segued from one word to the other, which was one way of revealing instances of phonological patterns. The choice of words across different syllable structure was in line with Bernhardt and Stemberger (2015:47) that "to enhance data comparability across languages, word lists are

created (approximately 100 words) that reflect the major phonological characteristics of the language in words familiar to children (from monosyllabic to multisyllabic words)". The researchers ensured words common to pupils at the age band in question were used for the data (Hart & Sutherland, 1977). This approach chimed with Caroll et al.'s (2003) reason for their choice of words for their study that "most of the words used were taken from an age-of-acquisition database (Morrison et al., 1997) that characterized them as words of high frequency that were in most children's expressive vocabularies earlier than $3^{1/2}$ years of age". Since such a database did not exist in Ghana, the researchers selected words from the textbooks that were used to teach the children. The list of words as the data for this study are indicated below:

Monosyllabic Words: *Rain strong shout cat box blade goat tree spot till mug teeth face*

Di-syllabic Words*: picture table*

Polysyllabic Word: *television*

Compound Words: *flower vase ceiling fan writing board classroom*

2.5. Data analysis

The researchers of this present work decided that the pronunciations of the words by both the teacher and the pupils should be transcribed phonemically using the International Phonetic Alphabet (IPA) notations to reveal how the participants differed from the adult (their teacher) in terms of pronunciation of English sounds. The phonemic transcription of the participants' speech was in line with an observation by Dodd et al. (2003) that "in a phonemic approach, children's production of sounds in word contexts are usually examined in terms of degree of production accuracy and the percentage of children of an age group who reached the level of accuracy in phoneme production". For the purpose of interrater reliability, the recorded speech of both the teacher and the participants were transcribed by both researchers. Interrater reliability score was 98% after comparison of the transcribed data.

The data analysis was guided by the subtypes of substitution phonological patterns (Leung & Brice, 2012, p. 43; Fabus, 2011, p. 149; Stoel-Gammon, 2002, p. 647). The term, phonological patterns, here refers to the various errors, simplifications or deviations in the realisation of English speech sounds or a class of sounds by children in relation to the adult model. This approach was supported by the position of McReynolds (1984:57) in his work on phonological patterns in the speech of children that "implicit in the notion of processes is the concept of organization of errors".

Kirk and Vigeland (2015:15) also reported that "the label phonological process analysis is based on the theory that a child's production of a word can be derived from the adult pronunciation by a series of rules or processes (Stampe, 1973). Thus, a child who pronounces *key* as [di] is said to apply the phonological process of velar fronting to convert /ki/ to /ti/ and then the process of prevocalic voicing to convert /ti/ to [di]".

Again, the theory of Natural Phonology was resorted to in discussing the challenges children encounter in their attempts to speak like the Ghanaian adults. Natural Phonology is a theory developed by David Stampe in the 1960s (Stampe, 1969). It basically provides explanation on phonological patterns exhibited by individuals especially children in relation to a given language. Donegan and Stampe (2009:1) explained that "natural phonology characterises production and perception of speech in terms of a set of universal phonetically motivated phonological processes". Donegan and Stampe (2009:25) further added that

> *Natural Phonology holds that all infants, discovering the capacities of their bodies and their senses through vocalization and babbling, and listening to the stream of actual speech around them, arrive at a universal theory of the relationship between articulatory actions and their perceptual results (features), and also of the multi-dimensional hierarchies of difficulty that stand between intended actions and their actual results in the real time rhythm of speech (processes).*

This meant aspects or components of the theory that were apt in

revealing the break down in the participants' speech or difficulties in producing English speech sounds of adults were used in this study to help understand the existence and some possible underlying reasons for the phonological errors in the participants' speech.

The researchers ensured that although both the teacher and participants' pronunciation of the words were transcribed, emphasis was placed on the participants' pronunciation as far as this study is concerned, to see how each participant differed from the adult's pronunciation. An unintelligible sound made by a participant was also considered as part of their phonological pattern. A participant's deviation from the pronunciation pattern of their teacher was counted as part of their phonological pattern. This mode of analysis chosen by the researchers of this present study was in line with Dodd et al.'s (2003:630) in their approach to the analysis of their study that "an error occurs when there is a difference between the child's and adult's realisation of a word". The researchers of this current work added, here, that pronunciation error by the teacher was not counted as part of the phonological pattern of the child regardless of a participant's repetition of it. The teacher's pronunciation of the English sounds that deviated from the RP was deemed a complexion of Ghanaian production of English vowel and consonant sounds (Huber, 2008, pp. 74–86; Simo Bobda, 2000, p. 191), or was idiosyncratic. An instance was the teacher's realisation of a consonant like the lingua-dental /θ/ produced as alveolar [t] as in teeth /ti:θ/ which has been confirmed by (Huber, 2008) as a representation of how Ghanaians tend to produce the sound in question. The teacher's production of the words was therefore a Ghanaian idealized version of the RP.

Although this study was cross-sectional as opposed to a cross-linguistic study, it was prudent to understand the participants' phonological pattern of the language of assessment (English) in relation to their first language(s) (i.e; L1). The juxtaposition or consideration of the phonology of various Ghanaian languages of the participants for the analysis of their English speech was largely motivated by Leung and Brice (2012:43) in their report from the literature that "learners of English as a second or other language may encounter problems in pronunciation because of contrastive differences between English and their first language (Chan & Li, 2000)". Again, in this research, the researchers were also partly motivated to consider how the first languages of the children used as participants affected their English speech by the work of Cairns et al. (1974:166) in their analysis of results of substitution phonological patterns of three groups of American children where they averred that "the results can be largely accounted for in terms of two lines of explanation. One of these is the set of expectations regarding variations due to black dialect and Spanish-influenced-English". As far as this study was concerned, Ewe, Ga, Akan and Dagbani were the Ghanaian languages spoken exclusively by different participants at home as their first language (i.e; L1).

3. Results

The substitution phonological patterns identified were fronting, backing, and stopping. It was observed that all the identified patterns occurred across age boundary. The processes and their respective participants showing their (processes) pervasion across the three age groups are in the discussion section. Leung and Brice (2012:43–44), in corroborating the pervasiveness of the patterns found across age boundary in their study, reported that "most English-speaking children resolve these processes by age 7, but stopping, gliding, backing, fronting, and cluster reduction are persistent and may continue beyond that age (Merkel-Piccini, 2001; Nicolosi, Harryman, & Kresheck 1996; Williamson, 2010)". The identified phonological patterns occurred at varying degrees of frequency among different participants indicating that children differ in their difficulty in their speech.

TidieR Table

Summary of instruments and approaches to the study.

Brief name	Substitution Phonological Patterns
Why	The study investigated the types of substitution phonological patterns in the English speech of Ghanaian children. It also sought to find probable reasons for the occurrence of the identified patterns
What	Spoken English speech of Ghanaian preschoolers between the ages of 3 and 5 was used as data. Twenty English lexical items served as the stimulus words for the data.
How	Each participant mentioned each of the stimuli after their own teacher while being recorded singly in a secluded place within the school campus of the participants. Both the recorded speech of the children and their teacher were transcribed according to the International Phonetic Alphabetic.
Where	The recorded speech of the children was done in a private-run basic school.
When	The entire study lasted for nine months. The recordings of the children's speech as the data lasted for a month with five sessions of the recording. Each session of the recording lasted for 40 min.

3.1. Discussions

A pool of literature and the theory used for this study sufficiently sought to give proximate causes of the substitution phonological patterns identified in the speech of the children used as participants. Each of the identified processes are therefore discussed below.

• Fronting

Kirk and Vigeland (2015:18) asserted that "the error pattern of velar fronting occurs when a velar phoneme is replaced by an alveolar phoneme". They also maintained that "the error pattern of palatal fronting occurs when a palatal phoneme is replaced by an alveolar phoneme". Fronting is basically divided into two - palatal and velar (Weismer, 1984, p. 48). As indicated in Table 4, four different stimulus words offered opportunity for fronting but nine cases of fronting occurred as some of the six participants had more than one case of fronting in their pronunciation of the affected stimulus words.

The two forms of fronting (Weismer, 1984, p. 44) were identified in this study. While one participant, 3J, produced the palatal fricative /ʃ/ in television /televiʃn/ and shout /ʃaʊt/ as the alveolar fricative /s/, 3E, 4B and 5G substitute /ʃ/ in only *shout* with /s/. Again, 3D, apart from producing /ʃ/ in *television* and *shout* as /s/, also replaced the affricate /tʃ/ in picture /pɪktʃa/ by the alveolar stop /t/ resulting in [pɪta]. It must be made clear, in this study, that emphasis was placed on the replacement of the affricate /tʃ/ in *picture* with /t/ resulting in fronting. The omission of /k/ in the medial position of picture /pɪktʃa/ does not amount to cluster reduction.

In all, there were eight cases of palatal fronting identified in this study. Although /tʃ/ offered opportunity for palatal fronting, it recorded only one incidence vis á vis the palatal fricative /ʃ/ which recorded seven instances in this study. There was replacement of /ʃ/ by /s/ in shout /ʃaʊt/ among five participants and in *television* /televiʃn/ among two participants as seen in the patterns of their production in Table 4. This observation made it possible to conclude that among the Ghanaian

Table 4

Summary of findings on fronting.

Participants	Stimuli	Corresponding fronting
3D 3J	Television	/televisn/
3D 3E 3J 4B 5G	Shout	/saʊt/
3D	Picture	/pɪktʃa/
5J	Mug	/mad/

children used as participants for this study, the palatal /ʃ/ was more difficult to be produced than the palatal alveolar /tʃ/.

Again, the researchers of this study identified that of the total six participants observed to have fronted, only one of them had velar fronting while the remaining five had palatal fronting. This finding in this study was in consonance with the finding made by Vihman and Greenlee (1987) who identified a high frequency of palatal fronting than velar fronting in 11 typically developing children at 36 months with two of the 3-year-olds testing both velars and palatals, whereas six children front only palatals as reported by Kirk and Vigeland (2015):19). Kirk and Vigeland (2015):19) corroborating the observation that velar fronting was rare relative to palatal fronting reported that "this phenomenon is seen as a result of velar fronting resolving earlier that palatal fronting in typical children". In this study the participants who committed fronting in *shout, picture and television* spoke Twi, a dialect of Akan as their L1. The voiceless alveolar-palatal fricative sound /ʃ/ being substituted for /s/ by the participants in the words *television* and *shout* and the palate-alveolar affricate sound /tʃ/ for /t/ in *picture* resulting in the phonological pattern in question are present in the first language (L1) of the participants. It presupposed that the L1 of the participants in question might not be a factor for the pattern in their speech because the presence of the sound in their L1 should have even aided the participants to produce the words correctly. Again, out of the thirty participants used for this study, twenty-five of them were Akan speakers, specifically Twi. It might be concluded that the six participants constituted insignificant number to establish that Akan preschoolers have a challenge to produce the sound /ʃ/ and /tʃ/ regardless of their being in their first language, Akan of the Akan speakers.

For clarity of distinction between the two forms of fronting, Kirk and Vigeland (2015):19) recommended them to be treated differently as they wrote that "we recommend that the fronting of palatals be assessed independently from the fronting of velars, given that velar fronting resolves earlier than palatal fronting in typically developing children (Stoel-Gammon & Dunn, 1985)". The pattern of production for velar fronting in this study is seen in its array of pronunciation below:

Mug /mag/ is realised as [mad]

In the pattern above, participant 5J, substituted velar stop /g/ in *mug* /mag/ for the alveolar stop /d/. Shriberg (1993):121) indicated in his work that the velar stop /g/ was mastered at the middle stage of the child's language development while the alveolar stop /d/ was mastered at the early stage of the child language acquisition. The researchers of this study did not therefore find it surprising for this participant at 5:03 replacing /g/ in *mug* /mag/ with /d/. This was because occurrence of only one case of this (/g/ for /d/ in *mug* /mag/) did not offer enough reason to maintain that the difference in age of mastery of both sounds as propounded by Shrieberg (1993) was the cause of the error in the participant's speech but rather might point to other factors. The researchers of this current study found the foremost cause of substituting /g/ in *mug* /mag/ for /d/ on the part of the participant in question apart from the reason given to perhaps physiological constraint on the acquisition of the sounds by the participant. This position by the researchers of this study was corroborated by Inkelas and Rose's (2003):6) observation on the possible cause of velar fronting (i.e; VF) as they admitted that

the first factor which contributes to velar fronting VF in children's productions concerns physiological characteristics of the vocal tract at early ages. Studies by Fletcher (1973) *and* Kent (1981) *demonstrate that in young children, the size of the tongue is much bigger, relative to the rest of the vocal tract, than it is in adults, while the palate is proportionally shorter. Based on comparative measurements, Crelin shows that the vocal tract of a two- year-old has basically the same shape as in a newborn infant, with the tongue filling the supralaryngeal cavity almost entirely. At around age two, the vocal tract begins its progressive evolution towards its adult shape, which is generally not attained before age six.*

Inkelas and Rose (2003):6) further reported an account for the

occurrence of velar fronting in the literature that

the second component of our explanation for VF comes from research in (adult) articulatory phonetics showing that consonants in prosodically strong positions, e.g. stressed or word-initial onsets, show larger amplitude in their articulatory gestures than those in other positions, e.g. codas or onsets of unstressed syllables. This difference in gesture magnitude appears to disproportionately affect velars, yielding a greater, more forward linguo-palatal contact for velar consonants in this position than for velars in weaker prosodic contexts.

The second reason for the cause of velar fronting is arguable though is somewhat evident in the case of velar fronting in this study. The only velar fronting identified in this study occurred in the coda of the affected word (*mug*). That occured when /g/ in *mug* /mag/ was replaced with /d/ . In this study, the researchers maintained that the doubt on the satisfaction of the second reason for velar fronting was as a result of an observation made in the participants' production of another stimulus word that had velar at a stressed position in this study. The participant who fronted the velar in the stimulus word in question did not do the same to other velars at stressed or strong position of the stimuli *like goat, cat* and *classroom* in this study. Although she fronted /g/ in *mug*, and produced /g/ in *goat* as /k/, she did not front it. This rather suggested that she did not have the voiced velar stop /g/ in both her phonemic and phonetic inventory. This participant had Gã as her L1. Campbell (2017):40) in her discussion of phonology of Gã stated that "the only consonant that may occur word-finally is ŋ". This means that neither the expected and mandatory sound /g/ or the substitute /d/ is permissible in Gã. Her L1 could therefore be a factor. This observation however, gave a probable feature of the phonological pattern of Ga preschoolers' production of the sound that resulted in the pattern in question implying that the participant of discussion might not have been largely inhibited by her L1.

The researchers of this study deemed it important to discuss age in relation to velar fronting. Velar fronting is a commonly observed process in children up to three years as reported by Byun et al. (2016):143). In view of the literature above, the researchers found it rather odd having a child at 5:03 exhibiting this kind of phonological pattern in this study. It however made this study revealing as it showed the possibility of its (VF) occurrence in a Ghanaian child beyond the age of 3. The age of six as the threshold for total development of the vocal tract as claimed by Inkelas and Rose (2003):6) partly justified the occurrence of velar fronting in one of the participants at 5:03.

The organs that aid in speech execution or production require physical strength which the child at a certain age may not have had theirs developed. In the case of velar fronting, the velar is said to require more energy in production, so underdevelopment of the vocal tract or any articulatory organ is likely to result in the child producing a sound easier than a velar. This might explain the participant's inability to produce the velar /g/ but rather the /d/ *mug* resulting in fronting.

• Stopping

The researchers of this current study found stopping as basically the replacement of fricatives by stops. Kirk and Vigeland (2015):16) also in their explanation of stopping as a phonological pattern described it as where "a fricative or affricate is replaced with a stop consonant that shares the same or similar place of articulation (/f/ and /v/ are replaced with labial stops; /s/, /z/, /ʃ/, /ʒ/, /tʃ/, and /dʒ/ are replaced with alveolar stops)".

In this study, only two words offered opportunity for stopping as can be seen in Table 5. While the labio-dental fricative /v/ was replaced with the voiced bilabial stop /b/ in *television* /televiʃn/ and *vase* /vas/ of *flower vase*, the alveolar fricative /t/ replaced the labio-dental fricative /f/ in *flower* /flawa/. The first observation made from Table 5 above was that the voiced labio-dental fricative /v/ was mostly replaced with the stop /b/ while /f/ was replaced with /t/. This was evident in the

Table 5
Summary findings on stopping.

Participant(s)	Stimuli	Corresponding stopping
3E 3I 4J	Television	/telebiʃn/
3I	Flower vase	/flawa bas/
5B	Flower vase	/tlawa vas/

replacement of /v/ in both *television* and *vase* of *flower vase* with /b/ while /t/ replaced only /f/ in *flower* of *flower vase*. The observation in this current study partly makes the position of Kirk and Vigeland (2015):16) on the place of occurrence of stopping faulty. This is because Kirk and Vigleand's (2015) explanation of stopping as when "a fricative or affricate is replaced with a stop consonant that shares the same or similar place of articulation", coupled with their position that /f/ and /v/ are substituted for labial stops was not entirely evident in this study. In this study, the researchers found that /f/ in *flower* of *flower vase* was rather replaced with an alveolar sound /t/ which does not share sameness or similarity of place of articulation with /f/ which is labio-dental. The voiced labio-dental /v/ however satisfied the assertion of Kirk and Vigeland (2015), as /v/ in the stimuli (words that offer opportunity for stopping) was replaced with labial stop /b/ in this study. It was clear from the above analysis that /v/ recorded four cases of stopping for two of the words, *television* and *vase* of *flower vase* among three participants while /f/ was replaced with /t/ once by only one participant as seen in Table 5. The high frequency of /v/ recording stopping in relation to /f/ suggested that the voiced labio-dental fricative /v/ was more difficult to produce by the participants vis à vis the voiceless labio-dental fricative /f/. This observation in this study was consistent with and gave credence to Smit's (1993):539) assertion that "stopping is more frequent for voiced than for voiceless fricative targets".

Pater (2002):352) provided useful information on the age of children in respect of presence of stopping in children's speech that "children's early productions often display "stopping", whereby fricatives are realised as stops". The difficulty in the production of fricatives at an early stage of the child is evident in the literature that "previous studies have shown that among different manners of articulation, fricatives are acquired at a relatively late age in normally-developing children (Stoel-Gammon & Dunn, 1985)" as cited in Yang et al. (2017):154). In this current study the researchers did not find it therefore odd to have two participants at 3 out of 4 recording stopping because children at 3 might be more predisposed to stopping relative to those at 4 and beyond as evident here. The presence of stopping in the speech of each of the participants at 4 and even at 5 in this present study was justified by the report of Holm and Dodd (1999):121) that "the processes still common in the speech of a 4-year-old are stopping and gliding".

In the literature, the position or the environment of a sound in a word triggers some phonological patterns. It is therefore worth considering the position of the phonological patterns in question (stopping) in relation to the English speech of the Ghanaian preschoolers used for this study. Smit's (1993):539) claimed that "the process of stopping appears to affect initial fricatives primarily, except that [b] is often used for final /v/ as well as initial /v/" might be said to have been supported here as the pattern of occurrence of stopping above revealed that stopping for /f/ is in word-initial and that of /v/ was in word-initial and penultimate in the patterns 1 and 2 above respectively. It could not however be incontrovertibly accepted as the stimuli used for this study did not have /f/ and /v/ in word-final to fully support Smit's claim. Inkelas and Rose (2007):725) also reported that "fricative consonants are neutralised to stops in prosodically strong (e.g: word-initial and stressed onsets), but accurately realised as fricatives in weak positions (e.g: word-medial, unstressed onsets, codas) Dinnsen (1996), Edwards (1996)". Byun et al.'s (2016):159) assertion that "fricatives in onset position are thus motorically more demanding than coda fricatives" suggesting difficulty in realising fricatives at onset than at the coda position added to the mountain of literature on stopping occurring often at word initial or

strong position of a word.

The wealth of literature on the position of a phoneme in a word giving rise to stopping was not entirely supported in this study. This was because the participants replaced the fricatives with stops in both word-medial and initial as could be seen in the pattern of occurrence for stopping above. The fricative /v/ in *television* /televiʃn/ which was replaced with a stop /b/ by three different participants was in the penultimate position which was neither word-initial nor strong position as claimed in the literature. Although the researchers identified instances of stopping occurring in the strong or initial position of the stimuli (i.e; *vase* and *flower* of *flower vase*) as seen in the analysis above, it must be stated that the occurrence of stopping in the initial and strong positions of the stimulus words *flower* of *flower vase* and *vase* of *flower vase* was not largely contingent on or triggered by the initial positions of the affected fricatives. This was because there were fricatives in other strong and initial positions of some of the stimulus words like *face* and *fan* of *ceiling fan* which failed to record stopping by the same participants. The morphological structure of the words that have stopping or their fricatives replaced by stops might be a reason. The difficulty in the processing chain of a word may be dependent on a syllable length. This was true of this current study because among the stimuli that are single or non-compound words for this study, *television* had the highest number of syllables while *flower vase* was a compound word of which both provided opportunities for stopping at their initial and medial positions. It was enough to conclude that the participants rather found it difficult to produce fricatives in polysyllabic or compound words.

The L1 of the participants who had stopping in their speech in this current study was Twi, a dialect of Akan. While the voiceless labio-dental fricative /f/ exists in the phonology of Twi, a dialect of Akan, its voiced counterpart /v/ is absent (Abakah, 2005, p. 47; Schachter & Fromkin, 1968, p. 25). The influence of a child's L1 on their L2 acquisition as one of the central premises of the theory of Natural Phonology is evident here, as /v/ which is absent in the L1 of the participants remained difficult to be realised and was replaced with a sound more common in their L1.

3.1.1. Backing

Fabus (2011):171) explained backing as "an unusual process that occurs when a consonant made in the back of the oral cavity is substituted for a consonant made in the front of the mouth (e.g., goggie for doggie)". Fourteen cases of backing occurred for three different stimuli as seen in Table 6 below.

- blade

In relation to *blade*, the voiced alveolar stop /d/ was replaced with the voiced velar stop /g/ as seen in Table 6. Two of the three participants at 3 who engaged in backing as a substitution process by replacing /d/ in *blade* with /g/ provided an interesting revelation in this present study. The participant, 3B, who failed to produce /g/ at the end of the stimulus word *mug* /mag/, now replaced /d/ at the end of *blade* /bleid/ with /g/ resulting in backing. The participant identified as 3C also omitted the voiced alveolar stop /d/ in *board* of *writing board* and replaced /d/ in blade /bleid/ with /g/. This suggested that the sound /d/ was not in both the phonetic and phonemic inventories of the participants (3B and 3C). Another participant, 3D, although correctly pronounced /d/ in the stimulus word *board* of *writing board*, replaced /d/ in *blade* with /g/. This

Table 6
Summary findings on backing.

Participants	Stimuli	Corresponding backing
3B 3C 3D	Blade	/bleig/
3B 3F 3G 4A 4F 4G 4H 4J 5E 5F	Classroom	/klaʃrum/
5E	Television	/ʃeleviʃn/

implied that the participant 3D had the sound /d/ in his phonetic inventory, but not stable in his phonemic inventory. This participant's production pattern of /d/ as discussed above was justified by the literature that "a child with multiple misarticulation errors may possess an age-appropriate sound inventory, yet have difficulty using sounds in the obligatory linguistic shapes, such as clusters and polysyllabic words—-thus, it is important to examine the context of the errors" as cited in Fabus (2011:149).

The literature has also reported that "in developing phonological systems, there is often a stage during which there is a preference for labial singleton consonants in syllable-onset position and singleton velars in syllable-coda position (Ingram, 1974)" cited in Kirk (2008:41). The researchers of this current study found the literature true as was evident in this study: the three participants (3B, 3C, 3D) rather produced the velar /g/ instead of the alveolar /d/ in the word-final of the stimulus word. Akan, the L1 of these participants, have its phonology excluding /d/ from phonemes that are permissible at word-final as Abakah (2005:47) maintained that "/d/ does not occur at word-final in Akan". The substitute /g/ as well is not permissible at word-final in the L1 of the participants. It therefore suggested that the participants' substitution of /d/ for /g/ did not owe much to their L1 but other factors including the one suggested by Ingram as stated above. The poor sequence of the phonological structure of the words in question by the respective participants might be as a result of poor articulatory planning which was a major position of the theory of Natural Phonology as children are known to misarticulate similar sounds when they have not yet attained the age needed to draw distinction between sounds making their speech dissimilar to the adult's. This was true as the participants were observed to not appropriately produce the expected and required sound (/d/) in the environment of the word (blade) perhaps due in part to their inability to plan their production of the word in their minds first to be sure of the required sound which resulted in the production /d/ instead of /g/.

- *classroom* and *television*

In relation to *classroom* and *television*, /s/ and /t/ respectively were replaced with /ʃ/, resulting in backing. Templin (1957:53); Fabus (2011:148) and Dodd et al. (2003:620) shared the result of the different ages at which 75 percent of participants of some major studies produced correctly /s/ and /ʃ/. Fabus and Templin reported that Wellman et al. (1931), Poole (1934), Templin (1957), Prather et al. (1975) and Arit and Goodban (1976) had the ages at which their participants correctly produced the sibilant /s/ as 5, 7.5, 4.5, 3 and 4 respectively. In respect of /ʃ/, apart from Wellman et al. (1931), the rest of the major studies such as Poole (1934), Templin (1957) and Prather et al. (1975) and Arit and Goodban (1976) maintained that age of its mastery was at 6.5, 4.5, 3–8 and 4.5 respectively. A close look at age of mastery of /s/ and /ʃ/ by children as indicated by the major and seminal studies above did not reveal a significant difference in the age needed to acquire one over the other.

The ages of mastery for both /s/ and /ʃ/ by these studies is in consonance with Shriberg's (1993:121) classification of both sounds (/s/ and /ʃ/) within the late-stage category in his three stages or sequences of mastery of consonant sounds. As indicated, the average age of mastery of 75 percent of children for both sounds in question is 4. The researchers of this present study however found it surprising that participants in this current study at 4 recorded the highest number of cases of backing in their bid to produce /s/ in *classroom* as five participants at 4 were observed to have replaced /s/ with /ʃ/ while two participants at 5 and three at 3 also did so. Carneiro Rosal et al. (2013:842) in their findings on phonological patterns in the speech of children reported that the processes such as backing for palatal, backing for velar, fronting etc disappeared at the age of 4:6. The literature on the age limit for elimination of the phonological patterns including backing was partly consistent with the finding in this study as participants at 5 in this study were observed to have the least frequency of backing for all the stimuli

that provided opportunity for backing as seen in the analysis above.

As far as the substitution of /ʃ/ for /s/ in some of the participants' production of *classroom* was concerned, one plausible and convincing reason among other factors was the one put forth by Byun (2011:375) in his report from the literature that "sibilant fricatives are in fact more energy-intensive than stops (Kirchner, 2001)". Though /ʃ/ is not a stop, it has the phonetic property as palatal fricative whereas /s/ being a sibilant fricative might therefore account for its (/ʃ/) easy articulation relative to /s/ which results in the replacement of the sibilant /s/ in classroom with /ʃ/ in this current study. Jongman et al.'s (2000:1255) made the assertion that "spectral properties serve to distinguish /s/ from /ʃ/, with /s/ having a concentration of energy in higher frequencies than /ʃ/" confirming the energy intensiveness of /s/ over /ʃ/.

The literature might however not account for the replacement of /t/ in *television* with /ʃ/ as stops are generally easier to produce than fricatives. The difficulty in the production of a sibilant like /s/ by children in the literature above as a result of a physiological challenge or being a natural phenomenon, as certain sounds by nature develop late in children's speech, can be understood through the theory of Natural Phonology. Dziubalska-Kołaczyk's (2007:1), in contributing to the theory indicated that "the theory operates with phonological processes, which constitute natural responses of the human vocal and perceptual systems to the difficulties encountered in the production and perception of speech". This means that in the face of difficulty in the production of a sound, the child quickly resorts to natural articulatory capability as a relatively easy sound was rather produced. The sound /ʃ/ seemed therefore to be easier than /s/ and /t/ to the participants in question, hence its (/ʃ/) choice over /t/ and /s/ in *television* and *classroom* respectively in this study.

Surprisingly, the L1 of the ten participants observed to have replaced /s/ with /ʃ/ in *classroom* and /t/ by /ʃ/ in *television* was Twi, an Akan dialect. In Akan phonology, the sibilant /s/ is among consonants that occur in a word-medial (Snatcher and Fromkin, 1968:25; Abakah, 2005, p. 47). The English sound /ʃ/ is not represented as a phoneme in Twi but its equivalence in Twi is by a cluster or a combination of sounds /h/ and /y/ or orthographically represented as 'hy'. Its occurrence in a word-medial is by reduplication. This information on /ʃ/ has been confirmed by Huber (2008:85) that "Akan does not have the post-alveolar fricatives /ʃ/ and /ʒ/ but rather similar voiceless palato-alveolar fricative (ɕ) occurs as an allophone of /h/ before front vowels". This information was enough to conclude that the L1 of the participants was not a cause of backing identified but other factors as reported in the literature. This is because Twi, a dialect of Akan which was spoken by the participants as their L1 both at home and at school has the /ʃ/ as one of its phonemes in its phonology which raised expectation of capability to produce the sound in question. The inability of the participants in question to produce the sound in question resulting in the phonological pattern showed that Ghanaian bilingual children learning English also could exhibit the pattern in question.

4. Limitation

Some of the children's pronunciations of some of the stimulus words did not exist in the phonology of English making the transcription a bit difficult. The participants were made to stay close to the classroom by the head teacher of the school in which the data collection took place while the participants pronounced the stimulus words. This made the background of the pronunciation exercise a bit noisy. It was observed that some of the participants who found some of the stimuli difficult to produce eventually did so in undertones. This gave the researchers and those engaged in evaluating the transcription of the recorded speech of the children a herculean and strenuous task of listening with rapt attention to arrive at accurate transcription. The researchers of this study admitted that the sample size of thirty children with ten each of the various age groups coupled with twenty stimulus words might not give a fair representation of Ghanaian children's pronunciation of

English sounds, however, this was a case study experimenting some the English sounds production by Ghanaian children at a particular school in Ghana.

5. Conclusions

The study investigated speech distortions otherwise known as phonological patterns in the speech of some Ghanaian children between the ages of 3 and 5. It specifically looked at different speech sounds children usually replace expected sounds with when they confront difficulty in speech production which is also known as substitution phonological patterns. The English speech of the preschoolers was compared to the idealized version of the adult's English speech. That was, the children's deviations from their teacher's production of the words for the study served as the basis for assessing the children. The children's data was analysed within the framework of Natural Phonology. Three phonological patterns observed in the children's speech were fronting stopping and backing. The first language, age and late development of articulators were some of the proximate reasons for the identified speech distortions as supported by the literature. This study therefore has helped to understand the various speech sounds that are developed at certain developmental stages of the child and other developmental challenges the Ghanaian bilingual child goes through before finally attaining the full complexion of the Ghanaian adult's speech.

The findings of this study have laid the foundation for understanding how children in Ghana, who are second language speakers of English, modelling the English speech of Ghanaian adults and teachers being second language speakers of English, exhibit some phonological patterns in their speech. Such an understanding would assist Ghanaian teachers, parents and indeed Ghanaian speech therapists as they help children maneuver speech developmental challenges, by falling on data collected from Ghanaian children themselves with whom they share similar social and linguistic features and circumstances, instead of relying on data from studies that focus on first language speakers of English with whom Ghanaian children have less in common.

CRediT authorship contribution statement

Thomas Abdull Jamel Asare: Methodology, Formal Analysis, Writing. **Elizabeth Orfson-Offei:** Conceptualization, Writing – review & editing, Supervision.

Declaration of competing interest

No external sponsors were involved in any aspect of the study. All costs were borne by the researchers.

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Appendix A

rain /reɪn/   strong /strɒŋ/   shout /ʃaʊt/   television /telɪvɪʒn/   picture /pɪktʃə/

box /bɒks/   cat / kæt/   blade / bleɪd/   goat / gəʊt/   tree /tri:/   table /teɪbl/

spot /spɒt/   till /tɪl/   mug /mʌg/   teeth /ti:θ/   face /feɪs/   flower vase /flaʊə va:z/   ceiling fan /sɪ:lɪŋ fʌn/   writng board /raɪtɪn bɔ:d/   classroom /kla:sru:m/

rain /rein/   strong /strɒŋg/   shout /ʃaʊt/   television /televiʃn/

picture /pɪktʃa/   box /bɒks/   Cat /kat/   blade /bleid/

goat /got/   tree /tri:/   table /teibl/   spot /spɒt/   till /tɪl/   mug /mag/

teeth /tit/   face /feis/   flower vase /flawa vas/   ceiling fan /si:lin fan/

writng board /raɪtɪn bɒd/   classroom /klasrum/

Appendix B

Table 1
Bio-data on the Participants at age 3.

Code	First language	Age	Sex
3A	Akan	3; 04	Female
3B	Akan	3; 07	Female
3C	Akan	3; 08	Male
3D	Akan	3; 08	Female
3E	Akan	3; 06	Female
3F	Akan	3; 05	Male
3G	Akan	3; 04	Female
3H	Dagbani	3; 6	Male
3I	Akan	3; 7	Male
3J	Akan	3; 09	Male

Table 2
Bio-data on the Participants at 4.

Code	First language	Age	Sex
4A	Akan	4; 05	Male
4B	Ga	4; 08	Male
4C	Dagbani	4; 09	Female
4D	Akan	4; 08	Male
4E	Akan	4; 08	Male
4F	Akan	4; 05	Male
4G	Akan	4; 03	Male
4H	Akan	4; 03	Female
4I	Akan	4; 06	Female
4J	Akan	4; 05	Male

Table 3
Bio-data on the Participants at 5.

Code	First language	Age	Sex
5A	Akan	5; 06	Male
5B	Akan	5; 06	Female
5C	Ewe	5; 07	Male
5D	Akan	5; 03	Male
5E	Akan	5; 06	Female
5F	Akan	5; 08	Male
5G	Akan	5; 06	Male
5H	Akan	5; 09	Female
5I	Akan	5; 09	Female
5J	Ga	5; 03	Female

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