



**Phonological Development of an American-English Native
Speaker in Producing Consonants
(A Case Study on a Californian Child named Brielle)**

A FINAL PROJECT

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PRONOUNCEMENT

I state truthfully that this project is compiled by me without taking the results from other research in any university, in S-1, S-2, and S-3 degree and in diploma. In addition, I ascertain that I do not take the material from other publications or someone's works except for the references mentioned in bibliography.

Semarang, 13 November 2018

Aghnia Dianah Anwar

MOTTO AND DEDICATION

“O you who have believed, enter into Islam completely [and perfectly] and do not follow the footsteps of Satan. Indeed, he is to you a clear enemy.”

— **Surah Al Baqarah: 208**

“If I remain silent and you remain silent, then who will teach the ignorant?”

— **Ibn Taymiyyah**

This thesis is dedicated to

my beloved mother

**PHONOLOGICAL DEVELOPMENT OF AN AMERICAN-ENGLISH
NATIVE SPEAKER IN PRODUCING CONSONANTS
(A Case Study on a Californian Child named Brielle)**

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I realize that this research is far from perfect. Therefore, I will be glad to receive any criticism and suggestion. Finally, I hope that this research may be useful for some people who intend to learn about systemic functional grammar and its relation to the value in society.

Semarang, 13 November 2018

(Aghnia Dianah Anwar)

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ABSTRAK

Proses pemerolehan bunyi bahasa dimulai sejak bayi berada di dalam kandungan (Partanen et al, 2013) dan pada umumnya selesai sebelum seorang anak menginjak usia 7 tahun (Vihman, 1996). Setiap anak cenderung memiliki proses perkembangan fonologis yang berbeda satu dengan yang lainnya, namun tahapan dari perkembangan tersebut dapat diprediksi menggunakan patokan usia yang telah disediakan oleh ahli bahasa mengenai kapan seharusnya seorang anak mampu memproduksi suatu bunyi tertentu. Penelitian ini bertujuan untuk mengetahui proses perkembangan fonologis seorang anak penutur asli Bahasa Inggris Amerika bernama Brielle sejak ia berusia tiga hingga enam tahun menggunakan patokan tabel perkembangan bunyi ujaran yang dikemukakan oleh Sander (1972). Penelitian ini menggunakan metode deskriptif kualitatif untuk menjelaskan proses perkembangan fonologis subjek penelitian. Hasil penelitian menunjukkan bahwa terdapat beberapa bunyi yang dapat diproduksi oleh Brielle lebih cepat dan lebih lambat dari usia pemerolehan bunyi yang seharusnya pada anak menurut Sander (1972). Selain itu, ketika Brielle belum mampu mengucapkan suatu bunyi tertentu, ia mengganti bunyi tersebut dengan bunyi lain yang memiliki fitur-fitur yang hampir sama, seperti mengganti bunyi velar hambat /k/ dengan bunyi alveolar hambat /t/.

Kata Kunci: *anak, bunyi bahasa, perkembangan fonologis*

ABSTRACT

The process of speech sound acquisition begins in the womb (Partanen et al, 2013) and is generally completed before a child reaches the age of 7 (Vihman, 1996). The stages of phonological development is quite predictable across children, yet the age in which they acquire a certain sound varies considerably. However, there are some general guidelines which can be used to analyze the phonological development of a child. This study aims to determine the phonological development process of a child named Brielle, who is a native American English speaker using the speech sound development chart provided by Sander (1972). This study uses a qualitative descriptive method to explain the phonological development of the research subject. The results shows that the phonological development of Brielle finished when she reached the age of six. It can also be drawn from the study that there are several sounds that Brielle could produce earlier or later than the age of customary consonant production according to Sander (1972). In addition, whenever she was not able to produce a certain sound before the age of six, she replaced that sound with another sound wich has similar features, such as replacing the velar stop sound /k/ with the alveolars top sound /t/.

Keywords: *child, speech sound, phonological development*

1. Introduction

The process of language learning begins with the production of speech sounds. There are two branches in linguistics that deal with the production of speech sounds, which are phonetics and phonology. According to Katamba (1989), phonetics is the study of the inventory of all speech sounds which humans are capable of producing, while phonology is the branch of linguistics which investigates the ways in which sounds are used systematically in different languages to form words and utterances.

In order to acquire words and sentences, one must first be able to produce correct sounds. The process of acquiring first language phonology begins in the womb (Partanen et al, 2013). Normally, children are already able to produce complex sound sequences and multisyllabic words of their first language by the age of seven (Vihman, 1996). Before that age, the phonological development is quite predictable across children since it happens in a somewhat similar way. For example, the labial consonants are usually acquired before the age of four, while sounds which tend to be harder to produce such as the dental sounds /θ/ and /ð/ are usually acquired quite late by children, sometimes as late as the age of eight (Sander, 1972). Nevertheless, phonological development also varies considerably between children. For instance, some children may be able to accurately produce certain sounds at a particular age, while others take much longer to produce those same sounds clearly. However, there are some general guidelines which can be used to analyze the phonological development of children. Thus, this study attempts to discuss the phonological development of a child in acquiring a first language using the speech sounds development chart provided by Sander (1972, p.62).

The speech sounds produced by an American child named Brielle in her appearances in American talkshow “The Ellen Show” are chosen as the object of this study. Brielle is a little girl who was born and raised in Salinas, California. She gained recognition from public after her mother, Carrie Milla, uploaded a video of her reciting the whole periodic table at the age of three on youtube.

In this study, the writer focused on two research problems. The first is what English consonants the subject of the study can and cannot produce at the age of three until six years old. The second is whether the phonological development of the subject of this study is in accordance with the age of customary consonant production according to Sander (1972).

Hence, there are two objectives of this study. The first one is to analyze the phonological development of an American English native speaker, Brielle, in producing consonants from three until six years old using the theory of distinctive features in generative phonology. The second objective is to examine her phonological development using the speech sound development chart provided by Sander (1972).

This study focused on analyzing the phonological development of Brielle, an American English native speaker, in producing the English consonants using descriptive qualitative method and note-taking technique. The data were taken from four videos of Brielle that were uploaded on a youtube account called “The Ellen Show”, which is the official youtube account of an American talk show with the same name, as well as the youtube account of the host of the talk show, Ellen DeGeneres, called “Ellen Tube”. The first video entitled “Adorable 3-Year-Old Periodic Table Expert Brielle” was recorded when she was three years old. It was the very first time

Brielle appeared on The Ellen Show with her mom, Carrie Milla. After her first appearance, she got her very own segment on the show called “She’s Brielle-iant”. The second and third videos entitled “She’s Brielle-iant, Anatomy” and “She’s Brielle-iant, Vitamins, Minerals and How to Stay Healthy” were recorded when she was four and five years old respectively. The last video, “Astronaut Brielle Shares Fun Facts on Aliens and Space”, was recorded when she was six years old. To collect the data, the writer took notes of the speech sounds produced by Brielle by listening to those four videos. The speech sounds data in this study are analyzed using the distinctive features theory in generative phonology as well as the age of customary consonant production provided by Sander (1972).

In order to ensure the originality of this research, the writer provides five previous studies. The first study entitled “Phonological Development: A Normative Study of British English-speaking Children” by Dodd B., Holm A., Hua Z., and Crosbie S. (2003) discussed the effects of age, gender and socio-economic status on speech sound development in children. The second study is “Phonological Development in the Home Language among Early Polish-English Bilinguals” by Marta Marecka, Magdalena Wrembel, Agnieszka Otwinowska-Kasztelanic, and Dariusz Zembrzuski (2014) from University of Warsaw, Poland. The study investigated the differences in phonological performance between Polish-English bilingual children of Polish immigrants to the UK and their Polish monolingual peers. The third study is entitled “Identification of Phonological Processes in Preschool Children's Single-word Production” by Wendy Cohen and Carolyn Anderson (2009) from Speech and Language Therapy Division, School of Psychological Sciences and Health, Faculty of Humanities and Social Sciences, University of Strathclyde,

Glasgow, UK. This research examined the speech errors of students in 94 West of Scotland preschool and how the result would benefit language therapists in evaluating the communication skills of preschool kids. The fourth study is “Speech Sound Acquisition and Phonological Error Patterns in Child Speakers of Syrian Arabic: A Normative Study” by Husen Owaida (2015) from City University London. The writer of this research found that the acquisition of the vowels and consonants in Syrian Arabic was almost complete by the age of 3 and 6,5 respectively, except for the affricate /ʒ/. The last study is “Speech Errors in Early Child Language Production” by Joseph Stemberger (1989) which focused on the comparison between speech errors made by children and adults.

The difference that this study offers compared to the previous ones, apart from the object, is the focus that lies on creating detailed patterns of speech sound errors using phonological rules and distinctive features that would hopefully help us discover phonetic environments that influence the production of speech sounds.

2. Theoretical Framework

To conduct this research, the writer uses the speech development chart provided by Sander (1972) as well as distinctive feature theory in generative phonology. The speech development chart is used as a guideline in discussing the phonological development of the subject of this study from three until six years old. The distinctive feature theory is used to analyze sound alternations that the subject of this study made whenever she was unable to produce a particular consonant.

2.1. Age of Customary Consonant Production

To analyze the results of this study, the writer requires a guideline to determine whether the phonological development of the subject of this study is in accordance

with the age of customary consonant production. Therefore, the writer uses the consonant development chart provided by Sander (1972) as follows:

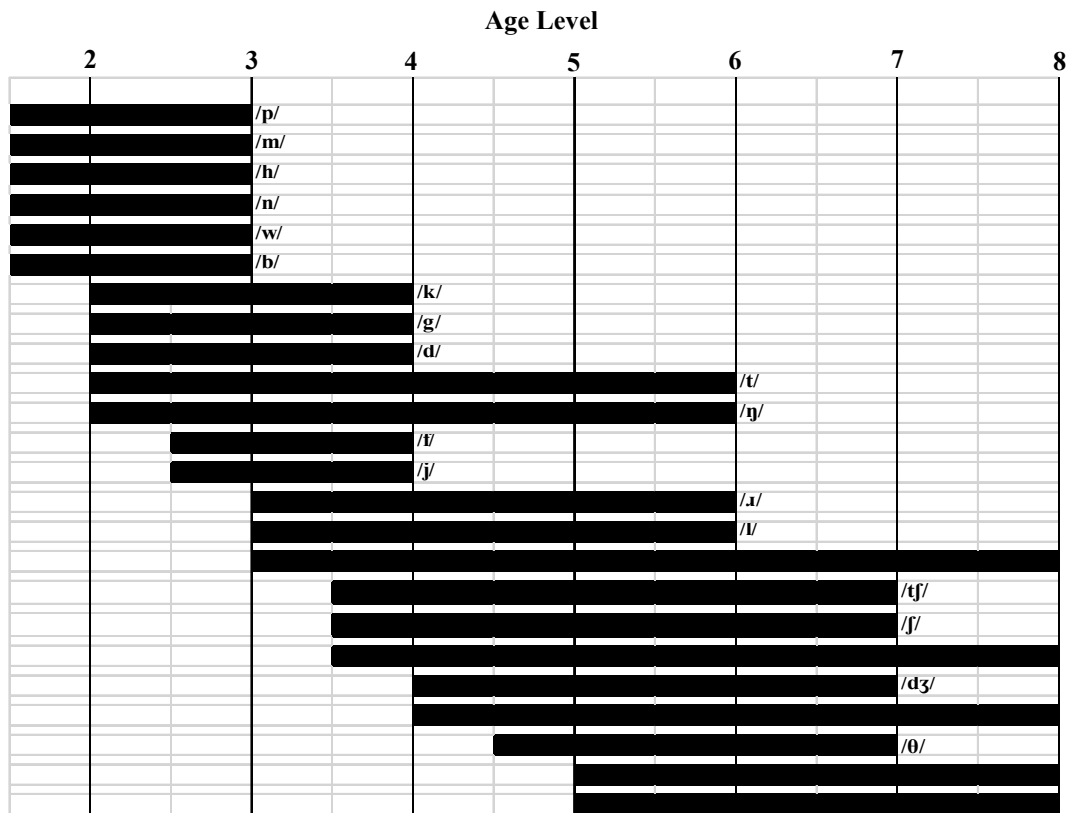


Figure 1. Average age estimates of customary consonant production (Sander, 1972).

The chart shows the average age estimates and upper age limits of customary English consonant production. The solid bar which corresponds to each sound starts at the median age of when a child usually starts producing a particular English consonant and stops at an age level at which 90% of all children are customarily producing the sound (from Templin, 1957; Wellman et al., 1931).

2.2. Distinctive Features

Distinctive features are phonological features that sounds have, which are used to identify a particular sound from the others that may be in their category (Carr, 1993). These features are usually unique or distinctive in a way that no other sounds

can share them. Below are the classifications of distinctive features according to Hayes (2009).

2.2.1. Major Class Features

The major class features are features used in describing and classifying sounds based on the constrictions of airstream from the lungs (sonority) and syllabic structure. These categories are used to distinguish between vowels, consonants, and approximants. The major class features include \pm consonantal, \pm syllabic, and \pm sonorant. Below is the explanation of those three features:

a. Consonantal – Non-consonantal [\pm con]

Consonantal [+cons] sounds are produced with varying degrees of airstream obstruction in the articulators of the vocal tract. The consonantal sounds of English include the stop, fricative, affricate, nasal, and liquid consonants. The non-consonantal [-cons] sounds are produced with no obstruction in the vocal tract such as in the production of the glide sounds.

b. Syllabic – Non-syllabic [\pm syl]

Syllabic [+syl] sounds are syllable nuclei (vowels and glides) whereas non-syllabic [-syl] sounds occur at syllable margins (consonants). The feature [\pm syllabic] is the inverse correlate for [\pm consonantal].

c. Sonorant – Non-sonorant [\pm son]

Sonorants [+son] are produced with a vocal cavity disposition which makes spontaneous voicing easy (vowels, nasals, liquids, and glides) while non-sonorants [-son] have a vocal cavity disposition which inhibits spontaneous voicing (stops, fricatives and affricates).

2.2.2. Cavity Features

The cavity features refer to the place where the sounds are produced inside the oral area (place of articulation). Based on their place of articulation, the English sounds are grouped into labials (bilabials /p/, /b/, /m/, /w/ and labiodentals /f/ and /v/), dentals (/θ/ and /ð/), alveolars (/t/, /d/, /s/, /z/, /n/, /l/), palatals (/ʃ/, /ʒ/, /tʃ/, /dʒ/, /ɹ/, and /ɻ/), velars (/k/, /g/, and /ŋ/), and glottal (/h/). Below is the further explanation on the category of cavity features:

a. Coronal – Non-coronal [± cor]

The coronal [+cor] sounds are made by raising the blade of the tongue towards either the front teeth or the alveolar ridge (dental, alveolar, and palatal consonants). As for non-coronal [-cor] sounds, the blade of the tongue stays in a neutral position /e/ (labial, velar, and glottal consonants).

b. Anterior – Non-anterior [± ant]

Anterior [+ant] sounds are made with obstruction in front of the palate-alveolar area (labial, dental, and alveolar consonants), whereas obstruction before the alveolar creates non-anterior [-ant] sounds (palatal, velar, and glottal consonants).

2.2.3. Manner Features

The manner features classify sounds based on the way and degree of airstream flowing through the vocal tract in the production of a consonant. Similar to the major class features, in this category the English consonants are viewed from their manner of articulation. There are three features which are characterized as manner features, which are:

a. Continuant – Non-continuant [\pm cont]

Continuants [+cont] are produced with the vocal tract slightly open in order to allow the airstream through the glottis, the pharynx, and the center of the oral tract with varying degrees obstruction (fricative, liquid, and glide consonants). Meanwhile, the non-continuants [-cont] consonants are produced by a total blocking of the airstream through the center of the vocal tract (affricate, nasal, and stop consonants).

b. Lateral – Non-lateral [\pm lat]

Lateral [+lat] sounds are produced when the air flows through one or both sides of the tongue while the airflow in the center of the mouth is blocked. The liquids /l/ and /ɭ/ are categorized as [+lat] while the fricatives and affricates are categorized as [-lat].

c. Nasal – Non-nasal [\pm nasal]

In producing nasal [+nas] sounds (/m/, /n/, and /ŋ/), the velum is lowered to allow air to escape through the nasal cavity. In contrast, the non-nasal [-nas] sounds are produced by raising the velum to block the nasal cavity so that the air escapes only through the mouth.

From the explanation given above regarding three categories of distinctive features, below are the examples of the use of those features in describing several English consonants:

/p/ /b/ /t/ /d/ /k/ /g/	/ɹ/ /l/	/m/ /ŋ/	/s/ /z/ /ʃ/ /ʒ/
[+con -syl -son -cor -cont]	[+con +son +cor -ant +lat +cont]	[+con -syl +son -cont +nas]	[+con -syl -son +cont]

3. Results and Discussions

From the observations, it was found that there are consonants that Brielle could already produce correctly since she was three which are labial sounds [p], [b], [m], [w], dental sound [ð], alveolar [t], [d], [s], [z], and [n], and palatal [ʒ], [tʃ], and [dʒ]. The rest of other consonants gradually developed until she was six. Among those consonants, there are some that are completed earlier or even later than the average age estimates of customary consonant production shown on the speech sound development chart provided by Sander (1972). Further explanations are elaborated below.

3.1. Consonants Production Completed at Age 3

The first group of consonants that Brielle could produce when she was three years old is labial consonants. The labial consonants in English include the bilabial ([p], [b], [m], [w]) and labiodental consonants ([f] and [v]). The fact that she could produce these sounds when she was three years old is aligned with the speech sound development chart provided by Sander (1972) which shows that all labial sounds start to appear in children as early as the age of the three. Below are the tables showing the labial consonant acquisition of Brielle at age three.

Table 1. The Bilabial Consonants Acquisition Data of Brielle at Age 3

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle
Stop	Voiceless	[p]	Europe	[jʊɪəp]	[jʊwəp]
	Voiced	[b]	Be	[bi:]	[bi:]
Nasal	Voiced	[m]	Make	[meɪk]	[meɪt]
Glide	Voiced	[w]	Why	[waɪ]	[waɪ]

Table 2.The Labiodental Consonants Acquisition Data of Brielle at Age 3

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle
Fricative	Voiceless	[f]	Africa	[æfɪnkə]	[æfɪwɪtə]
	Voiced	[v]	Have	[hæv]	[hæv]

As we can see from the tables, Brielle could produce all the bilabial and labiodental sounds perfectly at the age of three. However, it is noticeable that in the data there are also consonants which she was unable to produce at that age such as the sound [ɹ] and [k]. Those two sounds gradually developed after the age of three (they will be discussed in the sub chapter 3.2.).

Brielle was also able to produce the voiced fricative dental consonant [ð] by the age of three. In contrast, according to Sander (1972), the English consonant [ð] starts to appear at the age of five and customarily most children are able to produce this sound at the age of eight. The table below shows the dental consonant [ð] acquisition of Brielle at age three.

Table 3.The Dental Consonant /ð/ Acquisition Data of Brielle at Age 3

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle
Fricative	Voiced	[ð]	The	[ðe]	[ðe]

The next group of consonants which appears at the age of three is the alveolar consonants. There are six alveolar consonants in English namely [t], [d], [s], [z], [n], and [l]. According to Sander (1972), the development of alveolar sounds starts a bit later compared to the labial sounds. Both of the sounds [t] and [d] customarily start to appear by the age of two until the age of four for the sound [t] and six for the sound [d]. The voiced fricative alveolar [s] and the voiceless fricative alveolar [z] start to appear at the age of three and a half until the age of eight. Brielle already produced

those sounds accurately when she was three years old, except for the sound [l]. The following table shows the alveolar consonants acquisition data of Brielle when she was three years old.

Table 4. The Alveolar Consonants [t], [d], [s], [z], and [n] Acquisition Data of Brielle at the age of 3

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle
Stop	Voiceless	[t]	Table	[<u>t</u> eɪbl]	[<u>t</u> eɪbl]
	Voiced	[d]	Periodic	[pɪrɪɑ <u>d</u> ɪk]	[pɪwɪɑ <u>d</u> ɪt]
Fricative	Voiceless	[s]	States	[<u>s</u> teɪts]	[<u>s</u> eɪts]
	Voiced	[z]	Crazy	[kɪeɪ <u>z</u> i]	[tweɪ <u>z</u> i]
Nasal	Voiced	[n]	No	[<u>n</u> oʊ]	[<u>n</u> oʊ]

Brielle already mastered most of the palatal consonants, namely [ʃ], [tʃ], [dʒ] at the age of three as well. The speech sound development chart provided by Sander (1972) shows that the palatal consonants do not customarily appear before the age of three and a half for the sounds [tʃ] and [dʒ] and the age of six for the sound [ʃ]. Brielle, however, was able to produce all of those sounds by the age of three. Below is the table of the palatal consonants [ʃ], [tʃ], [dʒ] acquisition of Brielle.

Table 5. The Palatal Consonants [ʃ], [tʃ], and [dʒ] Acquisition Data of Brielle at Age 3

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle
Affricate	Voiced	[dʒ]	Geranium	[<u>dʒ</u> əɹeɪniəm]	[<u>dʒ</u> əweɪniəm]
	Voiceless	[tʃ]	Teacher	[ti: <u>tʃ</u> ə]	[ti: <u>tʃ</u> əw]
Fricative	Voiced	[ʃ]	Television	[tɛləvɪ <u>ʒ</u> ən]	[tɛləvɪ <u>ʒ</u> ən]

The glottal consonant [h] is the last sound which appears accurately on the video of Brielle which was recorded when she was three years old. This is in accordance

with the speech development chart provided by Sander (1972) which shows that customarily the production of the consonant [h] on children is accurate by the age of three. The following table shows the glottal consonant [h] acquisition of Brielle:

Table 6. The Glottal Consonant [h] Acquisition Data of Brielle at Age 3

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle
Fricative	Voiceless	[h]	Hi	[<u>h</u> ai]	[<u>h</u> ai]

3.2. Consonant Production Completed after Age 3

3.2.1. Fricative Dental Consonant [θ]

Brielle was not able to produce the voiceless fricative dental consonant [θ] before the age of five. This is in accordance with the speech sound development chart provided by Sander (1972) which shows that the production of the sound [θ] do not customarily appear before the age of four and a half and the development should end by the age of seven. The table below shows the development of Brielle in acquiring the sound [θ].

Table 7. The Fricative Dental [θ] Consonants Acquisition Data of Brielle

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle		
					Age 3	Age 4	Age 5
Fricative	Voiceless	[θ]	Three	[<u>θ</u> i:]	[<u>t</u> wi:]	[<u>t</u> wi:]	[<u>θ</u> i:]

From the table, it can be seen that when she was three until four years old, she represented the fricative voiceless dental consonant [θ] as the voiceless stop alveolar consonant [t]. The sounds [θ] and [t] share the same features such as [+consonantal], [+sonorant], [+coronal], [+anterior], and [-voice]. However, what distinguishes the sound [θ] from [t] is that the former is a continuant consonant [+cont] and the latter is a non-continuant consonant [-cont]. This is because the sound [θ] is a fricative sound which is produced by not completely blocking the air stream through the vocal

tract, while when the stop sound [t] is produced, the air stream is completely blocked.

This alternation can be represented in the phonological rule below:

$$\begin{array}{c} /θ/ \rightarrow [t] \quad / \# _ \\ \left[\begin{array}{c} +con \\ +son \\ +cor \\ +ant \\ -voice \\ +cont \end{array} \right] \quad \left[\begin{array}{c} +con \\ +son \\ +cor \\ +ant \\ -voice \\ -cont \end{array} \right] \end{array}$$

3.2.2. Liquid Alveolar Consonant [l]

The production of the voiced liquid alveolar consonant [l] on Brielle appears at the video of her which was recorded when she was six years old. This is aligned with the sound development chart provided by Sander (1972) which shows that the production of liquid alveolar consonant [l] customarily appear between three until six years of age. When she was three until five years old, Brielle substituted the sound [l] with other consonants with similar features. The table below shows the development of Brielle in acquiring the sound [l] starting from the age of three to the age of five.

Table 8. The Liquid Alveolar Consonant [l] Acquisition Data of Brielle

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle		
					Age 3	Age 4	Age 5
Liquid	Voiced	[l]	Loud	[laod]	[ad]		
			All	[ɔ:l]	[ɔ:]		
			Learn	[lɜ:m]		[jɔ:n]	[wɜ:m]
			Float	[flout]		[fjout]	
			Milk	[milk]			[milk]

From the table, it can be seen that when Brielle was three years old, she was not able to produce the sound [l] at the beginning or the end of syllable and she did not

substitute the sound with any other consonant. Therefore, she pronounced [laod] as [ad] and [ɔ:l] as [ɔ:].

When she was four years old, she was able to produce the sound [l] at the end of words, and yet failed to produce the sound at the beginning of a word or when it was preceded by another consonant. She made an attempt to substitute the sound [l] with another consonant with somewhat similar features, so she chose the sound [j]. The sound [l] is produced by the tip of the tongue against the alveolar ridge.

This means it has the [+anterior] feature since it is produced no further back than the alveolar ridge. She already made the right attempt to use her tongue to produce the sound [l], however she ended up placing her tongue at the palatal area, resulting the sound [j] to appear. The sound [j] has the [-anterior] feature because it is produced behind the alveolar ridge. This alternation can be represented in the following phonological rule:

$$\begin{array}{c} /l/ \rightarrow [j] / \# _ \\ \left[\begin{array}{c} +con \\ +ant \\ +lat \end{array} \right] \quad \left[\begin{array}{c} -con \\ -ant \\ -lat \end{array} \right] \end{array} \quad \begin{array}{c} /l/ \rightarrow [j] / C _ \\ \left[\begin{array}{c} +con \\ +ant \\ +lat \end{array} \right] \quad \left[\begin{array}{c} -con \\ -ant \\ -lat \end{array} \right] \end{array}$$

When she was five, she made a progress by substituting the sound [l] with [w] at the beginning of words. The sound [w] is a bilabial sound which means it is produced no further back than the alveolar ridge. This means, it has the similar feature to the sound [l], which is [+anterior]. This alternation can be represented in the following phonological rule:

$$\begin{array}{c} /l/ \rightarrow [w] / \# _ \\ \left[\begin{array}{c} +con \\ +ant \\ +lat \\ -cont \end{array} \right] \quad \left[\begin{array}{c} -con \\ +ant \\ -lat \\ +cont \end{array} \right] \end{array}$$

3.2.3. Approximant Alveolar Consonant [ɹ]

According to Sander (1972), the maximum customary age of when children should be able to produce of the approximant alveolar sound [ɹ] is at the age of five and a half. This is aligned with the result of this research which shows that the production of the sound [ɹ] appears at the age of five. At the age of three until four, Brielle consistently replaced the sound [ɹ] with the sound [w]. The following table shows the development of Brielle in acquiring the sound [ɹ].

Table 9. The Approximant Alveolar Consonant [ɹ] Acquisition Data of Brielle

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle		
					Age 3	Age 4	Age 5
Liquid	Voiced	[ɹ]	Three	[θɹi:]	[tɹi:]	[tɹi:]	[θri:]
			Water	[bɔ:ɹn]	[bɔ:wɹn]		
			Ribs	[ɹibz]		[wɹibz]	
			Learn	[lɜ:ɹn]		[jɔ:wɹn]	[wɜ:ɹn]
			Your	[jɔ:ɹ]			[jɔ:ɹ]
			Right	[ɹaɪt]			[ɹaɪt]

The sound [ɹ] is a voiced approximant alveolar consonant. Therefore, it possesses the features of [+consonantal], [+sonorant], [+anterior], and [+continuant]. Brielle replaced the sound [ɹ] with the sound [w] which has similar features to the ones belong to the sound [ɹ] which are mentioned previously, except that [w] is a [-consonantal] sound. It is because in her attempt to produce the alveolar sound [ɹ], she did not raise her tongue to the alveolar ridge. This alternation can be represented in the following phonological rule:

$$/ɹ/ \rightarrow [w]$$

$$\begin{bmatrix} +con \\ +son \\ +ant \\ +cont \end{bmatrix} \rightarrow \begin{bmatrix} -con \\ +son \\ +ant \\ +cont \end{bmatrix}$$

3.2.4. The Postalveolar Fricative Consonant [ʃ]

The production of the voiceless postalveolar fricative consonant [ʃ] should appear at the age of three and a half until the age of seven. Brielle was able to produce this sound when she was five years old. The following table shows the development Brielle in acquiring the sound [ʃ].

Table 10. The Postalveolar Fricative Consonant [ʃ] Acquisition Data of Brielle

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle		
					Age 3	Age 4	Age 5
Fricative	Voiceless	[ʃ]	Show	[ʃoʊ]	[sʊʊ]		
			Function	[fʌŋkʃn]	[fʌŋsn]	[fʌŋsn]	[fʌŋkʃn]

The table shows that when Brielle was three until four years old, she substituted the sound [ʃ] with the voiceless fricative alveolar fricative sound [s] from the age of three until the age of four. The sound [ʃ] and [s] share the same features such as [+consonantal], [-sonorant], [+coronal], and [+continuant]. However, the place of the articulation of both sounds is what distinguishes them from each other. The sound [ʃ] is produced by raising the tongue at the postalveolar area, which means it possesses the [-anterior] feature. On the other hand, the sound [s] is produced by raising the tip of the tongue at the alveolar ridge which makes it an anterior consonant [+anterior]. This alternation can be represented in the following phonological rule:

$$/ʃ/ \rightarrow [s]$$

$$\begin{bmatrix} +con \\ -son \\ +cor \\ -ant \\ +cont \end{bmatrix} \rightarrow \begin{bmatrix} +con \\ -son \\ +cor \\ +ant \\ +cont \end{bmatrix}$$

3.2.5. Voiceless Velar Consonants [k]

According to the age of customary consonant production provided by Sander (1972), the consonant [k] appears on children between the two until four years old.

However, Brielle was a bit late in producing this consonant accurately. The result shows that the sound appears at the age of five. Below is the table of velar sound [k] acquisition of Brielle.

Table 11. The Voiceless Velar Consonant [k] Acquisition Data of Brielle

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle		
					Age 3	Age 4	Age 5
Stop	Voiceless	[k]	Kills	[kɪls]	[tɪ:s]		
			Dark	[dɑ:ɹk]	[dɑwt]		
			Speak	[spi:k]		[spi:k]	
			Okay	[oukɛɪ]		[otɛɪ]	
			Called	[kɔ:ld]		[tɔ:ld]	
			Can	[kæn]			[kæn]
			Milk	[mɪlk]			[mɪlk]

From table it is known that when Brielle was three years old, she substituted the sound [k] with [t] in all phonetic environments. Both of those sounds share similar features such as [+consonantal], [-sonorant], [-continuant], [-coronal], and [-voice]. What distinguishes the sound [k] from [t] is that the former is produced by raising the tip of the tongue to the velum [-anterior] and the latter is produced by raising the tongue to the alveolar ridge [+anterior]. This alternation can be represented in the following phonological rule:

$$/k/ \rightarrow [t]$$

$$\begin{bmatrix} +con \\ -son \\ -cont \\ -ant \\ -cor \\ -voice \end{bmatrix} \rightarrow \begin{bmatrix} \bar{+}con \\ -son \\ -cont \\ +ant \\ -cor \\ -voice \end{bmatrix}$$

It can also be seen from the table that when she was four years old, the sound [k] is accurately produced in the word [spi:k]. This means that before the age of five,

Brielle could produce the sound [k] only when it was preceded by a high vowel.

These phenomena can be described in a phonological rule as follows:

$$/k/ \rightarrow [k] \quad / \text{vowel } _$$

$$\begin{bmatrix} +con \\ -son \\ -cont \\ -ant \\ -cor \\ -voice \end{bmatrix} \begin{bmatrix} +con \\ -son \\ -cont \\ -ant \\ -cor \\ -voice \end{bmatrix} \begin{bmatrix} +syl \\ +high \end{bmatrix}$$

3.2.6. Voiced Velar Consonant [g]

Similar to its voiceless pair, [k], the voiced stop velar consonant [g] should also appear in most children by the age of four (Sander, 1971). However, the result shows that the production of the sound appears at the age of five. Below is the table of velar sound [g] acquisition of Brielle.

Table 12. The Voiced Velar Consonant [g] Acquisition Data of Brielle

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle		
					Age 3	Age 4	Age 5
Stop	Voiced	[g]	Argon	[ɑ:ɪgɑ:n]	[ɑwɔɑ:n]		
			Guys	[gɑɪz]		[ɔɑɪz]	
			Gums	[gʌms]			[gʌms]

It can be seen from the table that when Brielle was three until four years of age, she substituted the consonant [g] with [d] regardless of the phonetic environment of the sound. Both of those sounds have similar features which are [+consonantal], [-sonorant], [-continuant], [-coronal], and [+voice]. However, the sound [t] is produced by raising the tip of the tongue against the alveolar ridge [+anterior], while the sound [g] is produced by raising the tongue against the velum [-anterior]. This alternation is described in the following phonological rule:

$$/g/ \rightarrow [d]$$

$$\begin{bmatrix} +con \\ -son \\ -cont \\ -ant \\ -cor \\ +voice \end{bmatrix} \quad \begin{bmatrix} +con \\ -son \\ -cont \\ +ant \\ -cor \\ +voice \end{bmatrix}$$

3.2.7. Nasal Velar Consonant [ŋ]

According to Sander (1972), the age of customary consonant production of the nasal velar consonant [ŋ] is between the age of two until six. The result shows that the sound appears at the video of Brielle which was recorded when she was four years old. The velar sound [ŋ] acquisition of Brielle is shown at the following table.

Table 13. The Nasal Velar Consonant [ŋ] Acquisition Data of Brielle

Manner of Articulation		Sound	Word	Word Transcription	Phonetic Data of Brielle	
					Age 3	Age 4
Nasal	Voiced	[ŋ]	Function	fʌŋkʃn	fʌnsn	fʌŋksn

It can be seen from the table that when she Brielle was three years old, she substituted the sound [ŋ] with [n] that share the same features which are [+nasal] and [+coronal]. The difference of both sounds is that the nasal velar consonant [ŋ] is produced behind the alveolar ridge by raising the tongue at the velum [-anterior], while the alveolar consonant [n] is produced by raising the tip of the tongue to the alveolar ridge [+anterior]. This alternation is represented in the following phonological rule:

$$/ŋ/ \rightarrow [n]$$

$$\begin{bmatrix} +nas \\ -ant \\ +cor \end{bmatrix} \quad \begin{bmatrix} +nas \\ +ant \\ +cor \end{bmatrix}$$

4. Conclusions

It can be drawn from the results of the research that the phonological development of Brielle was completed at the age of six. Before that age, she substituted the consonants that she could not produce accurately with another consonant with similar features. For example, at the age of 3 until 4, she substituted the voiceless and voiced velar pair [k] and [g] with the alveolar [t] and [d] respectively. Her speech sound development was also aligned with the speech sound development chart provided by Sander (1972), although there were some sounds that she acquired earlier than the age range shown in the chart, such as the dental sound [ð] and most of the fricative palatal sounds, or even later than that, such as the velar consonants [k] and [g].

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