THE INFLUENCE OF LINGUISTIC AND NON-LINGUISTIC FACTORS ON THE VARIATION OF ARABIC MARKED CONSONANTS IN THE SPEECH OF GULF PIDGIN ARABIC: ACOUSTIC ANALYSIS

by

MOHAMMAD FAHAD ALJUTAILY

(Under the Direction of Chad Howe)

ABSTRACT

This dissertation investigates the potential effect of linguistic and non-linguistic factors on the variation and realization of Arabic marked consonants including /tˤ/, /sˤ/, /θ/, /χ/, /ɣ/, / ħ/ and /ʕ/ by speakers of Gulf Pidgin Arabic (GPA), a variety spoken by immigrant workers living in the Gulf States (e.g., Saudi Arabia). GPA emerged due to a continual influx of immigrant workers after the discovery of oil in 1983, linguistic diversity among speakers, and a social gap between Gulf speakers and immigrants.

The data was collected by short sociolinguistic interviews and a picture-naming task with 40 male GPA speakers from two linguistic backgrounds, Malayalam and Urdu. Five Arabic speakers served as a control. The GPA speakers were divided into two groups depending on their length of residency (LOR): short-stay and long-stay. I adopted auditory and acoustic analysis to categorize the target consonant and its variant. I compared the values of each group of GPA speakers to the values of the control group to determine similarities and differences in Arabic marked consonant realization.

The results indicate that there is considerable inter-speaker variation among both groups across all consonants investigated. The alternations of GPA speakers include the local form vs. the L1 form (e.g., /tˤ/ vs. /t/, /θ/ vs. /t/or /s/, /sˤ/ vs. /s/or /θ/, /χ/ vs. /k/or /h/, /ɣ/ vs. /g/or /h/ or /x/, /ħ/ vs. /h/, /ʕ/ vs. /h/ or /ʔ/ or deletion). Differences in speakers' L1 likely account for most of these alternations. As I hypothesized, Urdu speakers perform most Arabic consonants better than Malayalam speakers due to the partial influence of Arabic on Urdu. Moreover, the degree of variation of the Arabic marked consonants are linked to the degree of consonant difficulty. Age does not play a significant role in the realization of Arabic consonants. The LOR and amount of exposure are robust predictors that influence the realization of Arabic marked consonants. GPA speakers who have stayed longer in Saudi Arabia and have a high amount of exposure to GA demonstrated superior performance in realizing Arabic marked consonants compared to those who have stayed for less time in Saudi Arabia and have low exposure.

INDEX WORDS: Gulf Pidgin Arabic, Gulf Arabic, Arabic marked consonant variation, substrate language, length of residency, amount of exposure

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MOHAMMAD FAHAD ALJUTAILY

B.A., Qassim University, Saudi Arabia, 2005

M.A., Oakland University, 2012

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2018

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MOHAMMAD FAHAD ALJUTAILY

Major Professor: Chad Howe
Committee: Margaret Renwick
Pilar Chamorro

Electronic Version Approved:

Suzanne Barbour
Dean of the Graduate School
The University of Georgia
August 2018

DEDICATION

I dedicate this dissertation to my wonderful family, especially to my beloved mother, Helah Alkhodair; to my lovely wife, Norah Aljutayli; to my sweet children, Yazeed, Jawad, and Asser; and to my brothers and sisters.

ACKNOWLEDGEMENTS

Before anything, I am eternally grateful to Allah (God) for his support and blessings while completing this research.

Accomplishing this research would not have been possible without the constant encouragement and assistance of many people. First and foremost, I would like to express my sincere debt of appreciation and gratitude to Dr. Chad Howe, my major professor, for his excellent supervision, patience, continuous support, and encouragement throughout the entire journey of my doctoral study at the University of Georgia and the writing of this research. His feedback, valuable guidance, and suggestions were vital to the overall success of completing this dissertation. I also would like to extend my gratitude to my wonderful committee members, Dr. Margaret Renwick and Dr. Pilar Chamorro, for devoting their time to working with me, reading this dissertation and offering their input regarding my work. I thank Dr. Renwick for providing me with specific feedback on phonetics and phonology.

Sincere thanks also must go to those who have helped me arrive at this point, my fellow Ph.D. student Joey Stanley for his assistance and sharing the Praat script I needed to analyze the sounds in this dissertation, my colleague Drs. Mazen Shawosh and Tawfiq Alashoor for statistical consultations, and Dr. Megan Morgan for helping me in proofreading this dissertation. I am also grateful to all my friends and colleagues, Drs. Ali Alshamrani, Mohammed Alasmari, Ibrahim Asiri and Ammar Alammar, who have provided me with useful suggestions and sources and greatly supported me in completing this dissertation.

I am also very much indebted to my employer, Qassim University in Saudi Arabia, for giving me the opportunity to achieve my graduate studies in the United States. My graduate studies would not have run smoothly without the munificent scholarship I received from my employer through the entire journey of my academic life.

My family also deserves great appreciation and gratitude. I am immensely indebted to my wonderful mother, Helah Alkhodair, who has continuously supported me all my life and endured patiently the many years that my graduate studies have taken me away from her; to my lovely wife, Norah Aljutayli, for her endless love, encouragement, and sacrifices in all my endeavours; to my sweet children, Yazeed, Jawad, and Asser, for their unconditional love and spiritual support; and to my brothers and sisters for their sincere prayers and support throughout my whole academic journey. May Allah bless you all!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

This dissertation investigates the potential influence of linguistic and non-linguistic factors on the phonological variation and production of consonants of Arabic in the speech of speakers in a language contact setting. There are different types of situations in which groups of speakers of different languages are in social contact with one another in the same geographical area. Among the situations of language contact are those that occur as the consequence of trade, migration, and colonization. In this case, the speakers need to achieve a common language for communicative purposes, and such constant contact often results in the emergence of a contact language, namely, pidgin. Almoaily (2013) states that language variation is predicted among the speakers of pidgin because the pidgin primarily evolves in a multi-ethnic speech community. In addition, Grama (2015) points out that variation is inherent in people's speech, and thus, the variability might be conditioned by linguistic or social factors. Therefore, the current study explores the phonological production and alternations of the marked consonants of Arabic in the production of GPA speakers working in Saudi Arabia. More specifically, it examines the possible effect of linguistic and non-linguistic factors (e.g., markedness/difficulty or L1 influence or length of stay or age or amount of exposure) on the variation and realization of Arabic marked consonants.

This chapter provides a brief overview of language contact and contact language which refers to the interaction of different languages and how this communication allows the contact language to arise. Moreover, it addresses the influences that contribute to the emergence of contact languages, as well as their characteristics. The chapter will end by addressing linguistic variation, a statement of the problem, the purpose and significance of the study, the research questions and the organization of this dissertation.

1.1 Language Contact and Contact Languages

Human mobility, occurring under conditions of migration or trade or for any reason, is found throughout history, integrating societies and cultures by allowing people of different languages and cultures to meet and interact with one another. According to Sankoff (2002:3), language contacts historically occur "in large part under conditions of social inequality resulting from wars, conquests, colonialism, slavery, and migrations." Such contact occurs everywhere, particularly in places where different languages are spoken concurrently, which ultimately results in languages' effect on one another in terms of lexical, phonological or syntactic level, cultural exchange, and so on (e.g., (Thomason & Kaufman 2001; Sankoff 2002; Winford 2013). Thus, such ongoing social interactions among those people/speakers catalyze the occurrence of language contact. With extended contact among these groups, a new contact language can arise. For instance, pidgins and creoles are considered contact languages that arise in a situation of contact in which more than two groups speaking different languages meet and need to communicate with each other but do not have tools for communication (Almoaily 2013). Contrary to non-contact language, the usage of these contact languages (pidgins or creoles) is restricted to limited purposes (i.e., trade) (Todd 1990; Sebba 1997; Thomason 2008). The current study will consider the variation of marked consonants in the speech of Gulf Pidgin Arabic speakers, the language of interest in this dissertation, and all speakers involved in this dissertation are pidgin speakers. Thus, before beginning the discussion of the project itself, it will be useful to provide the reader with information on pidgins in general, and specifically, Gulf Pidgin Arabic, as I will highlight in the subsequent paragraphs of this chapter and in Chapter 2.

The term "pidgin" refers to a particular sociolinguistic phenomenon: a language that emerges as a result of contact with or acculturation to the target language (Al-Jasser 2012). Historically, the emergence of pidgins and creoles around the world can be attributed to factors such as migration, trade, slavery, colonization and an internationally mobile workforce (Bassiouney 2010; Winford 2003). Most commonly, pidgins emerge among traders who have a great deal of contact with a group of native speakers of the target language (Yule 1996). According to Almoaily (2013), pidgin languages are typically made up of at least two languages: one substrate language (i.e., the minority language or non-dominant language in a language contact setting) and one superstrate language (i.e., the dominant language on which the pidgin is based).

Almoaily also states that the term pidgin lacks a unanimous explanation; however, most scholars (see Sebba 1997; Todd 1990; Thomason 2008; Holm 2000; Wardhaugh 2006; Almoaily 2013; Winford 2013; Alghamdi 2014; Özüorçun 2014), agree that pidgins are no one's native tongue, and defining a pidgin as a reduced variety of a language used as a lingua franca in a place where two or more groups of speakers from different linguistic backgrounds, not sharing a common language, come into contact in the same geographical region. Those speakers use this variety regularly but restrict it to limited purposes (Thomason 2008; Grama 2015), such as trading (e.g., Chinese Pidgin English), mass migrant labor (Gulf Pidgin Arabic), plantation work (Hawaii Pidgin

English), or military occupation (e.g., Japanese Pidgin English). In contrast to pidgins, creoles (e.g., Haitian Creole French) are an expanded version of pidgins. However, a creole develops in two stages. First, it evolves as an initial pidgin with a reduced and simplified system, whereas the second stage involves an expansion of this variety, in that it broadens its function and becomes the native language of its speakers (Wardhaugh 2006; Isa, Halilu & Ahmed 2015).

A pidgin mostly derives its grammar and lexicons from different source languages. That is, it draws most of its vocabulary from one source language (i.e., the lexifier) but the grammar and meaning from one or more other languages (Thomason 1997). For instance, Tok Pisin (an English-based pidgin spoken in Papua New Guinea) derives its lexical items from its lexifier (i.e., English), while it derives its grammar and meaning from different languages spoken in Melanesia. Tok Pisin and most of the languages spoken in Melanesia show a distinction between inclusive and exclusive 1st–person plural pronouns, but the lexifier (i.e., English) does not. English has only the pronoun *we*, whereas the Tok Pisin has *yumi,* which is derived from English *you* + *me*, and *mipela* which is derived from English *me* + *fellow*, to represent inclusive and exclusive pronouns, respectively (Romaine 2001).

Pidgin is characterized by grammar simplification and a reduced lexicon (Sebba 1997), as will be discussed more fully in 1.2 and 1.3. Nevertheless, we still require an explanation for similarities or for common features (e.g., simplification) among all pidgins in the world despite their different sources. Pidgins come into existence under different influences, as demonstrated in some of theories of genesis discussed in 1.2. Therefore, from these theories, we can discover how most, if not all, pidgins are structured alike. Sebba (1997: 72) states that there are "specific 'mechanisms' which have been claimed to be relevant to pidgin and creole genesis", including imperfect second language learning, substrate influence and universals. Thus, the following section will describe the scenarios and briefly review the theories that lead to the formation of pidgins.

1.2 The Genesis of Contact Language

As previously stated, pidgins are established in a situation of contact when groups of speakers from different linguistic backgrounds mingle but have no shared language. Holm (2000) states that the genesis of a pidgin cannot be traced and understood without considering the social factors. Sociolinguistic factors play a major role in shaping pidgins, and the above definition of pidgin reveals that this variety does not have native speakers, has a restricted function, and also appears in specific social settings due to the contact and interaction between groups of unequal status and power. According to Bell (2013), pidgins were a recognized form of communication in the European expansion from the 15^{th} -19^{th} centuries. Nevertheless, contact languages like pidgins and creoles became a formal field of research and linguistics only in the middle of the 20^{th} century (Holm 2000; Almoaily 2013). Despite their earlier existence, the study of pidgins has only recently become a formal field of study. This might be because these varieties were previously recognized as broken languages that do not deserve to be investigated (Almoaily 2013).

Contact languages are claimed to be structured similarly regardless of their sources, in that these languages tend to be simpler, have more mixed grammar, and show more internal variability than non-contact languages (Muysken & Smith 1995). Muysken and Smith state that the resemblance of contact languages is not accidental. Several theories have been developed to explain these structured similarities, which may also play a role in several theories of the genesis of contact languages. The literature on contact languages includes various theories to explain the existence of these contact languages, including imperfect second language learning (Siegel 2009), monogenesis (Taylor 1961), substrates (Mufwene 1990), superstrates (Mufwene 1990), universals (Bickerton 1984) and many others. The genesis of pidgins/creoles may involve one of the previous theories or a combination of these theories, and the theories may complement one another (Mufwene 2015). The subsequent paragraphs briefly review relevant theories in contemporary linguistic theory, including imperfect second language varieties of their lexifier languages (Coelho 1881; Siegel 2009), substrate influence (Holm 1989), and Universalist theories, as supported by Bickerton (1984).

In the theory of imperfect second language acquisition, the speakers of a hypothesized proto-creole have little access to the dominant/superstrate language, which results in an "approximate simplified system of the type of that found in some cases of second language acquisition" (Lefebvre 2004: 16). Mufwene (1990) and Almoaily (2013) link the genesis of contact languages (e.g., pidgins) with imperfect second language acquisition since both cases could result from simplifying the structure of the target language by using unmarked and simple forms of the language. Almoaily (2013) found that GPA speakers, especially in the early stages of speech process, produce verbless clauses, as is most common in the speech of second language learners. He attributes this to a potential imperfect language acquisition that may result from insufficient knowledge of and access to L2.

The substrate hypothesis was based on the Atlantic varieties influenced by their African substrate languages. That is, the speakers of pidgins/creoles have been influenced by their L1 or their ancestral languages under the process of relexification. Relexification is a mental process in which pidgin/creole speakers tend to relexify/change the contact language according to their substrate languages (Finney 2004; Isa, Halilu & Ahmed 2015). For instance, the speakers of the contact language (pidgin/creole) borrow words from the superstrate but maintain the grammar and sounds of the speakers' L1.

The Universalist theory is expressed differently within different theoretical perspectives. This theory is considered one of the recent theories of pidgin/creole formation (Isa, Halilu & Ahmed 2015), and also attempts to explain the structural similarities among contact languages (e.g., pidgins and creoles), such as having a simplified system in their structures regardless of their different language sources/lexifiers. Its assumption is based on the universal tendency of humans to employ their innate ability to simplify language when learning/acquiring languages (Isa, Halilu & Ahmed 2015; Vicente 2007). Smart (1990) and Neass (2008), in their studies of investigating Gulf Pidgin Arabic, Smart and Neass assume a Universalist perspective. They show that the similarities found in Gulf Pidgin Arabic (GPA) result from capacity for linguistic simplification, which is an innate and universal ability of all humans. Thus, this process is applied in pidginization, since the pidgin speakers from different substrate languages usually select unmarked linguistic elements.

I will be returning to these theories throughout the dissertation to discuss their possible implications in my work and to determine, with respect to my data, whether they agree or suggest different predictions than my own. Therefore, after reviewing some of the theories that demonstrate the genesis of the contact language and explaining why all pidgins in the world, regardless of their different lexifiers, are similarly structured, the next section explains common features of pidgins.

1.3 Characteristics of Pidgin Languages

A pidgin typically has general proposed linguistic features that facilitate typifying the true pidgin. Pidgins have a simplified grammar structure, morphology, and phonology, as well as a limited lexicon. Most of their features appear in morphology and syntax.

Winford (2003) presents some morphological characteristics, as suggested in Bickerton (1981) and Drechsel (1997), such as the absence of inflections and some functional categories, which in turn, characterize pidgins by reduced inflections. The pidgins comprise a small number of functional morphemes, pronouns and question words. For instance, in Tok Pisin Pidgin, *Sikspela man i kom,* from English "six people are coming" and *Wanpela man i kom,* from English "A man is coming" demonstrate the absence of inflections that indicate agreement and plurality. From both examples, we notice that agreement is lost, and there is no inflection to mark plurality. The form of the noun remains unchanged, and the plural is indicated by only numeral items. Additionally, Tok Pisin lacks gender morpheme distinction, specifically in object pronouns "*him, her, it"*. Instead, they are neutered, and the English object pronouns are represented as *em* (Schreier 2008).

As for syntax, a pidgin system lacks complex sentence structures (e.g., an embedded or subordinated structure) and has a common word order, generally SVO (Alghamdi 2014). In addition, there is one main pattern of negation in most pidgins, irrespective of the different kinds of negation in the lexifiers. The common pattern is a preverbal negative element. Pidgin speakers tend to place the negative element before the verbal phrase. An example of this kind of negation can be found in Tok Pisin *Yu no laik go long ples?* from English “Don’t you want to go to the village?” (Holm 2000).

In terms of phonological features, pidgins are characterized by a reduced inventory of phonemes (e.g., consonants and vowels), and their inventory is generally less than the inventory of their lexifier. Holm (2000) states that universals play a major role in the pidginization process, specifically at the phonological level. The reduction has been attributed to the markedness of sounds (i.e., less common sounds in the world’s languages that are more difficult to pronounce), which tend to be substituted by the closest equivalents in the speakers’ L1. In other words, the common phonemes that occur in the phonological systems of most natural languages, including stops /b, t/ and nasals /m, n/, are more likely to appear in the inventory system of pidgin, while rare or marked sounds, such as dental fricative /θ/ and uvular fricative /x/, or such as the marked vowel front rounded vowels /y/, tend to be simplified by replacing them with the closest equivalents in the substrate languages. Tok Pisin speakers, for instance, replace the English labiodental /f/ with /p/, as in the word *finish* > *pinis* (Holm 1989), and the speakers of Gulf Pidgin Arabic also tend to replace the voiceless uvular fricative /x/, as in the word *xamsah* ‘five’ and dental fricative /θ/ as in the word *thani* ‘second’ with the voiced velar stop /k/ and alveolar stop /t/, respectively (Neass 2008).

Finally, in terms of lexicon, pidgins contain small vocabularies compared to natural languages. Winford (2003) and Sebba (1997) state that the near-absence of synonyms in pidgins gives rise to the reduction of lexical items. Each word can be multifunctional (i.e, a word with various syntactic uses) and polysemous (i.e., word with various meanings) so as to cover a wide range of semantics and compensate for the reduced lexicon (Holm 2000).

The previous characteristics support the claim that the GPA is a pidgin, and hence, Smart (1990), Neass (2008), and Bakir (2010) categorize GPA as a contact variety spoken by immigrant workers in different Arabian Gulf countries (Saudi Arabia, Qatar, etc.).

1.4 Linguistic Variation

Linguistic variation appears in a language at the phonological, morphological, and syntactic levels (Tagliamonte 2006). Labov (2004:3) simply defines this term as "two alternative ways of saying the same thing." Unlike non-contact languages, contact language tends to change rapidly and coexist with the dominant language of the speech community. Thus, linguistic variation is more likely to appear (Muysken & Smith 1995). That is, the linguistic diversity that occurs within the speakers in language contact may contribute to language variation. The speakers show a great degree of variation, which may be conditioned by social or linguistic factors (Weinreich, Labov & Herzog 1968; Almoaily 2013; Bayley 2013). Sankoff (2002) claims that transfer is one of the factors that leads to language variation. Sankoff states that transfer is overwhelmingly observed among speakers of different languages in language contact. The speakers of different languages might see some effects of their L1 on performing linguistic patterns of the dominant/target language (Bayley 2005). That is, they have different performances on a wide range of variables, particularly in the initial stages, and exhibit linguistic patterns derivable from their L1. Moreover, Almoaily (2013) claims that there is an effect of socio-economic standing and length of exposure to the dominant language on linguistic variation in contact language. As stated above, contact languages (e.g., pidgins) develop in multi-ethnic communities, and therefore it is predicted that the alternation of the linguistic structure is more likely to appear among speakers with different substrate languages.

1.5 Statement of the Problem

Gulf Arabic (the lexifier for GPA speakers) contains some typologically uncommon phonemes (marked consonants), including emphatic/pharyngeal consonants. These phonemes are challenging for immigrant workers (e.g., Gulf Pidgin Arabic speakers) to produce, particularly those speakers whose L1 lacks such marked phonemes because they have somewhat complexity in its articulation (Almoaily 2013).

Language variation is more likely to appear among GPA speakers with different substrate languages (Almoaily 2013). However, some GPA speakers substitute these sounds for the closest equivalents in their L1, while other speakers tend to shift to the local form regardless of the absence of these sounds in their L1 phonology. The variant selection is not accidental, and the variation may be governed by social or linguistic factors or both (Weinreich, Labov & Herzog 1968; Bayley 2013). Therefore, this research will investigate how the marked consonants of Arabic (i.e., /tˤ, θ, sˤ, χ, ɣ, ħ, ʕ/) are produced by GPA speakers from different substrate languages and what factor(s) may influence these realizations/variations.

1.6 Purpose of the Study

The purpose of this study is to investigate the effect of length of residency (LOR) in Saudi Arabia, L1, age, and amount of exposure to GA on the consonant variation of

Arabic marked consonants in Gulf Pidgin Arabic (henceforth GPA), a variety spoken by immigrant workers living in the Gulf States–Saudi Arabia, Qatar, Kuwait, Bahrain, and Oman. More specifically, the study focuses on patterns in the production and variation of marked consonants of Arabic from a corpus of GPA speakers working in Saudi Arabia, including emphatic (/tˤ, sˤ/), dental (/θ/), uvular (/χ, ɣ/), and pharyngeal (/ ħ, ʕ/).

1.7 Significance of the Study

Arabic-based pidgins, particularly Gulf Pidgin Arabic (GPA), are not as widespread as other pidgins in the world, such as pidgins that are mainly based on European lexifiers (e.g., English-based pidgins) (Versteegh 1984). Accordingly, the Arabic-based pidgins, and particularly the GPA, have received relatively little attention in the literature. Thus, the current study will address the shortage of studies of Arabic pidgins in the literature. Moreover, as most genesis theories of pidgins are examined based on data coming from European languages. Therefore, investigating certain theories occurring in the literature by a non-European language might support or contradict these theories. This study, furthermore, is significant because most previous studies on Arabic pidgin studies, as well as studies of other pidgin languages (e.g., English-based pidgins), investigate the phonology of pidgin varieties descriptively using only auditory perceptual analysis. However, using this method alone results in inaccurate judgment and is often unreliable. Adopting auditory analysis, together with acoustic measures, in the study of GPA consonants is certainly an important contribution to the field of pidgin research, particularly on Arabic-based pidgins, and one that brings the study of GPA in line with prevailing trends in the field. Thus, it is useful for this dissertation to compare the accuracy of the previous descriptive analyses of pidgin consonants using acoustic analysis. In addition, many studies in the field of contact languages (pidgins/creoles), and particularly Arabic-based contact languages, have emphasized the investigation of morpho-syntax phenomena, and very few scholars (e.g., Avram 2010; Almoaily 2013) have focused on language variation. However, none of the language variation studies consider phonological variations, except for Avram's work. Nevertheless, Avram does not consider the potential roles of linguistic and non-linguistic factors and their influence on the production and variation of the phonological alternations (i.e., consonantal realization and variation). The current study aims to fill this gap by conducting a sociophonetic analysis addressing the following research questions.

1.8 Research Questions

1. How do GPA speakers produce the marked consonants of Arabic?
2. To what extent does the GPA speakers' realization of the marked consonants differ from the lexifier language?
3. To what extent does the realization of each substrate language (Malayalam and Urdu) differ from the lexifier?
4. Is the degree of difficulty/markedness of the consonants (less common consonants) associated with the variant frequency within each GPA group (Malayalam and Urdu)?
5. How do the length of residency in Saudi Arabia, age, and amount of exposure to Arabic influence the realization/variation of the marked consonants of Arabic?

1.9 Organization of the Dissertation

This dissertation comprises eight chapters, including this chapter (Introduction). Chapter Two discuses Gulf Arabic (lexifier), its phonology, pidiginization in Saudi Arabia, Gulf Pidgin Arabic and its development, and the phonological description of Gulf Pidgin Arabic. Chapter Three describes the substrate languages involved in this dissertation including Malayalam and Urdu and their consonantal inventories. Additionally, Chapter Three discusses similarities/differences between the substrate and superstrate languages investigated in this dissertation. This is followed by Chapter Four which reviews the related literature in Arabic-based pidgins and the phonological changes in Gulf Pidgin Arabic. It also reviews L2 phonology, concentrating on transfer, similarities and differences in L1 and L2, markedness/difficulty as well as non-linguistic factors and their influence on language variation. Finally, Chapter Four ends by presenting the theoretical framework (Variationist Approach). Chapter Five describes the methodology employed in this dissertation including a description of participants, procedures and materials, as well as data analysis. It also describes how the data segmented and prepared for acoustic Voice Onset Time, formant frequencies, frication noise duration and Center of Gravity. Chapter Six presents the results of the dissertation. Chapter Seven discusses the results. This is followed by Chapter Eight, which concludes the dissertation.

CHAPTER 2

DESCRIPTION OF GULF ARABIC AND GULF PIDGIN ARABIC

This chapter is dedicated to describing Gulf Arabic (GA), as spoken in Saudi Arabia in where the participants in the current study have their primary contact with the language, and its phonology. It also demonstrates the factors that have contributed to the emergence of Gulf Pidgin Arabic (henceforth GPA).

2.1 Arabic Language

Arabic is classified as one of the Semitic languages (e.g., Hebrew and Amharic); approximately 200 million people speak this language natively. Additionally, it is one of the official languages adopted by the United Nations[1] and has an influence on a number of languages, such as Persian, Turkish and Urdu, in particular, at the lexical level (Alkhateeb & Hasan 2016; Ryding 2005). Moreover, it is spoken natively and officially in the Middle East and North Africa in countries including Saudi Arabia, Sudan, Morocco, Egypt, and the United Arab Emirates (Holes 2004). The Arabic language can be classified into three forms: Classical Arabic, Modern Standard Arabic (MSA), and vernacular dialects. Classical Arabic is the language of the *Quran* (i.e., the Holy Book for Muslims) as well as the liturgical language for over a billion Muslims in all Muslim countries (Chejne 1969; Abu-Absi 1986). Currently, few people use this form unless the context is specifically religious. MSA is used everywhere: in schools, in government, and in the media. It is a modified version of Classical Arabic (Abu-Absi 1986), as well as the

[1] http://www.un.org/en/sections/about-un/official-languages/ retrieved in October 2017.

best means of communication between speakers of totally different Arabic dialects. Wehr and Cowan (1976:1) state that "MSA is the form of the language which, through the Arab world from Iraq to Morocco, is found in the prose of books, newspapers, periodicals and letters. This form is also employed in formal public address, over radio and television and in religious ceremonial." Finally, there are the vernacular dialects of Arabic, which are different from the Classical and Modern Standard forms, are also different from each other. Arabic comprises different dialects distributed in different geographical areas, such as Egyptian Arabic, Moroccan Arabic, and Levantine Arabic. These Arabic dialects are regional and differ in certain aspects, particularly in vocabulary and sometimes phonology (Zaidan & Callison-Burch 2014).

2.2 Gulf Arabic (GA)

Gulf Arabic is another common Arabic dialect/variety and is the lexifier language of the speakers involved in this dissertation. Gulf Arabic differs from other Arabic varieties (e.g., Moroccan, Algerian, and Libyan Arabic) in that foreign languages (e.g., European languages) were not imposed on Gulf societies and culture (Buali 2010). That is, unlike what happened in some other Arab countries (i.e., Algeria, Morocco), the Gulf countries and societies have had no colonial language imposed upon them that might directly or indirectly affect the GA variety. Although some of the Gulf countries, such as Kuwait and Qatar, have been colonized, they did not become bilingual like other Arab nations (Morocco) that were colonized and were exposed to the colonizers' languages.

Although there exists little research on this variety, there are differences in definitions regarding the speakers and the geography of GA, Qafisheh (1977) defines it as the language spoken by people of Qatar, Bahrain and the United Arab Emirates. Holes

(1990), on the other hand, refers to GA as the spoken language of the indigenous people in Oman, Southern Iraq, the United Arab Emirates and some eastern regions of Saudi Arabia. In addition to Oman and the United Arab Emirates, Smart (1990), Neass (2008), Almoaily (2013) and Albaqawi (2017) assert that the GA variety is also spoken by the domestic people of Qatar, Bahrain, Saudi Arabia and Kuwait. The disparity in defining this variety might be due to the fact that some of the excluded Gulf states have distinct features in their dialects that distinguish them from other Gulf Arabic dialects in other Gulf states. For instance, Holes (1990) excludes the dialect spoken in Kuwait because it displays common/mutual distinctive local features with southern Iraqi Arabic. This is also the case with Omani Arabic; Qafisheh (1977) excludes Oman from the definition of GA, though he does not provide any reason for this elimination. Geographically, most of Oman's borders are directly connected with nearby Yemen, and, consequently, these two dialects (i.e., Yemeni and Omani Arabic) might influence one another, making some of the linguistic characteristics interrelated. Additionally, Almoaily (2013) excludes the varieties spoken in the south, north and west of Saudi Arabia from belonging to GA because they have some different phonological systems.

From a political perspective, the Gulf States consist of the countries that are members of the Gulf Cooperation Council (GCC), including Saudi Arabia, Qatar, Bahrain, Oman, Kuwait, and the United Arab Emirates, and also have borders directly connected to the Arab Gulf. Therefore, I am in line with the previous authors (Smart 1990; Neass 2008; Almoaily 2013; Albaqawi 2017) who assign GA as the language spoken by people inhabiting the following Gulf States: Saudi Arabia, Qatar, Bahrain, Oman, Kuwait, and the United Arab Emirates (Map 1 in Appendix A illustrates the countries that speak GA). Moreover, the social structure and most of the linguistic features in these countries are very close to one another, regardless of the slightly different linguistic features that appear in any of the Gulf countries' dialects that have been transformed by language contact. Thus, such slight differences in dialects of Gulf Arabic does not preclude their belonging to the more general classification of Gulf Arabic, meaning that the small differences in dialects are not sufficient to make them distinct of Arabic. The current study will concentrate on the center of Saudi Arabia, specifically the Qassim Region, where the data were collected. Following Feghali (2004) and Almoaily (2013), who assign the variety spoken in the central region of Saudi Arabia as belonging to GA, I will be referring to the term GA throughout this dissertation to indicate the variety that is spoken in the center of Saudi Arabia.

As mentioned in 1.7, for the purpose of this dissertation, which aims to investigate the production and variation of the marked consonants of Gulf Arabic in the speech of Gulf Pidgin Arabic speakers, the next section will briefly discuss the consonants and vowel systems of Gulf Arabic to provide the reader with some background on the phonology of Gulf Arabic, which this dissertation considers as a lexifier to Gulf Pidgin Arabic speakers.

2.2.1 Phonology of Gulf Arabic

Gulf Arabic is comprised of twenty-nine consonants (Holes 1990; Albaqawi 2017), as shown below in Table 1 and represented in standard IPA symbols. The table demonstrates both place and manner of articulation together with voicing. The leftmost sound is voiceless, whereas the rightmost one is voiced.

Table 1 Gulf Arabic phonemes: consonants

	Bilabial	Labiodental	Dental	Alveolar	Alveopalata	Palatal	Velar	Uvular	Pharyngeal	Glottal
Stop	b			t d tˤ[2] dˤ			K g	q		ʔ
Fricative		f	θ ð ðˤ	s z sˤ	ʃ			x ʁ	ħ ʕ	h
Affricate					dʒ					
Nasal	m			n						
Trill				r						
Approximate	w					y=j				
Lateral				l						

As shown in Table 1, GA exhibits three distinctive classes and has some typologically uncommon consonants (Almoaily 2013), including emphatic, uvular and pharyngeal consonants that do not appear in most languages. According to (Newman

[2] IPA Symbol "ˤ" is used to indicate an emphatic sound.

2002: 66), “Arabic is one of only thirty-five languages within UPSID[3] to have stop phonemes in five different places of articulation”.

The phonological system of GA does not include voiceless bilabial stop /p/, though some works on the phonology of Gulf Arabic, such as Qafisheh (1977) includes it as a phoneme in the inventory. Naess (2008) states that /p/ exists in specific loanwords borrowed from Persian. Daniels and Kaye (1997) claim that the voiced bilabial stop /b/ is devoiced in Arabic if it is followed by a voiceless segment. For instance, the speakers of Arabic pronounce the voiced bilabial stop in the word /kabs/ ‘push’ as a voiceless bilabial stop.

Moreover, the voiceless uvular stop /q/ is considered an unstable sound in many Arabic dialects. It can be realized as a voiced velar stop /g/, as in the word *gamar* ‘moon’ < *qamar,* or as /q/ (the latter being how it occurs in Classical Arabic/religious language), as in loan words that are borrowed from Classical Arabic (Qafisheh 1977), such as the word Qurʔaan ‘the Holy book for Muslims’ in which /q/ is preserved and pronounced as /qʊrʔa:n/.

As illustrated above in Table 1, GA has three unique emphatics and affricate phoneme, which are the so-called emphatic consonants /ðˤ, tˤ, sˤ/, and one affricate /dʒ/. This affricate exhibits phonological variation in most Gulf Arabic dialects (Albaqawi 2017), including Kuwait, Oman, and the United Arab Emirates. The consonant /dʒ/, for example, is realized as either /ʤ/ or /g/ or /j/. It is realized as /g/ in Oman, as in *gamal* < *ʤamal* ‘camel’, but realized as /j/ in Kuwait and the United Arab Emirates, as in *majlis* < *maʤlis* ‘guest room’. Nevertheless, the GA system differs from classical Arabic in the

[3] UPSID is a UCLA Phonological Segment Inventory Database that contains the sound inventories of 317 of the world’s languages.

emphatic consonants, in that the emphatic (voiced-alveolar-stop) /dˤ/ that occurs in classical Arabic has been lost from the inventory of GA. Naess (2008) argues that the disappearance of the emphatic phoneme /dˤ/ from GA resulted from the merger of /dˤ/ and /ðˤ/ due to the difficulty of the former's articulation, therefore becoming /ðˤ/.

As for vowels, the vowel system of Gulf Arabic lacks a unified description. Most researchers (e.g., Alghamdi 1998; Hassig 2011; Almisreb, Abidin & Tahir 2016) assign six monophthongal vowels that appear in short-long counterparts, /i, i:, a, a:, u, u:/, while others distinguish eight vowels /i, i:, e:, a, a:, o:, u, u:/ (Qafisheh 1977; Holes 1990) or 10 vowels, /i, i:, e, e:, a, a:, o, o:, u, u:/ (Johnstone 1967). The phonological contrast of Arabic vowels depends on the vowel quantity (Saadah 2011), and the vowel duration is contrastive, as is the case in other languages (e.g., Japanese, Malayalam, Urdu). Consider the following minimal pairs:

sab 'to curse' vs. *sa:b* 'to leave'

dam 'blood' vs. *da:m* 'to keep on' (Tsukada 2009: 129)

The variability in describing the inventory of vowels in Gulf Arabic might result from the regional dialects of Gulf Arabic spoken in different Arabian Gulf countries (i.e., Saudi Arabia, Oman, Qatar, etc.). Alghamdi (1998) conducted his study in the central part of Saudi Arabia, namely Riyadh. Holes (1990) conducted a study on GA spoken in Oman and United Arab Emirates. Qafisheh (1977) describes the GA spoken in Abu Dhabi (the capital city of United Arab Emirates), and Johnstone (1967) describes the GA spoken in Kuwait, Bahrain and Qatar. In Table 2 below, I present the vowels that are observed in most of the research on Gulf Arabic.

Table 2 Gulf Arabic vowels

	Front	Central	Back
High	i vs. i:		u vs. u:
Mid			
Low		a vs. a:	

Having described Gulf Arabic and its phonology, the next section addresses how the sociolinguistic situations and language contact in the Gulf area, and in particular, Saudi Arabia, could facilitate the pidginization process and therefore contribute to the emergence of Gulf Pidgin Arabic.

2.3 Sociolinguistic Situation and Pidginization in Saudi Arabia

Saudi Arabia, where my fieldwork data were collected, is one of the largest countries situated in Southwestern Asia. It has a total population of 20 million people occupying a total area of approximately 2,000,000 km^2. Geographically, Saudi Arabia is distinguished from other Gulf countries in terms of geographical location. It overlooks the Arabian Gulf to the East and the Red Sea on its western side. Additionally, it is bordered by Yemen and Oman to the south and Kuwait, Iraq and Jordan to the north, placing it directly in the middle of the Gulf countries. Saudi Arabia also is considered a crossroads for all the inhabitants of the Arabian Peninsula and the African continent since, as stated above, it overlooks the Red Sea, which is considered the natural barrier separating the Arabian Peninsula from the African continent. Therefore, overlooking the Red Sea and Arabian Gulf allows Saudi Arabia to control many important sea ports, which has been important in the development of the trade with the countries of the African continent and the Arabian Peninsula, as well as with many Asian countries.

With regard to its economy, after the discovery of oil in the Gulf region in 1938 (Bakir 2010), Saudi Arabia witnessed rapid changes to its economy and demography in a short period of time. According to CSC[4], Saudi Arabia has a strong petroleum-based economy and is ranked first in the world in oil reserves, production and export. It is considered an oil-rich Gulf countries, and it is one of the largest and fastest-growing economies in the Middle East. The strength of its economy makes it a strong economic force in the region and has helped Saudi Arabia to witness massive development and unprecedented prosperity through the development of large construction projects. The Saudi government wanted to increase the rates of economic growth, but it does not have the necessary national workforce to implement such huge projects. The national workforce at the time of economic growth in Saudi Arabia was quite small and did not have the required skills to accomplish these projects (Albaqawi 2017). In addition, the majority of the national labor force sought to work in administrative professions and office work in the governmental sector, refusing to work in the services sector or any low-income jobs like construction, agriculture, cleaning, wholesale, restaurants and fishing. Consequently, many kinds of employment that locals would not perform lead to an increased demand for foreign labor. Accordingly, many immigrant workers were hired from varying international and consequently linguistic backgrounds to work in different jobs. This significant development has caused a constant flow of immigrant labor into Saudi Arabia, and this number has been growing consistently for decades. Table 3 below

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[4] http://www.csc.org.sa/English/AboutKsa/SaudiEconomy/Pages/SaudiEconomyInWorldEyes.aspx retrieved in October, 2017. Council of Saudi Chamber (CSC).

displays the growth in the number of immigrant laborers during the years 1974-2010 (The Central Department of Statistics & Information in Saudi Arabia, 2014).

Table 3 Population growth of immigrant laborers in Saudi Arabia between 1974 and 2010

Year	1974	1992	2004	2010
Total of immigrant laborers	1.791105	4.638335	6.150922	8.429401

Table 3 demonstrates that the total number of foreign workers in Saudi Arabia in 1974 was roughly 1.8 million, whereas by 2010, that number had increased to 8.4 million workers, which amounts to nearly 44 percent of the local population. These immigrant workers come from varying linguistic backgrounds and speak different languages. This diverse linguistic background, with no language in common, encourages the formation of a new variety (e.g., pidgin) with which the community is able to communicate. There are some essential factors that have contributed to the emergence of pidgin in Saudi Arabia, such as a continual influx of expatriates, a social gap between local speakers and expatriates, and linguistic diversity among expatriates.

One of the main reasons for the flow of immigrant workers is the deterioration of the living and economic situation of the workers' countries. Albaqawi (2017) mentions that most immigrant workers in the Gulf area come from the Indian subcontinent and are regarded as Asian migrant workers. These workers come primarily from India, Nepal, Pakistan, Bangladesh and Sri Lanka. Albaqawi also states several reasons for the existence of the large number of Asian workers in the Gulf area, including the geographic proximity between the Gulf area and South Asian countries and the fact that the Gulf-area governments are targeting Asian workers because they are inexpensive.

The different cultures and social distance between dominant and non-dominant groups lead to the genesis of pidgins. Alghamdi (2014: 114) states that the immigrant workers in the Gulf countries “are kept socially distanced from the locals”. Accordingly, the two groups (immigrants and locals) have little contact, usually limited to business affairs (Neass 2008). Naess claims that the native residents do not admit the immigrant workers fully into the Arabic language community and that Arabs tend to use a simpler register to communicate with non-dominant groups. Therefore, the immigrant workers might not make an effort to learn the language of the host country, and thus, they tend to use a simplified and reduced variety of the dominant language (Arabic) for communication.

The linguistic diversity in Saudi Arabia, also plays a role in the development of new varieties/pidgins. The immigrant workers in Saudi Arabia, as previously mentioned, have been hired from varying linguistic backgrounds and speak different languages, such as Urdu, Malayalam, Bengali, Indonesian, Tagalog, and many others. The constant contact among the immigrant workers, as well as the presence of diverse linguistic backgrounds with no language in common, encourages the formation of a new variety for oral communication.

In short, prior economic factors and the geographical location of Saudi Arabia, together with the influx of a great number of expatriates, social distance and linguistic diversity, combine to encourage pidginization, and this incorporation of differing backgrounds has promoted the development of a new pidgin, namely Gulf Pidgin Arabic (GPA). The next section defines this variety (i.e., GPA) and discusses its phonological features, particularly its vocalic and consonantal inventory.

2.4 Gulf Pidgin Arabic

The term "pidgin" as defined earlier, is a new and reduced variety used in a place where two or more groups of speakers from different linguistic backgrounds, not sharing a common language, come into regular contact in the same geographical region (Sebba 1997; Holm 2000; Almoaily 2013). Based on this definition, and on other factors such as different cultures, social distance and inhabitance movement for work purposes, the Gulf area in general, and Saudi Arabia specifically, are typical places for a pidgin language varieties to arise. Almoaily (2013) mentions that the new and reduced variety that has emerged in the Arab Gulf came into being when Asian immigrant workers, as well as other immigrant laborers with different linguistic backgrounds, came to work in various countries in the area and, subsequently, came into contact with the Arabic-speaking community. After constant contact between those groups (i.e., local and immigrant workers), these groups found themselves in need of a means of communication, thereby the contact produced the conditions for the formation of a simplified variety of Gulf Arabic, namely Gulf Pidgin Arabic.

The development of Gulf Pidgin Arabic (GPA) is little-documented, as is common with most pidgin languages, and there is no clear-cut evidence elucidating the early stages of GPA. Bakir (2010) and Bassiouney (2010) speculate that the initial stages of GPA occurred with the influx of immigrant workers into the Gulf area (i.e., Saudi Arabia, Qatar, Kuwait, Bahrain, and Oman) who came to work in the oil industry after the discovery of oil in the Gulf region in 1938. According to the linguistic characteristics of pidgins described in 1.3 as well as the sociolinguistic situations discussed in 2.3, most scholars conducting research on the Arabic pidgin (e.g., GPA), including Smart (1990), Wiswall (2002), Neass (2008), Bakir (2010), and Almoaily (2013), consider GPA to be a pidgin used as a lingua franca between the immigrant workers and the native Arabic-speaking community in the Gulf countries.

The literature on Arabic pidgins employ different names for this pidgin (i.e., GPA) depending on where this variety is spoken or depending on the substrate language or the origin of speakers. The following studies consider this pidgin to have appeared in Saudi Arabia, although they use varying names for it. Al-Moaily (2008a) chooses the term Urdu Pidgin Arabic, Al-Azraqi (2010) chooses Gulf Asian Pidgin, and Alshammari (2010), Albakrawi (2012) and Al-Zubeiry (2015) term it as Saudi Pidgin Arabic. On the other hand, most works, such as those by Smart (1990), who studies the pidgin in the United Arab Emirates, Wiswall (2002) in Kuwait, Neass (2008) in Oman, Bakir (2010) in Qatar, and Almoaily (2013) in Saudi Arabia, refer to this pidgin as Gulf Pidgin Arabic, regardless of where it is spoken. Avram (2014) mentions that the term GPA refers to any Arabic pidgin spoken in the Gulf area, since the other terms occurring in the literature (e.g., Saudi Pidgin Arabic or Omani Pidgin Arabic) are frequently compiled together under the term GPA. Moreover, I argue that utilizing the term GPA to refer to any Arabic pidgin spoken in the Gulf area is reasonable for two reasons. First, there are no meaningful linguistic differences between the different varieties of GA, save for slight phonological differences. Second, as previously stated in 2.3, the work conditions and geographical origin that these speakers have in common suggest that any Arabic pidgins spoken in the Gulf region will have much more in common than not. Accordingly, I have chosen the term GPA to represent the variety involved in this dissertation and will be referring to the speakers participating in this dissertation as "GPA speakers" throughout the rest of this dissertation.

The next section addresses the consonantal system of GPA as found in the current study and other studies (Neass 2008; Albaqawi 2017). The section also presents a brief summary of the inventory of the vowel system in GPA, as demonstrated in Neass's work, although further discussion is beyond the scope of this dissertation.

2.4.1 Phonological Description of GPA

Generally speaking, a pidgin language differs from its lexifier at most linguistic levels (i.e., syntactic, phonological, morphological and lexical). It tends to be a simplified version of its lexifier in most linguistic aspects. This section is dedicated to describing the phonology of GPA, particularly the inventory of consonants. Both GA (lexifier) and GPA are distinct from one another in terms of the phonological dimension. Holm (1989) mentions that universals play a significant role in shaping pidgin phonology. One of the common characteristics in the phonology of pidgin is that pidgins have a reduced inventory of phonemes compared to their lexifiers. This reduction is mainly attributable to the highly marked sounds (i.e., less common in the world's languages and typically more difficult to pronounce) that have been substituted by the closest equivalents in the substrate languages. Table 4 below demonstrates the reduced consonant inventory of GPA, which shows that GPA comprises 18 consonants as opposed to 29 consonants of the lexifier (GA).

Table 4 Gulf Pidgin Arabic phonemes: consonants (Neass, 2008:43; Albaqawi, 2017:270)

	Bilabial	Labiodental	Alveolar	Alveopalatal	Palatal	Velar	Glottal
Stop	p b		t d			k g	
Fricative		f	s z	ʃ			h
Affricate				dʒ			
Nasal	m		n				
Trill	w		r				
Approximate					y=j		
Lateral			l				

Universally, the common consonants in the world's languages are preserved in pidgin and creole languages (Holm 1989). Maddieson and Ladefoged (1996) claim that most, if not all, languages contain the following stop consonants: bilabial /b/, alveolar /t, d/ and velar /k, g/. This is the case in Gulf Pidgin Arabic (Table 4), which includes all the previous common consonants, and all GPA speakers realize them with ease regardless of their different substrate languages (Neass 2008). Table 4 illustrates that the consonant inventory of GPA has undergone a notable reduction, given that the marked consonants of Arabic are either replaced or lost (Almoaily 2013; Salem 2013). The GPA consonants include most of the other GA consonants (Table 1), except the following marked consonants: emphatic consonants /tˤ, dˤ, sˤ/, uvular stop /q/, dental fricatives /θ, ð/, uvular fricative /x, ʁ/ and pharyngeal fricatives /ħ, ʕ/. These uncommon consonants do not appear in the GPA speakers' substrates, and thus, the speakers tend to replace them with the closest counterparts in their substrate languages. In the replacement process, GPA frequently substitutes the emphatic consonants with their non-emphatic counterparts. Neass (2008) states that the emphatic / tˤ/ is replaced with voiceless alveolar stop /t/. For example, the GA words ***tˤ**amat**ˤ*** 'tomato' and *pa**tˤ**a**tˤ**is* 'potato' as in (1) below, appeared in the dialogue of S5 as ***tamat*** and *pa**t**a**t**is* when he talked about his job in his home country.

(1) ʔana ʃugul mazrʔah sawwi **tamat** **patatis**

I work farm make tomato potato

'I work on a farm and plant tomatoes and potatoes'

As shown by the example in (1), the GPA speaker replaced the marked emphatic sound /tˤ/ with the closest equivalent, /t/, which occurs in his substrate language (Malayalam). According to Neass (2008), the emphatic consonants lose their emphatic traits in the speech of GPA speakers. Thus, when the emphatic feature is lost, the consonant shifts to its plain counterpart. Neass (2008) also states that, in GPA, the emphatic fricative /sˤ/ is frequently replaced with /s/, and this was also found in the current data when S30 answered the question 'What size is your city?.' S30 replaced the emphatic consonant (voiceless-alveolar-fricative) /sˤ/ with the plain voiceless alveolar fricative /s/, as shown in the word ***s**agir* 'small' < GA **sˤ***aʁir*. In regard to the emphatic consonant (voiced dental fricative) /ðˤ/, this consonant is realized by GPA as /d/ (Neass 2008). The current data show that the emphatic voiced dental fricative /ðˤ/ has variations and is pronounced by GPA as either /z/ or /d/. The consonant /ðˤ/ is replaced by the voiced alveolar fricative /z/, as in the word *nazif* 'clean' < GA *na**ð**ˤif,* which appears in the context of S33 when he answered the question 'Why did you choose this apartment?'. The shifting of /ðˤ/ to /d/ is also seen in the context of S11 when he was asked about his next trip to his country. This is shown in the version of GA *Rama**ð**ˤan* 'The Holy month for Muslims', as in (2) below:

(2) ʔana safar gabul Rama**d**an

I travel before Ramaðˤan

'I will travel before Ramadan [The Holy Month for Muslims]'

The variable realizations of the emphatic voiced dental fricative /ðˤ/ as either /z/ or /d/ are caused by the influence of speakers' substrate languages (Avram 2010). S33 (an Urdu speaker) shifted /ðˤ/ to /z/ because /z/ is the nearest equivalent in his substrate language. In contrast, S11 (a Malayalam speaker) shifted to /d/ rather than /z/ because this sound is not part of the phonological in the inventory of Malayalam. Instead, it is shifted to /d/, which is the closest counterpart in the inventory.

Neass (2008) mentions that the GPA speakers, in most cases, substitute the dental fricatives /θ, ð/ with the alveolar stops /t, d/, respectively. She demonstrates these replacements using the words *tani* < GA *θani* 'second' and *hada* < GA *haða* 'this'. The uvular fricatives /χ, ʁ/ and uvular stop /q/ are replaced with the voiceless velar stops /k/ or /g/. The last replacement considers the pharyngeal consonants /ħ, ʕ/. Neass (2008) states that the sound /ħ/, as in the GA word *ittiħaad* 'unity' is realized in GPA as /h/. However, the sound /ʕ/ is either replaced with the glottal stop /ʔ/ or deleted, as in *maʔluum* < GA *maʕluum* 'known' or deleted, as in *ʕarabi* for *arabi* 'Arabic'.

Concerning vowels, pidgins have reduced vowel inventories compared to their lexifiers, and ranging from five to eight vowels (Klein 2006). However, in most cases, pidgins consist of the following five vowels, /i, e, a, o, u/, as found in Juba Arabic, Kituba and Kinubi (Sebba 1997; Klein 2006; Özüorçun 2014). Klein (2006) claims that most, if not all, pidgins consist of the most frequent vowels in the world's languages (e.g., /i/, /a/, /u/). This is also the case in Gulf Pidgin Arabic, which also includes all the previous common vowels. Neass (2008) found that reduction appears in the inventories of GPA vowels. Table 5 below exhibits a brief summary of the inventory of the vowel system in GPA.

Table 5 Summary of the vowel inventory system of Gulf Pidgin Arabic

	Front	Central	Back
High	i		u
Mid	e		o
Low		a	

Table 5 demonstrates that the vowel system of GPA is reduced compared to its lexifier (GA), as it comprises five vowels as opposed to the eight vowels, /i, i:, e, a, a:, o, u, u:/, of the lexifier (GA). The table also lacks the vowel distinction that occurs in GA. The speakers of GPA are influenced by their L1s, and this is evidenced in their vowel length. The vowel length of GA is neutralized by GPA speakers. For instance, the words *gul* 'say

IMP' vs. *gu:l* 'said' carry the same meaning among GPA speakers. Thus, the absence of the phonemic length in the speakers' L1 results in reduced vowel inventories in GPA.

As shown above, there are some examples that demonstrate the influence of substrate languages on the realization of Arabic consonants, especially those that do not exist in the speakers' substrate language. This means that considering the substrate languages of pidgin speakers is helpful in determining L1 influence when approaching pidgins. The current study, as stated in 1.6, considers the patterns in the production and variation of marked consonants of Arabic from a corpus of GPA speakers whose substrate languages include Malayalam and Urdu. Therefore, describing the phonology of the substrate languages (i.e., Malayalam and Urdu), as I will address in the next chapter, will enable me to determine if there is a potential influence of L1 on the realization of Arabic consonants.

CHAPTER 3

SUBSTRATE LANGUAGES UNDER INVESTIGATION

This chapter addresses the phonology of the substrate languages of Gulf Pidgin Arabic (GPA) investigated in this dissertation: Malayalam and Urdu. The chapter begins with a brief introduction to Malayalam and Urdu as substrate languages and also a description of their consonantal systems. This chapter concludes with the similarities/differences between the substrate and superstrate languages to determine how the substrate languages may have a potential effect on the production and variation of marked Arabic consonants in the speech of GPA speakers.

3.1 Substrate Language

The substrate language is the non-dominant language or the language of the powerless in a language contact situation (Bell 2013), whereas the superstrate language/lexifier is the dominant language (i.e., the language spoken by a prestige group) on which pidgin is mainly based (Almoaily 2013). Almoaily states that GPA emerged from a varied linguistic situation that involves several substrate languages, such as Malayalam, Urdu, Indonesian, Pashtu, Tagalog and Bengali. This linguistic diversity in Saudi Arabia might be a source for potential linguistic variation in the speech of GPA speakers at most linguistic levels, particularly at the phonological level, on which this dissertation tends to focus its investigation in the subsequent chapters. The present study addresses only speakers from India who speak a Dravidian language (in this case, Malayalam) as their L1 and speakers from Pakistan whose L1 is Urdu. The reason for selecting Indian and Pakistani speakers in this dissertation to represent GPA speakers in Saudi Arabia is because the overwhelming majority of immigrant workers are from India and Pakistan. According to The Ministry of Labor and Social Development in Saudi Arabia[5] (2016), Indian and Pakistani people are the two largest groups of immigrants in Saudi Arabia, with a total population of 2.1 million and 1.8 million, respectively. On the other hand, the lexifier language in the present study, as mentioned above, is Gulf Arabic. Some researchers, e.g., Smart (1990), Almoaily (2013), Alghamdi (2014), and Neass (2008) use "Gulf Arabic" to refer to the lexifier language, while others, e.g., Salem (2013) and Al-Zubeiry (2015) use "Arabic." Therefore, to avoid confusion, I will consider both "Gulf Arabic" and "Arabic" interchangeably to refer to the lexifier/superstrate language of GPA.

3.1.1 Malayalam

Malayalam is a Dravidian language, which is the official language in a state of India called Kerala, which is a state with 14 districts that is located in the southwest region of India. According to AWL[6], Malayalam is considered the language of government, media and trade, specifically after India's independence from British rule in 1947. More than 37 million speakers speak it as a mother tongue. Malayalam is also referred to by some other names: Malayalani, Malayali, and Malean (Jiang 2010). Unlike other Indian states, Kerala is linguistically homogeneous (Asher & Kumari 1997).

Malayalam differs from other Dravidian languages (e.g., Tamil, Kannada) in that it is significantly influenced by Sanskrit, specifically at the phonological level. Such influence results in increasing the number of distinctive segments in Malayalam (Asher &

[5] https://mlsd.gov.sa/en/node retrieved in November 2016
[6] AWL (About World Languages) http://aboutworldlanguages.com/malayalam in November 2017

Kumari 1997). Table 6 below illustrates the Malayalam consonantal inventory, based on Mohanan (1984), involving 8 places of articulation and 7 manners of articulation.

Table 6 Malayalam phonemes: consonants

	Bilabial	Dental	Alveolar	Palato-alveolar	Retroflex	Palatal	Velar	Glottal
Stop	b p b^h p^h	t̪ d̪ t̪^{h} d̪^{h}	t	tʃ dʒ tʃ^h dʒ^h	ʈ ɖ ʈ^h ɖ^h	K’ g’ K’^{h} g’^{h}	k g k^h g^h	
Fricative			s		ʂ			h
Nasal	m	n̪	n	ɲ	ɳ	Ŋ’	ŋ	
Lateral			l		ɭ			
Tap			r					
Approximate					ʐ			
Glide	w					y=j		

Table 6 shows that Malayalam comprises 41 consonants. The table shows most of the common consonants in the world languages including the voiceless stops /p, t, k/, nasals /m, n/ and the lateral /l/. Mohanan (1984) also points out that stops and nasals in Malayalam are complicated due to their appearance in seven different places of articulation, including bilabial, dental, alveolar, palato-alveolar, retroflex, palatal and velar. In addition, Malayalam differs from languages that have aspirated sounds as allophones (e.g., English). The aspirated stops, as the table demonstrates, occur in most places of articulation and show a distinction from unaspirated ones, meaning that Malayalam has aspirated stops as distinctive segments, for instance, /k/ vs. /k^h/ kaɾ^{j}anam 'because' k^hananam 'digging' (Jiang 2010: 9). In sum, the table 6 did not display any of the target consonants for the current study.

3.1.2 Urdu

Urdu belongs to an Indo-Aryan language that is spoken officially in Pakistan. It is widely spoken there and is also found in a wider distribution in other parts of the world. According to Ethnologue[7] (2017), Urdu is a widespread language that is also spoken in many other countries, including India, Bangladesh, South Africa, Nepal and Mauritius, with a total of approximately 163 million speakers. It is spoken as a mother tongue by 69 million speakers and by 94 million speakers as an L2. Schmidt (1999) mentions that Urdu is used as a common language between speakers from the Indian subcontinent residing in the Middle East or Europe. Rahman (2008) points out that its wide spread, particularly in South Asian countries, because Urdu was considered a part of Muslim identity in the Indian subcontinent and nearby areas prior to British colonisation. As with most languages, Urdu has also been influenced by Arabic and Persian lexically, morphologically and orthographically, in that it has similar script to that used by Arabic, and the majority of its vocabulary is transmitted from Arabic (Almoaily 2013). Therefore, such influence of Arabic might provide a potential effect on the Urdu speakers included in this dissertation, particularly in the realization of Arabic consonants such as uvular

[7] https://www.ethnologue.com/language/urd Retrieved in November 2017

fricatives. Phonologically, Urdu lacks a unanimous description when assigning consonants. Kachru (1990) and Siddiqi (2001) assign 37 consonants, Hussain (1997) 36 consonants, and Khan (1997) 42 consonants. Table 7 below illustrates the consonantal inventory of Urdu based on Siddiqi (2001).

Table 7 Urdu phonemes: consonants

	Bilabial	Dental	Labio-Dental	Alveolar	Retroflex	Palatal	Velar	Uvular	Glottal
Stop	b p bʰ pʰ	t̪ d̪ t̪ʰ d̪ʰ			ʈ ɖ ʈʰ ɖʰ	tʃ dʒ tʃʰ dʒʰ	k g kʰ gʰ	q	
Fricative			f	s z		ʃ ʒ		x ʁ	h
Nasal	m	n							
Lateral				l					
Flap					ɽ ɽʰ				
Trill				r					
Glide	w					y=j			

As shown in the previous table, Siddiqi (2001) proposes that Urdu comprises 37 consonants, including the common consonants (i.e., /p, k, g, m, n, l/). Moreover, it includes distinctive aspirated bilabial, dental, retroflex, palatal and velar consonants. As mentioned above, Urdu has been influenced by Arabic and Persian in most linguistic aspects (i.e., morphological, lexical, etc.). Nevertheless, there exist certain Arabic-Persian consonants that were transmitted to Urdu. Despite the heavy borrowing from Arabic-Persian, Urdu did not borrow a large number of Arabic sounds as phonemes. Beg (1988) states that there are Perso-Arabic consonants that were transmitted to the Urdu consonantal system such as /f, z/. Moreover, Urdu retained some marked/uncommon consonants that also occur in Arabic, such as uvular stop /q/ and uvular fricatives /x, ʁ/. Although Urdu did not borrow many Arabic-Persian consonants as phonemes, it kept their written forms in its conventional spelling system. For instance, Urdu did not adopt the alveolar emphatic consonant /tˤ/ that is found in Arabic as a phoneme, but it retained its written form of Arabic scripts. That is, the Arabic lexicons that are transmitted into Urdu are not written with Urdu orthography. Instead, they are written with Arabic orthography.

Overall, based on Table 7, the consonantal systems of Urdu can be recapped in terms of their manner of articulation as follows: Urdu contains 21 stops, 8 fricatives, 2 nasals, 1 lateral, 2 flaps, 1 trill, and 2 glides. The table also displays two target consonants for the current study (i.e., /x, ʁ/).

3.2 Similarities/Differences between the Substrate and Superstrate Languages

According to a survey conducted of consonant inventories in Arabic (Table 1), Malayalam (Table 6) and Urdu (Table 7), it turns out that Malayalam, Urdu and Arabic reveal some similarities and differences in their consonantal inventory. The following diagram demonstrates the sounds that occur in all these languages, as well as the sounds that are absent in one or two languages while existing exclusively in the other, and so on.

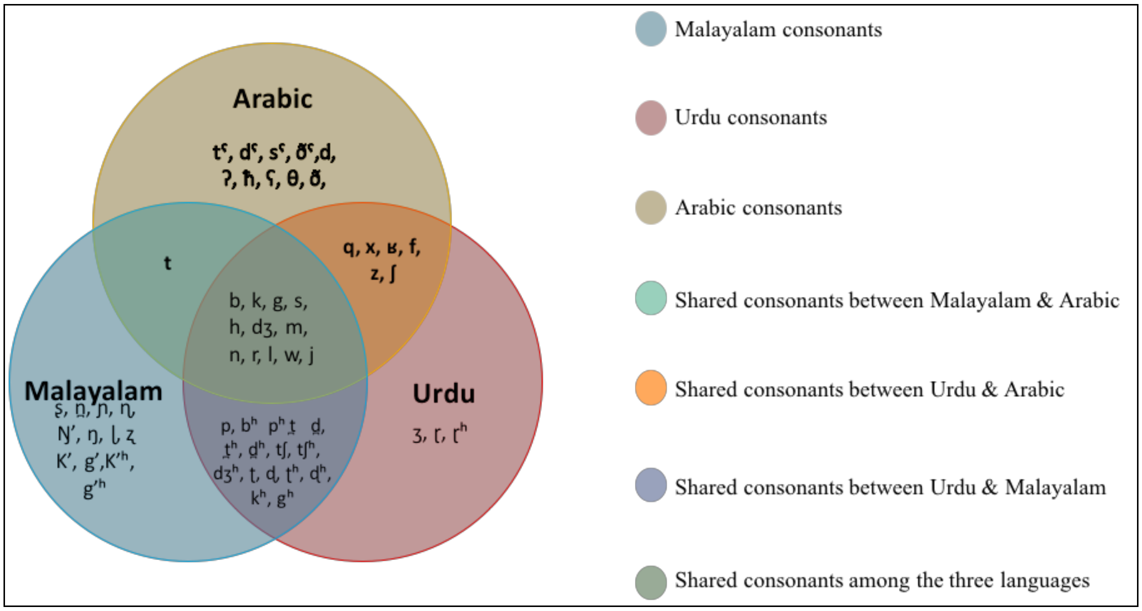

Figure 1. Diagram of shared consonants in languages examined.

The description illustrated in the diagram above shows that the languages under investigation (i.e., Arabic, Malayalam, and Urdu) all contain the following consonants in their phonological systems: the stops /b, k, g/; fricatives /s, h/; affricate /dʒ/; nasals /m, n/; trill/tap /r/; lateral /l/; and glides /w,j/. However, there are some segments that are exclusively found in a specific language and not in the other investigated languages of this study. For instance, Malayalam is characterized by the existence of a complicated set of nasal consonants, since they are articulated in different places of articulation (e.g., dental, palato-alveolar, retroflex, palatal, velar nasals), yet these categories of consonants do not appear in either Arabic or Urdu. Arabic, on the other hand, features some consonants that are typologically uncommon, such as the emphatic/pharyngealized consonants /tˤ, dˤ, sˤ, ðˤ /, uvular stop /q/ and dental, uvular and pharyngeal fricatives /θ, ð/, /x, ʁ/ and /ħ, ʕ/, respectively. Unlike Malayalam, which does not contain any of the previous uncommon consonants, Urdu contains the uvular stop and the uvular fricatives

/x, ʁ/. Therefore, if we compare the consonantal inventories of both Urdu and Malayalam to that of Arabic, we notice that Urdu and Arabic share several consonants that do not occur in Malayalam. The following consonants occurred in both Arabic and Urdu: /q, f, z, x, ʁ/. From these consonants, the uvular fricatives /x, ʁ/, as mentioned in Chapter One, are under investigation in this dissertation. Therefore, the Gulf Pidgin Arabic speakers, specifically those for whom Urdu is their substrate language, are expected to realize the target consonants of Arabic /x, ʁ/ with more accuracy than the Malayalam speakers do.

Such a comparison between the lexifier (Gulf Arabic) and the investigated substrate languages (Malayalam and Urdu) in a consonantal inventory may play a role in determining if there is a possibility of an L1 influence/transfer from GPA speakers, particularly in the initial stage, on the realization and variation of Arabic marked consonants. That is, the occurrence or absence of consonants in these languages determine if the speakers of GPA apply their L1's phonology to produce the sounds of the target language. Applying an L1 in performing an L2 can be approached under a process of a second language acquisition, namely, transfer (i.e., a linguistic element transmitted from language to language). The next chapter reviews some general literature on Arabic-based pidgins and their phonological changes, as well as other issues related to L2 phonology (i.e., transfer). Moreover, it discusses some factors that may influence the realization of Arabic marked consonants (i.e., age, LOR and so on).

CHAPTER 4

LITERATURE REVIEW

The chapter reviews the literature related to the arguments pertaining to this dissertation. The chapter begins with a description of the common African and non-African Arabic-based contact languages that have been discussed in the literature, including Juba Arabic, Nubi Arabic, and Bongor Arabic, as well as the recent pidgins occurring in the Gulf area (i.e., Gulf Pidgin Arabic). This is followed by a discussion of the phonological change in Arabic pidgins, particularly the changes that have appeared at the consonantal level. The chapter also discusses the influential factors, as found in the extant literature of L2 phonology (i.e., transfer, similarities and differences in L1 and L2, and markedness/difficulty), that lead to variability in speakers' performance in the target language. This is followed by a discussion of certain factors adopted in the current study (i.g., age, LOR and amont of exposure). Finally, the chapter concludes by addressing the key concepts of the variationist approach adopted in the analysis of this dissertation.

4.1 Review of Arabic-based Contact Languages

Arabic-based pidgins are not as widespread as other pidgins, such as English-based pidgins (Versteegh 1984). Versteegh discusses the history of Arabic and the process of pidginization, which was followed by creolization and then decreolization. Arabic pidgins were initially found only in Africa. Versteegh speculates that this limited appearance is because the Arab communities lived in isolation at the time of the pidgin languages' emergence and consequently failed to spread the use of Arabic. The Arabic language reached Africa after the spread of Islam in the 700s, which in turn resulted in the appearance of restructured forms of Arabic. Thus, Arabic, as well as its restructured forms, was considered as the primary language of religion and trade in Africa (Versteegh 1984; Holm 1989). In the 1800s, the Ottoman Empire spread to the eastern parts of Africa, and such expansion promoted the emergence of Arabic-lexified contact languages.

The most established contact languages of Arabic occurred in Africa, including Juba Arabic, Nubi Arabic, and Bongor Arabic. The verities (e.g., Juba and Nubi Arabic) emerged in South Sudan as a result of direct contact between Sudanese and other speakers of African languages (Manfredi & Petrollino 2013; Albirini 2016). Some scholars, such as Miller (2006) and Manfredi and Petrollino (2013), refer to these languages as military lingua franca, as they resulted from the relationship between the Arab soldiers and traders and speakers of Africa. At present, none of the speakers of Sudanese Arabic can understand these varieties, although they were initially lexified by Sudanese Arabic (Miller 2006). In contrast with the past, they are now spoken in different geographical distributions. For example, Juba Arabic is spoken in South Sudan, whereas Nubi Arabic is spoken in Tanzania and Kenya. Bongor Arabic, as will be discussed below, emerged in Chad as a trade pidgin and was lexified by Chadian Arabic. In contrast, non-African Arabic lexified pidgins have recently emerged in the Gulf area and some parts of the Middle East as workforce pidgins. For instance, Gulf Pidgin Arabic is now spoken in the Gulf countries after constant contact between the Arabic-speaking locals and immigrant workers of the Indian subcontinent (see Almoaily 2013), Romanian Pidgin Arabic was spoken in Iraq by Romanian and Arab oil workers (see Avram 2010), and Madame Pidgin is spoken in Lebanon between female Sinhala speakers and their Lebanese Arabic employers (see Bizri 2010). For the purpose of this dissertation, which aims to investigate the realization and variation of the marked consonants of Arabic in the speech of Gulf Pidgin Arabic speakers, the next section reviews the literature regarding the phonological system of the common African and non-African Arabic pidgins (Juba, Nubi and Bongor Arabic vs. Gulf Pidgin Arabic) as they relate to consonants. Therefore, describing the phonology of the Arabic pidgin varieties from separate substrate languages determines whether or not these varieties mostly show identical phonological variation on the realization of Arabic consonants, and may also clarify any potential influence of substrate languages on the production of Arabic consonants.

4.1.1 Review of Phonological Change in Arabic-based Pidgins

Typically, pidgins/creoles evolve in different situations (i.e., in a plantation or trade or military situation), meaning that the pidgin/creole arises from separate substrate and superstrate languages depending on where it emerges, and in most cases, the substrate or superstrate languages or both may influence the structures of the contact languages (pidgins/creoles). That is, African and Indian subcontinent languages (substrate languages) have played roles in shaping the structures of these Arabic pidgins. Therefore, the influence of the substrate or superstrate languages may lead to linguistic diversity in the speech of pidgins/creoles speakers. The speakers of African and non-African Arabic-lexified pidgins may vary in realizing some Arabic consonants and exhibit different variation depending on their substrate languages. The subsequent sections describe the literature regarding the Arabic consonantal realization in the speech of African and non-African Arabic pidgin speakers.

To begin, Juba Arabic is a pidgin that was lexified by Sudanese Standard Arabic (Manfredi & Petrollino 2013). Versteegh (1984) points out that this variety was used as a lingua franca, particularly in South Sudan, between the people of Juba and the multilingual Ottoman army. More specifically, it appeared in the military camps while the region was under the control of the Ottoman Empire. It is still spoken as a pidgin variety by approximately 44,000 people (Almoaily 2013). Similar to other pidgins around the world, Juba Arabic has a reduced system at most of its linguistic levels compared to its lexifier and shares the typological characteristics of pidgin, as described earlier in 1.3. For instance, at the phonological level, Manfredi and Petrollino (2013: 55) list some of the linguistic characteristics that are absent in Juba Arabic but appear in its lexifier (Sudanese Arabic). For instance, gemination and pharyngealization are lost in Juba Arabic, meaning Juba Arabic comprises a reduced system in its consonantal inventory. Manfredi and Petrollino (2013) assign 17 consonants, stating that it contains most common consonants appearing in the world's languages, such as the stops /b, t, d, k, g/ and nasals /m, n/ and glides /w, j/, and so on. However, the speakers of Juba Arabic show phonological variations between the Arabic consonants /s/ and /ʃ/. They realize the Arabic word *ʃokol* 'work' as *sokol*. In addition, the fricative uvular /x/ and /ʁ/ mostly merge with /*k* or *h*/ and /g/, as in the word *xamsa* 'five,' which is rendered in Juba Arabic as *kamsa* or *hamsa*. Juba Arabic lasted and was spoken for years until it became more stable, leading it to display typical features of creoles (i.e., having native speakers). Thus, Juba Arabic was nativized, which in turn resulted in the development of a creole variety, namely, Nubi Arabic.

Nubi or Ki-Nubi Arabic is recognized as an Arabic creole and is considered by most Arabic-based pidgin/creole literature the only modern Arabic creole that emerged from the pidginized variety Juba Arabic. Its decreolization was due to increased exposure to Standard Arabic (Versteegh 1984; Wellens 2003; Bakir 2010; Almoaily 2013; Manfredi & Petrollino 2013). Nubi is an Arabic-based variety, as it derived most of its lexicon and morphology from Arabic (lexifier/source language). Furthermore, it has been categorized as a creole because it is acquired by children and because a large number of its structural characteristics match the key features of creoles. Currently, Nubi is spoken in some parts of Kenya, Tanzania, and Uganda by more than 25 thousand speakers (Luffin 2002; Wellens 2003). Nubi Arabic was initially used in a military situation, and most of the Nubi Arabic speakers descended from multi-ethnic groups of African soldiers enlisted by the Egyptian ruler Mohammad Basha when he conducted his military activities in East Africa in the early nineteenth century. Initially, Arabic (Nubi's lexifier) was mainly used as a lingua franca for mercantile affairs in Sudan, and later on, the Arabic language made its way towards the military camps in southern Sudan, as well as through merchants in southern provinces of Sudan. The Arabic-speaking soldiers and merchants continued using a simplified version of Arabic when they spoke with their subordinates, and this promoted the development of Nubi Arabic (Wellens 2003).

With respect to its phonology, Nubi Arabic, to a large extent, is similar to Juba Arabic in that it has a reduced phonological system. Nubi Arabic comprises 23 consonants (Owens 1991), including the typical phoneme inventory appearing in most languages (e.g., /b/, /t/, /k/, /m/, /n/, /w/, /j/). However, Nubi Arabic does not contain the less common phonemes (e.g., pharyngealized and uvular phonemes). Such marked phonemes occurring in the lexifier were subjected to linguistic simplification by the Nubi speakers' replacement processes. Maddieson and Disner (1984: 25) state that segment substitution occurs commonly among speakers, especially those who acquire a new segment that does not exist in their own language. The substrate languages of Nubi Arabic (i.e., African languages) lack pharyngealized and uvular consonants, and thus it is not surprising that these sounds were subjected to replacements, as was the case in Juba Arabic and other pidgins and creoles. The uvular fricatives /x/ and /ʁ/ were substituted for the velar stops /k/ and /g/, while the pharyngealized consonants lost their phonetic features (i.e., pharyngealization) and were rendered as plain consonants. Thus far, based on the descriptions mentioned above, both Juba Arabic and Nubi Arabic are similar to one another in their phonology and source language (i.e., Sudanese Arabic) and are mostly used in similar circumstances, such as military situations.

The last Arabic-based contact language occurring in Africa is Bongor Arabic, which, unlike Juba and Nubi Arabic, is used largely in trade situations. Bongor Arabic, or Turku, is another Arabic pidgin spoken in Chad, particularly in Eastern Chad (Almoaily 2013). This variety is considered a trade pidgin that resulted from the continual interaction and contact between the people of Chad, who originally spoke Niger-Congo and Chadic languages, and Arabic-speaking traders in the 19th and 20th centuries. As stated above, Bongor Arabic differs from Juba and Nubi Arabic regarding emergence and source language. Juba and Nubi Arabic were mainly lexified by Sudanese Arabic and emerged in military situations, whereas Bongor Arabic was lexified by Chadian Arabic and developed as a trade pidgin. Nevertheless, Bongor Arabic resembles Juba and Nubi Arabic in some of its linguistic features. Khan et al. (2012) point to common characteristics among these contact languages in most linguistic aspects. For instance, at the level of phonology, all these Arabic-based varieties have a reduced phonological system resulting from the absence of several Arabic phonetic/phonological features. For instance, they lack gemination (i.e., consonant doubling) and vowel length. Moreover, the reduced system of the phonology results from the disappearance or modification of some of the Arabic consonants by replacing the pharyngeal/emphatic consonants with their non-pharyngeal/emphatic counterparts in the speakers' L1. However, Bongor Arabic is distinguished from the other two Arabic-lexified varieties in some Arabic consonant realizations. Bongor Arabic speakers tend to replace the Arabic consonants /f/ and /t/ with /p/ and /d/, resulting from the influence of substrate languages of Bongor Arabic speakers.

In short, the three African Arabic-based pidgins/creoles described above are the most established African Arabic-based pidgins, compared to the more recently established Arabic pidgins in the Gulf area. Moreover, it is shown that Juba and Nubi Arabic are more closely related to one another than to Bongor Arabic. Bongor Arabic differs from the other two varieties with respect to several phonological processes, and a large part of its lexicon is also linked to Chadian Arabic.

The Arabic pidgins, on the other hand, particularly those that emerged in the Gulf areas or in other parts of the Middle East, have developed more recently and also go by varying names. The term GPA, as stated above, will be used to refer to these Arabic pidgins, specifically those arising in the Gulf area or in the Middle East, regardless of where they are spoken.

The Arabic pidgin studies discussed below were conducted in different Gulf countries (e.g., Saudi Arabia, UAE, Oman, etc.). The social situation in which immigrant speakers appear is a significant factor in developing Arabic pidgins. The social environments in the Gulf countries are similar. Al-Ageel (2015: 113) states that the social life in these countries was affected by the increasing development after the discovery of oil in the 1930s. Such a growth in the Gulf countries enticed immigrant workers, especially those with poor living conditions in their own countries, to come to the Gulf area and work there for several years. The immigrant speakers come from different linguistic backgrounds and are in need of a common means of communication.

The development of these Arabic pidgins is significantly linked with social dimensions (i.e., social distance and power status) (Al-Ageel 2015). These dimensions can appear in the communication between the immigrant workers and locals in public places (e.g., markets). Neass (2008: 19) mentions that superstrate speakers (i.e., dominant group) may form a register to communicate with substrate speakers (i.e., non-dominant group) to keep immigrant workers culturally isolated and socially distant from the locals. Such a social gap between the immigrant speakers and locals has played a significant role in the development of Arabic pidgins.

Arabic-based pidgins such as Gulf Pidgin Arabic (GPA) have not received the same extensive attention by researchers as other pidgins in the world (e.g., English-based pidgins). To the best of my knowledge, there is no quantitative variationist analysis of phonological variation in GPA. The only study on GPA dealing with linguistic variation was conducted by Almoaily (2013). Almoaily investigates morpho-syntactic variants appearing in the speech of GPA speakers. Most works on Arabic-based pidgins discuss morpho-syntactic features such as inflectional affixation, possession, verb form, negation, word order, and copula (Smart 1990; Al-Moaily 2008b; Neass 2008; Avram 2010; Albakrawi 2012; Almoaily 2013; Salem 2013; Al-Haq & Al-Salman 2014; Alghamdi 2014; Al-Zubeiry 2015). Moreover, most of these studies explored GPA in different Arab Gulf countries, attempting to investigate whether or not GPA forms a true pidgin by examining different linguistic features. However, the relatively small number of previous studies (e.g., Smart 1990; Neass 2008; Avram 2010; Salem 2013) provides only a very limited view of the phonology of GPA as an introductory part of their analyses by listing only unmarked forms of the consonants, without considering any indication of their variants. I will survey these studies, providing a general critique of their shortcomings as they relate to the current study.

The term GPA was coined by Smart (1990), who conducted the earliest study on Gulf Pidgin Arabic (GPA). He provided an overview of the geographical and sociolinguistic situation in the Gulf region and described the features of the phonology, orthography, morphology, syntax, and lexicon of this variety. Smart raised the question of whether this language constitutes a true pidgin and addressed the question based on humorous printed material (cartoon captions) published in two Gulf newspapers. The Arab journalists created the captions to emulate the language of workers, thus representing the migrant workers' speech as a language. In addition to the printed materials, Smart also based his discussion on other immigrant communities that he personally observed, such as taxi drivers, shopkeepers, and other unskilled workers. The findings illustrated one of the essential features in pidgin languages, namely, reduction resulting from the simplification of complex linguistic elements. Smart's descriptive analysis stated that Arabic consonants are complicated and that GPA speakers tend to reduce the marked sounds to the nearest counterpart in their L1 (p. 88).

According to Smart, the following marked sounds are simplified by replacement processes: the voiceless uvular fricative /χ/ is replaced with the voiceless velar stop /k/, the voiced pharangeal fricative /ʕ/ with the glottal stop /ʔ/, the voiceless dental fricative /θ/ with the voiceless alveolar stop /t/, the voiceless fricative pharyngeal /ħ/ with the voiceless fricative glottal /h/, and, finally, the voiceless emphatic alveolar stop /tˤ/and the voiceless emphatic alveolar fricative /sˤ/ are replaced with their non-emphatic counterparts, the voiceless alveolar stop /t/ and the voiceless alveolar fricative /s/, respectively. His findings suggested that this variety (i.e., GPA) was an emergent pidgin. However, Smart's description should be considered with some caution, particularly his claims regarding the phonological variation. Because most of Smart's corpus was comprised of cartoon captions, these data may not provide an accurate representation of language use. Such written material should not necessarily represent immigrant workers' speech.

Neass (2008) devoted an MA thesis to exploring the linguistic features of GPA in the city of Buraimi in Oman and in the city of El-Ein in the United Arab Emirates. She provided a descriptive, detailed explanation of the phonology and morpho-syntactic features of GPA. The primary question of her research was whether GPA can "be considered a separate variety with its own grammatical norms, different from the lexifier Gulf Arabic and with its own structural unity" (p. 9). She based her answer to this question on data gathered from recorded sociolinguistic interviews. She interviewed sixteen Asian migrant workers living in the Gulf region. The informants came from different Asian countries with different linguistic backgrounds. Findings were gleaned from a systematic comparison of the major features of GPA and GA (lexifier). As found in all pidgins in the world, GPA showed great simplicity regarding the linguistic features of GA, resulting in reduction at most linguistic levels. With respect to phonology, GPA has a reduced consonant inventory, with just 18 consonants as opposed to the 29 consonants of the lexifier (GA). Neass presented the reductions that were demonstrated in the study under the replacement process. For example, the voiceless uvular fricative /χ/ and voiceless pharyngeal stop /q/ are from GA, and they are replaced with the voiceless velar stop /k/, which is a sound that exists in both the substrate and superstrate languages of the participants. Following Ferguson's (1971) Foreign Talk theory, Neass argued that GPA should be considered as a variety of pidgin, namely, a workforce pidgin, which typically emerges in situation where the workforce in a particular area is multilingual.

Avram (2010) investigated Romanian Pidgin Arabic (RPA), which is considered a short-lived pidgin Arabic that was spoken in Iraq by Romanian and Arab oil workers. Based on a corpus of data gathered during his fieldwork, Avram described the phonology and observed significant inter-speaker variation among the speakers of RPA that emerged from their L1 influence through the replacement process with the counterparts in their L1. As found in other Arabic pidgins in the studies by Smart (1990) and Neass (2008), RPA is characterized by consonant replacements. The uvular voiceless fricative /χ/ is replaced with the voiceless fricative glottal /h/ in the word-initial position, but if /χ/ occurs finally, then it would be replaced by /h/ or ø. Furthermore, the voiced uvular fricative /ɤ/ is replaced with the voiced velar stop /g/, the pharyngeal voiced fricative /ʕ/ is replaced with the voiceless glottal stop /ʔ/, and the emphatic sounds are replaced with their non-emphatic counterparts. Finally, the geminate consonants are lost in RPA, as in other Arabic pidgins, and undergo degemination. Avram argued that RPA was a pre-pidgin (which is also called an unstable pidgin or early pidgin) (Holm 2000). Unlike a stable pidgin, which has less variation in structure, pre-pidgins are confined in use and have multiple variations and intense simplification in structure. In addition, they are characterized by numerous interferences from the speakers' substrate language (mother tongue) (Kouwenberg & Singler 2009).

Salem (2013) describes the features of Pidgin Arabic in Kuwait, which is spoken by Asian housemaids. The social situation in which this variety developed occurred after the discovery of oil in Kuwait in the 1930s. Following this discovery, Kuwait flourished and developed rapidly. As a result, a large number of jobs became available in the government and private sectors. Most members of Kuwaiti families have a job, necessitating a servant/housemaid at home to raise children and manage the home, which has become a fundamental element of Kuwait's social structure. Those people (i.e., housemaids) came from other countries (e.g., India, the Philippines, Indonesia) to work as housemaids in Kuwait. Neither employers nor employees know one another's languages and must therefore use a common language for communication. Thus, a new variety has arisen to fulfill their needs, namely, Asian Arabic Pidgin (AAP).

The study focused on explaining the following linguistic features: phonology, syntax and lexicon. The study was based on recorded oral interviews conducted with forty Asian workers who had been living and working in Kuwait for periods ranging from 6 to 18 years. Salem analyzed his data based on other studies of Arabic-based pidgins. He claimed that there was an inter-speaker variation in the syntax of this variety resulting from influence of the speakers' L1. In addition, the marked sounds were either lost or replaced; for instance, the replacement of the voiceless glottal fricative /h/ or ø for the voiceless fricative pharyngeal /ħ/, voiceless glottal stop /ʔ/ for the pharyngeal voiced fricative /ʕ/, the voiced velar stop /g/ for the voiced uvular fricative /ɣ/, and, finally, the voiceless velar stop /k/ for the voiceless uvular fricative /χ/. Moreover, the emphatic sounds /tˤ/ and /sˤ/ are replaced with their non-emphatic counterparts /t/ and /s/, respectively. The results also show that geminate consonants are lost, as was also found in Romanian Pidgin Arabic (RPA) (Avram 2010), and undergo degemination.

Finally, Al-Haq and Al-Salman (2014) describe the linguistic features of Jordanian Bengali Pidgin Arabic (JBPA), particularly the phonology, verbal system and negation. The JBPA is spoken among Bengali workers and native speakers of Jordan in Al-Hassan Industrial City in the north of Jordan. Al-Abed Al-Haq and Al-Salman attempted to determine whether this variety constituted a true pidgin. The study was based on a total of four hours of recorded interviews conducted with ten male Bengali workers who had lived in Jordan for periods ranging from 3 to 8 years. The analysis of the study showed that the phonology of JBPA is characterized by reduction and simplification, and the sounds are either lost or replaced. As in most of the Arabic-based pidgins, this variety replaces the uvular voiceless fricative /χ/ with the voiceless velar stop /k/, and the voiceless glottal stop /ʔ/ is replaced by either a long vowel or ø. Furthermore, the voiced uvular fricative /ɣ/ is replaced with the voiceless/voiced velar stops /k, g/. The pharyngeal voiced fricative /ʕ/ is replaced with the voiceless glottal stop /ʔ/ or a long vowel or ø, the voiceless fricative pharyngeal /ħ/ is replaced with the voiceless glottal fricative /h/, and the voiceless dental fricative /θ/ is replaced with the voiceless alveolar stop /t/. Finally, the emphatic sounds are replaced with their non-emphatic counterparts. Al-Abed Al-Haq and Al-Salman concluded their study by claiming that the JBPA is not a stable pidgin. Instead, it is considered an incipient pidgin (i.e., early and unstable pidgin).

Most of the Arabic pidgin studies that are reviewed above, such as those by Smart (1990), Neass (2008), Salem (2013), Al-Abed Al-Haq and Al-Salman (2014), as well as studies of other pidgin languages (e.g., English-based pidgins), describe the phonology of pidgin varieties descriptively using auditory perceptual analysis and provide only a cursory overview of the phonology of GPA as an introductory part of their studies, without considering phonological variation. In one example, Avram (2010) observed some consonant variations among the speakers of Romanian Pidgin Arabic but did not consider a quantitative analysis to explain these variations. Using the auditory perceptual method alone lacks accurate judgment and is often unreliable. Therefore, adopting acoustic measures in the study of GPA consonants is certainly an important contribution to the field of pidgin research, particularly with respect to Arabic-based pidgins. It is thus useful to compare the accuracy of the aforementioned descriptive analyses of these consonants with the acoustic analysis. Due to the lack of acoustic/phonological studies describing the phonology of GPA in detail, particularly the phonological variations, it is worth investigating how the Arabic marked consonants (i.e., /tˤ, θ, sˤ, χ, ɣ, ħ, ʕ/) are produced by GPA speakers from different substrate languages (Malayalam and Urdu) and how their production is similar to or different from the lexifier. Linguistic variation, particularly phonological variation in the field of pidgin studies, has been insufficiently addressed thus far, especially in the Arabic-based pidgins. The appearance of such phonological variations among pidgin speakers is not a coincidence, but there must be factor(s) behind these variations, and the disparity in the speakers' performances may be governed by factor(s) that could be either social or linguistic. Thus, the current dissertation will address the shortage of studies in the literature of Arabic pidgins.

Typically, pidgin speakers are adults, and the adult learners of a language might encounter difficulty in producing some of the non-native sounds (i.e., consonants/vowels) in a native-like fashion (Munro 1993). Adult speakers mostly tend to substitute certain L2 sounds with other sounds appearing in their native inventory. Some linguists (Schumann 1976; Siegel 2008) consider pidginization as a model for adult second language acquisition (SLA) at the early stage. Thus, considering research on SLA, particularly in L2 phonology, is useful for understanding the issue of variation of non-native sound realization by adult learners (e.g., pidgin speakers). Since this dissertation aims to investigate the realization and variation of the marked consonants of Arabic in the speech of Gulf Pidgin Arabic speakers, it useful to provide some general literature on the potential factor(s) that may provide explanatory facts towards variation. The extant L2 phonology literature addresses some linguistic factors that cause L2 speakers to substitute non-native sounds with their equivalents in L1. The following section will address these prevalent factors, including transfer, similarities and dissimilarities between L1 and L2, and relative difficulty or markedness.

4.2 L2 Phonology

This section briefly sketches the literature on prevalent concepts in L2 phonology that affect L2 phonological acquisition. The research into L2 sounds acquisition has witnessed growth in the past three decades (Edwards & Zampini 2008). The predominant concepts in the acquisition of L2 phonology, particularly L2 sound acquisition, include transfer, similarities and difference in L1 and L2, and the markedness/difficulty of the sound. These concepts will be addressed below.

4.2.1 L1 Transfer

The term "transfer," which means carrying over certain linguistic properties from L1 to the target language in some way during the acquisition, is considered one of the significant concepts in the field of second language acquisition (SLA) (Keys 2001; Han 2004). The transfer process happens through an interaction of both previous linguistic knowledge and the amount of L2 input that the second-language speakers have. Transferring linguistic elements is not limited to a specific language domain but appears at most linguistic levels (i.e., syntactical, phonological, morphological and lexical). However, phonological transfer is the most commonly discussed process in SLA studies (Edwards & Zampini 2008). In addition, it has become the focus of many researchers because it has been claimed that adult second-language speakers are more likely to acquire the grammar, morphology and lexicon of L2 in a native-like manner, while the phonology more frequently shows an L1 influence. Second-language speakers, particularly adult speakers in the initial stage, encounter some difficulties in performing in an L2, leading them to apply their L1's grammar in the performance of the L2/target language. Such an L1 transfer contributes to the lack of attaining native-like performance and full competence in the L2. Nunan and Carter (2001: 37) state that the adult speaker's L1 has a clear effect on L2 pronunciation, especially if the sound system in the L1 and L2 is different. Consequently, speakers tend to assimilate, by the transfer process, the non-native sounds of the L2 into their L1 phonology, where they have the tendency to replace the non-native sounds with the closest equivalents in their L1 sound system.

On the other hand, the pidgin literature also demonstrates that transfer plays a role in pidginization and accounts for pidgin formation. For instance, Thomason and Kaufman (1992) and Siegel (2003) discussed, respectively, the role of transfer in pidgin formation and the influence of transfer and substrate languages on Melanesian Pidgin, suggesting that linguistic transfer is not limited only to full-fledged languages but also appears in pidgins and creoles (Almoaily 2013). As discussed earlier, a pidgin mostly derives its grammar and vocabulary from different source languages. That is, it draws most of its lexicon from one source language (i.e., the lexifier), but the grammar and meaning may be transferred from substrate languages (Thomason 1997: 71). Therefore, pidgins exhibit various linguistic features transferred from substrate and superstrate influence, but with disparate degrees of influence. Most pidgins, for example, present some phonological properties that transferred from the substrate languages of their speakers (Siegel 2003). Among such phonological transfers, which are frequently found in pidgins, is sound transfer. Sound transfer commonly appears among pidgin speakers through sound replacement, in which speakers tend to substitute the non-native sound with the nearest counterpart in their L1, as attested in the speech of Gulf Pidgin Arabic speakers, in which they predominantly substitute the non-native consonant /θ/ with /t/.

Sankoff (2002: 503) claims that transfer is one of the factors that leads to language variation, which is overwhelmingly observed among speakers of different languages in situations of language contact. The speakers of different languages might see some effects of their L1 on realizing L2/target language sounds (Bayley 2005). That is, the speakers may demonstrate different productions of a wide range of sounds, particularly in the initial stages, and exhibit some equivalent sounds derivable from their L1. Therefore, one of the expected linguistic factors that leads to such sound variation among most pidgin speakers with different substrate languages is transferring L1 sounds in place of some L2 sounds, and this kind of transfer may be triggered by dissimilarities of sound system in the substrate languages and the target/superstrate language.

4.2.2 Similarities and Dissimilarities in L1 and L2

The previous highlights the fact that the speakers of contact languages (e.g., pidgin/creoles) are oriented toward L1 sound transference when realizing new L2 sounds. Such a transfer is explained through the Contrastive Analysis Hypothesis (CAH), as put forth by Lado (1957). This theory still occupies a central place in the L2 literature, although some criticisms do exist. The CAH attempts to provide insights into the cause of transfer and potential errors that occur in the L2 performance. It predicts that acquiring the L2 speech in a native-like manner depends on the similarities and differences of linguistic elements between the L1 and L2. The linguistic features that are similar in the L1 and target language will be easier to acquire than those features that are different from the L1. Thus, the dissimilarities of the sound system between the speakers' L1 and target language provoke an L1 transfer. In other words, the contrastive system of L1 and L2 leads the speakers to encounter difficulty in realizing non-native sounds, and, consequently, the sounds of L2 undergo sound substitution with the closest counterpart in L1. The Arabic pidgin studies discussed above show the effect of different sound systems on realizing the sounds of the target language. For example, Avram (2010) described the phonology in Romanian Pidgin Arabic (RPA), which was spoken in Iraq by Romanian and Arab oil workers. Avram points out that the dissimilarities in phonological system, particularly consonantal inventory, between Romanian and Arabic gave rise to interspeaker variation among the speakers of the RPA, which emerged from their L1 influence through the replacement process with the closest counterparts in their L1. The speakers do not have experience in producing the sounds, specifically those that are absent in their native phonemic inventory. For example, Romanian and Arab speakers do not have, respectively, the voiced uvular fricative /ɣ/ and voiceless bilabial stop /p/. Thus, speakers of these languages are unaccustomed to producing these sounds and have insufficient training to allow their speech organs to successfully produce them. Accordingly, the previous sounds are replaced with their counterparts in the speakers' L1: the voiced velar stop /g/ and voiced bilabial stop /b/, respectively. Hassan (2014: 32) mentions that the systematic differences between the phonological systems (e.g., consonantal system) in L1 and L2 contribute to hindering competence in production, particularly among adult speakers, since the speakers' speech organs are still not familiar with such non-native sounds. Keys (2001: 162), on the other hand, points out that similarities between the L1 and L2 contribute to a positive transfer, which in turn leads the speakers of the L2 to experience little difficulty in realizing L2 sounds. This is the case in the literature on Arabic pidgins reviewed above (see Smart 1990; Neass 2008; Avram 2010), in which the similar sounds are noted as being acquired easily compared to dissimilar ones. Nevertheless, some researchers (e.g., Eckman 2008; Edwards & Zampini 2008) have stated that dissimilarities that occur between the L1 and target language are not the sole issue in explaining the problematic areas in acquiring the target language. The case here is more complicated than similarities and differences of L1 and L2.

Relying on the similarities and differences of phonological elements between the L1 and L2 as a measure for ease or difficulty of L2 sound acquisition is insufficient. Rather, there are certain factors other than contrastive analysis that may facilitate or hamper phonological acquisition. Eckman (1977) reformulates the CAH by providing additional norms for the similarities and dissimilarities of the L1 and target language. Eckman incorporates the level of markedness/difficulty of sound to predict the acquisition difficulty of a specific sound in the target language, which will be addressed in detail in the next section.

4.2.3 Markedness and Difficulty

The notion of markedness was first presented in linguistic studies by Trubetzkoy (1939). It occupies a central role in areas of linguistics (e.g., syntax, morphology and semantics) in general, and in phonology in particular. I will first address the definition of markedness and then discuss its role in language acquisition. The term markedness lacks a unanimous definition and is thus defined variably in the literature (e.g., Major 2008; Greenberg 1966). According to Major (2008: 78), the term markedness "deals with the likelihood of occurrences of phenomena." One definition utilizes "implicational hierarchies: *x* is more marked than *y* if the presence of *x* implies the presence of *y* but not vice versa" (Major 2008: 78). Furthermore, markedness could refer to cross-language frequency, meaning that the linguistic element that is statistically more frequent is "unmarked," whereas the less frequent one is marked. For instance, Maddieson and Disner (1984) state that the alveolar approximant /ɹ/ is more marked than alveolar lateral /l/ and, respectively, represents 5.6 % and 42.6 % of instances in the world's languages. In addition, the term could be related to acquisition such that the less marked structure is acquired prior to the more marked one. That is to say, the linguistic element, particularly "unmarked structure," is characterized as being formally simpler, more basic, natural or common, widely distributed and acquired earlier than the marked structure, which is characterized by being typologically marked or complex, less common and rare in the world's languages (Eckman 1977). The marked form is also more difficult, so it is acquired later compared to the unmarked one (Ulatowska & Baker 1975; Eckman 2008). For example, languages have universal preferences regarding voicing (i.e., voice/voiceless); languages prefer the voiceless feature over the voiced one, and the voiceless obstruents are designated as "unmarked" relative to voiced obstruents because the voiceless sounds are more natural and common than the voiced ones in the world's languages. Moreover, pharyngeal fricatives such as / ħ, ʕ/ are not common cross-linguistically (Alotaibi & Muhammad 2010) relative to the alveolar fricative /s/. The pharyngeal fricatives occur in only 2.5% of the world's languages, compared to 77% for the alveolar fricative /s/ in the world's languages in UPSID. Furthermore, the pharyngeal fricatives involve complexity in their articulation, as they are articulated with a retracted tongue root against the back wall of the pharynx (Alwan 1989); in contrast, the alveolar fricative is articulated with the involvement of tip of the tongue against the alveolar ridge. Accordingly, the pharyngeal fricative is designated as "marked" and the alveolar fricative as "unmarked." Having demonstrated the different definitions of the term markedness, the next section discusses the role of markedness in language acquisition, particularly the phonological acquisition of L2.

The notion of markedness is of great importance in the analysis of language acquisition in general, and of acquiring L2 phonology in particular. Markedness is considered as an explanatory fact in the analysis of acquiring L2 phonology (Eckman 2008). The L2 phonological elements that are of interest in this dissertation, as stated earlier, are the marked consonants of Arabic as produced by GPA speakers working in Saudi Arabia. Thus, it is useful to see how the view of markedness might explain the disparate performances among GPA speakers in realizing the typologically uncommon consonants of Arabic. The claim that ascribes the difficulty of acquiring new/non-native elements (e.g., sounds) to the differences of L1 and L2 is not the case because, for example, there exist certain non-native sounds that do not appear in the speakers' L1 that are, nonetheless, not difficult to acquire. The speakers might take an advantage of an extant feature in their L1, which in turn facilitates the acquisition of the new sound or feature of L2. Within the Speech Learning Model (SLM, Flege 1995), one of the predictions concerns the feature hypothesis, which states that the L2 speaker/learner encounters difficulty in realizing a feature that does not exist in the L1 grammar. Brown (2000), for instance, examines this hypothesis and reports that both Chinese and Japanese speakers lack the sounds /l/ and /r/ in their phonological system. However, the Chinese speakers were able to acquire the English /l/ and /r/ distinction, while the Japanese speakers were not. Brown assumes that these liquids are distinguished through the "coronal" feature, and the reason behind this different performance is that the "coronal" feature is present in the Chinese inventory and absent in Japanese. Thus, the Chinese speakers could properly form the representations needed for /l/ and /r/ distinction, whereas Japanese speakers were unable to realize this distinction due to the lack of such a feature in Japanese. This means that acquisition difficulty cannot be explained only by the role of dissimilarities of L1 and L2.

Accordingly, Eckman (2008) developed the Markedness Deferential Hypothesis (MDH) to predict the acquisition difficulty of a specific element (e.g., sound) in the target language. Eckman does not neglect the role of CAH as difficulty predictor in phonological acquisition. Instead, he reformulates the CAH and incorporates the level of markedness/difficulty of sound for measuring the difficulty of the new sound/feature. In other words, the MDH still retains the differences between the system of L1 and L2 as predictors for learning difficulty, accompanied by the addition of the level of markedness of different sounds. The MDH predicts that the learning difficulties encountered by L2 speakers are a function to two particular issues. First, the linguistic element of the L2 (i.e., sound(s) of L2) must be different from the linguistic representation in the L1. Second, the linguistic element in the L2 must be more marked than the corresponding linguistic element in the L1. However, the L2 elements that are different from the L1 but less marked will cause no difficulty in acquisition. For instance, the voiceless stops are claimed to be easier to acquire than their voiced counterparts since they are considered typologically more common, and therefore less marked, than voiced ones.

Eckman (2008) also provides an example supporting the MDH. He involves the notion of markedness to explain the relative difficulty associated with speakers from various native languages backgrounds (Mandarin, Japanese, Spanish and Cantonese) acquiring a given target language. Based on the claim of the MDH, the speakers from different native language backgrounds expect to perform differently on realizing, for example, a voiced obstruent in the syllable-final position. Martínez-Gil (2014: 114) states that voiced obstruents in the coda position are marked and uncommon among languages due to the difficulty resultant from combining the constriction of the oral cavity and vibration of vocal folds. In this case, the factor that seems to determine the difficulty lies in whether or not the native language of the speakers permitted any obstruents in coda position. The coda obstruents are not allowed, for example, in the grammar of Mandarin and Japanese, and, consequently, the speakers of these languages are more likely to add a vowel in the word-final position in each target language word. On the other hand, Spanish and Cantonese allow some obstruents in syllable-final positions, and thus, the speakers tend to devoice the last consonant in the target language word. Accordingly, the relative difficulty is measured in MDH by being both different and more marked.

4.3 Degree of Difficulty/Markedness of Arabic Consonants

The degree of variation of the marked consonants may also be governed by a linguistic factor (e.g., the degree of difficulty/markedness), and thus could vary for each consonant. The relationship between the degree of variation of the target consonants and the degree of difficulty will be discussed by establishing an ordering based on the degree of difficulty of the investigated consonants from the most marked consonant to the least marked one, based on the markedness of distinctive features relevant to the target consonant (Yamane-Tanaka 2007; Wetzels & Mascaró 2001; Clements 2009; Altvater-Mackensen 2010). The frequency of each variant is predicted to be associated with the degree of markedness/difficulty, in which the more difficult consonant displays more marked features than the one with fewer marked features.

Although there is not a precedent model in the literature that is based on feature counting as an absolute measure for explaining the consonant markedness/difficulty, Schane (1984) employs particle phonology to describe vowels complexity/markedness. The vowels are specified through a different number of particles and these particles determine whether the vowel is more marked or less marked. For instance, the least marked vowel will contain fewer particle compared to the more marked one. The idea is that the vowel features are based on multiple aperture particles, “which can easily capture stepwise shifts in vowel height” (Chitoran 2002: 208). That is, the number of aperture particles provides a measure of vowel height such that multiple appearance of particles represents a more open vowel. According to the view of feature compositions in Schane’s work, the [i] and [u] are tonality particles that represent the phonological features palatality/ frontness and labiality/rounding, respectively. On the other hand, the [a] is an aperture particle that represents the openness (height) of the vowel. The diphthongs and other vowels such as [*e*] or [*o*], tend to have combinations of particles. So, how is particle phonology implemented in specific cases? Table 8 below displays the vowels of Romanian based on (Chitoran 2002: 208).

Table 8 Romanian vowels (based on Chitoran 2002: 208)

	Front	Central	Back
High	i	ɨ	u
Mid	e	ə	o
Low	ea	a	oa

Under the view of feature compositions in Schane’s work, the Romanian vowels are represented in Table 9 below as cited in Chitoran (2002: 208).

Table 9 Feature composition for Romanian vowels

Vowels	ɨ	i	u	ə	e	o	a	ea	oa
Particles	-	i	u	a	a i	a u	a a	a a i	a a u

Based on Table 9, the vowel /ɨ/ in Romanian vowels gets no particle because it is not palatal, it is not rounded, and it is high. On the other hand, the /i/, /u/ and /ə/ have one particle as palatal, rounding and height, respectively. The vowels /e/ and /o/, on the other hand, each gets two particles. The vowel /e/ gets the frontness/palatal particle, and lowering particle, whereas the vowel /o/ gets a rounding particle and lowering particle. As for the /a/, it gets two particles because it has two degrees down of aperture. Finally, the diphthongs /ea/ and /oa/, are described having a total of three particles. The diphthong /ea/ has one particle as in /e/ (i.e., frontness /palatal particle), and a lowering particle in which it has two degrees down of aperture, while the /oa/ has one particle which includes rounding particle and also it has two degrees down of aperture. Accordingly, based on the different number of particles, it turns out that the vowel /ɨ/ in Romanian vowels is the least marked one in the system, compared to the diphthongs, which are more complex. Therefore, counting features to determine the degree of consonant difficulty is similar in spirit to particle phonology, which comes closest to the kind of feature counting that is proposed for the current study. That is, the more distinctive features/pluses (i.e., the positive value [+]) the sound has, the more difficult it will be.

4.3.1 Features and their Relative Markedness

This section addresses the relevant marked distinctive features of the investigated Arabic consonants. The features include [DORSAL], [CORONAL], [+Voice], [+Continuant], [+Distributed], [+Retracted Tongue Root], [+Low], [+Back], and [+High]. As proposed in the generative literature, the feature [+dorsal] is more marked than [+coronal] (Yamane-Tanaka 2007). The [+voice] feature is more marked than the [-voice] feature (Wetzels & Mascaró 2001). Also, the fricatives are more marked than stops (Clements 2009; Altvater-Mackensen 2010); thus, "fricatives would be marked for being [+continuant], while stops may remain unspecified" (Altvater-Mackensen 2010: 12).

As for the distinctive features of Emphatic consonants, the Arabic literature lacks a unanimous distinctive feature for representing Arabic emphatic consonants. Broselow (1976) employs the feature (+constricted pharynx) to differentiate between the emphatic consonants and their non-emphatic counterparts. Davis (1995), on the other hand, uses the feature [+Retracted Tongue Root (RTR)] to represent the Arabic emphatic consonants. Finally, Emphatic consonants have been represented as having the feature [+Emphatic] (Elgadi 1987). Thus, following Davis (1995), I adopt the feature [+RTR] in Tables 10 and 11 below to represent the Emphatic consonants. I maintain that using the feature [+RTR] is more appropriate than [+constricted pharynx] and [+Emphatic] since the [+RTR] has concrete articulatory correlates of emphatics in which the emphasis process has to do something with tongue itself. That is, the articulation of the pharyngealized consonants (i.e., emphatic & pharyngeal consonants) involves tongue retraction towards the back of the vocal tract.

Specific feature values might be more marked than others. Hume (2004) states that increased markedness is commonly correlated with articulatory complexity. Therefore, it seems reasonable to consider consonants with more marked features as more articulatorily complex (Clements 2009) than those with fewer marked features or with features that are found in the literature to be least marked or unmarked. For instance, a voiced and dorsal consonant is more marked than a voiceless and coronal consonant, and so on. The difficulty in producing the target consonant will be reflected in low production rate and vice versa. Therefore, the current study considers these consonants /tˤ, sˤ, θ, χ, ʁ, ħ, ʕ/, and Table 10 below summarizes the features and their relative markedness of the investigated consonants.

Table 10 Marked features related to investigated consonants

Feature	**Its relative markedness**
Voice	+ > -
Retracted Tongue Root (RTR)	+ > -
Continuant	+ > -
Dorsal vs. Coronal	Dorsal > Coronal
Low	+ > -
Back	+ > -
Distributed	+ > -

Table 11 below counts the only distinctive features that are relevant to the target consonants. (see Appendix B for a complete set of distinctive features for Arabic consonants as based on (Alotaibi & Muhammad 2010; Hassan 2015).

Table 11 Counting distinctive features of the target Arabic consonants

	Alveolar		Dental	Uvular		Pharyngeal	
	tˤ	sˤ	θ	χ	ʁ	ħ	ʕ
Voiced	-	-	-	-	+	-	+
RTR	+	+	-	-	-	+	+
Continuant	-	+	+	+	+	+	+
DORSAL (Unary)				+D	+D	+D	+D
Low	-	-	-	-	-	+	+
Back	-	-	-	+	+	+	+
High	+	+	-	-	-	-	-
CORONAL (Unary)	(+) C	(+) C	(+) C				
Distributed	-	-	+	-	-	-	-
Number of marked features	2	3	2	3	4	5	6

The table shows that voiceless emphatic alveolar stop /tˤ/ and voiceless dental fricative /θ/ contain equal features in total count in that both of them have two marked features. Nevertheless, they do not have the same (+) or (-). Accordingly, this may suggest that one feature could be more marked than the other or it could be something related to differences in place of articulation and so on. Accordingly, as shown above, the generative literature shows that the feature [+continuant] is more marked than [-continuant], which in turn, makes the voiceless dental fricative more difficult than the voiceless emphatic alveolar stop. Moreover, as mentioned above, the linguistic element that is statistically more frequent is “unmarked,” whereas the less frequent one is marked. Thus, the voiceless dental fricative /θ/ occurs in only 3.6% of the world’s languages, compared to 22 % for the voiceless emphatic alveolar stop /tˤ/ in the world’s languages in in LAPSyD[8]. Such rarity of the sound /θ/ leads to difficulty in pronunciation since involving the tongue between the lower and upper teeth, as is the case in articulating the dental fricative, is uncommon among most languages. Taken together, the phoneme /θ/ becomes more marked than the /tˤ/ and consequently harder to pronounce than /tˤ/.

The coronal feature is included in Table 11 though it is an unmarked feature. For the sake of completeness, the coronal feature is included in the table and specified by pluses in parentheses to indicate that the coronal feature is active but not included in feature counting. Furthermore, Table 11 shows that the voiced pharyngeal fricatives /ʕ/ is the most marked consonant as it has six features while the voiceless emphatic alveolar stop / tˤ/ is the least marked one. Thus, the most marked consonant is predicted to have low production rate and vice versa. That is, the voiced pharyngeal fricatives /ʕ/ tend to be realized at lower rate of production than the emphatic alveolar stop / tˤ/.

In short, the level of difficulty affects the acquisition of L2 phonology, and thus contributes to different performances among L2 speakers. Such previous linguistic factors (e.g., transfer, similarities and dissimilarity, and markedness/difficulty) are predicted to affect the GPA speakers' production and variation of the Arabic marked consonants. The production and variation of the Arabic marked consonants are not only influenced by linguistic factors but can also be affected by non-linguistic/social factors. Most studies of phonetic/phonological variation, particularly those conducted in the field of sociolinguistics (see Taqi 2010; Tanner 2012; Almoaily 2013; Grama 2015), have found that social factors (e.g., age, gender, length of residency, level of education, and amount of exposure, among others) play a role in language variation. The current study

[8] LAPSyD stands for Lyon-Albuquerque Phonological Systems Database. It is a researchable database of the phonological information of a substantial number of different languages around the world (more than 400 languages).

involves certain social factors including age, length of residency, and amount of exposure, to achieve some of the objectives of this dissertation.

4.4 Social Factors and Their Influence on Language Variation

4.4.1 Age Factor

Numerous sociolinguistic studies (Labov 1972; Taqi 2010; Grama 2015) have linked the person's age to linguistic variation or realization. According to Bell (2013: 195) "age is the most fundamental social factor structuring any study of language variation." Moreover, the speaker's age is found to be an influential factor in the extant L2 literature, especially regarding the phonological structure, in which old speakers fail to achieve native-like performance relative to younger speakers. The influence of age is clear from the claim of the Critical Period Hypothesis (CPH) as put forth by (Lenneberg, Chomsky & Marx 1967). The CPH claims that there is an ideal period for acquiring a language in a native-like manner. The acquisition should begin before the start of puberty, and the speaker will demonstrate a noticeable foreign accent if acquiring the L2 after the critical period. Thus, younger speakers acquire the phonological L2 faster than older speakers, which in turn leads to different realization in L2 sounds across age groups (Flege et al. 2006; Major 2014). Other studies in contact languages (pidgins/creoles) have also linked age as a factor for variation. Grama (2015) investigated the acoustic-phonetic variation of the vowel systems of 32 Hawai'i Creole speakers. Grama incorporated several social factors such as age, gender, and phonological context in his study to demonstrate how these factors play a role in vowel realizations. His results revealed that the vowel realizations show some variation across age groups. For example, both groups (younger and older speakers) exhibit different vowel spaces. The older speakers tend to exhibit overlap between the vowels /i/ and /ɪ/ and /u/ and /ʊ/. In contrast, the younger group tends to differentiate between the vowels /i/ and /ɪ/ and /u/ and /ʊ/. In addition, the younger speakers differ from the older speakers regarding to the realization of vowels /a/ and /ʌ/, in that the younger speakers realize them with less overlapping in the vowel spaces, making the acoustic spaces of the younger group approximate the vowel space of its lexifier (i.e., English). Accordingly, Grama's results show evidence that the spectral vowel spaces of Hawai'i Creole speakers change significantly with age. On the basis of age, this dissertation includes participants of different ages, ranging in age from 22 to 50 years old, and this factor may provide evidence that production/variation of the investigated Arabic marked consonants may be conditioned by age. However, Flege (1981) states that the speaker's age may not hinder adult speakers from successful acquisition, and acquiring the language in a native-like manner is never lost. Both adult and young speakers have the ability to learn the language in a native-like manner, but with disparate degrees of learning ease. Flege (1995) developed the Speech Learning Model (SLM) as a model of L2 sound acquisition in adulthood. This model relies on the duration of immersion in the L2 environment as opposed to age. The adult learners are able to form new phonetic categories for new L2 sounds after many years of speaking L2 speech. Therefore, L2 adult learners/pidgin speakers with long-stays and high exposure to L2 sounds are more likely to produce the non-native sound in a native-like way than those who have short stays and less exposure to the L2 sounds. Thus, the following two sections address, respectively, the possible influence of length of stay and amount of exposure on L2 phonological acquisition in adulthood.

4.4.2 Length of Residency (LOR) Factor

The length of residency or length of stay factor is the period of time for which a speaker stays in the target language community. The length of residency factor is found extensively in the L2 literature (e.g., Flege, Bohn & Jang 1997), which employs it as one of the factors for evaluating L2 speakers' performance in the target language, in addition to other factors such as amount of input/exposure, gender, motivation and so on (Kasper & Rose 2002). Many studies, particularly those that consider LOR for measuring L2 performance (see Olshtain & Blum-Kulka 1985; Flege, Bohn & Jang 1997), have found a positive correlation between the duration of stay and achieving native-like performance. For instance, Flege et al. (1997) conducted a study on the production of English vowels produced by 80 speakers having different L1s, including German, Mandarin, Spanish, and Korean. The speakers vary in their length of residency (LOR) in the United States. Flege reports that speakers who have stayed longer in the US produce the new English vowels in a more native-like manner compared to those who stay for a shorter duration in the US. Thus, variability in the speakers' performance is predicted, and the realization of the L2 elements is posited to vary depending on the speakers' length of residency. In the current study and based on Flege's claim, I expect that GPA speakers who stayed longer in Saudi Arabia are able to produce the Arabic marked consonants at a higher rate than those with a shorter LOR in Saudi Arabia. The adult L2 literature shows that when a speaker spends a significant amount of time in an L2 speech community, s/he will adequately perform the L2 because of the multiple opportunities that the speaker has to practice the target language (Eslami & Ahn 2014). That is, the speakers staying for several years in a target speech community are more likely to interact in the L2, which, consequently, increases their success in L2 performance.

The LOR is also employed in contact languages (e.g., pidgins/creoles) (see Almoaily 2013; Alghamdi 2014). Almoaily (2013) investigated language variation in Gulf Pidgin Arabic, particularly the variation of morpho-syntactic phenomena. He considers the length of residency in Saudi Arabia as an influential factor for language variation among the speech of GPA speakers. Some of Almoaily's results are consistent with the adult L2 studies mentioned above (see Olshtain & Blum-Kulka 1985; Flege, Bohn & Jang 1997; Eslami & Ahn 2014) in that the speakers who have been longer in Saudi Arabia produced more GA (lexifier language) tokens than the speakers of the short stay groups. Only speakers who stay longer in Saudi Arabia are found to shift towards the lexifier language in three out of six morpho-syntactic features including conjunction, definiteness and nominal agreement. Likewise, Alghamdi (2014) considers the LOR as a predictor for language competence in the use of inflections, sentence structures, and negation markers among GPA speakers staying in Saudi Arabia. Similar Almoaily's results regarding the effect of the LOR, Alghamdi (2014) concludes that the speakers who stay for shorter length of time in Saudi Arabia more frequently use features from their mother languages, while those who stay longer times in Saudi Arabia use most of the inflections and exhibit a greater control over their performance of GA. Nevertheless, a few studies (e.g., Moyer 1999; McAllister, Flege & Piske 2002; Baker & Trofimovich 2006) exist that argue that the LOR is not an effective predictor of L2 performance. For instance, Baker and Trofimovich (2006) examine the production of English vowels by 40 Korean speakers. Their study considers the effect of age and the length of residency on

Korean speakers' realization of English vowels. Based on the individual differences occurring among the participants' age and length of stay, the results show that age, but not the length of stay, has a positive relationship with their production. That is, only the younger speakers realized the L2 vowels in a native-like manner relative to the adult speakers. Similar results were also obtained from the study of McAllister, Flege and Piske (2002). They investigated the realization of vowel length contrast in Swedish as produced by adults 60 speakers from different linguistic backgrounds (i.e., American English, Latin American Spanish and Estonian). Their study considers the speakers' L1 and LOR in the target language country as possible factors affecting the success of adults' performance of L2 phonological production. What they found is that the L1 influence, but not LOR, plays an influential role in their performance. Certain American English speakers were able to realize the L2 vowel length contrast of Swedish like native speakers of Swedish, but not others. The reason behind this different performance is that a phonetic cue or length feature does occur in English, but does not exist in the other speakers' L1. Thus, the English speakers could properly form the representations needed for vowel length distinction, whereas the other speakers, especially the speakers of Latin American Spanish and Estonian, whose L1s lack this durational feature, were unable to realize this distinction regardless of their length of residency, even when they had stayed for at least ten years in Sweden. Accordingly, their study suggests that the influence of L1, but not LOR could be a robust predictor for proper realization. That is, greater LOR in the target language country does not necessarily lead to successful L2 realization. The speakers of the current study, as shown in section 5.2, were divided into two groups depending on their length of residency in Saudi Arabia: a short stay group (staying for 6 years or less) and a long stay group (staying for 10 years or more). Therefore, considering the LOR factor in this dissertation might be a predictor to account for the disparate realization and variation of Arabic marked consonants in the speech of GPA speakers. However, such a single factor is insufficient to account for the successful realization of L2 elements. Romero-Trillo (2012: 51) states that "it is not that important how long an immigrant lives in a country where the L2 is spoken, it is more important with whom the immigrant spends a lot of time communicating in the L2 while living in that country." That is, some speakers may stay longer in the target language country but have less exposure to the target language, such as those who work in factories or who work as technicians, jobs in which they usually do not have direct contact with the speakers of the target language. For this reason, this dissertation also considers the amount of exposure to the target language, as will be addressed in the next section, to account for the realization and variation of Arabic marked consonants.

4.4.3 Amount of Exposure to the Target Language

Amount of exposure refers to the quantity of usage and intensity of interaction that the L2 speakers have with the target language community. The L2 speakers are expected to have significant variability in their speech, such that some speakers demonstrate superior performances. One presumed explanation to such disparity is the different amount of input/exposure to the target language/L2 that occurs among the speakers. The level of exposure can be increased through using the target language repeatedly and more often on a daily basis; this repetition allows the speaker to become highly experienced in the target language, and consequently, prepares the speaker for greater success in L2 performance. Therefore, the more L2 speakers use the target language/L2, the more those speakers receive high input from other speakers of the target language (Romero-Trillo 2012). Although there are no Arabic-based pidgin/creole studies that examine whether the amount of exposure leads to proper L2 realization, Rickford (1977) discusses this factor (i.e., amount of exposure) in an English-based pidgin (Tok Pisin), particularly at the morphosyntactic level. Rickford found that there exist some minor differences between the Tok Pisin speakers and native English speakers, more specifically when the pidgin speakers increased their social mobility and increased their exposure to the lexifier (i.e., English). For example, the following English sentence *'It's my book'* can be realized by the pidgin speakers as *'iz mi buk'* or *'is mai buk.'* Additionally, many studies on adult acquisition of L2 (e.g., Flege, Yeni-Komshian & Liu 1999; Nagle 2013; Eslami & Ahn 2014) have considered this factor (amount of exposure) and have claimed that intensive use of the target language with its native speakers and immersion in the target language culture contribute to acquiring the phonology of L2 in a near-native or native-like fashion. This finding can be supported by the study by Flege, Yeni-Komshian and Liu (1999), which aimed to contribute to the examination of the role of the Critical Period Hypothesis and the amount of exposure to English on the successful performance of L2. Their study was conducted with 240 Korean speakers whose ages ranged from 17 to 47 years old, all of whom had stayed in the United States for at least 8 years. The speakers' production was assessed through reading 21 English sentences, each repeated three times, containing a large porportion of English consonants and vowels. Their results suggest that age could impede the acquisition of accurate L2 phonology but could not hinder acquiring the morphosyntax of L2, whereas the amount of exposure/usage of the L2 (English) is an important factor in the success of speakers' acquisition of both the morphosyntax and the phonology of the target language. Those speakers who use English much more often attained a native-like production and have better pronunciation than those with rare use or lower exposure to English, regardless of their long residency in the United States. Thus, the speakers who speak the dominant or target language repeatedly on a daily basis with native speakers of the target language are more likely to perceive more input of the target language and, consequently, establish a new phonetic category for the new sound/features, which results in successful production of the L2 sound/feature. Therefore, the amount of immersion/exposure is more informative than the LOR in evaluating an L2 production, meaning that the accurate L2 production is not correlated with how many years a speaker stays in the target-language country. Instead, it is associated with the amount of exposure to the target language because the amount of exposure and the amount of interaction with the culture of the target language are expected to differ from speaker to speaker. Therefore, the amount of exposure may explain more about successful L2 performance than length of stay in the target language community. Although it is hard to measure precisely the amount of exposure to the target language (McAllister 2009), the current study evaluated the quantity of L2 input/exposure through asking questions about the number of hours participants spend interacting with native speakers, how often the GPA speakers speak Arabic and their L1 and how often they watch or listen to Arabic TV. Their responses were reported to raters in order to convert their response to the following scale (high input or low input).

In short, based on inconsistent results found in the previous studies, successful L2 realization relies on a constellation of factors. Some of the above studies have suggested different predictions regarding the investigated factors (i.e., age, LOR, and amount of exposure). Moreover, some of these factor(s) are found to be more informative in some studies, while the same factor(s) were less informative in the others. Therefore, these issues or factors cannot be neglected, especially with L2 adult speakers since each speaker has different personal dimensions, different attitudes towards the target language and its culture, different ability in acquiring language, and different goals, which in turn affect the amount and speed of individual acquisition of the L2 element.

This dissertation examines the previous non-linguistic factors to determine the possible correlations of age, LOR and amount of exposure with the realization and variation of the marked Arabic consonants among GPA speakers. Therefore, based on the non-linguistic and linguistic factors involved in this dissertation, it is appropriate to employ a variationist approach to analyze the data, as will be addressed in the following section.

4.5 The Variationist Framework

The lack of quantitative studies of consonant variation in Gulf Pidgin Arabic motivates the current research. Based on the framework of the variationist paradigm as put forth by William Labov in the 1960s, the present study discusses the alternation of marked consonants of Arabic in the speech of GPA speakers. Such variations may be affected by non-linguistic factors (e.g., LOR in Saudi Arabia, age, amount of exposure) and linguistic factors (e.g., the difficulty of articulation or substrate language/ L1). Labov (1969: 715), states that this approach claims that alternation is one of the inherent attributes of human languages. The speakers of a language "engage in a multitude of choices among discrete alternatives in a discourse which, for all intents and purposes, have the same referential value or grammatical function" (Poplack & Tagliamonte 2001: 88). Moreover, the variant selection is not random; rather, it is governed by "orderly heterogeneity" (Weinreich, Labov & Herzog 1968: 100). That is, the alternation may be conditioned by social or linguistic factors, or both (Bayley 2013).

The social factors considered in the current study and anticipated to explain variation are age, amount of exposure to GA and LOR in Saudi Arabia. For example, the factor LOR might play a role in realizing L2 sounds that are absent in the speakers' L1. Flege, Bohn, and Jang (1997) report that speakers who have been longer in a language contact setting produce non-native sounds more frequently than those who stay for a shorter time. Thus, variability in the speakers' performance is predicted. In this case, and based on Flege's claim, it is expected that GPA speakers who have been longer in Saudi Arabia are more likely to realize the marked consonants at a higher rate compared to those who have a shorter LOR in Saudi Arabia. Moreover, they are able to realize them with a value closer or similar to the value of the local form. The variant and its distribution can be examined via statistical analysis (Tagliamonte 2006), and the variationist paradigm is one of the appropriate approaches for quantitatively revealing distribution rates of the variant within the speech community. Furthermore, comparing the rates of occurrence or absence of each target consonant of GPA speakers also enables the researcher to assess the influence of such previous factors in the production of the Arabic marked consonants.

4.6 Summary

This chapter first reviews some of the Arabic previous pidgin studies that are relevant to the current study. It surveys these studies, providing a general critique of their shortcomings as they relate to the current study.

The chapter then discusses the socio-historical influence on the development of Arabic pidgin, particularly in the Gulf area. Historically, this variety (Arabic pidgin) emerged in the Gulf countries during the period of growth of these countries after the discovery of oil in the 1930s. The lack of a common language and enforced social distance between the immigrant workers and the locals further contributed to the emergence of this variety.

As this dissertation aims to investigate the variants in realizing the Arabic marked consonants in the speech of Gulf Pidgin Arabic speakers, this chapter reviews the literature regarding the phonological system of Arabic pidgins (particularly Gulf Pidgin Arabic) as they relate to consonants. The speakers of Arabic pidgin are from separate substrate languages, and the influence of their substrate languages on their production of Arabic consonants is determined among speakers. Arabic pidgin speakers tend to simplify non-native consonants by replacing them with the corresponding sounds in their L1. Nevertheless, some pidgin speakers tend to realize the local form even though those consonants do not exist in their L1.

The chapter also reviews the potential linguistic and non-linguistic factors that may influence the Arabic pidgin speakers on realizing the Arabic marked consonants. For instance, the contrastive system between the L1 and L2 and the level of consonant difficulty may lead the speakers to encounter difficulty in realizing non-native sounds, requiring them employ their L1 in their performance through transfer process. The relationship between the degree of variation of the target consonants and the degree of difficulty is discussed by establishing an ordering based on the degree of difficulty of the investigated consonants from the most marked consonant to the least marked one, based on counting the marked distinctive features of the target Arabic consonant. The more distinctive features the sound has, the more difficult it will be and vice versa.

Moreover, this chapter reviews the influence of age, LOR and amount of exposure on L2 production. Age is found to be an influential factor in L2 studies: younger speakers are found to acquire and produce non-native sounds in a target-like manner more rapidly than older speakers. Furthermore, the speakers who have a longer LOR and a high amount of exposure to the target language are more likely to have clear shift to the local norm relative to those who have a shorter LOR and low exposure.

Finally, this chapter concludes by discussing the key concept of the variationist approach, as it holds the notion that variation is an inherent part of language. The variability among the speakers is systematic and constrained by either linguistic or non-linguistic factors.

CHAPTER 5

METHODOLOGY

5.1 Introduction

As stated in Chapter 1, the objective of this dissertation is to explore the possible effects of linguistic and non-linguistic factors on the variation and realization of Arabic marked consonants in the speech of GPA speakers. More specifically, it considers both linguistic factors including difficulty/markedness or L1, and non-linguistic factors, such as LOR in Saudi Arabia, age, and amount of exposure to GA. This study examines patterns in the production of marked consonants of Arabic, including emphatic (/tˤ, sˤ/), dental (/θ/), uvular (/χ, ɣ/), and pharyngeal (/ ħ, ʕ/) consonants. This chapter explains the research methodology of this dissertation and presents the research questions, participants, materials, procedures, acoustic measurements, data analysis and statistical procedures. The dissertation addresses the following research questions:

1. How do GPA speakers produce the marked consonants of Arabic?
2. To what extent does the GPA speakers' realization of the marked consonants differ from the lexifier language?
3. To what extent does the realization of each substrate language (Malayalam and Urdu) differ from the lexifier?
4. Is the degree of difficulty/markedness of the consonants (less common consonants) associated with the variant frequency within each GPA group (Malayalam and Urdu)?

5. How do the LOR in Saudi Arabia, age, and amount of exposure to GA influence the realization/variation of the marked consonants of Arabic?

Addressing the previous questions, such as determining the overall realization of marked consonants as well as consonants' variation by each group of GPA speakers, will determine the potential social or linguistic factor(s), or both, behind the phonological variations among speakers of GPA. I observe that GPA speakers in Saudi Arabia perform differently, with significant variability in their speech, and some speakers demonstrate more target-like realization (i.e. more like Gulf Arabic) than others. Such variations are expected to occur among the target population of speakers, since the GPA speakers in Saudi Arabia are of different ages, have different lengths of stay, and have different amounts of exposure to Arabic. However, no studies to date have discussed in detail the phonological realization/variation among GPA speakers or shown the relevant factor(s) behind the speakers' variable realizations. These factors, I argue, should be viewed as related to age, LOR or amount of exposure to Arabic, or it could be some combination of the above factors. Therefore, this dissertation aims at determining the potential factor(s) that may influence the production and variation of the given target consonants of Arabic in the speech of GPA speakers.

5.2 Participants

For this study, three groups were recruited to participate. Two groups of GPA speakers whose L1 is Malayalam (20 speakers) or Urdu (20 speakers) and all of whom have been working in Qassim, Saudi Arabia for between 1 and 24 years, comprise the primary test groups. Additionally, five speakers of (Gulf) Arabic were also included in the sample as a control group. The selected participants' level of education, particularly that of GPA speakers, varied from elementary to high school, and all participants in this study are males ranging in age from 22 to 50 years old. The participants of each group of GPA speakers (i.e., the Malayalam and Urdu speakers) were divided into two groups depending on their length of residency in Saudi Arabia. I follow Almoaily (2013) in defining short and long stay groups: a short-stay group comprises those who have lived in Saudi Arabia for 6 years or less, whereas a long-stay group includes those living for 10 years or more in Saudi Arabia. For a complete list of the participants' data and a summary of their age, gender, native language, linguistic background, length of stay, and career, the reader is referred to Appendix C.

5.3 Procedures and Materials

The GPA-speaking participants were selected according to the following primary selection criteria: male gender, having Malayalam or Urdu as their L1 and having LOR in Saudi Arabia either for six years or less or 10 years or more. The data was collected by recording short sociolinguistic interviews and a picture-naming exercise in a quiet place using a Marantz PMD661 Portable Digital Audio Recorder with a sampling rate of 44.1 kHz. The participants were met face-to-face in the public market, Kerala Market in Buraidah city, where most of the participants live and work. The GPA variety was used to communicate with the participants, as well as to introduce the current study to them. The interview addresses several matters, including demographic information, traditions, childhood experiences, and general social practices. In the picture-naming task, both GPA speakers and control speakers were recorded as they completed a picture task in which they were asked to identify 50 pictures that carry the target consonant in the word-initial position. The pictures were presented randomly and ordered the same for each speaker. The prompts were presented with a word in a frame sentence, and the participants were asked to point to each picture and say [ha: ða ____] ("this is a" ____), repeating it three times. Each speaker had only one session for both the interview and the picture-naming task, which lasted for approximately ten to fifteen minutes.[9] Afterwards, a total of 6000 tokens in .wav files were analyzed (50 target words x 3 repetitions x 40 participants) and submitted to Praat for segmentation and for scrutinizing acoustic correlates.

5.4 Data Analysis

5.4.1 Segmentation of Speech

The study adopts auditory analysis and acoustic analysis to analyze the data, using certain relevant acoustic measurements to classify the target consonants and their alternations among the GPA speakers. To accomplish this, I first recorded all target consonants from the speakers participating in the current study (i.e., GPA and control speakers) and imported the recordings to Praat. Afterwards, I divided the recording files into smaller files, each consisting of a word with the target consonant that was separated from the carrier sentence in the elicitation and the conversation in the interview, so as to be ready for formatting in TextGrid and conducting acoustic measurements. The acoustic measurements were made automatically using a Praat script, and if a fatal error was discovered, I checked and corrected it manually. Afterwards, the measurements were exported to an Excel spreadsheet for later statistical testing.

5.4.2 Acoustic Correlates Employed for Classifying Consonant Alternations

Here, I discuss the acoustic cues and measurements that are relevant to the

[9] For a complete list of tokens and pictures, see Appendix D

classification of each target consonant and its variants. These measurements include Voice Onset Time (VOT) of the emphatic stop, F1 and F2 frequencies of the vowel following the emphatic and pharyngeal consonant, friction noise duration of the target emphatic fricatives, and Center of Gravity (COG). In addition to these measurements, I rely on the visual representation of spectrogram for confirming the target consonant classification.

The following sections characterize the measurements included in this dissertation to classify the investigated uncommon typologically Arabic consonants (i.e., /tˤ, sˤ, θ, χ, ʁ, ħ, ʕ/), such as Voice Onset Time (VOT), F1 and F2 frequencies, friction noise duration, and Centre of Gravity (COG).

5.4.2.1 Voice Onset Time (VOT)

The VOT is one of the most reliable acoustic cues in determining the phonemic categories of stop consonants in various languages. The feature VOT is measured in milliseconds (ms) and is defined as the durational interval from the release of the stop to the start of the voicing of the following vowel (Lisker & Abramson 1964: 389). Figure 2 below displays the target area of VOT measurement. The spectrograms in Figure 2, specifically the left spectrogram, represent the realization of the emphatic voiceless alveolar stop /tˤ/ in the word *tˤuul* 'length,' while the right spectrogram represents S16 pronouncing the non-emphatic counterpart /t/. The VOT is considered because it was investigated in other Arabic studies, including Khattab, Al-Tamimi and Heselwood (2006), Abudalbuh (2010), and AlDahri (2012), and has been shown to be a reliable acoustic cue for distinguishing stop variants. The VOT of the emphatic voiceless alveolar stop /tˤ/ tends to be significantly shorter than its non-emphatic stop /t/. Abudalbuh (2010a: 62) states that "the pharyngeal constriction, a secondary articulation of emphasis, increases the tension of the vocal tract during the closure phase of the voiceless emphatic stop, resulting in a shorter delay in the commencement of voicing, i.e., shorter VOT." The current study investigates the variant(s) of the emphatic voiceless alveolar stop /tˤ/; thus, VOT plays a major role in the perceptual discrimination of stops, particularly pairs that occur in the same place of articulation (AlDahri 2012).

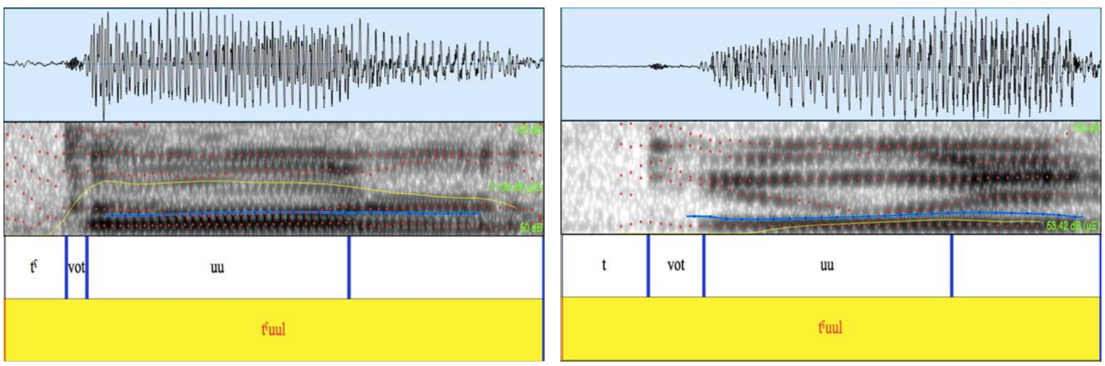

Figure 2. Spectrograms of /tˤ/ in the word *tˤuul* 'length' (left) and its variant /t/ (right).

The two spectrograms above display different VOT measurements attested in the current data. The left spectrogram shows that the VOT in the /tˤ/ is produced with shorter VOT duration (average value 16 ms) compared to the right one. The right spectrogram displays the VOT in the non-emphatic counterpart /t/, where it has longer VOT duration, at an average value of 33 ms.

5.4.2.2 First and Second Formant

The formant frequencies are measured in Hertz (Hz) and are considered the primary method for describing vowel quality. Acoustically, the first two formants are related to the position and shape of the tongue. That is, the first formant (F1) is associated with tongue height, whereas the second formant (F2) is related to tongue backness/advancement (Zsiga 2012).

One of the most common acoustic cues found in the Arabic literature (e.g., Kahn 1975; Card 1983; Khattab, Al-Tamimi & Heselwood 2006; Shoul 2008; Abudalbuh 2010) related to the determination of emphatic and pharyngeal consonants is the lowering of F2, compared to the value of the plain vowel (i.e., a vowel in the non-emphatic/pharyngeal context). The pronunciation of emphatic consonants involves coronal articulation and raising the back of the tongue (Al-Solami 2013). In contrast, the pharyngeal consonants are articulated by retracting the tongue root toward the back of the pharynx (Hassan 2012). In this case, the pharyngealized consonant (i.e., the emphatic/pharyngeal consonant) influences the adjacent vowel such that the pharyngealization is preserved throughout the production of the adjacent vowel. Consequently, the vowel is articulated further back than its plain counterpart due to the tongue retraction. Thus, the pharyngealized vowel (i.e., the vowel in the vicinity of the emphatic and pharyngeal consonants) tends to have higher F1 and lower F2 compared to the F1 and F2 values of the vowels neighboring non-emphatic and non-pharyngeal consonants (Al-Solami 2013).

Therefore, the current study involves measurements of the first (F1) and second (F2) formants at the midpoint of the steady portion of the vowel following emphatic consonants (/$t^ʕ$/, /$s^ʕ$/) or the vowel following consonants that are articulated at the back of the oral cavity, such as the pharyngeal consonants (/ħ/, /ʕ/). Considering the relationship between these measurements (F1 and F2) and the articulation of emphatic and pharyngeal sounds can provide an acoustic correlate in distinguishing sounds articulated at the back of the oral cavity from their non-emphatic/pharyngeal counterparts or any other sounds with which they alternate.

5.4.2.3 Frication Noise Duration

Frication noise is a turbulence that comes from the airflow that passes through a constriction of two articulators in the oral cavity. The aerodynamic turbulence is the essential source of fricative consonants (Al-Khairy 2005). Davenport and Hannahs (2010: 27) state that in a spectrogram, the frication noise (turbulence) appears as irregular striations resulting from aperiodic noise. The frication noise duration presents a cue to voicing distinction as well as sibilant and non-sibilant distinction (Jongman, Wayland & Wong 2000). The noise duration is measured in milliseconds (ms), and the duration measurement is taken from the beginning of the high frequency energy of the noise to the start of vocalic voicing pulse as indicated by the arrows in Figure 3 below. The visual sign of friction noise can be observed in the existence of aperiodic burst noise and absence of formants in the spectrogram.

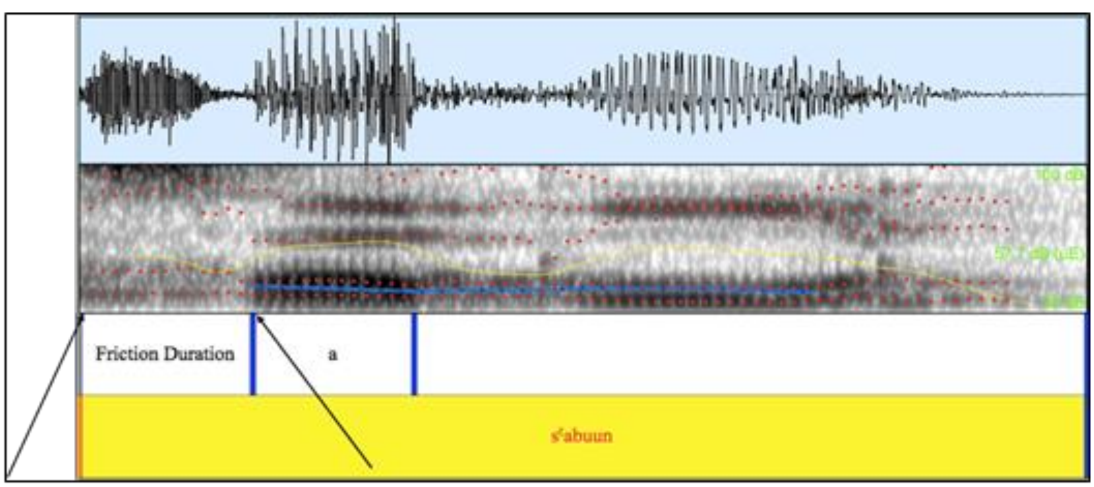

Figure 3. Friction noise duration of /sˤ/ in the Arabic word sˤabuun 'soap' taken from data of the current study. Arrows refer to the onset and offset of the friction noise.

The current study considers the friction noise duration of the target fricatives that serves to distinguish, for example, the voiceless alveolar fricative /s/ from its emphatic counterpart /sˤ/. Acoustically, the frication noise duration of the emphatic fricative /sˤ/ tends to be shorter than its counterpart /s/ (Abudalbuh 2010a). The friction noise duration is used as a secondary cue for segmenting the investigated fricatives, along with the primary cues (F1/F2 measurements).

5.4.2.4 Center of Gravity (COG)

The COG is one of the typical measures for fricatives and corresponds to the average frequency of the entire spectrum of the aperiodic waves/friction noise (Smith 2013). The friction noise appearing in the fricatives results from the resonator that the tongue provides through a narrower constriction. That is, the fricatives' articulation involves forcing the airstream through a narrow passage in the vocal tract, which, in turn, causes the friction noise to occur. The noise frequencies change depending on the place of articulation. Thus, the fricatives will have different values of COG depending on their places of articulation, such that the values change as the place of articulation moves further back in the vocal tract (Kiss 2013: 23). Therefore, Johnson (2004: 106) states that the front cavity in front of the constriction becomes longer, especially when the fricative constriction occurs further back in the vocal tract. Such lengthening lowers the resonant frequencies. In contrast, we obtain a higher frequency for the friction noise as the fricative constriction moves towards the front cavity, thereby shortening it. Therefore, considering this acoustic cue (i.e., COG) in the current study for classifying fricatives is useful, especially if the investigated fricative consonant alternates with another fricative consonant from a different place of articulation. The higher the frequency the consonant has, the more fronted towards the mouth it will be and vice versa (Gordon, Barthmaier & Sands 2002: 20).

5.4.2.5 Visual Representation of Acoustic Signals

In addition to the previous measurements, I employed visual representation of spectrogram for confirming the target consonant classification, from which I can extract certain acoustic information, such as the existence of a clear dark band at the bottom of the spectrogram to represent vocal fold vibrations (e.g., voicing); the aperiodic noise that distinguishes predominantly fricative sounds from other sounds (e.g., stops), the absence of energy or the presence of burst or closure phases to represent stops and so on, may be objectively observed in this fashion. Figure 4 below displays an example of how to confirm the segmentation of the voiceless dental fricative /θ/, representing the word *θalladʒah* 'refrigerator.' The voiceless dental fricative /θ/ is articulated by placing the tip of the tongue between the upper and lower teeth (Jarrah 2013). The current data demonstrates that GPA speakers of both groups vary in its realization. Some speakers tend to alternate the voiceless dental fricative /θ/ with either the local variant /θ/ or the variant /t/. This variant is demonstrated by the two spectrograms shown in Figure 4.

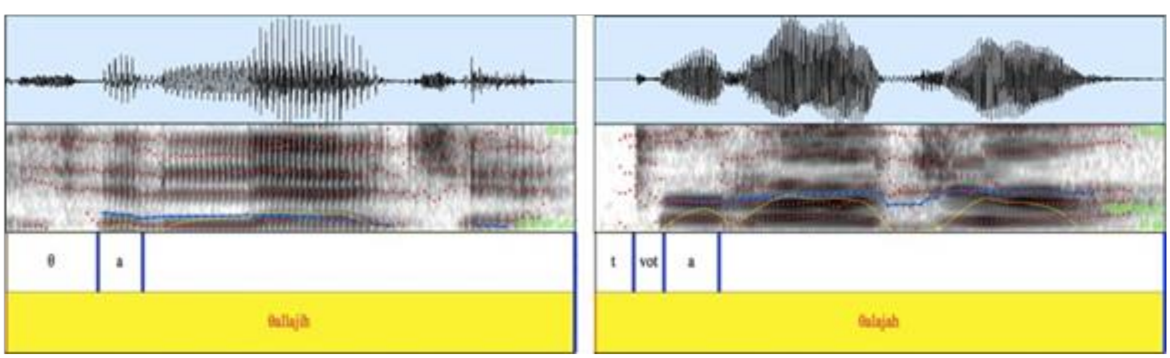

Figure 4. Spectrograms of /θ/ for the word *θalladʒah* 'refrigerator' (left) and its variant /t/ (right).

Figure 4 shows waveform and wideband spectrograms representing the dental fricative realization of /θ/ and stop realization of /t/ in producing the word *θalladʒah* 'refrigerator.' The left spectrogram represents S3 pronouncing the local variant /θ/, whereas the right one represents S11 pronouncing the variant /t/. Here, we note the difference between the two spectrograms that represents the variants of /θ/. In the left spectrogram, we can see how /θ/ is produced with frication noise duration (average value 77 ms) resulting from forcing the air through a narrow channel, followed by an immediate periodic frequency of the following vowel. The right spectrogram, on the other hand, is distinct from the left one and illustrates the production of /t/. The spectrogram shows acoustic cues pertaining to stop consonants, including a closure phase (average value 48 ms), weak release burst and VOT (average value 27 ms), which occurs right before the periodic frequency of the following vowel.

In sum, measuring various acoustic cues contributes to accurate judgment of consonant variation, particularly if the consonant and its alternation belong to the same category. For instance, the data for the current study exhibits that both emphatic stops and fricatives /$t^ʕ$, $s^ʕ$/ alternate more frequently with their non-emphatic counterparts /t/ and /s/, respectively. Both emphatic consonants and their variants belong to the same category (i.e., voiceless alveolar stop and voiceless alveolar fricative). Therefore, considering the previous measurements provides a reliable consonant classification. Nevertheless, the visual representation of spectrograms is also considered in confirming consonant classification. The visual representation is useful for gaining general acoustic information regarding the given target consonant, particularly if the investigated consonant alternates with a consonant from different category. For instance, the target consonant (voiceless dental fricative /θ/) is attested in the literature as alternating with the stop /t/. Therefore, classifying this alternation visually by examining specific signals in the spectrogram (e.g., friction noise, presence of burst, etc.) is a reasonable method of categorization. [10] Thus, after demonstrating how to classify the investigated consonants along with their variants, the following section restates the research questions addressed in this dissertation and explains how the methodology is intended to answer them.

5.4.3 Research Questions Revisited

As mentioned above, the analysis relies on both auditory analysis and the acoustic measurements of the above-mentioned cues to categorize the realization of each token. Thus, research question #1, which asks how GPA speakers produce the marked consonants of Arabic, including /tˤ, sˤ, θ, χ, ɣ, ħ, ʕ/, was investigated. The speakers of GPA might variably produce these marked Arabic consonants depending on linguistic or non-linguistic factor(s) (e.g., degree of difficulty or influence of L1 or length of stay and so on). This question was addressed by recording both short sociolinguistic interviews and a 50-picture naming exercise (see section 5.3) with both groups of GPA speakers. Then, I compared the rates of occurrence or absence of each target consonant pronounced by each group by comparing relative frequency of the variants. I employed descriptive statistics to calculate the overall percentages that reflect the relative frequency distribution of the marked consonants of Arabic and their variant(s) realized by each group of GPA speakers (i.e., Malayalam vs. Urdu). This quantitative method is useful since it gives a clear picture of the overall realization of a specific variant, as compared to the other variant(s) realized by the speakers of a group in the data (Almoaily 2013). Each

[10] See Figure 4 above for an example of classification that is based on visual representation of the spectrogram.

relative frequency is expressed as a percentage and represents how often a target consonant and its variant(s) alternate in the data. The calculation was conducted by dividing the number of observations of each variant (e.g., the production of /tˤ/ or its variant /t/) by the total number of all variants of the target consonant in the data set. The result was then multiplied by 100. Tables12 and 13 exemplify how the target consonant and its variant(s) are quantified in each group of GPA speakers. To be clear, these tables do not represent actual data; rather, they provide examples of how the data will be summarized quantitavely.

Table 12 Percentages of /tˤ/ production of GPA speakers whose L1 is Malayalam

Speaker #	**N. token** Realized as /tˤ/	**%**		**N. token** Realized as /t/	**%**
S1	1/5	20 %		4/5	80 %
S2	3/5	60 %		2/5	40 %
S3	2/5	40 %		3/5	60 %
Total	6/15	40 %		9/15	60 %

Table 13 Percentages of /tˤ/ production of GPA speakers whose L1 is Urdu

Speaker #	**N. token** Realized as /tˤ/	**%**		**N. token** Realized as /t/	**%**
S21	5/5	100 %		0/5	0 %
S22	2/5	40 %		3/5	60 %
S23	3/5	60 %		2/5	40 %
Total	10/15	67 %		5/15	33 %

Again Tables 12 and 13 are not observations about actual data. The tables illustrate the percentages of all variants for the voiceless emphatic alveolar stop /tˤ/. They show the rates of occurrence of the GA and GPA variants of the target consonant (i.e., voiceless emphatic alveolar stop) as they were produced by the two groups (Malayalam and Urdu speakers). The constructed data presented in these tables would suggest that both groups produce the Arabic marked consonant as either /tˤ/ or /t/. Nevertheless, when comparing the two groups in the substitution, the highest frequency of substitution to the /t/ variant (L1 variant) would be observed to occur amongst the Malayalam group, at 60 %, compared to 33 % for the Urdu group, and other substitutions, may be observed in this fashion.

Regarding research question #2 *(To what extent does the realization of both groups of GPA speakers (as one group) differ from the lexifier language?)*, this query was addressed by comparing the values of relevant acoustic measurements of the target consonants performed by each group (GPA vs. control/native speakers). Using the statistical software SPSS, an independent-sample t-test was conducted to find out how each group's mean values of each consonant's measurement are similar or different from each other, in which the independent variable was participant group (GPA vs. control/native speakers), and the dependent variable was the mean values of each measurement (i.e., Alpha was set at .05).

With regard to research question #3 *(To what extent does the realization of each substrate language (Malayalam vs. Urdu) differ from the lexifier (i.e., Arabic)?)*, the methodology is largely similar to that for question # 2. Research question #3 was addressed by conducting some acoustic measurements of the target consonants. However, in this question, each group of GPA speakers was separated, and then the performance of each group (Malayalam vs. Urdu speakers) was measured. In this case, each group's mean values of each consonant's measurement were compared to the measurements of the control speakers by conducting a one-way ANOVA, in which the independent variable was the participant groups (Malayalam vs. Urdu vs. control/native speakers) and the dependent variable was the mean values of each measurement (i.e., Alpha was set at .05). Answering this question determines which group of GPA speakers is similar or approximate to the lexifier (i.e., Arabic).

Research question #4 *(Is the degree of difficulty/markedness of the target consonant associated with the variant frequency/degree of variation?)* was addressed by referring to Table 11 above. The table ranks the degree of difficulty of the investigated consonants in order from the most marked consonant to the least marked one, from the perspective of markedness of distinctive features that are relevant to the target consonant (Yamane-Tanaka 2007; Wetzels & Mascaró 2001; Clements 2009; Altvater-Mackensen 2010). The difficulty in producing the target consonant will be reflected in low production rate and vice versa. For instance, based on Table 11 above, the voiced pharyngeal fricative /ʕ/ is assumed to be the most marked consonant, since six features are inherent to it, while the voiceless emphatic alveolar stop /tˤ/ is the least marked consonant, as it displays only two features. Thus, the most marked consonant is predicted to have low production rate and vice versa. Aljutaily's study (2016) found that the degree of alternation is significantly affected by the linguistic factor (e.g., degree of markedness/the difficulty of consonant). On the one hand, the voiced pharyngeal fricative alternates only amongst GPA speakers of the long stay group, who tend to pronounce the local form /ʕ/in 27.5 % of the tokens. On the other hand, the short stay group did not pronounce it at all, deleting it in 100 % of the tokens. In contrast, the /tˤ/, which is considered the least marked consonant as displayed in Table 11, is realized with 50 % of the tokens for the long stay group, compared to 29 % for the short stay group. Therefore, comparing the degree of variation between the two investigated consonants (/tˤ, ʕ/), particularly in the performance of the long stay group, shows that the highest frequency of realization occurred with the voiceless emphatic alveolar stop, which was produced with 50 % of tokens compared to 27.5 % for the voiced pharyngeal fricative (most marked consonant in the data).

Finally, research question #5 asked how the length of residency in Saudi Arabia, age, and amount of exposure to Arabic influence the production of the marked consonants of Arabic. It was predicted that one of these independent variables (e.g., age, LOR, amount of exposure to GA), or some combination of them, might have a strong influence on the consonant realization/variation. The question was addressed by applying the statistical technique of Regression. This type of test is useful for determining which independent variable (factor(s)), if any, has an impact on the variation. In addition, it can explain the function of the overall performance on consonant variation among GPA speakers to determine if the short and long stay groups differ in their choice of the local variant. Moreover, it helps us determine whether the younger speakers perform better (in terms of realization of local target-like variants) than the older ones and so on. It is expected that the younger participants, especially those who have a longer LOR in Saudi Arabia in both substrate language groups, will produce the target consonant with a higher rate of realization than those older speakers who have stayed for a shorter time in Saudi Arabia.

Moreover, this dissertation involves the amount of exposure to GA to determine if it plays a role in the participants' performance. Although it is hard to measure the amount of exposure to the target language (McAllister 2009), the current study evaluated the quantity of L2 exposure through, for example, querying speakers regarding the number of hours of spent interacting with native speakers, how often the GPA speakers speak Arabic and their L1 and so on. These are qualitative measures and are subsequently transformed/coded to quantitative measure to be used in the statistical method. To ensure that the quantitative coding is consistent, inter-rater reliability is utilized. The reliability of coding the amount exposure is tested by conducting inter-rater reliability technique in which the participants' responses were coded by two Ph.D. raters. The raters converted the participants' qualitative responses to a scale ranging from (high input and low input). Agreement on coding by the two raters is performed by observing the correlation between the coding of the two raters for each measure. The higher the correlation (e.g., 0.9), the higher the inter-rater reliability. Then, average ratings were calculated for each participant and see how the two inter-raters were consistent with each other in measuring amount of exposure of each speaker.

5.5 Summary

In short, this chapter describes the research methodology of this dissertation and the participants, procedures, materials and methods of data analysis. In addition, the chapter addresses the acoustic measurements that were employed for classifying the variation and realization of the Arabic marked consonants among the speech of GPA speakers. It also discusses the research questions and how they are answered along with the statistical procedures. Based on the procedures discussed in this chapter, Chapter 6 presents the results of this dissertation.

CHAPTER 6

RESULTS

6.1 Introduction

This chapter exhibits the findings of the current study as obtained through implementing the methods addressed in Chapter 5. As mentioned earlier, this dissertation examines the realization and variation of the following Arabic marked consonants, including (/tˤ/, /sˤ/, /θ/, /χ/, /ɣ/, /ħ/, /ʕ/) and their variants, by two groups of GPA speakers in Saudi Arabia (i.e., Malayalam and Urdu speakers). In section 6.2, I present the results related to the following research questions: 1) How do GPA speakers produce the marked consonants of Arabic? and 2) To what extent does the GPA speakers' realization of the Arabic marked consonants differ from the lexifier language (Arabic)? The overall average occurrence of each Arabic marked consonant and its variant(s) by GPA speakers is presented as the section displays the acoustic correlates employed for categorizing each variant. Then, these acoustic correlates are compared statistically with the acoustic values of the control speakers to determine the similarities/differences of the values between these groups (GPA vs. Arabic control speakers). Next, Section 6.3 presents the findings related to the research question 3 that related to which group (Malayalam or Urdu speakers) is closer to the values of the lexifier (i.e., Arabic/Gulf Arabic). Section 6.4 presents the overall observations pattern of the interview data and how similar it is to the pattern of the elicitation data. This is followed by Section 6.5, which displays the results concerning research question 4, which shed lights light on the influence of the degree of difficulty/markedness on the variant frequency within each GPA group (Malayalam and Urdu group). Finally, Section 6.6 displays the results of research question 5 and presents the influence of the chosen variables (age, LOR, and amount of exposure) on the realization and variation of the marked Arabic consonants among GPA speakers.

6.2 Overall Realization/Variation of Arabic Marked Consonants by GPA Speakers

This section presents the results of the observed target sounds (/tˤ/, /sˤ/, /θ/, /χ/, /ɣ/, /ħ/, /ʕ/) and their variants. It displays acoustically the productions of each target sound under investigation among GPA speakers. Then, the values of the target consonants as produced by the GPA speakers will be compared statistically with those of the control speakers. These results will be discussed in more detail in Chapter 7.

As mentioned earlier, pidgins are characterized by phonological simplicity and have reduced phonemic systems resultant from the simplification of some complex phonemes that have occurred in the lexifier. According to Al-Jasser (2012: 72), “pidgin speakers are not aware of the intricate phonemic sounds” of the lexifier language, and thus they vary in realizing these sounds from speaker to speaker in that they replace the less common sounds with more common ones. Gulf Arabic (the lexifier for GPA speakers) contains some typologically uncommon phonemes (marked consonants), including emphatic/pharyngeal consonants (Almoaily 2013). Therefore, these marked consonants undergo different replacements among GPA speakers, as demonstrated in the following subsections.

6.2.1 Variation of the Voiceless Emphatic Alveolar Stop /tˤ/

The results revealed that GPA speakers, particularly those participating in this study, tend to alternate by either producing the local variant of Arabic /tˤ/ (voiceless emphatic alveolar stop) or replacing it with its non-emphatic counterpart in their L1 /t/ (voiceless alveolar stop). Table 14 illustrates the rates of occurrence of the GA and GPA variants of the consonant /tˤ/ and demonstrates how often /tˤ/ was produced as in Gulf Arabic or replaced with /t/.

Table 14 Percentages of /tˤ/ production for all GPA speakers (percentages rounded to the nearest whole number; numbers of observations indicated in brackets)

Variant	All GPA Speakers Realization
Local variant /tˤ/ (GA)	39% (108)
L1 variant /t/ (GPA)	61% (172)
Total of both variants in the data	280

Table 14 displays the percentages of all variants observed for the consonant /tˤ/. The table represents all GPA speakers, as both groups of speakers (Malayalam and Urdu speakers) were combined in one group. The table compares the two variants in substitution, showing the highest frequency of substitution occurring with the /t/ variant (L1 variant). These alternations were confirmed acoustically, in that the VOT of the emphatic stop tends to be shorter than its non-emphatic VOT. Such shortening results from the pharyngeal constriction accompanying the articulation of the Arabic emphatic stop /tˤ/ (Abudalbuh 2010b). This constriction occurs in the performance of Gulf Pidgin Arabic speakers, in that they produced the Arabic emphatic stop with a shorter VOT duration than its non-emphatic VOT. The GPA speakers produced the emphatic /tˤ/, especially in the vowel context /i/, with an average value of 18 ms (*SD* = .0021), with a value of 17 ms (*SD* = .0024) in the emphatic stop with the vowel /a/, and finally with an average value of 18 ms (*SD* = .0031) in the vowel context of /u/.

Thus, it is expected that GPA speakers, particularly those who alternate the emphatic stop /$t^{ʕ}$/ with /t/, will realize the VOT with longer duration relative to the emphatic stop. The GPA speakers produced /t/ in the vowel contexts /i/, /a/, and /u/ with VOT values of 28 ms (*SD* = .0062), 26 ms (*SD* = .0050), and 31 ms (*SD* = .0075), respectively. Such VOT distinction in categorizing the emphatic and non-emphatic stops was confirmed statistically. An independent t-test was conducted to determine if the differences in the VOT values are statistically significant between the Arabic emphatic and non-emphatic stops in the speech of GPA speakers. The test shows a significant difference in the VOT values between the emphatic and non-emphatic stops, reporting that the differences of VOT values in the vowel context /i/, /a/ and /u/ are significant, t (-13.137) = 112.528, p = .000, t (-11.584) = 66.770, p = .000, and t (-10.723) = 76.162, p = .000, respectively. For the sake of simplicity, these values are plotted and displayed below in Figure 5.

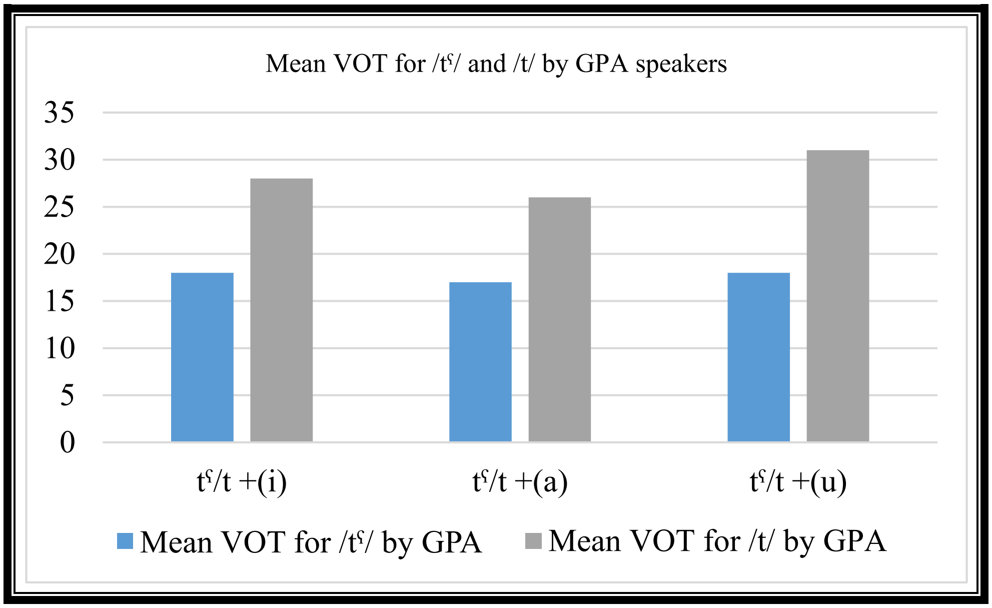

Figure 5. Differences in VOT for emphatic /tˤ/ and non-emphatic /t/ by GPA speakers.

Figure 5 above clearly shows how the emphatic and non-emphatic stops can be categorized in terms of measuring the VOT values. What we notice here is that the GPA speakers realized the emphatic stop with a shorter VOT than the VOT of the non-emphatic stop. Such differences between the VOT values provide reliable acoustic cues for classifying the stop alternations in the current study.

Furthermore, the F2 values of the adjacent vowels of both alternations (i.e., /tˤ/ vs. /t/) show significant differences, as displayed in Table 15 below.

Table 15 Differences in mean F2 values for /tˤ/ vs. /t/ by GPA speakers

Context	Mean F2 for /tˤ/ by GPA	Std.	Mean F2 for /t/ by GPA	Std.	t	df	* P-value
tˤ+ i	1819 Hz	231.98	1931 Hz	264.16	-2.314	122	*.022
tˤ+ a	1226 Hz	143.35	1304 Hz	119.54	-2.765	85	*.007
tˤ+ u	927 Hz	94.01	1012 Hz	177.64	-2.551	84	*.013

Accordingly, based on these acoustic and statistical results, the GPA speakers realized the emphatic stop and its non-emphatic variant differently. They produced the emphatic stop as either /$t^ʕ$/ or /t/. The current results are consistent with previous studies on Arabic emphatic consonants (e.g., Khattab, Al-Tamimi & Heselwood 2006; Abudalbuh 2010; Aldamen 2013), in that the VOT values and F2 values of the vowel(s) adjacent to emphatic consonants tend to be shortened and lowered, respectively.

For those speakers who produced the emphatic stop as /$t^ʕ$/, to what extent their production of the emphatic stop is similar to the values of control speakers was determined. An independent-samples t-test was conducted to determine how the mean value of VOT of the emphatic stop /$t^ʕ$/ in the speech of GPA speakers is similar to or different from the VOT values of control speakers. The t-test reported that GPA speakers realized the Arabic emphatic stop /$t^ʕ$/ with similar VOT value to the control speakers, particularly in the environment of *# $t^ʕ$ +/a/* and *# $t^ʕ$ +/u/*. The test indicated that the differences of VOT value in the vowel context /a/ between the control speakers (M = 17, SD = .00576, N = 10) and the GPA speakers (M = 17, SD = .00246, N = 41) were not statistically significant, t (.076) = 9.817, p = .941. Likewise, the VOT values in the vowel context /u/ between the control speakers (M = 18, SD = .00517, N = 10) and the GPA speakers (M = 18, SD = .00315, N = 34) were not statistically significant, t (.288) = 42, p = .774, indicating that the GPA speakers did not differ from the native speakers in terms of their VOT realization of the Arabic emphatic stop in the environments of *# $t^ʕ$ +/a/* and *# $t^ʕ$ +/u/*.

On the other hand, the VOT of the emphatic stop in the context of *# $t^ʕ$ +/i/* is produced differently. The t-test reported that the mean VOT values between the control speakers (*M* = 21, *SD* = .00477, *N* = 15) and the GPA speakers (*M* = 18, *SD* = .00214, *N* = 41) was significant, *t* (-2.309) = 16.117, *p* = .035, suggesting that the GPA speakers did not attain the VOT values of the control speakers in the vowel environment /i/. Nevertheless, they demonstrate the same trend in shortening the VOT of the emphatic stop more than the non-emphatic one (i.e., voiceless alveolar stop /t/).

Concerning the other acoustic correlate (i.e., F2), although the GPA speakers produced the emphatic stop with lower F2 values, the statistical results reflected that the GPA speakers did not reach the values of the F2 of the control speakers, except in the vowel context of /i/. These F2 values and their statistical results are displayed in Table 16 below.

Table 16 Differences in mean F2 values for /tˤ/ *by control and GPA speakers*

Context	Mean F2 for /tˤ/ by control	Std.	Mean F2 for /tˤ/ by GPA	Std.	t	df	* P-value
tˤ+ i	1819 Hz	231.98	1829 Hz	274.88	-.141	54	.888
tˤ+ a	1092 Hz	140.50	1226 Hz	143.35	-2.660	49	*.011
tˤ+ u	813 Hz	61.96	921 Hz	97.94	3.299	42	*.002

The results in Table 16 suggest that, in most cases, GPA speakers could not realize the F2 with values similar to the control speakers. However, the GPA speakers had a tendency to approximate Arabic native speakers, in that they lowered the F2 when they produced the emphatic stop.

6.2.2 Variation of the Voiceless Emphatic Alveolar Fricative /sˤ/

The other investigated consonant is the voiceless emphatic alveolar fricative /sˤ/. Table 17 below presents the percentages of realization/variation of /sˤ/ as /sˤ/ or as /s/ or as /θ/ by GPA speakers.

Table 17 Percentages of /sˤ/ variation for all GPA speakers

Variant	All GPA Speakers Realization
Local variant /sˤ/ (GA)	46% (130)
L1 variant /s/ (GPA)	51% (141)
L1 variant /θ/ (GPA)	3% (9)
Total of all variants in the data	280

Table 17 shows that large proportions of realization vary between the voiceless alveolar fricative /s/ and voiceless emphatic alveolar fricative /sˤ/. GPA speakers realized the alveolar fricative variant /s/ in a higher rate of production, at 51%, followed by 46% for the local variant /sˤ/. However, very few GPA speakers replaced the /sˤ/ with /θ/, and it was found at a very low rate not exceeding 3% of the tokens.

These alternations are classified acoustically through measuring the friction noise duration, center of gravity (COG) and F2 of the vowel following the emphatic fricative. A small number of speakers realized the emphatic /sˤ/ as a dental fricative /θ/, especially in the vowel context of /a/ as in the words like *sˤandug* 'box,' *sˤamuly* 'bread,' and *sˤabun* 'soap,' in that they produced them with a mean friction noise duration of 84 ms (*SD* =.0024), mean F2 value of 1429 Hz (*SD* = 53.01) and mean COG value of 4986 Hz (*SD* = 823.38).

The Arabic literature considers friction noise duration (Abudalbuh 2010b), center of gravity (COG) (Al-Masri 2009) and F2 of the vowel following the emphatic fricative (e.g., Khattab, Al-Tamimi & Heselwood 2006; Abudalbuh 2010) as acoustic cues for the distinction between the emphatic and non-emphatic fricative. The emphatic fricative tends to have a lower COG, lower F2 and shorter friction noise duration than the non-emphatic fricatives. The acoustic measurements for categorizing the other alternations, including the emphatic fricative /sˤ/ and alveolar fricative /s/, are presented, respectively, in Table 18 and 19 below.

Table 18 Acoustic measurements representing the emphatic /sˤ/ by GPA speakers

Context	Mean of friction noise duration	Std.	Mean of F2 values	Std.	Mean of COG values	Std.
sˤ+ i	114 ms	.029	1614 Hz	344.46	6898 Hz	1009
sˤ+ a	100 ms	.023	1285 Hz	109.35	6635 Hz	1219
sˤ+ u	123 ms	.026	959 Hz	84.12	6505 Hz	1233

Table 19 Acoustic measurements representing the non-emphatic /s/ by GPA speakers

Context	Mean of friction noise duration	Std.	Mean of F2 values	Std.	Mean of COG values	Std.
s+ i	116 ms.	.0296	1836 Hz	322.13	7085 Hz	1095
s+ a	101 ms.	.0288	1367 Hz	107.3	6444 Hz	1206
s+ u	121 ms.	.0317	1022 Hz	90.75	6685 Hz	1122

The results in Table 18 show that the F2 values are lower when they are followed by an emphatic fricative than when they are followed by the non-emphatic /s/. Independent t-tests were conducted to determine if the differences in the F2 values between the emphatic fricative and non-emphatic fricative are statistically significant. The test shows a significant difference in the F2 values of emphatic and non-emphatic fricatives in the context of /i/, /a/ and /u/, t (-2.543) = 79, p = .013, t (-5.467) = 120, p = .000, and t (-3.067) = 78, p = .003, respectively. However, the friction noise duration and COG of both alternations show similar values. The test shows that the values of the friction noise duration and COG of both alternations (i.e., /sˤ/ vs. /s/) in the context of /i/, /a/, and /u/ did not significantly differ from the non-emphatic fricative.[11] Similar to previous studies (e.g., Khattab, Al-Tamimi & Heselwood 2006; Al-Masri 2009; Abudalbuh 2010; Aldamen 2013), these results suggest that lowering F2 is a reliable acoustic cue of emphasis for the fricative /sˤ/. The results obtained from the COG in the present results agree with those of Abudalbuh (2010) and Aldamen (2013), in that the COG of emphatic fricative does not differ from the COG of the non-emphatic fricative, although the results do contradict those obtained by Al-Masri (2009). In addition, the results of friction noise duration contradict with those of Abudalbuh (2010), in that the friction noise duration of the emphatic fricative does not differ from the non-emphatic fricative. These findings suggest that the COG and friction noise duration are not reliable acoustic correlates, at least in the current study, for distinguishing between the emphatic and non-emphatic fricative.

The GPA speakers realized the Arabic emphatic fricative /sˤ/ with significant values to the values of the control speakers. The test indicated that the differences of friction noise duration values between the control speakers (M = 124, SD = .0227, N = 67) and the GPA speakers (M = 108, SD = .0288, N = 331) were significant, t (4.093) = 396, p = .000. Figure 6 below displays the values of friction noise duration of /sˤ/ between the control and GPA speakers.

[11] For complete t-test results, see Table 59 in Appendix E.

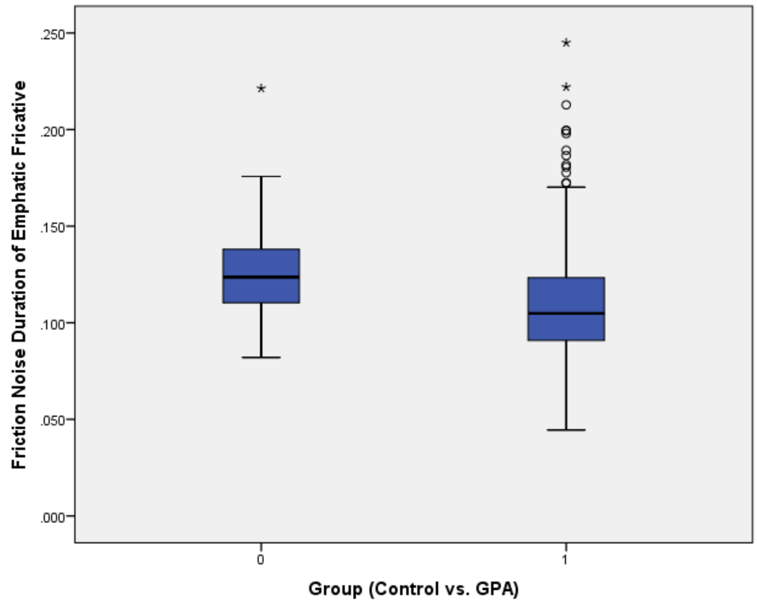

Figure 6. Box plots displaying values of friction noise duration for /sˤ/ by control (left boxplot) and GPA speakers (right boxplot).

The GPA speakers realized the friction noise duration of the Arabic emphatic fricative /sˤ/ with acoustic values different from the control groups. They realized the values of the friction noise duration of */sˤ/* with shorter values than the control speakers did.

The second acoustic correlate for the Arabic emphatic fricative is center of gravity (COG). The present findings indicate that the GPA speakers realized all the values of COG of the Arabic emphatic fricative, regardless of the vowel context without any significant differences. Table 20 demonstrates only the mean values of COG as produced by the control and GPA speakers.[12]

[12] See Table 55 in Appendix E for statistical results.

Table 20 Mean of COG of the emphatic /$s^ʕ$/ by control and GPA speakers

Context	Mean of COG by control speakers	Std.	Mean of COG by GPA speakers	Std.
$s^ʕ$+ i	6482 Hz	1199	6898 Hz	1009
$s^ʕ$+ a	6503 Hz	1343	6635 Hz	1219
$s^ʕ$+ u	6152 Hz	1320	6505 Hz	1233

The last acoustic cue for categorizing the Arabic emphatic fricative is the F2 value of the vowel following the emphatic fricative. The statistical results reflected that the GPA speakers did not reach the values of the F2 of the control speakers, except in the vowel context /i/. Table 21 below displays the mean values of F2 in the vicinity of the Arabic emphatic fricative as produced by the control and GPA speakers.

Table 21 Differences in F2 values for the emphatic /$s^ʕ$/ by control and GPA speakers

Context	Mean F2 for control	Std.	Mean F2 for GPA	Std.	t	df	* P-value
$s^ʕ$+ i	1615 Hz	474.35	1614 Hz	344.46	-.519	26	.608
$s^ʕ$+ a	1161 Hz	153.16	1258 Hz	109.35	2.892	84	*.005
$s^ʕ$+ u	863 Hz	96.08	959 Hz	84.12	3.242	61	*.002

Table 21 shows that the F2 of the vowel adjacent to the emphatic fricative tends to be lowered. Such lowering appears due to tongue retraction during the emphatic production (Abudalbuh 2010b). The GPA speakers demonstrate consistency in lowering F2 with the emphatic fricative. They lowered the F2 value with the vowel /i/ without any significant difference from the control group. The test reported that the differences of F2 values in the vowel contexts of /a/ and /u/ between the control and GPA speakers are statistically significant. Although the GPA speakers did not reach the values of the F2 values of the control speakers, particularly in the vowel contexts of /a/ and /u/, they show the same trend regarding backness, namely, that the vowels in the vicinity of the emphatic fricative become more backed than the non-emphatic ones.

The results obtained from the acoustic and statistical results in this subsection and the few statistical differences between the control and GPA speakers indicate that the group of GPA speakers is very close to the control group, particularly in producing the Arabic emphatic fricative.

6.2.3 Variation of the Voiceless Dental Fricative /θ/

Additional patterns of variation can be illustrated in Table 22, below, which displays the frequencies of occurrence per variant of the given target consonant /θ/. The GPA speakers realized the dental fricative /θ/ as /θ/ or as /t/ or as /s/.

Table 22 Percentages of /θ/ production for all GPA speakers

Variant	All GPA Speakers Realization
Local variant /θ/ (GA)	17% (42)
L1 variant /t/ (GPA)	76% (182)
L1 variant /s/ (GPA)	7% (16)
Total of all variants in the data	240

The results showed that GPA speakers produced the local variant /θ/ as /θ/ in 17% of instances and in 7% for the variant /s/. Within the replacement instances, as shown in Table 22, the GPA speakers predominantly substituted the local variant /θ/ with /t/, at a rate of 76%. The alternations of /θ/ are supported by the visual representation of spectrograms in Figure 7 below.

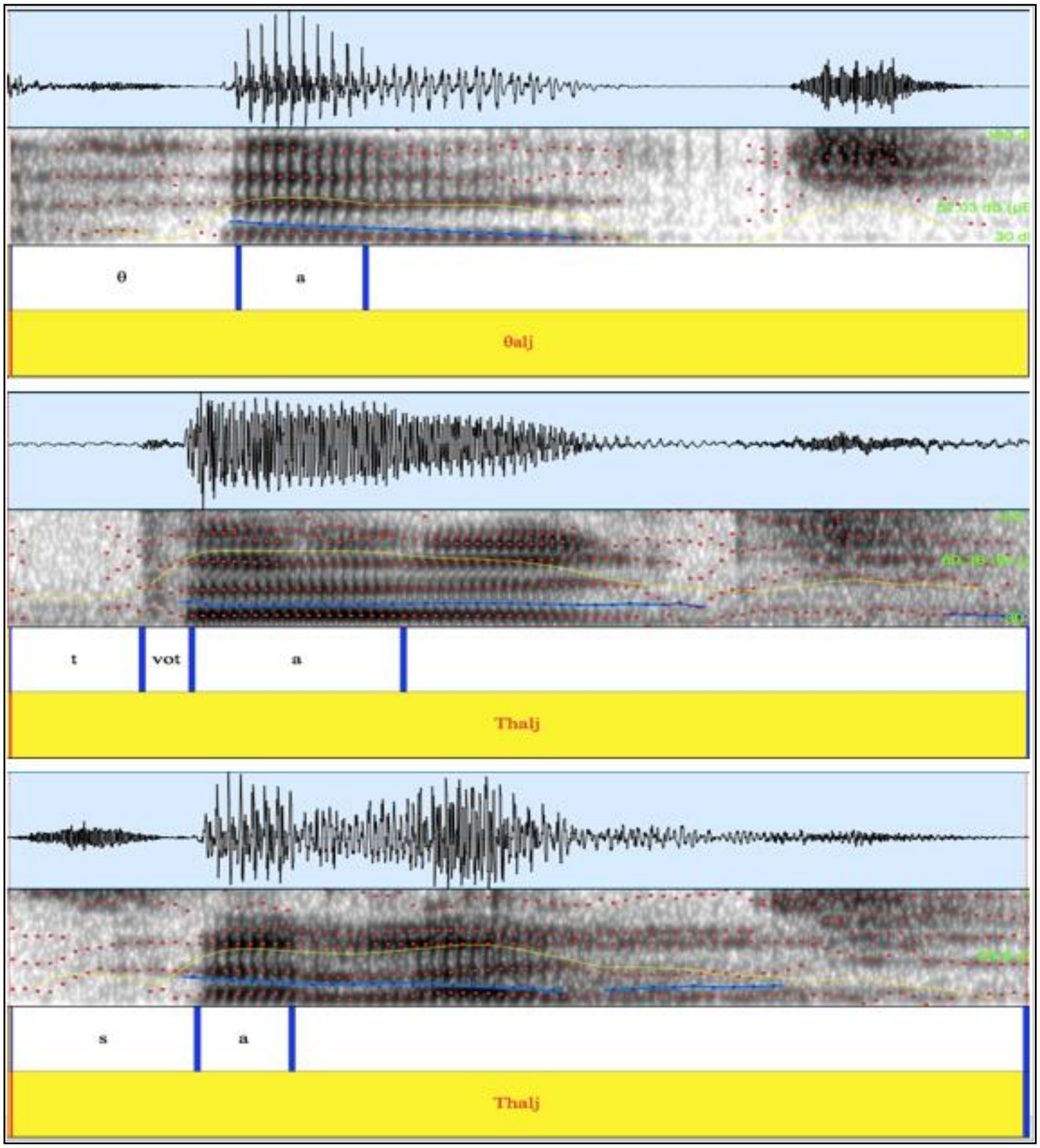

Figure 7. Spectrograms representing the variation of /θ/ by GPA speakers.

Figure 7 shows waveform and wideband spectrograms representing the realization of dental fricative /θ/, alveolar stop /t/ and alveolar fricative /s/ in producing the word *θaldʒ* 'ice.' Here, we notice the difference between the three spectrograms that represent the variants of /θ/. In the top spectrogram, we can see how /θ/ is produced with frication noise duration (average value 74 ms (SD = .023) resulting from forcing the air through a narrow channel, followed by an immediate periodic frequency of the following vowel. In addition, the COG of /θ/ was 5518 Hz (SD = 1366).

In contrast, the middle spectrogram, which illustrates /t/ realization, is distinct from the top one. The middle spectrogram shows acoustic cues pertaining to stop consonants, including VOT (average value 25 ms (*SD* = .0051), which occurs right before the periodic frequency of the following vowel. Finally, the bottom spectrogram represents the realization of the alveolar fricative /s/. It displays acoustic signals pertaining to alveolar fricative /s/, such as the existence of a high frequency generated at the top of wideband spectrogram, and also has an average friction noise duration (116 ms (*SD* = .0314) and COG (6995 Hz (*SD* = 1282). The following paragraph presents the acoustic values of /θ/ and its variants.

The GPA speakers realized /θ/ as dental fricative /θ/ with the acoustic measurements displayed in Table 23, as an alveolar stop /t/ with the acoustic measurements presented in Table 24, and as an alveolar fricative /s/ with the acoustic measurements displayed in Table 25.

Table 23 Acoustic measurements representing /θ/ realization by GPA speakers

Context	Avg. friction noise duration	Std.	Avg. COG	Std.
/θ/ + i	89 ms	.027	5295 Hz	1408.4
/θ/ + a	74 ms	.023	5518 Hz	1366.8
/θ/ + u	76 ms	.014	5390 Hz	1195.4

Table 24 Acoustic measurements representing /t/ realization by GPA speakers

Context	Avg. F2 values	Std.	Avg. VOT	Std.
/θ/= t+i	1803 Hz	241.5	31 ms	.0056
/θ/= t+a	1402 Hz	143.3	25 ms	.0051
/θ/= t+u	974 Hz	91.4	29 ms	.0084

Table 25 Acoustic measurements representing /s/ realization by GPA speakers

Context	Avg. friction noise duration	Std.	Avg. COG	Std.
/θ/= s+ i	104 ms	.019	6435 Hz	546.3
/θ/= s+a	116 ms	.031	6995 Hz	1282.1
/θ/= s+u	117 ms	.030	7025 Hz	1189.3

The GPA speakers were able to realize the Arabic dental fricative /θ/, particularly in the vowel context /i/, as in the word *θiran* 'ox,' and in the context /a/, as in the words *θaldʒ* 'ice' and *θalladʒah* 'refrigerator,' with similar values to the values of the control speakers. They realized the friction noise duration and COG of the Arabic dental fricative /θ/ without any significant differences from the control speakers.[13] However, the GPA speakers produced the dental fricative /θ/ differently in the words like *θum* 'garlic' and *θub* 'robe.' The t-test reported that the means of friction noise duration between the control speakers (M = 102, SD = .017, N = 10) and the GPA speakers (M = 76, SD = .014, N = 12) were significant, t (-3.725) = 20, p = .001. Likewise, the test also reported that the COG values in the vowel context /u/ between the control speakers (M = 6672, SD = 992.6, N = 10) and the GPA speakers (M = 5390, SD = 1195, N = 12) were

[13] For more details on standard deviation and t-test results, see Table 61 in Appendix E.

statistically significant, *t* (-2.700) = 20, *p* = .014, indicating that the GPA speakers did not differ from the native speakers in realizing the Arabic dental fricative in the vowel environments of /i/ and /a/.

6.2.4 Variation of the Voiceless Uvular Fricative /χ/

Table 26 below exhibits the frequencies of variation per variant of the given target consonant /χ/. The GPA speakers realized the voiceless uvular fricative /χ/ as /χ/ or as /k/ or as /h/.

Table 26 Percentages of /χ/ variations for all GPA speakers

Variant	All GPA Speakers Realization
Local variant /χ/ (GA)	63% (177)
L1 variant /k/ (GPA)	14% (39)
L1 variant /h/ (GPA)	23% (64)
Total of all variants in the data	280

Table 26 illustrates that the target sound /χ/was produced in 63% of tokens. The GPA speakers substituted it with the L1 variant /k/ less frequently, in 14% of tokens, compared to 63% and 23% for the variants /χ/ and /h/, respectively. These variants have been categorized with the aid of acoustic measurements together with the visual representation of spectrograms. The GPA speakers realized the uvular fricative variant /χ/ and glottal fricative /h/ with the following acoustic values, presented below in Tables 27 and 28.

Table 27 Acoustic measurements representing the uvular fricative /χ/ realization by GPA speakers

Context	Avg. friction noise dur	Std.	Avg. F2	Std.	Avg. COG	Std.
χ + i	87 ms.	.0200	1900 Hz	250.62	3158 Hz	962.3
χ + a	84 ms.	.0204	1381 Hz	229.0	3378 Hz	801.8
χ + u	97 ms.	.0280	951 Hz	96.06	3445 Hz	776.6

Table 28 Acoustic measurements representing the fricative /h/ realization by GPA speakers

Context	Avg. friction noise dur	Std.	Avg. F2	Std.	Avg. COG	Std.
χ = h + i	57 ms.	.0076	1957 Hz	126.26	3083 Hz	339.1
χ = h + a	77 ms.	.0249	1483 Hz	213.8	3113 Hz	841.6
χ = h + u	69 ms.	.0195	894 Hz	96.98	3546 Hz	898.8

As previously mentioned, the uvular fricative /χ/ alternates with the velar stop /k/. These alternations belong to different manners and places of articulation. Thus, examining the visual representation of the spectrogram, particularly in comparing two sounds belonging to different categories, provides us with general acoustic signals for categorizing these alternations. The present results show that the uvular fricative /χ/ is articulated with turbulence of airflow, and such turbulence leads to show aperiodic noise in the spectrogram. In contrast, the variant /k/ is clearly demonstrated in the spectrogram with the acoustic signals of the stop consonant, such as the existing of closure and burst release (VOT values). Table 29 below presents the acoustic cues related to the variant /k/.

Table 29 Acoustic measurements representing /k/ realization by GPA speakers

Context	Avg. F2 values	Std.	Avg. VOT	Std.
/χ/= k+i	1792 Hz	322.02	38 ms	.0090
/χ/= k+a	1471 Hz	141.9	26 ms	.0057
/χ/= k+u	952 Hz	76.9	32 ms	.0101

The GPA speakers had a higher frequency of producing the local variant /χ/, which ranks at the second-highest percentages in the current data; this production occurs despite its position at the posterior vocal tract, which is likely to result in difficulty in articulation. A possible motivation behind the high rate of realization will be discussed in Chapter 7. So, to what extent is the GPA speakers' production of the local variant /χ/ similar to the values of control speakers? The t-test reported that the GPA speakers realized most of the acoustic cues of the uvular fricative /χ/ with values statistically different from the values of the control speakers, specifically in the values of friction noise duration and F2 values of the vowel that follows the uvular fricative. However, the COG values are mostly realized without any significant differences between the control and GPA speakers.[14] These results indicate that the GPA speakers realize the voiceless uvular fricative variant /χ/ differently, as they did not attain the same values of F2 and friction noise duration as the control speakers in realizing the Arabic variant /χ/.

6.2.5 Variation of the Voiced Uvular Fricative /ɣ/

Table 30 below displays the results of variation for the given target consonant /ɣ/ among the GPA speakers.

[14] For more details on statistical results and standard deviation, see Table 57 in Appendix E

Table 30 Percentages of /ɣ/ variations for all GPA speakers

Variant	All GPA Speakers Realization
Local variant /ɣ/ (GA)	73% (234)
L1 variant /g/ (GPA)	16% (51)
L1 variant /h/ (GPA)	7% (23)
L1 variant /x/ (GPA)	4% (12)
Total of all variants in the data	320

The GPA speakers realized the voiced uvular fricative /ɣ/ as /ɣ/ or as /g/ or as /h/ or as /χ/. The variants in pronouncing the local form shows that the GPA speakers pronounced the local variant /ɣ/ more frequently than replacing it, realizing it in 73% of the tokens; less frequently, they replaced it with the voiced velar stop /g/ (16% of tokens), with the glottal fricative /h/ (7% of tokens), and with the uvular fricative /χ/ (4% of tokens). These variations are categorized acoustically through measuring the friction noise duration, COG and F2 of the vowel following the voiced uvular fricative /ɣ/.

A very small number of speakers realized the /ɣ/ as a uvular fricative /χ/ and as /h/ in the context of /u/, as in the words like *ɣurfah* ‘room,’ *ɣutrah* ‘a man's headdress,’ and *ɣubar* ‘dust.’ They produced the /ɣ/ as /x/ with an average friction noise duration of 92 ms (*SD* = .0169), average F2 value of 998 Hz (*SD* = 148.60) and average COG value of 3735 Hz (*SD* = 948.48). On the other hand, they produced the /ɣ/ as /h/ with an average friction noise duration of 83 ms (*SD* = .0245), average F2 value of 947 Hz (*SD* = 121.94) and average COG value of 3493 Hz (*SD* = 823.94). Unlike the variants of /x/ and /h/, the GPA speakers alternated the voiced uvular fricative /ɣ/ with /g/ in all the following vowel contexts: /i/, /a/, and /u/. Table 31 exhibits the acoustic measurements for the variation /g/.

Table 31 Acoustic measurements representing /g/ realization by GPA speakers

Context	Avg. F2 values	Std.	Avg. VOT	Std.
/ɣ/ = g + i	1626 Hz	188.03	33 ms	.0099
/ɣ/ = g + a	1570 Hz	185.90	24 ms	.0051
/ɣ/ = g + u	1084 Hz	74.79	25 ms	.0092

After presenting the acoustic correlates that relate to the variations of /x/, /h/, and /g/, we will now compare how similarly GPA speakers realized the voiced uvular fricative /ɣ/ to the control speakers. The t-test reported that the GPA speakers realized most of the acoustic cues of the voiced uvular fricative /ɣ/ with values statistically similar to the values of the control speakers, specifically in the values of friction noise duration and F2 values in the environments of /i/ and /u/. Similarly, the COG values are mostly realized without any significant differences between the control and GPA speakers, particularly in the vowel contexts /i/ and /u/.[15] These findings indicate that the GPA speakers are producing the voiced uvular fricative similarly to the production of Arabic speakers.

6.2.6 Variation of the Voiceless Pharyngeal Fricative /ħ/

Table 32 below displays the results of variation for the given target consonant /ħ/ among the GPA speakers.

Table 32 Percentages of /ħ/ variations for all GPA speakers

Variant	All GPA Speakers Realization
Local variant /ħ/ (GA)	16% (52)
L1 variant /h/ (GPA)	84% (268)
Total of both variants in the data	320

[15] For more details on statistical results and standard deviation, see Table 58 in Appendix E

The voiceless pharyngeal fricative /ħ/ shows high rates of substitution amongst the GPA speakers compared to their percentages of the substitution of other target sounds in the previous tables. The speakers produced the local variant /ħ/ with a much lower rate of production, at 16%, compared to its substitution with /h/, at 84%.

Unlike the previous target sounds, I categorized the variants of the pharyngeal consonant through measuring an extra acoustic cue, which includes the F1 of the vowel following the pharyngeal fricative. Therefore, I involved the F1 in addition to the F2, the friction noise duration and COG. I included the F1 values because some studies (e.g., Hassan 2012; Aldamen 2013) found an effect of the pharyngeal consonant on the F1 such that the F1 of the vowel in the vicinity of pharyngeal consonant tends to be more raised. The current results of the variant /ħ/ showed that it differs acoustically from the variant /h/ in the mean values of F1, friction noise duration and COG, but not in the F2 values.

The GPA speakers produced the pharyngeal fricative /ħ/ that follows the vowel contexts /i/, /a/, and /u/ with average F1 values of 478 Hz (*SD* = 103.4), 658 Hz (*SD* = 90.31), and 575 Hz (*SD* = 98.67), respectively. On the other hand, the variant /h/ is realized with average F1 values of 434 Hz (*SD* = 68.99) in the vowel environment /i/, 628 Hz (*SD* = 106.04) in the vowel environment /a/, and 481 Hz (*SD* = 77.71) in the vowel environment /u/. The t-test shows significant differences in the F1 values with the variants /ħ/ and /h/ in the vowel contexts /i/, /a/ and /u/, t (2.145) = 83, p = .035, t (2.089) = 130, p = .039, and t (4.248) = 125, p = .000, respectively. These results indicated that the F1 of the vowel in the context of the pharyngeal consonant /ħ/ has higher F1 values than in the context of the non-pharyngeal consonant /h/.

Regarding the friction noise duration, the GPA speakers produced the pharyngeal fricative /ħ/ that follows the vowel contexts /i/, /a/, and /u/ with an average friction noise duration of 92 ms (*SD* = 0191), 94 ms (*SD* = .0199), and 89 ms (*SD* = .0152), respectively. In contrast, the variant /h/ is realized with a friction noise duration of 61 ms (*SD* = .0136) in the vowel environment /i/, 67 ms (*SD* = .0186) in the vowel environment /a/, and 72 ms (*SD* = .0182) in the vowel environment /u/. The t-test reported significant differences in the friction noise duration with the variants /ħ/ and /h/ in the vowel contexts /i/, /a/ and /u/, t (7.860) = 83, p = .000, t (7.124) = 130, p = .000, and t (4.032) = 125, p = .000, respectively. These results showed that the pharyngeal variant /ħ/ has a longer friction noise duration than the non-pharyngeal variant /h/.

As for the COG, both variants /ħ/ and /h/ display different COG values. The COG values of the pharyngeal fricative /ħ/ show average COG values of 2916 Hz (*SD* = 444.1) in the vowel environment /i/, 2843 Hz (*SD* = 530.2) in the vowel environment /a/, and 3095 Hz (*SD* = 667.2) in the vowel environment /u/. In contrast, the COG value of the variant /h/ shows 3301 Hz (*SD* = 752.4) in the vowel environments /i/, 3276 ms (*SD* = 923.7) in the vowel environment /a/, and 3720 ms (*SD* = 971.04) in the vowel environment /u/. The t-test reported that there are significant differences in the COG values between the variants /ħ/ and /h/ in the vowel contexts /i/, /a/ and /u/, t (-2.765) = 46.250, p = .008, t (-3.319) = 100.986, p = .001, and t (-2.753) = 125, p = .007, respectively. These results indicated that the COG values of /h/ are higher than the GOG values of the variant /ħ/. Nonetheless, the GPA speakers realized the F2 values in the variants /ħ/ and /h/ similarly, without any significant differences.

The GPA speakers had a lower frequency of producing the variant /ħ/, which has the second-lowest percentages in the current data after the voiced pharyngeal fricative, a distribution that is likely due to the difficulty of its articulation. Very few GPA speakers realized the Arabic variant /ħ/; however, they realized it with values that differ significantly, in most cases, from the production of the control speakers, specifically in the COG and friction noise duration values. Table 33 displays the mean values and the statistical results for the COG between the control and GPA speakers.

Table 33 Differences in COG values for the voiceless pharyngeal fricative / ħ / by control and GPA speakers

Context	Mean COG for control	Std.	Mean COG for GPA	Std.	t	df	* P-value
ħ + i	2566 Hz	416.61	2916 Hz	444.11	2.041	26	*.051
ħ + a	2172 Hz	311.29	2843 Hz	530.28	4.553	47	*.000
ħ + u	2430 Hz	571.58	3095 Hz	667.21	3.101	33	*.004

Moreover, the two groups (control and GPA speakers) differ significantly in producing the friction noise duration of the variant /ħ/. The GPA speakers realized the pharyngeal fricative /ħ/ with significant values to the values of the control speakers. The test indicated that the differences of friction noise duration values between the control speakers (M = 0.116, SD = .031, N = 80) and the GPA speakers (M = .092, SD = .025, N = 152) were significant, t (6.487) = 230, p = .000. Figure 8 below shows the values of friction noise duration of /sˤ/ between the control and GPA speakers.

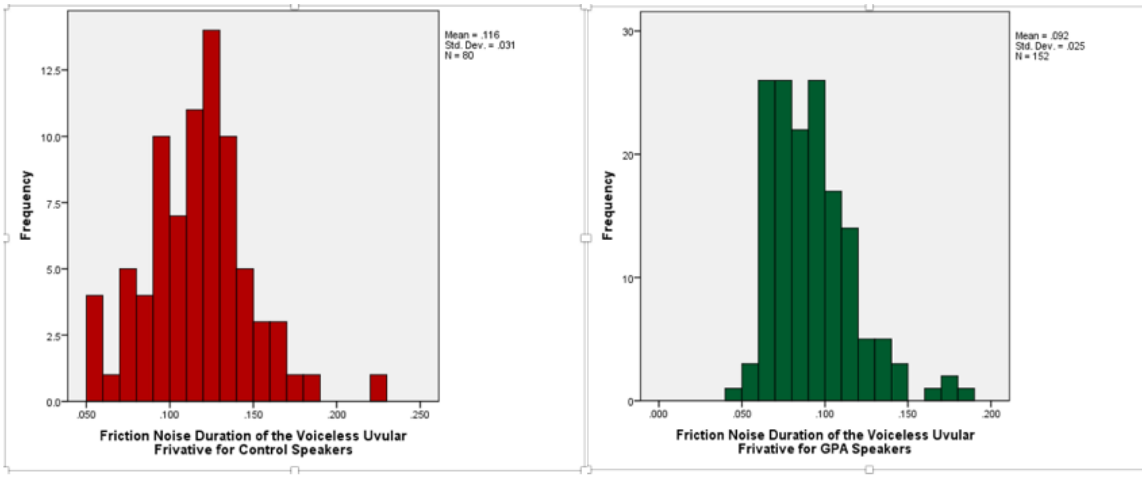

Figure 8. Histograms for friction noise duration of /ħ/ by control (red histogram) and GPA speakers (green histogram).

The results shown in Table 33 and Figure 8 reflect the fact that the GPA speakers realized the values of the COG and friction noise duration of the Arabic variant /ħ/ with higher values and shorter duration, respectively, than the control speakers did. However, both groups (control and GPA speakers) mostly realized the F1 and F2 values of the vowel following the voiceless pharyngeal fricative /ħ/ without any significant differences.[16] The existence of several acoustic differences suggest that the GPA speakers are not very close to the values of the control speakers in realizing the voiceless pharyngeal fricative.

6.2.7 Variation of the Voiced Pharyngeal Fricative /ʕ/

The variations illustrated in Table 34 below display the frequencies of occurrence per variant for the given target consonant /ʕ/ in the speech of GPA speakers.

[16] For more details on statistical results and standard deviation, see Table 59 in Appendix E.

Table 34 Percentages of /ʕ/ variations for all GPA speakers

Variant	All GPA Speakers Realization
Local variant /ʕ/ (GA)	6% (17)
L1 variant /ʔ/ (GPA)	75% (209)
L1 variant /h/ (GPA)	5% (15)
Deleting local variant /ʕ/	14% (39)
Total of all variants in the data	280

The results shown in Table 34 demonstrate that the GPA speakers vary in realizing the voiced pharyngeal fricative /ʕ/. The GPA speakers realized the pharyngeal fricative /ʕ/ as the glottal stop /ʔ/, or as the voiced pharyngeal fricative /ʕ/, or as the glottal fricative /h/, or simply deleted it. Figure 9 below displays different visual representations of spectrograms that provide us with general acoustic information for categorizing the voiced pharyngeal fricative /ʕ/ and its variants.

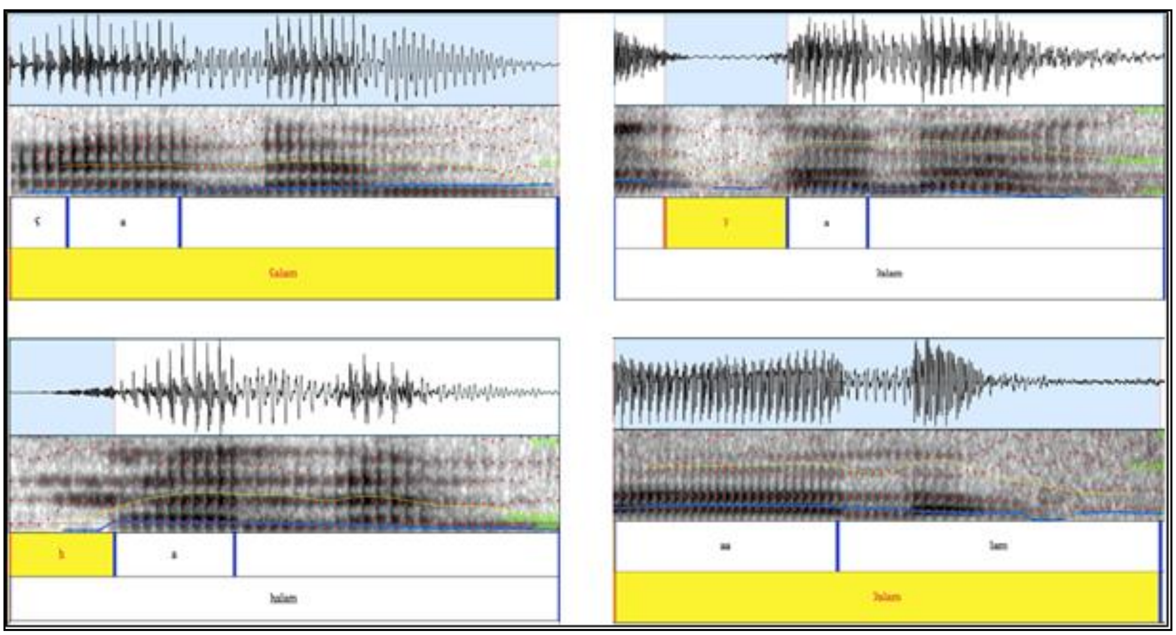

Figure 9. Spectrograms for /ʕ/ and its variants by GPA speakers.

Each spectrogram represents one variant for the voiced pharyngeal fricative /ʕ/ in producing, for example, the word *ʕalam* ‘flag’ in the carrier phrase [ha:ða ʕalam]. Hassan and Heselwood (2011:151) state that the spectrogram of the voiced pharyngeal phoneme consists of a “well-defined vowel-like formant structure.” In keeping with their assertion, we notice how the first sound tier in each spectrogram differs with respect to the shapes of each waveform.

The top left spectrogram represents the voiced pharyngeal fricative, as it has some kind of harmonic structure and formant-like structures in the first sound tier. In addition, the top right spectrogram represents the glottal stop variant and contains acoustic signals that are linked to the glottal stop, such as a silence gap of the closure phase and an abrupt drop in F0. The left bottom spectrogram represents the glottal fricative /h/, as it lacks the strong friction noise and formant-like patterns, and the friction noise is depicted as flat without marked lumps because /h/ does not have any shape in the tube and the articulators are relaxed during its production. Finally, the bottom right spectrogram represents /ʕ/-deletion. When the /ʕ/ is deleted, the adjacent vowel is lengthened. Theoretically, losing a segment can be compensated by lengthening. Gess (1998: 353) states that “a vowel can be lengthened in compensation for the loss or reduction of another vowel or consonant.” Therefore, the bottom right spectrogram suggests that this was the case with this sort of deletion. The first sound tier in the bottom right spectrogram presented the presence of lengthening vowel (156 ms) with clear acoustic signals for categorizing the vowel, such as visible formant and fundamental frequencies.

Most of the GPA speakers encounter difficulty in articulating the voiced pharyngeal fricative /ʕ/. Thus, a very few number of speakers realized it at a much lower rate, at 6% of tokens, compared to the other investigated target sounds (e.g., /tˤ/, /θ/, /sˤ/, /χ/, /ɣ/, /ħ/). So, do the GPA speakers produce the voiced pharyngeal variant /ʕ/ in a similar way to the control speakers? The t-test reported that the GPA speakers, on the one hand, realized some of the acoustic cues of the voiced pharyngeal fricative /ʕ/ with values statistically different from the values of the control speakers, specifically in the F2 values and the COG in the vowel context /a/. However, the F1 value and friction noise duration of the pharyngeal fricative /ʕ/ do not show any statistical differences from the values of the control speakers. Tables 35 and 36 display, respectively, the mean values and the statistical results for the F2 and COG values of the voiced pharyngeal fricative between the control and GPA speakers.

Table 35 Differences in F2 values for the voiced pharyngeal fricative /ʕ/ by control and GPA speakers

Context	Mean F2 for control	Std.	Mean F2 for GPA	Std.	t	df	* P-value
ʕ + i	1932 Hz	215.7	1650 Hz	155.6	-3.407	22	*.003
ʕ + a	1509 Hz	99.26	1399 Hz	71.42	-3.108	28	*.004

Table 36 Differences in COG for the voiced pharyngeal fricative /ʕ/ by control and GPA speakers

Context	Mean COG for control	Std.	Mean COG for GPA	Std.	t	df	* P-value
ʕ + i	2202 Hz	287.97	2421 Hz	643.11	1.150	22	.263
ʕ + a	2020 Hz	382.10	3068 Hz	651.08	5.579	28	*.000

The results in these tables demonstrate that the GPA speakers realized the F2 and COG of the voiced pharyngeal fricative /ʕ/ with lower F2 and higher COG values than the control speakers did. However, the F1 values and friction noise duration are realized without any significant differences between the control and GPA speakers.[17]

The overall findings explained in the previous sections demonstrate that the GPA speakers did not approximate the local norm with respect to the realization of F2 and COG values of the voiced pharyngeal fricative.

6.2.8 Initial Summary of Results (Overall)

To conclude this section, the percentages of the overall variations of the Arabic marked consonants in the speech of GPA speakers are summarized and integrated below in Figure 10.

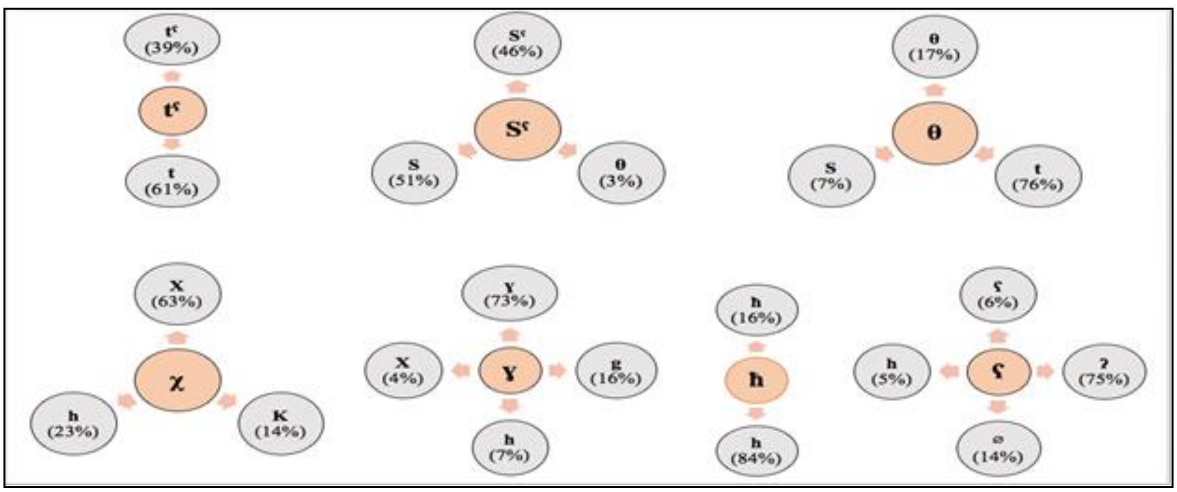

Figure 10. Overall variations of the Arabic consonants in the speech of GPA speakers.

Figure 10 displays that the degree of variation of the marked consonants varies from consonant to consonant. The percentages indicate that the voiced pharyngeal fricative /ʕ/

[17] For more details on statistical results and standard deviation, see Table 60 in Appendix E.

shows the lowest percentages of realization amongst the GPA speakers, whereas the voiced uvular fricative /ɣ/ ranks with the highest percentages in the current corpus. These differences will be discussed further in Section 6.5. Furthermore, the previous results reported that the GPA speakers, particularly those who were able to realize the Arabic marked consonants, produced the target consonants with similar acoustic values to the control speakers, except for some of the F2 values of the vowels following the consonants /tˤ/, /sˤ/, /χ/, and /ɣ/, some friction noise durations of the consonants /θ/, /χ/, /ɣ/, /ħ/, and /ʕ/, and some COG values of the consonants /θ/, /ɣ/, /ħ/, and /ʕ/. Although the GPA speakers did not attain some of the values of the acoustic cues of the control speakers, they demonstrate the same trend that Arab native speakers follow when they realize these Arabic consonants, for instance, shortening the VOT and lowering F2 values with the emphatic consonants and also decreasing the COG values for the fricative consonants produced at back in the vocal tract, and increasing the COG for the consonants produced at the front cavity. Accordingly, such small differences in some of the acoustic cues indicate that the GPA speakers, to a large extent, tended to have very similar realization to that of the control speakers.

The current section presents the results of GPA speakers as one group containing two groups of speakers of two different languages (i.e., Malayalam and Urdu). Combining two groups of speakers belonging to different languages may affect both groups and may not provide accurate results in terms of realizing the target consonants or in the degree of closeness of each group to the pronunciation of native speakers. Therefore, in the subsequent Section 6.3, I divided the GPA speakers into two groups (i.e., a Malayalam and an Urdu group) in order to determine the degree to which the

Malayalam and Urdu groups behave similarly in their realization of the Arabic marked consonants, as well as which of these groups is closer in values to the local norm.

6.3 Realization/Alternation of Arabic Consonants for Each Group of GPA Speakers

This section will present the findings that are linked to the third research question. This question involves determining which group (Malayalam or Urdu speakers) is closer to the values of the lexifier (i.e., Arabic/Gulf Arabic). It investigates how each group of GPA speakers realize the target consonants of Arabic, taking into account the overall differences of the acoustic values with the control speakers explained in the previous section. I separated the GPA speakers into two groups based on their ethnicity: those who are from India having Malayalam as their L1 and those who are from Pakistan whose L1 is Urdu. Each group's mean acoustic values of each target consonant's measurements will be compared to the acoustic values of the control group. This section contains a series of tables distributed in several subsections. I start each subsection by presenting tables displaying the rates of occurrence of Arabic marked consonants and their variants by each group (Malayalam and Urdu group). This is followed by the results of a one-way ANOVA comparing the acoustic value differences of the target consonant of each group (Malayalam, Urdu, and control group) in order to discover the extent of similarity and/or difference in the consonants' performance and to what extent the GPA speakers' performances in both groups (Malayalam and Urdu speakers) acoustically differ from or match the values of the consonants produced by the control speakers (Arabic native speakers).

6.3.1 Variations in Voiceless Emphatic Alveolar Stop /tˤ/ by Each Group

GPA participants variably realized the voiceless emphatic alveolar stop /tˤ/. Table 37 displays the rates of variations of /tˤ/ as produced by Malayalam and Urdu speakers, respectively.

Table 37 Variations of the voiceless emphatic stop /tˤ/ by Malayalam and Urdu speakers

Group	Percentages of realizing /tˤ/	
	/tˤ/ (GA)	/t/ (GPA)
Malayalam	41% (58)	59% (82)
Urdu	36% (50)	64% (90)
Total of both variants in the data	280	

The results showed that GPA speakers produced the local variant /tˤ/ as /tˤ/ in 41% of tokens for the Malayalam group and 36% for the Urdu group. Within the replacement instances, as shown in Table 37, speakers of both groups predominantly substituted the local variant /tˤ/ with /t/, at a rate of 59% for the Malayalam speakers and 64% for the Urdu speakers. The local variant /tˤ/ shows high rates of substitution amongst the GPA groups. The results showed that there is a slight difference between the overall performance of Malayalam and Urdu speakers in producing local variant /tˤ/. Nevertheless, the highest percentages of realizing this sound occurred among the Malayalam speakers. Therefore, from the performances of these groups (Malayalam and Urdu group), I would like to determine whether the Malayalam and Urdu groups behave alike or differently in realizing the acoustic cues of Arabic emphatic stop /tˤ/, as well as which of these groups is closer in values to the local norm.

To begin with the F2 values with the Arabic emphatic stop /tˤ/, the results report that both groups of GPA speakers (Malayalam and Urdu group) show consistency in lowering the F2 in the vowel contexts /i/, /a/, and /u/, as the control group does. Both groups of GPA speakers realized the F2 values in the vowel context /i/ with similar values to the control speakers, without any significant differences. However, neither group reached the F2 values of the control speakers in the environments of /a/ and /u/. The test shows a significant difference in F2 values for the three groups. Tukey post-hoc tests reported that the mean F2 value in the context /a/ for the control group (n = 10, M = 1092, SD = 140.50) is significantly different than for the Malayalam group (n = 24, M = 1230, SD = 104.01) and the Urdu group (n = 17, M = 1252, SD = 99.93). The F2 value in the context /u/ for the control group (n = 10, M = 813, SD = 61.96) is significantly different than that of the Malayalam group (n = 14, M = 951, SD = 106.93) and the Urdu group (n = 20, M = 901, SD = 88.08). The F2 values in both groups (Malayalam and Urdu group) did not show a significant difference, suggesting that they produce this sound similarly to one another and unlike the local form.

On the other hand, the VOT of the emphatic stop is produced with short VOT in all the groups. The results indicated that the Malayalam and Urdu speakers similarly realized the VOT of the Arabic emphatic stop in the vowel contexts /a/ and /u/ with values much like those of native speakers, except for the VOT in the environment of /i/. There is a significant difference of VOT values, specifically in the context /i/, for the three groups, F (2.53) = 5.124, p = .009. Tukey post-hoc tests reported that the mean

VOT for the control group (*n* = 15, *M* = 21, *SD* = .0047) was significantly different than for the Malayalam group (*n* = 24, *M* = 18, *SD* = .0023) and for the Urdu group (*n* = 17, *M* = 17, *SD* = .0017). However, the Malayalam and Urdu groups show no significant difference from one another, indicating that both groups of the GPA speakers behave alike in terms of their realization of the VOT of the Arabic emphatic stop, and neither reached the VOT value of the native speakers, particularly in the environment of /i/.

Overall, the GPA speakers behave alike in realizing the Arabic emphatic stop, in that both groups similarly realized most of the acoustic values of the Arabic emphatic stop with values much like those of native speakers, regardless of their ethnic group.

6.3.2 Variations in Voiceless Emphatic Alveolar Fricative /sˤ/ by Each Group

Table 38 presents the use of the three variants (i.e., /sˤ/, /s/, and /θ/) of the voiceless emphatic alveolar fricative /sˤ/ in the speech of Malayalam and Urdu group.

Table 38 Variations of the emphatic fricative /sˤ/ by Malayalam and Urdu speakers

Group	Percentages of realizing /sˤ/		
	/sˤ/ (GA)	/s/ (GPA)	/θ/ (GPA)
Malayalam	47% (66)	53% (74)	N/A
Urdu	46% (65)	47% (66)	7% (9)
Total of all variants in the data	280		

Table 38 illustrates that the target sound /sˤ/ was produced in 47% and 46% of tokens for the Malayalam and Urdu groups, respectively. As for substitution, the Malayalam group alternated the target sound /sˤ/ with only the variant /s/ in 53% of tokens, whereas the Urdu speakers alternated the sound /$s^ʕ$/ with either /s/ or /θ/ in 47% and 7% of tokens, respectively. The results showed that there were no differences between the overall performance of Malayalam and Urdu speakers in producing the emphatic alveolar fricative /$s^ʕ$/. So, the next question to determine is which of these groups, the Malayalam or the Urdu group, is closer in values to the control speakers in realizing the acoustic cues of Arabic emphatic fricative /$s^ʕ$/.

Both groups of GPA speakers similarly realized the COG values of the Arabic emphatic fricative /$s^ʕ$/ in the vowel contexts /i/, /a/, and /u/ with values much like those of the control speakers. Likewise, the friction noise duration in the vowel contexts /i/ and /u/ is not significantly different from the control group, except for the friction noise duration in the environment of /a/. There is a significant difference of friction noise duration for the three groups, F (2, 83) = 8.052, p = .001. Tukey post-hoc tests reported that the mean friction noise duration for the control group (n = 15, M = 115, SD = .018) was significantly different than that of the Malayalam group (n = 37, M = 92, SD = .015). However, the Urdu and control group show no significant differences with respect to the friction noise duration.

Neither group approximated the F2 values of the local norm for the emphatic fricative in the vowel contexts /i/ and /u/. The test shows a significant difference in F2 values with /i/ for the three groups, F (2, 25) = 11.581, p = .000. Tukey post-hoc tests reported that the mean F2 for the control group (n = 10, M = 1615, SD = 387.43) is significantly different than the Malayalam group (n = 9, M = 1314, SD = 71.91) and the Urdu group (n = 9, M = 1914, SD = 210.93). Similarly, the test shows a significant difference in F2 values with /u/ for the three groups, F (2, 60) = 5.393, p = .007. Tukey post-hoc tests reported that the mean F2 for the control group (n = 10, M = 863, SD = 96.08) is significantly different from those of the Malayalam group (n = 26, M = 952, SD = 79.39) and the Urdu group (n = 27, M = 966, SD = 89.34). In this case, both groups were unable to attain the local norm in the values of F2, particularly with the vowels /i/ and /u/. Nevertheless, the Malayalam group, but not the Urdu group, were able to attain the F2 value of the local form in the context /a/ without any significant difference.

In short, the findings for this emphatic fricative were similar to what we found in the emphatic stop realization, in that both groups of GPA speakers behaved somewhat alike in realizing the Arabic emphatic fricative. However, the Malayalam group surpassed the Urdu group in one acoustic realization. The Malayalam speakers are closer in F2 values to the local form in the context /a/ than are the Urdu speakers.

6.3.3 Variations in Voiceless Dental Fricative /θ/ by Each Group

Table 39 illustrates additional patterns of variation that show the frequencies of occurrence for the variants of the target consonant /θ/ by Malayalam and Urdu speakers.

Table 39 Variations of the dental fricative /θ/ by Malayalam and Urdu speakers

Group	Percentages of realizing /θ/		
	/θ/ (GA)	/t/ (GPA)	/s/ (GPA)
Malayalam	10% (12)	90% (108)	N/A
Urdu	26% (31)	59% (71)	15% (18)
Total of both variants in the data	240		

The results showed that both groups (the Malayalam and the Urdu groups) replaced the dental fricative more often than realizing it. The GPA speakers of both groups predominantly substituted the local variant /θ/ with /t/, replacing it in 90% of tokens for the Malayalam group and 59% for the Urdu group. If we compare the overall performance of both groups with respect to the realization of the local variant /θ/, we notice that GPA speakers of both groups show a very low rate of producing the variant /θ/. In this case, both groups do not appear to have acquired the local variant. This difficulty is expected because this sound is considered one of the marked segments (i.e., rare in languages and difficult to pronounce) in world languages, and many L2 speakers who lack the phoneme /θ/ in their L1 experience difficulties in pronouncing it (Jones 2005; Hanulikova & Weber 2010). Thus, it is substituted with the stop /t/, a much more common and typologically unmarked segment.

The Malayalam group realized the values of the variant /θ/, such as friction noise duration and COG values, in all vowel contexts (i.e., /i/, /a/, and /u/) with acoustic values similar to the control group without any significant differences. On the other hand, the Urdu group were only able to realize the friction noise duration and COG of the variant /θ/ in the contexts of /i/ and /a/ with values approximate to the local norm without any significant differences. The Urdu group could not attain the values of friction noise duration and COG for the dental fricative in the vowel context /u/. The test shows a significant difference in the friction noise duration and COG values with /u/ for the three groups, $F\ (2, 19) = 6.628$, $p = .007$ and $F\ (2, 19) = 3.600$, $p = .047$, respectively. Tukey post-hoc tests reported that the mean friction noise duration for the control group ($n = 10$, $M = 102$, $SD = .0174$) is significantly different than that of the Urdu group ($n = 9$, $M =$

76, *SD* = .0150). Furthermore, Tukey post-hoc tests show that the mean COG values for the control group (*n* = 10, *M* = 6672, *SD* = 992.29) are significantly different than those of the Urdu group (*n* = 9, *M* = 5306, *SD* = 1202.30). However, the Malayalam group (*n* = 3, *M* = 5645, *SD* = 1395.65) shows no significant difference from the control group. In this case, I argue that Malayalam group is closer to the values of the lexifier (i.e., Arabic/Gulf Arabic), particularly with the dental fricative.

6.3.4 Variations in Voiceless Uvular Fricative /χ/ by Each Group

Table 40 depicts the percentages of the three variants (i.e., /χ/, /k/ and /h/) of the voiceless uvular fricative /χ/ in the speech of the Malayalam and Urdu groups.

Table 40 Variations of the voiceless uvular fricative /χ/ by Malayalam and Urdu speakers

Group	Percentages of realizing /χ/		
	/χ/ (GA)	/k/ (GPA)	/h/ (GPA)
Malayalam	51% (71)	26% (37)	23% (32)
Urdu	76% (107)	N/A	24% (33)
Total of both variants in the data	280		

The tables illustrate that the Urdu group had a higher frequency of producing the local variant /χ/ than speakers in the Malayalam group, at 76% and 51% of tokens, respectively. The GPA speakers of both groups perform a better pronunciation for the local form /χ/, producing it with a higher percentage than the replacement process. It is expected that Urdu speakers tend to produce the local variant with higher percentages than Malayalam speakers because the voiceless uvular fricative /χ/ is present in the Urdu consonantal inventory (Table 7) and absent in the Malayalam phonemic inventory.

Both groups of GPA speakers realized the values of the uvular fricative /χ/, such as friction noise duration values in all vowel contexts (i.e., /i/, /a/, and /u/), and the COG value of uvular fricative /χ/ in the context /a/ and /u/, with acoustic values statistically different from the control group.[18] In contrast, both groups of GPA speakers realized the F2 value in the context /a/ and the COG value in the context /i/ with acoustic values similar to the control group without any significant differences. Nonetheless, the Urdu group was only able to realize the friction noise duration and COG of the variant /χ/ in the contexts of /i/ and /a/ with values approximate to the local norm without any significant differences.

The Urdu group, but not the Malayalam group, were able to produce the F2 values in the contexts /i/ and /a/ with similar values to the control speakers without any significant differences. This result indicates that Urdu speakers and control speakers behave substantially alike in realizing the Arabic voiceless uvular fricative, as compared to Malayalam speakers.

6.3.5 Variations in Voiced Uvular Fricative /ɣ/ by Each Group

Table 41 below demonstrates the results of the variation for the target consonant /ɣ/ in the speech of both group of GPA speakers. The table displays multiple variants for this consonant (/ɣ/).

[18] See Table 61 in Appendix E for statistical details.

Table 41 Variations of the voiced uvular fricative /ɣ/ by Malayalam and Urdu speakers

Group	Percentages of realizing /ɣ/			
	/ɣ/ (GA)	/g/ (GPA)	/h/ (GPA)	/χ/ (GPA)
Malayalam	47% (75)	30% (48)	8% (12)	15% (25)
Urdu	97% (156)	3% (4)	N/A	N/A
Total of both variants in the data	320			

Both groups pronounce the local variant /ɣ/ more frequently than substituting it. However, as expected, the higher rate of producing the given target consonant /ɣ/ occurred amongst the Urdu group, with 97% of tokens, compared to 47% for the Malayalam group. This result is explained by the presence of the sound /ɣ/ in the consonantal inventory of Urdu, which in turn reduces the possibility of the appearance of multiple variations for the variant /ɣ/ among the Urdu speakers. In contrast, as previously presented in Table 6, Malayalam does not have the phoneme /ɣ/ in its inventory; thus, the Malayalam speakers variably produced it as /ɣ/ in 47% of tokens, as /g/ in 30%, as /h/ in 8%, or as /x/ in 15% of the tokens.

The results revealed that the Urdu speakers, but not Malayalam speakers, realized the fricative /ɣ/ in all contexts /i/, /a/, and /u/ with similar F2, friction noise duration and COG values to the control speakers without any significant differences. In contrast, the Malayalam speakers were only able to realize the fricative /ɣ/ in the context /i/ with similar F2, friction noise duration and COG values to the control speakers. However, the Malayalam speakers produced the fricative /ɣ/ in the contexts /a/, and /u/ partially similarly to the acoustic cues for the local form. They realized the friction noise duration of the fricative /ɣ/ only in the contexts /a/ and /u/ with similar values to the control speakers, whereas the other acoustic cues, such as F2 and COG values, are produced significantly different from the local form. The test reveals a significant difference in F2 values, especially in the environment of /a/ for the three groups, F (2, 147) = 10.290, p = .000. Tukey post-hoc tests reported that the mean F2 for the control group (n = 20, M = 1316, SD = 135.52) is significantly different than for the Malayalam group (n = 52, M = 1465, SD = 192.01). Moreover, the test shows a significant difference in F2 values in the vowel context /u/ for the three groups, F (2, 34.042) = 7.737, p = .002. Tukey post-hoc tests reported that the mean F2 for the control group (n = 15, M = 915, SD = 193.30) is significantly different than that of the Malayalam group (n = 30, M = 1057, SD = 75.35). As for the COG values in the context /a/, the Malayalam speakers realized it with significant differences among the three groups, F (2, 147) = 4.760, p = .010. Tukey post-hoc tests reported that the mean COG for the control group (n = 20, M = 3428, SD = 906.23) is significantly different than that of the Malayalam group (n = 52, M = 2913, SD = 674.60). Moreover, Malayalam speakers realized COG in the context /u/ with significant differences among the three groups, F (2, 102) = 8.221, p = .000. Tukey post-hoc tests reported that the mean COG for the control group (n = 15, M = 4043, SD = 763.44) is significantly different than that of the Malayalam group (n = 30, M = 3118, SD = 599.66).

Accordingly, these comparisons reveal that the GPA speakers from the only Urdu group were able to produce the Arabic voiced uvular fricative /ɣ/ in all contexts with similar values to the control speakers without any significant differences, suggesting that Urdu speakers and control speakers behave more alike in realizing the Arabic fricative /ɣ/

than the Malayalam and control speakers.

6.3.6 Variations in Voiceless Pharyngeal Fricative /ħ/ by Each Group

Table 42 below lists the percentages of the variation for the target consonant /ħ/ as produced by both group of GPA speakers.

Table 42 Variations of the pharyngeal fricative /ħ/ by Malayalam and Urdu speakers

Group	Percentages of realizing /ħ/	
	/ħ/ (GA)	/h/ (GPA)
Malayalam	19% (31)	81% (129)
Urdu	13% (21)	87% (139)
Total of both variants in the data	320	

Both groups lack the phoneme /ħ/ in their native inventory, and this phoneme is also very rare in the world's languages (Mitchell 1993). Thus, the voiceless pharyngeal fricative /ħ/ shows high rates of substitution amongst both groups of GPA speakers compared to their percentages of its realization. Both groups performed similarly, to a large extent. The Urdu speakers produced the local variant /ħ/ with a much lower rate of production, at 13% of tokens, compared to its substitution with /h/, at 87% of tokens. The Malayalam group, on the other hand, produced the local variant at 19% of tokens and substituted it with /h/ in 81% of tokens.

Both groups of GPA speakers, as well as control speakers, produced the local variant /ħ/ in the context /i/ similarly to one another. The statistical tests of the F1, F2, friction noise duration, and COG values among the three groups showed no significant differences.[19]

Concerning the variant /ħ/ in the context /a/, both groups produced the F1 values similarly to the F1 of the local form without any significant differences. However, they differed from the control group in realizing the F2, friction noise duration, and COG values. The test reveals a significant difference in F2 for the three groups, F (2, 46) = 13.173, p = .000. Tukey post-hoc tests reported that the mean F2 for the control group (n = 15, M = 1544, SD = 169.97) is significantly different than that of the Malayalam group (n = 21, M = 1291, SD = 104.46) and of the Urdu group (n = 13, M = 1358, SD = 179.33). Similarly, the test reported that the values of friction noise duration are significantly different among the groups. This result indicates that both groups were unable to attain the values of the local norm /ħ/ in the environment /a/. Tukey post-hoc tests showed that the mean friction noise duration for the control group (n = 15, M = 118, SD = .027) is significantly different than for the Malayalam group (n = 21, M = 94, SD = .020) and the Urdu group (n = 13, M = 94, SD = .019). Finally, the test found that there is a significant difference in COG values for the three groups, F (2,46) = 10.760, p = .000. Tukey post-hoc tests showed that the mean COG value for the control group (n = 15, M = 2172, SD = 311.29) is significantly different than that of the Malayalam group (n = 21, M = 2903, SD = 545.64) and Urdu group (n = 13, M = 2747, SD = 510.76).

In addition, both groups were unable to attain the values of the variant /ħ/ in the context /u/, particularly regarding the values of F1, friction noise duration and COG. There is a significant difference of F1 values for the three groups, F (2,32) = 11.757, p = .000. Tukey post-hoc tests reported that values for the control group (n = 15, M = 448, SD

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[19] See Table 62 in Appendix E for the standard deviation and t-test results.

= 88.71) are significantly different than those of the Malayalam group (*n* = 15, *M* = 534, *SD* = 83.82) and the Urdu group (*n* = 5, *M* = 658, *SD* = 85.13).

In sum, unlike the previous target consonants, the Arabic voiceless pharyngeal fricative is produced by the GPA groups in most cases with acoustic cues differing significantly from the values of the local form. Both groups of GPA speakers are, for the most part, equal and behaved similarly in realizing the Arabic variant /ħ/.

6.3.7 Variations in Voiced Pharyngeal Fricative /ʕ/ by Each Group

The variation illustrated in Table 43 below shows the frequencies of appearance for the Arabic variants /ʕ/ by Malayalam and Urdu groups.

Table 43 Variations of the pharyngeal fricative /ʕ/ by Malayalam and Urdu speakers

Group	Percentages of realizing /ʕ/			
	/ʕ/ (GA)	/ʔ/ (GPA)	/h/ (GPA)	Deleting /ʕ/
Malayalam	9% (21)	63% (89)	6% (8)	22% (31)
Urdu	4% (5)	86% (120)	3% (4)	7% (11)
Total of both variants in the data	320			

The local variant /ʕ/ is produced at a much lower rate, in 9% and 4% of the tokens for the Malayalam and Urdu group participants, respectively. Therefore, the substitution of /ʕ/ is not surprising, since the voiced pharyngeal fricative is considered one of the marked segments (i.e., rare in languages and difficult to pronounce) in world languages, occurring in only 2.5% of the UPSID languages. The results shown in Table 43 demonstrates that the GPA speakers encountered difficulty in producing the voiced pharyngeal fricative. Therefore, it is substituted with either the local form /ʕ/ or with the glottal stop /ʔ/, or with /h/, or it is deleted.

Although very few speakers from both groups realized the pharyngeal fricative /ʕ/, one group is closer to the values of the local form. For instance, the Urdu group produced the local form /ʕ/ more closely to the lexifier than did the Malayalam group. The test reported that the Urdu speakers were able to realize the Arabic voiced pharyngeal fricative in the contexts /i/ and /a/ with similar F1, F2, friction noise duration and COG values to the control speakers without any significant difference. In contrast, the Malayalam speakers produced the local form /ʕ/ in most cases with values differing significantly from the control group's values. For instance, the Malayalam speakers realized the F2 in the contexts /i/ and /a/ with different F2 values to the control speakers. There is a significant difference of F2 values in the environments /i/ and /a/ for the three groups, F (2,22) = 7.078, p = .004 and F (2,28) = 5.507, p = .010, respectively. Tukey post-hoc tests reported that the mean F2 with the /i/ context for the control group (n = 15, M = 1932, SD = 215.70) was significantly different than that of the Malayalam group (n = 7, M = 1605, SD = 123.92). Also, the Tukey post-hoc tests reported that the mean F2 with the /a/ context for the control group (n = 20, M = 1509, SD = 99.26) was significantly different than that of the Malayalam group (n = 7, M = 1385, SD = 70.28). Likewise, the COG values in the context /a/ are realized significantly differently between the three groups, F (2, 28) = 16.617, p = .000. Tukey post-hoc tests revealed that the mean COG for the control group (n = 20, M = 2020, SD = 382.10) is significantly different than that of the Malayalam group (n = 7, M = 3210, SD = 674.25). Nevertheless, the Malayalam speakers were able to realize some of the values of the /ʕ/ similarly to the local form. For instance, they realized the fricative /ʕ/ in the contexts /i/ and /a/ with similar F1 and friction noise duration values to the control speakers without any significant differences. Taken together, I conclude that the multiple appearance of non-significant differences between the Urdu and control groups indicates that the Urdu speakers, but not the Malayalam speakers, produce the voiced pharyngeal fricative close to the Arabic form.

6.3.8 Initial Summary of Results (By Group)

In conclusion, this section is summarized as follows. Each group produced the same target consonants. The speakers' production values are compared to the control speakers (native Arabic speakers) in order to investigate which group is closer to the values of the lexifier (i.e., Arabic/Gulf Arabic). These acoustic comparisons demonstrate that the Urdu speakers produced the Arabic marked consonants (/tˤ/, /χ/, /ɣ/, /ʕ/) with similar values to the control speakers more frequently than the Malayalam speakers did. The Malayalam speakers, on the other hand, were very close in approximating the control group with the Arabic consonant /θ/, /tˤ/and /sˤ/. However, both groups behave similarly with Arabic consonants /ħ/ and neither group approximated its local values. Accordingly, I argue that the Urdu group is closer to the local norm in the production of most Arabic consonants than the Malayalam group. Figure 11 below summarizes the overall observations of the local variant frequency as obtained in the elicitation data by both groups of GPA speakers (Malayalam and Urdu).

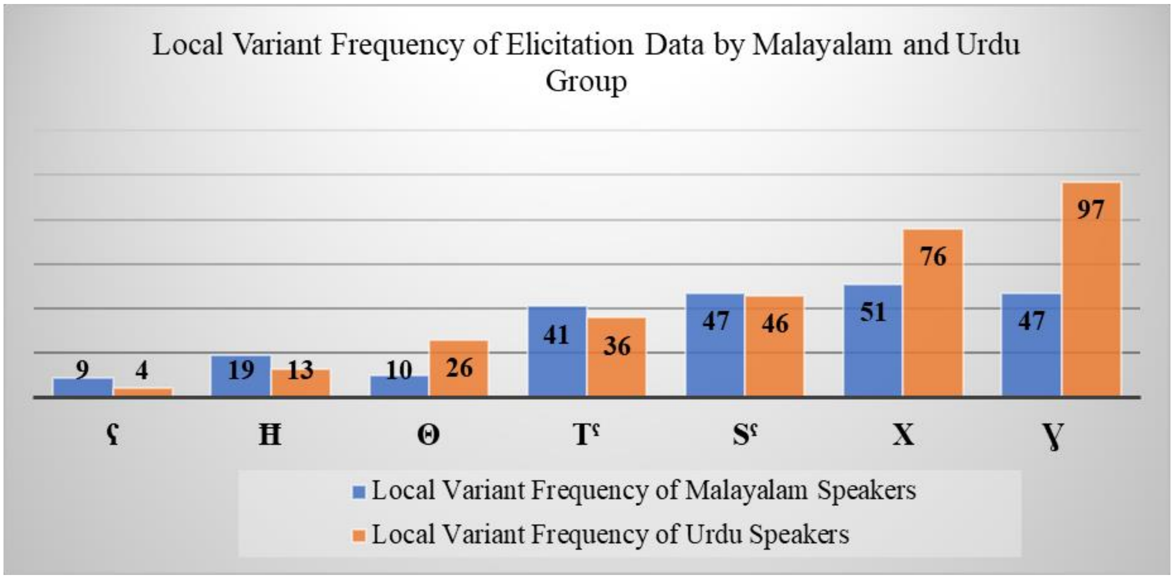

Figure 11. Performance pattern of the elicitation data production of Arabic marked consonant by both groups of GPA speakers (Malayalam and Urdu).

6.4 Analysis of Interview Data

This dissertation, as earlier stated, is also based on short sociolinguistic interviews conducted to investigate the realization of Arabic marked consonants. Obtaining casual speech from sociolinguistic interviews is one of the methods employed in the literature for obtaining samples of casual or natural speech. It has been claimed that production in casual speech may have different results compared to production in isolation (Tucker & Ernestus 2016). Typically, speakers have an articulatory control in isolation or more careful production than in spontaneous speech. Consequently, the rate of errors is more likely to increase in spontaneous speech compared with careful speech (De Wilde 2010). Accordingly, the current study implements both styles of data collection (interview vs. elicitation) to facilitate comparison over possible different realizations of Arabic marked consonants in the speech of GPA speakers. Such observation provides overall performance patterns obtained from the interview and elicitation data.

The interview data was based on a total of 376 tokens that carry the Arabic marked consonants. The following table displays how I count the frequency of these consonants in Arabic words in the interview data.

Table 44 Calculation of segment frequency in Gulf Arabic words

The segment	Frequency of segments
/tˤ/	4% (14)
/sˤ/	5% (19)
/θ/	3% (12)
/x/	4% (15)
/ɣ/	2% (11)
/ħ/	6% (23)
/ʕ/	7% (27)

The table shows that the consonant /tˤ/ occurs in 4% of the tokens, /sˤ/ in 5%, /θ/ in 3%, /χ/ in 4%, /ɣ/ in 2%, /ħ/ in 6%, and /ʕ/ in 7% of tokens. Based on the previous table, it appears that these marked consonants, particularly in the current data, occurred in few words, which in turn may result in a low rate of production for most of them because the speakers are less likely to hear them frequently. Thus, I speculate that high segment frequency might affect speakers' production of these consonants, although further discussion regarding the influence of frequency as a possible factor for acquiring these consonants is beyond the scope of this dissertation due to small sample size. A future study with a larger sample size would provide sufficient data to allow revisiting the notion of frequency and determining whether high segment frequency could affect the learning of these sounds.

Figure 12 below displays the overall observations of the local variant frequency, as obtained in the interview data, by both groups of GPA speakers (Malayalam and

Urdu). In addition to Figure 12, Figure 11, which represents the performance pattern of elicitation data, is shown again below to facilitate the comparison between the two data forms.

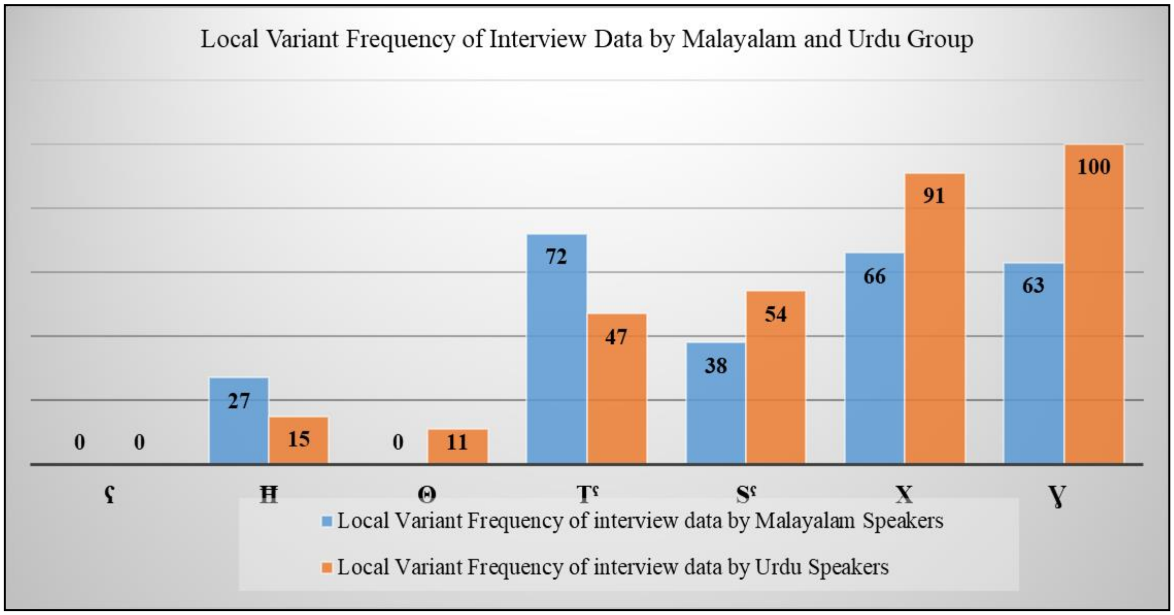

Figure 12. Performance pattern of the interview data production of Arabic marked consonants by both groups of GPA speakers (Malayalam and Urdu).

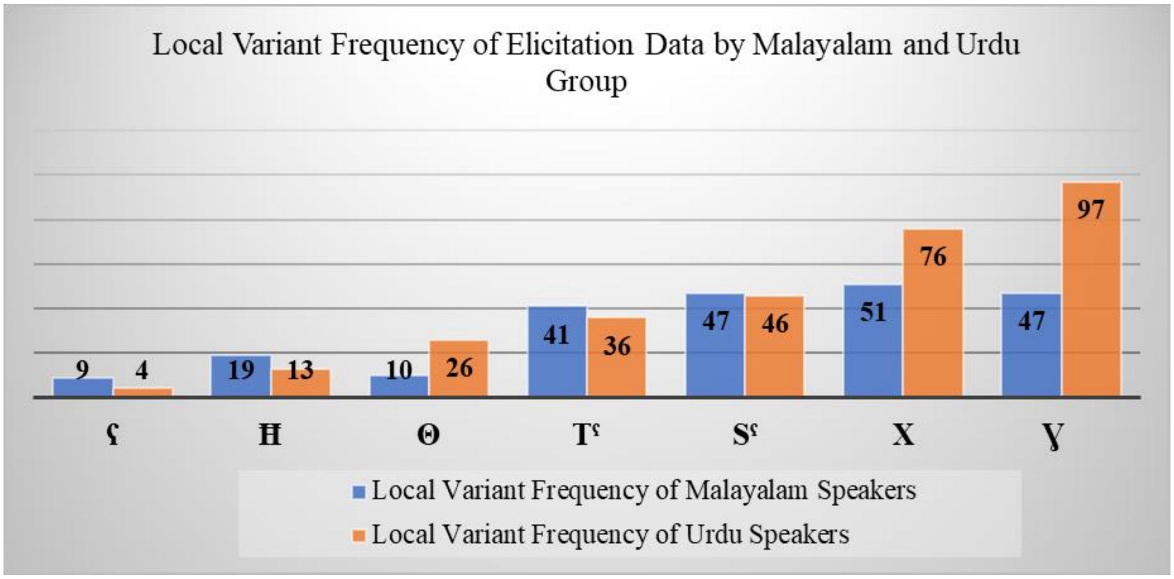

Figure 11. Performance pattern of the elicitation data production of Arabic marked consonants by both groups of GPA speakers (Malayalam and Urdu)

The findings of the interview data (Figure 12) display greatly the same direction in performance to what we found in the elicitation data (Figure 11), except for the emphatic fricative and voiced pharyngeal fricative. Table 45 displays the disparity of producing the emphatic fricative in both data sets (interview and elicitation).

Table 45 Differences in producing the emphatic fricative in interview and elicitation data

Group	Percentages of realizing the sound /sˤ/	
	Elicitation Data	Interview Data
Malayalam	47% (66)	38% (8)
Urdu	46% (65)	54% (13)

Comparing Figure 11 with Figure 12, we notice that Urdu speakers show superiority over the Malayalam speakers in performing the target consonants /θ/, /χ/, and /ɣ/ in both data forms. Similarly, Malayalam speakers showed higher percentages than the Urdu speakers did, particularly in realizing Arabic consonants /tˤ/ and /ħ/. The difference between these data lie only in the realization of the emphatic fricative (Table 45). Both groups produce the emphatic fricative in a very similar way, specifically in the elicitation data, but their interview data differed in that the Urdu speakers show a higher rate realization that the Malayalam speakers did. With respect to the pharyngeal fricative /ʕ/, none of the groups produced it in the interview data.

Moreover, the same types of variants of the target consonants in the elicitation data also appeared in the interview data. For example, both data forms present the substitute /t/ for the target /tˤ/, the substitute /t/ or /s/ for the target /θ/, and so on. However, some of the investigated variants appeared only in specific phonetic environments (i.e., initially, medially or finally) in the interview data. For instance, the variants /k/ and /h/ in the realization of the target /χ/ and the glottal stop /ʔ/ in the realization of pharyngeal fricative /ʕ/ occurred in the interview data only initially. Furthermore, the deletion of pharyngeal fricative /ʕ/ occurred only medially. The overall frequency of deletion is higher in the interview data and lower in the elicitation data. This result is expected because deletion often appears in casual/spontaneous speech because speakers tend to pay less attention to these utterances (Kingston & Beckman 1990).

The simplification phenomenon is universal, specifically among adult speakers for developing language (Leung & Brice 2012). The interview data showed that the GPA speakers exhibit more phonological process simplifications (substitution), particularly in realizing medial emphatic and pharyngeal consonants. The GPA speakers encounter difficulty articulating these consonants, especially in the middle environment. I assume that the GPA speakers were unable to control the movement of their vocal articulators during the articulation of emphatic and pharyngeal consonants in the middle of the word. Consequently, the GPA speakers decreased the difficulty of these consonants by eliminating the emphatic/pharyngeal feature, replacing these consonants with their non-emphatic/pharyngeal counterparts.

The overall performances in the interview data and in the elicitation data are similar and show the same trend regarding the realization of the consonants /tˤ/, /θ/, /χ/, /ħ/, and /ɣ/. Nevertheless, higher percentages of realizing the target consonants occurred in the elicitation data as compared to the interview data. This result is a result, I argue, of the articulatory control that the speakers displayed in the elicitation data. The tokens observed in the interview data were very low compared to the elicitation data. Thus, these findings should be interpreted with caution. In this case, I will consider the overall production results of both groups (Malayalam and Urdu) as displayed in the elicitation data. The reason why I limit the main result discussion to the elicitation data, particularly in discussing the degree of difficulty and its influence on the local variant frequency in the subsequent section (Section 6.5), is because most data of the current study were solicited via the elicitation task. Moreover, it is hard to treat the interview data in the same way as the elicitation data because the interview data, as previously stated, is reduced and poorly distributed. Therefore, the results of the next section are based on the elicitation data summarized in Figure 12.

6.5 Degree of Difficulty and Local Variant Frequency

The previous sections show that the GPA speakers realized the Arabic marked consonants in different degrees of variation. That is, we notice that some of the target consonants, such as /ħ, ʕ/, are produced in a very low percentage of the tokens in both groups (Malayalam and Urdu) compared to the other consonants. This result is expected due to the systematic differences between the phonological systems (e.g., consonantal system) in the L1 and the target language (Gulf Arabic): the participants do not have most of the Arabic target consonants in their L1. Moreover, the articulation of the investigated consonants is complicated, as these consonants are articulated differently in the vocal tract. Some of them (e.g., /ħ/ and /ʕ/) involve constriction in the further back of the tract, which in turn leads the GPA speakers to experience difficulty in realizing these consonants at high rates of frequency. On the other hand, the similar consonants or the consonants that are articulated in front of the tract are noted as being produced at high rates of frequency.

The degree of variation of the marked consonants varies from consonant to consonant. I argue that the disparity in alternations between these consonants may be linked to the degree of the consonant difficulty. Based on counting the marked distinctive features of Arabic consonants presented in Table 11 above, the following table ranks the degree of difficulty of the target consonants as follows.

Table 46 Ranking the degree of difficulty of the target consonants

Voiced Pharyngeal Fricative	/ʕ/	Most difficult
Voiceless Pharyngeal Fricative	/ħ/	↑
Voiced Uvular Fricative	/ɣ/	
Voiceless Uvular Fricative	/χ/	
Voiceless Emphatic Fricative	/sˤ/	
Voiceless Dental Fricative	/θ/	↓
Voiceless Emphatic Stop	/tˤ/	Least difficult

Now, let us compare the results shown in Figure 12 with the ranking provided in Table 46 and determine whether or not the data follow these rankings. The realization percentages shown in Figure 12 are arranged from the lowest to the highest percentages.

The pharyngeal fricatives /ħ, ʕ/, in both groups, saw the least proportion of realization, while the uvular fricatives received the highest rate of production. The present findings did not follow the hypothesized ranking with most consonants, except for the pharyngeal fricatives. The GPA speakers produced the sounds /ħ, ʕ/ at very low rates, and these rates imply that these sounds are considered the most marked consonants in the current study.

On the other hand, the second most difficult category, as hypothesized in the ranking table (Table 46), is that of the uvular fricatives /χ, ɣ/. This consonant category contradicts the claim of the ranking table. The GPA speakers of both groups realized the local consonants /χ, ɣ/ at a much higher rate, although these are produced at the back of the vocal tract, which is expected to be difficult to articulate. So, based on the marked features of the uvular fricatives /χ, ɣ/, I argue that this consonant category maintains its difficulty and markedness, representing the second most difficult consonants in the current study, but the higher rate of realizing the local variants results from the influence of Urdu, which contains the sounds /χ, ɣ/ in its inventory. Urdu is spoken as L1 for Pakistani speakers (Urdu group) and also by most of the Malayalam participants of the current study as a second language.

Contrary to what might be expected from the ranking in Table 46, both groups of GPA speakers realized the emphatic fricative with a high rate of frequency even though it has more marked distinctive features than the emphatic stop and dental fricative.

Alsayuty (1967: 113) claims that the sibilance feature weakens the Arabic emphatic fricative, and it is thus easier to pronounce amongst GPA speakers. Finally, the dental fricative is one of the universally marked consonants that is difficult to acquire. It occupied the third-lowest frequency of realization in the present study because, I argue, it is among the most marked and rarest consonants in the world's languages and, moreover, it is not part of the phonemic inventory of most languages.

To ensure the validity of the ranking table, we should include groups of speakers from languages that do not have any of the above-examined consonants in their phonemic inventories. Then, I test how the degree of difficulty/markedness is associated with the variant frequency of the target consonant. The present results display that the speakers of the Urdu group and some of the Malayalam speakers were able to realize the uvular fricatives /χ, ɣ/ at a much higher rate than the other investigated consonants, though these consonants are ranked as the second most difficult category in the table ranking. These results are likely because Urdu speakers have these consonants in their L1 and most Malayalam speakers also speak Urdu as an L2. Accordingly, I obtained results contrary to the expected findings (i.e., expecting low rate production due their difficulty).

In sum, the degree of difficulty influences the degree of variation, in that the most difficult consonants (pharyngeal fricatives) were reflected at a low production rate, while the rate increases gradually as the consonant become less difficult, as in the cases of the dental fricative and emphatic stops. Nevertheless, degree of difficulty alone cannot account for the variation. From the variationist's perspective, the variation is not only influenced by linguistic factors but can also be affected by non-linguistic/social factors. The next section investigates the variation with regard to the realization of Arabic marked consonants in the speech of GPA speakers and examines the effect of social factors (e.g., LOR in Saudi Arabia, age, amount of exposure) on the variation and realization of Arabic marked consonants.

6.6 Effect of Non-Linguistic Factors on Variation of Arabic Marked Consonants

It is claimed that non-linguistic factors (e.g., age, length of residency, amount of exposure, level of education, and gender, among others) play a role in language variation (Taqi 2010; Tanner 2012; Almoaily 2013; Grama 2015). The current study considers L1, age, length of residency in Saudi Arabia, and amount of exposure to GA as possible factors affecting the realization of Arabic marked consonants. A Pearson correlation was conducted in order to examine the possible correlations of these factors with the realization of Arabic marked consonants in the speech of GPA speakers.

In Table 47, Pearson correlation analysis depicts that most of the dependent variables (DVs) are significant with age, except for the emphatic fricative /sˤ/ (.118) and voiceless pharyngeal fricative /ħ/ (.037). It is clear that the dental fricative /θ/ shows the highest correlation with age (.439***) and is higher than the average, while the voiced pharyngeal fricative /ʕ/ displays the least amount of correlation (.311*) among the other dependent variables. Generally speaking, these results display that all relationships between the two variables are positive and significant with most of the dependent variables, meaning that the realization of Arabic consonants as local variants increases as a function of age.

Table 47 Pearson correlation between age and Arabic marked consonant realization

Correlations

	DVs	/tˤ/	/sˤ/	/θ/	/χ/	/ɣ/	/ħ/	/ʕ/
Age	**Pearson Correlation**	.317**	.118	.439***	.337**	.406***	.037	.311*
	Sig. (2-tailed)	.046	.467	.005	.033	.009	.822	.051
	N	40	40	40	40	40	40	40

***. Correlation is significant at the 0.01 level (2-tailed).

**. Correlation is significant at the 0.05 level (2-tailed).

*. Correlation is significant at the 0.1 level (2-tailed).

The second independent variable (IV) is the length of residency (LOR) in Saudi Arabia, which was tested with all dependent variables (i.e., target consonants). As stated in the methodology chapter, the GPA speakers were divided into two groups depending on their length of residency in Saudi Arabia: a short-stay group (staying for 6 years or less) and a long-stay group (staying for 10 years or more). Therefore, I constructed dummy variables to represent the LOR (1 for the long-stay group and 0 for the short-stay group). Since the Pearson correlation coefficient is only appropriate to measure pairs of continuous variables, but not for use with the dummy variable as is the case with the LOR, I employed an independent-sample t-test to measure the relationship between the LOR and the realizations of Arabic marked consonants.

Table 48 Means of Arabic marked consonant realization by GPA speakers with long and short residency in Saudi Arabia

	Length of Stay Short (0), Long (1)	N	Mean	Std. Deviation
/θ/	0	18	8.4444	10.37090
	1	22	30.3636	24.96196
/tˤ/	0	18	21.7222	21.43061
	1	22	52.5909	25.45521
/sˤ/	0	18	43.6667	26.61048
	1	22	49.3182	24.73360
/χ/	0	18	57.0000	32.62983
	1	22	68.0000	21.17276
/ɣ/	0	18	68.7778	36.92051
	1	22	75.0455	26.89393
/ħ/	0	18	13.3333	18.50278
	1	22	18.9091	20.80730
/ʕ/	0	18	.0000	.00000
	1	22	11.0000	17.05174

The results report that there is a correlation between the LOR and the realization of Arabic marked consonants. The LOR correlates significantly with the high rate of realization only in the dental fricative /θ/ t (-3.743) = 29.191, p = .001; emphatic stop /tˤ/ t (-4.091) = 38, p = .000; and voiced pharyngeal fricative /ʕ/ t (-3.026) = 21.00, p = .006. Although the LOR and realizing the other consonants (e.g., /sˤ/, /χ/, /ɣ/, /ħ/) did not reach the significance level between the performances of the long- and short-stay groups, they demonstrate the same direction in all dependent variables (Arabic marked consonants), in that the GPA speakers who stayed longer in Saudi Arabia tend to realize the Arabic marked consonants at a higher rate than those with a shorter LOR in Saudi Arabia.[20]

[20] See Table 63 in Appendix E for more statistical details.

Another independent variable involved in the current study is the speakers' L1. According to CAH (Lado 1957), the L1 influences the production of the L2/target language, and this influence is, in most cases, based on differences and similarities between the two languages. It predicts that the phonemes that occur in the L1 and the target language will be easier to acquire than those phonemes that are different from the L1, and vice versa. Figure 1 above demonstrates that the Urdu language shares some consonants with Gulf Arabic (e.g., q, χ, ɣ, f, z, ʃ). Thus, I hypothesized that the speakers whose L1 is Urdu will perform better than Malayalam speakers. I conducted an independent-sample t-test to determine the overall performance of the Arabic marked consonants between both groups of speakers (Urdu and Malayalam groups). Table 49 below demonstrates the means of Arabic consonant realization in the speech of Malayalam and Urdu speakers.

Table 49 Means of Arabic marked consonant realization by GPA speakers of Malayalam vs. Urdu

	L1	N	Mean	Std. Deviation
/θ/	Malayalam	20	12.5500	16.97204
	Urdu	20	28.4500	24.78216
/tˤ/	Malayalam	20	41.4500	28.48356
	Urdu	20	35.9500	28.21995
/sˤ/	Malayalam	20	47.1000	24.43445
	Urdu	20	46.4500	27.00190
/χ/	Malayalam	20	50.6000	29.53927
	Urdu	20	75.5000	17.67097
/ɣ/	Malayalam	20	46.9500	25.85074
	Urdu	20	97.5000	5.13502
/ħ/	Malayalam	20	19.5000	21.72193
	Urdu	20	13.3000	17.57720
/ʕ/	Malayalam	20	8.5500	16.32716
	Urdu	20	3.5500	10.23140

The t-test demonstrates that three dependent variables are significant, and that the more frequent realization of the consonants is influenced by the speakers' L1. From Table 49, it is clear that the L1 correlates significantly with the more frequent realization of the voiceless uvular fricative /χ/ t (-3.235) = 31.05, p = .003, and the voiced uvular fricative /ɣ/ t (-8.577) = 20.49, p = .000. What we notice is that Urdu speakers are successful in realizing the uvular fricatives at much higher rates than Malayalam speakers, presumably taking advantage of familiarity with the uvular fricatives extant in the Urdu inventory system. Furthermore, the test shows that the performance of the dental fricative /θ/ is statistically significant between the Urdu and Malayalam group t (-3.743) = 29.191, p = .001, indicating that Urdu speakers are superior to Malayalam speakers in realizing the dental fricative.[21] Siraji (2010) mentioned that Urdu and Arabic are close to each other, particularly in the script and vocabulary, though they are not genetically related. Siraji (2010) states that the influence of Arabic on the Indian subcontinent emerged through the entry of Muslims in the late 10th century. The Arabic language remained the language of culture and religion in the subcontinent and was the source of the words of civilization in its broad sense. Furthermore, Arabic had a great impact in the field of scientific translation, and Arabic words were used instead of English words or local words. This occurred at a very early stage of the entry of Muslims to the subcontinent. Consequently, most Urdu words are of Arabic origin. In addition, the Arabic words that were transferred to the Urdu language retained the Arabic script but were pronounced with Urdu pronunciation, such as the dental fricative and emphatic consonants. Several Urdu speakers of the current study reported that some Urdu speakers tend to pronounce the Arabic words with Arabic pronunciation to reflect that they are well-educated. Moreover, the actual script of Urdu is taken from the Perso-Arabic script that originally developed from the Arabic script, which allows Urdu speakers to read Arabic well. Accordingly, it is reasonable to argue that Urdu speakers will realize, at least most of Arabic consonants much better than Malayalam speakers will be able to do.

The last independent variable involved in the present study is the amount of exposure to the target language. Table 50 below depicts the means of Arabic consonant realization as produced by the GPA speakers with high and low exposure to Gulf Arabic.

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[21] See Table 64 in Appendix E for more statistical details.

Table 50 Means of Arabic marked consonant realization by GPA speakers with high vs. low amounts of exposure

	Amount of exposure	N	Mean	Std. Deviation
/θ/	Low	20	18.4500	26.45050
	High	20	22.5500	18.07725
/tˤ/	Low	20	29.5500	27.45997
	High	20	47.8500	26.33044
/sˤ/	Low	20	42.8500	26.24034
	High	20	50.7000	24.60445
/χ/	Low	20	59.8000	30.36896
	High	20	66.3000	23.80425
/ɣ/	Low	20	78.1500	35.51023
	High	20	66.3000	26.54510
/ħ/	Low	20	8.2500	14.29713
	High	20	24.5500	21.37257
/ʕ/	Low	20	.0000	.00000
	High	20	12.1000	17.53163

It is evident from Table 50 that the GPA speakers who had received high exposure to the target language have higher means of realizing the Arabic marked consonants than those with lower exposure. However, the t-test reported that there is a significant correlation between the amount of exposure and the realization of Arabic marked consonants for the emphatic stop /tˤ/ t (-2.151) = 38, p = .038; voiceless pharyngeal fricative /ħ/ t (-2.835) = 33.168, p = .008; and voiced pharyngeal fricative /ʕ/ t (-3.087) = 19.000, p = .006. In contrast, the amount of exposure did not display any significant correlation with /θ/, /sˤ/, /χ/, or /ɣ/. Nevertheless, they show the same pattern of increase in terms of the means of Arabic-like realization for speakers who were heavily exposed to the target language relative to those with low exposure.[22]

In brief, the section tests the influence of each investigated independent variable on all dependent variables. The emphatic fricative is the only target consonant that was not influenced by the independent variables. This finding suggests that all GPA speakers are more likely to realize it with a high rate of frequency regardless of their age, type of native language, length of residency or degree of exposure to the target language. The current observation suggests that this was the case. None of these independent variables has had a consistent effect on all dependent variables (Arabic consonants). For instance, the realization of the emphatic stop /ħ/ and pharyngeal fricative /ʕ/ correlate with age, LOR and amount of exposure, while the realization of the pharyngeal fricative /ħ/ correlates only with the amount of exposure, and so on. After testing how each independent variable relates to the target consonants, I ran a logistic regression controlling all the independent variables in one model.

Logistic regression was conducted to investigate which factors, if any, specify significant predictors of probability of higher realization of the Arabic marked consonants. Table 51 below exhibits the results of the regression analysis.

[22] See Table 65 in Appendix E for more statistical details.

Table 51 Logistic regression results for elicitation data

VARIABLES	tˁ	sˁ	θ	χ	ɣ	ħ	ʕ
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Length of Residency	.798***	.346	.732***	.037	.037	.160*	.579***
S.E.	(.286)	(.327)	(.240)	(.280)	(.183)	(0.092)	(.207)
Age	-.036	-.013	-.023	.002	.015	.009	-.024*
S.E.	(.020)	(0.022)	(.016)	(0.019)	(0.012)	(0.011)	(.014)
L1	-.083	.041	.299**	.437**	.745***	.016	.073
S.E.	(.166)	(.190)	(.139)	(0.163)	(.106)	(.159)	(.120)
Amount of Exposure	.064	.020	.102	.354**	.084	.079	.277**
S.E.	(.175)	(.200)	(.147)	(.171)	(.112)	(0.097)	(.127)
Constant	1.289	.725	.493	.177	-.308	.513	.542
S.E.	(.533)	(.610)	(.448)	(.522)	(.341)	(.297)	(.385)
Observations	40	40	40	40	40	40	40
R-squared	.275	.050	.391	.236	.684	.190	.408
F	3.312	4.58	5.611	2.705	18.929	2.051	6.036
F Sig	0.021	0.766	0.001	0.046	.000	0.108	0.001

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 51 combines all seven dependent variables and all four independent variables. The model controls all IVs and then tests them with each DV. As shown in Table 51, the IVs show different patterns in their influence. That is, the results show that there is no specific IV that affects all DVs. Rather, each IV affects a specific consonant category. For instance, the results report that the realization of the emphatic stop /tˁ/ is only influenced by the length of residency (LOR) predictor. The model reported significance and also probability of an increase of approximately 79% of the realization of /tˁ/ ($R^2 = .798$, $F (4, 35) = 3.312$, $p<.05$). That is, as the LOR increases, the probability of emphatic stop realization increases as well. This finding supports the relationship between the increase in the number of years in Saudi Arabia and the increase in realizing the emphatic stop.

Similar to what we found in the Pearson correlation and the independent t-tests, the independent variables in the regression results contribute nothing to the emphatic fricative, and none of the above factors influenced its realization.

The realization of the dental fricative /θ/, on the other hand, is significantly influenced by both LOR and the speakers' L1. If the length of residency increases, then the dental fricative will be realized at an increase of 73 % among the GPA speakers who have stayed longer in Saudi Arabia. In addition, Urdu has an effect on the realization of the fricative /θ/. Urdu speakers, but not Malayalam speakers, will realize the /θ/ at a probable increase rate 29% higher than that of the Malayalam speakers.

The results shown in Table 51 also demonstrate that the voiceless uvular fricative /χ/ is significantly influenced by the L1 and amount of exposure at a significance level of .05. When I tested each IV with the whole DVs, I found a relationship between the speakers' L1 and the realization of the fricative /χ/. Thus, the recurrence of the effect of L1 on the realization of /χ/ in both statistical tests (i.e., independent-sample t-test and logistic regression) suggests that the speakers' L1 more strongly affects the realization of the fricative /χ/ than does the amount of exposure. The Urdu speakers have been influenced by their L1 and will have 43% higher rates of realizing the uvular fricative than speakers of Malayalam. This result not surprising, given the existence of this consonant in the phonological system of Urdu.

The speakers' L1 is the only IV that significantly influences the realization of the voiced uvular fricative /ɣ/. Urdu affects the realization of the fricative /ɣ/ in which the Urdu speakers will produce successfully the /ɣ/ at a rate 74 % higher than those who do not speak Urdu.

The realization of voiceless and voiced pharyngeal fricatives /ħ/ and /ʕ/ are significantly influenced by one and three factors, respectively. The voiceless pharyngeal fricatives /ħ/ is only influenced by LOR, whereas the voiced pharyngeal fricatives /ʕ/ is influenced by the age, LOR and amount of exposure to Arabic. These fricatives are more likely to be produced by the GPA speakers, especially those who are heavily exposed to the target language and those who stay for many years in Saudi Arabia. However, the age is the less powerful variable in influencing the production of /ʕ/ relative to the LOR and amount of exposure. The production of /ʕ/ is also significantly influenced by the age but at a significance level of .1, and the /ʕ/ will be produced with small increase of approximately 2%.

The regression results show that the increased rate of realization for these consonants is much lower than that for other investigated sounds. Thus, if the number of years of living in Saudi Arabia increases, then the voiceless and voiced pharyngeal fricatives will be realized with increases of roughly 16% and 57%, respectively, among the GPA speakers who have stayed longer in Saudi Arabia compared to those who stay for a shorter duration in Saudi Arabia. Furthermore, the voiced pharyngeal fricative is also influenced by the amount of exposure to the target language, and it is produced with increases of roughly 27% among the GPA speakers who have more exposure relative to those with low exposure. This result is expected because these sounds, as categorized above (Table 46), are the most difficult consonants in the current study. It is clear from the results of the t-test and regression that the realization of these sounds relates to high exposure to the target language and the increased number of years of living in Saudi Arabia. Accordingly, the speakers who were exposed to the target language more often and who stay many years in Saudi Arabia are more likely to have received more input of the target language and, consequently, to establish a new phonetic category for the new sound/features, which results in the successful production of the L2 sound/feature.

Figures 11 and 12 above demonstrate that the overall performances of the interview data as well as the elicitation data tend to resemble each other to a great extent. So, if we examine the influence of the target independent variables on the realization of Arabic marked consonants in the interview data, will we see results almost similar to the elicitation results occurring in Table 51? Table 52 exhibits below the results of the regression analysis as obtained from the interview data.

Table 52 Regression results for interview data

Variables	tˤ	sˤ	θ	χ	ɣ	ħ	ʕ
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Length of Stay	3.602*	1.287	1.547**	2.181	-0.185	1.621*	0
S.E.	(1.962)	(1.931)	(0.645)	(2.024)	(2.102)	(0.872)	(0)
Age	0.0666	0.0755	-0.0706	-0.0503	0.191	-0.0380	0
S.E.	(0.127)	(0.125)	(0.0418)	(0.131)	(0.136)	(0.0565)	(0)
L1	-1.437	0.810	0.282	1.399	-0.376	-0.138	0
S.E.	(1.294)	(1.274)	(0.426)	(1.335)	(1.386)	(0.575)	(0)
Amount of Exposure	0.0579	0.935	-0.631	-0.367	-1.178	0.258	0
S.E.	(1.421)	(1.399)	(0.467)	(1.466)	(1.523)	(0.631)	(0)
Constant	-0.414	-1.321	1.900	3.393	-1.212	1.051	0
S.E.	(3.474)	(3.420)	(1.143)	(3.584)	(3.723)	(1.544)	(0)
Observations	40	40	40	40	40	40	40
R-squared	0.332	0.151	0.150	0.075	0.110	0.199	
F	4.35	1.56	1.55	0.71	1.08	2.18	.
F Sig	0.0058	0.2077	0.2096	0.5888	0.3810	0.0916	.

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 52 tests all four independent variables with each dependent variable. The first model represents the influence of IVs on the realization of the emphatic stop /tˤ/. This model is significant, and the length of residency (LOR) only influences the realization of the emphatic stop/tˤ/. Similar to what we found in the elicitation results (Table 51), increased production of the emphatic stop is related to the length of stay.

The second model investigates how the IVs influence the realization of the emphatic fricative /sˤ/. The model is not significant, meaning that the controlled independent variables in the regression results did not have any influence on the realization of the emphatic fricative.

The third model also demonstrates that the realization of the dental fricative is influenced by the length of residency. The dental fricative realization increases by approximately 1.5 % with a one-unit increase in the year. Again, similar to the results obtained from the elicitation data, the LOR is the IV that influences the realization of the dental fricative.

With respect to the uvular fricatives, Models 4 and 5 are not significant, and none of the IVs have any influence on the realization of these consonants. These results contrast with the results in the elicitation table, in which the speakers' L1 was the predictor for realizing the uvular fricative.

Model 6 represents the voiceless pharyngeal fricative. Similar to the elicitation results, the F statistic is not significant; however, one out of the four independent variables has a significant (at 10%) effect on the realization of /ħ/, namely, the length of residency. In contrast, the last model (i.e., voiced pharyngeal fricative) does not have any value because the speakers did not realize it in the interview data, which is unsurprising in casual/spontaneous speech.

I will limit the discussion chapter to discussing the elicitation data as representing the performance of the GPA speakers in the current study. This choice is due to the overall similarity between the two data forms in the statistical results. In addition to that similarity, the elicitation data, as presented earlier, is more robust and has more sufficient and well-distributed data relative to the interview data, which is reduced and poorly distributed. Moreover, relying on picture task elicitation can provide balanced data from both groups of GPA speakers. Boyd et al. (2015:12) state that although interview data is good for eliciting more authentic speech and useful for phonetic analysis, the picture task elicitation can also provide partial naturalistic speech.

6.7 Summary of Results

The first part of the results section presents the findings that represent all GPA speakers as one group. GPA speakers realized the Arabic marked consonants as the following variants. The variants include the local form vs. the L1 form (e.g., /tˤ/ vs. /t/, /θ/ vs. /t/or /s/, /sˤ/ vs. /s/or /θ/, /χ/ vs. /k/or /h/, /ɣ/ vs. /g/or /h/ or /x/, /ħ/ vs. /h/, /ʕ/ vs. /h/ or /ʔ/ or deletion). These variants are categorized acoustically. For instance, the emphatic stop is categorized by measuring the VOT. The differences in VOT values are statistically significant between the emphatic stop /tˤ/ and non-emphatic stop (e.g., /t/), in which the /tˤ/ is produced with a shorter VOT duration than in its non-emphatic counterpart. The t-test reported that the GPA speakers, to a large extent, realized most of the Arabic marked consonants with values similarly to the production of the control speakers, except for /x/, /ħ/, and /ʕ/.

After that, I divided the GPA speakers into two groups (i.e., a Malayalam and an Urdu group) to determine which of these groups is closer in values to the local norm. The test reported that the Urdu group is closer to the local norm in the production of most Arabic consonants than the Malayalam group.

The GPA speakers realized the Arabic marked consonants with different degrees of variation. In other words, some of the target consonants, such as /ħ, ʕ/, are produced in a very low percentage of the tokens by both groups of GPA speakers, while the uvular fricatives display the highest percentages. These differences depend on certain factors, such as the speakers' L1 and the degree of the difficulty of the consonants. In addition, the variants are influenced not only by linguistic factors but also by social factors such as age, LOR and amount of exposure.

There was a positive correlation of the non-linguistic factors with the realization of some of the Arabic marked consonants. For example, the LOR correlates significantly with the high rate of realization of /θ/, /tˤ/, and /ʕ/. The L1 correlates significantly with the realization of /χ/, /ɣ/, and /θ/. Moreover, there is a significant correlation between the amount of exposure and the realization of /tˤ/, /ħ/, and /ʕ/. However, the emphatic fricative is the only target consonant that was not influenced by the previous independent variables.

In addition, logistic regression was also conducted to investigate which factors are able to specify significant predictors in influencing the realization of the Arabic marked consonants. The results displayed that the LOR, L1 and amount of exposure, but not age, play a significant role in the production of Arabic marked consonants. Therefore, the following chapter is set up and structured based on these results.

CHAPTER 7

DISCUSSION

7.1 Introduction

This chapter discusses the results of the present study with regard to the research questions presented in Chapter 6. As stated earlier, the goal of this dissertation is to investigate the potential influence of certain factors (i.e., L1, age, length of residency, and amount of exposure) on the variation and realization of Arabic marked consonants, including emphatic (/tˤ, sˤ/), dental (/θ/), uvular (/χ, ɣ/), and pharyngeal (/ ħ, ʕ/) consonants, in the speech of GPA speakers. In the subsequent sections, I discuss the overall realization of the Arabic marked consonants in the speech of GPA speakers, with a focus on the similarities and differences of the acoustic values of the investigated sounds from those of the control speakers. Then, I discuss the influence of the following factors (i.e., L1, age, length of residency, and amount of exposure) on the variation and realization of Arabic marked consonants.

7.2 Realization of Arabic Marked Consonants by GPA Speakers

Previous Arabic-based pidgin studies have described the phonological system of Arabic pidgins without any focus on the possible factors that may lead to the occurrence of phonological variation. The current study focuses on the speakers' overall realization as well as the variation of the Arabic marked consonants. As mentioned earlier, the phonological system of a pidgin is reduced compared to its lexifier (Bakker 2008). This phonological simplicity results from the simplification of certain complex phonemes that occur in the lexifier. Pidgin speakers tend to replace the less common sounds with more common ones. Gulf Arabic (the lexifier for GPA speakers) contains some typologically uncommon phonemes (marked sounds), such as emphatic, uvular and pharyngeal consonants. The present results show replacements among both groups of GPA speakers. Each consonant variable considered in this dissertation showed different variants in terms of its realization.

7.2.1 Emphatic Consonant Realization (/tˤ/ vs. /sˤ/)

The first consonant category explored comprised the emphatic consonants /tˤ/ and /sˤ/. The emphatic consonants are co-articulated consonants, which means that these sounds involve two articulators: a primary constriction in the alveolar ridge and a secondary constriction in the pharynx, which might result in difficulty in production. Sedlatschek (2009: 49) states that learners of a language tend to exchange the linguistic elements that are difficult to acquire for the closest equivalent in their L1.

The present findings reported that the emphatic consonants /tˤ/ and /sˤ/ have two and three realizations, respectively, in the speech of GPA speakers. Thus, as shown in Table 6 and Table 7, neither substrate language (Malayalam and Urdu) has the sound /tˤ/ and /sˤ/ in its phonemic system. Consequently, both groups tend to alternate by either producing the local variant of Arabic /tˤ/ or replacing it with its counterpart in their L1, /t/, as well as producing the local variant /sˤ/ or replacing it with either /s/ or /θ/. I argue that such variations reflect an influence from their L1s.

The alternations were confirmed acoustically and demonstrated that the sound /tˤ/ is more often replaced with /t/, at a rate of 59 % for Malayalam speakers and 64 % for Urdu speakers, whilst the sound /sˤ/ is replaced more frequently with /s/, at a rate of 53 %

for Malayalam speakers and 47 % for Urdu speakers. The results given for the current study are also consistent with previous impressionistic studies on GPA (e.g., Smart 1990; Neass 2008; Avram 2010; Salem 2013; Al-Haq & Al-Salman 2014) with regards to replacing the emphatic with its non-emphatic counterparts in the speakers' L1. In all these studies, the Arabic pidgin speakers have the tendency to replace the emphatic consonants with /t/ and /s/. However, the current study found another realization of the emphatic /sˤ/, particularly among Urdu speakers. A few Urdu speakers realized the emphatic /sˤ/ as /θ/ in 7 % of the tokens. Such sounds reflect systematic differences of the substrate languages (Malayalam and Urdu), and these differences from Gulf Arabic lead GPA speakers to substitute the non-native sounds with the closest counterparts in their L1.

However, the results above show that some of the GPA speakers were able to realize the local variant regardless of its absence from their L1s. I consider the speakers' L1 and age, LOR and amount of exposure as factors that may influence the GPA speakers in realizing the Arabic marked consonants. I expected that one of these factors, or some combination of them, might have a clear effect on the realization of Arabic marked consonants. The t-test reports that the length of residency was a predictor for realizing the emphatic stop. It displays that the means of producing the emphatic stop of each group (short-stay and long-stay groups) are significantly higher only among GPA speakers who have stayed for a long time in Saudi Arabia. This current result is in agreement with a few pidgin studies (e.g., Almoaily 2013; Alghamdi 2014) and numerous L2 studies (e.g., Olshtain & Blum-Kulka 1985; Flege, Bohn & Jang 1997) that argue that the LOR is an effective predictor for measuring L2 speakers' performance in the target language.

Moreover, when I controlled all the target factors in the regression results, I found that the LOR is the only factor that influences the realization of the emphatic stop. Accordingly, I argue that the LOR in the present study was the factor that most strongly affected GPA speakers' production of the emphatic stop. The LOR gives GPA speakers an opportunity to indulge intensively in GA, which in turn increases their success in producing the emphatic stop. In contrast, the regression and the t-test show that there was no correlation between the realization of the emphatic fricative /sˤ/ and each target independent variable. That is, none of the factors had an effect on producing the emphatic fricative, indicating that the GPA speakers were able to realize the /sˤ/, to large extent, more frequently than substituting it. If we compare the two emphatic consonants in terms of replacements, we notice that the emphatic stop /tˤ/ is replaced more often in both groups (Malayalam and Urdu) than the emphatic fricative /sˤ/, though both /tˤ/ and /sˤ/ have the same voicing, same place of articulation, and also involve the same secondary articulation (i.e., constriction in the pharynx). Contrary to the results of the emphatic stop, the results of emphatic fricative /sˤ/ disobeys the phonological markedness that holds the notion of that the marked element tends to be complicated and more difficult, so it is acquired later relative to unmarked one. Both groups of GPA speakers display high rates of realization regardless of their LOR, L1 and amount of exposure to the GA. One possible reason for this tendency (the high rate of replacing the emphatic stop and realizing the emphatic fricative) may be attributed to an articulatory factor, as the voiceless emphatic alveolar fricative /sˤ/ may not be as difficult to pronounce as is the voiceless emphatic alveolar stop. Alsayuty (1967:113) classifies the degree of strength/difficulty of Arabic emphatic consonants depending on the degree of contact (i.e., complete or partial contact etc.) between the articulators. Alsayuty sorts them from the most to the least strong emphatics, in the following order: voiceless emphatic alveolar stop /$t^ʕ$/, voiced emphatic alveolar stop /$d^ʕ$/, voiceless emphatic alveolar fricative /$s^ʕ$/, and voiced emphatic dental fricative /$ð^ʕ$/. Therefore, as stated earlier, the production of the voiceless emphatic alveolar stop involves a complete contact between the articulators, and thus, this characteristic makes it stronger than the emphatic alveolar fricative. On the other hand, the articulation of the voiceless emphatic alveolar fricative involves sibilance that results from incomplete contact between the articulators (e.g., the blade of the tongue and alveolar ridge). Therefore, the sibilance feature makes the emphatic fricative less strong and thus easier to pronounce amongst GPA speakers. Consequently, none of the investigated factors affected the realization of the emphatic fricative, and both groups were able to realize the local variant /$s^ʕ$/ more frequently than the emphatic stop, regardless of their ages, L1s, LOG and amount of the exposure to the GA.

7.2.2 Dental Fricative Realization (/θ/)

The voiceless dental fricative is considered one of the most marked segments in world languages (Jones 2005; Wester, Gilbers & Lowie 2007; Mousa 2014). This phoneme, as previously mentioned, is difficult to pronounce and exceedingly rare, occurring in just 5.6 % of the UPSID languages. Another possible reason for the difficulty of the dental fricative comes from its perception. Perceptually, the fricative /θ/ is weak and does not have consistent acoustic correlates. It phonetically resembles the phoneme /f/ and phonologically resembles the phoneme /s/ which in turn give rise to trouble in acquiring both L1 and L2 alike (Wester, Gilbers & Lowie 2007; Jekiel 2014). Furthermore, the dental fricative is phonologically unstable and undergoes alternations across many languages. For instance, it alternates with /t/ in Urdu, Russian, and some dialects of Arabic (e.g., Hijazi Arabic), with /s/ among Dutch and Japanese speakers, and with /f/ among Chinese and Japanese speakers (Mousa 2014; Jekiel 2014). Thus, according to the previous possible reasons, the /θ/ is often replaced by /t/, /f/, or /s/. Such replacements are not random, and the sound and its replaced variant share certain properties extant in the grammar of the speakers' L1, in that both sounds may share voicing, place, or manner of articulation and so on.

In a pidgin situation, the speakers have the tendency to simplify highly marked sounds by replacing them with less marked phonemes from their L1. The replacement process in pidginization can be explained by the linguistic universals (Holm 2000), as the pidgin retains the common sounds appearing in the world's languages relative to the rare ones. It has been claimed that the stop sounds are acquired before fricatives, and thus, the alveolar stop (a more common segment) is the most favored replacement for the voiceless dental fricative (Hattem 2009; Mousa 2014). Pidgin and creole speakers usually replace the voiceless dental fricative with /t/, and the current results suggest that this was the case in the subjects under study as well.

As shown in Tables 6 and 7, the marked phoneme /θ/ does not appear in the inventories of the substrate languages (Malayalam and Urdu). Consequently, based on the previous characteristics of the dental fricative, the GPA speakers are expected to experience difficulties in pronouncing it. Thus, it is not surprising that both participant groups replace the local variant more often than producing it. The results shown in Table 39 demonstrate that both groups of the GPA speakers produced the voiceless dental fricative /θ/ at very low rates compared to the emphatic consonants. The GPA speakers considerably substitute the variant (i.e., /θ/) at high rates, in 90% and 74% of the tokens for the Malayalam group and the Urdu group, respectively. The high rates of substitution are explained by the phonological markedness in which the marked consonants is categorized by being difficult, rarely distributed in the world's languages and acquired later. This was the case in the dental fricative as reflected in low production, indicating that the GPA speakers show a very slow development in shifting to GA.

The current data displays acoustically that the GPA speakers of both groups tend to alternate the voiceless dental fricative /θ/ with either the local variant /θ/ or the L1 variants /t/ or /s/. The results given in the current study confirmed other impressionistic studies, including studies on Jordanian Bengali Pidgin Arabic (Al-Haq & Al-Salman 2014) and Gulf Pidgin Arabic (Smart 1990), in that the Arabic pidgin speakers in these studies, regardless of their substrate languages, have the tendency to replace the dental fricative with the alveolar stop /t/. Nevertheless, the current study observes another realization of the phoneme /θ/, particularly among the Urdu speakers. A few Urdu speakers realized the emphatic /θ/ as /s/, in 15% of the tokens. However, as previously stated, some independent linguistic and non-linguistic factors might affect the realization of Arabic marked consonants. Among the investigated independent variables, the regression results reported only two independent variables that significantly influenced the realization of the dental fricative. These are the LOR and the speakers' L1.

I hypothesized that the LOR would correlate positively with realizing most of the Arabic marked consonants. This was the case in the dental fricative /θ/, which is also influenced by the increased number of years of living in Saudi Arabia. Most GPA speakers replaced the local variant more often than producing it. However, only few speakers from the long-stay group could produce the /θ/, a finding that is consistent with the previous studies on L2 production (e.g., Flege, Bohn & Jang 1997), which mentioned that the LOR in the target language country affects the successes of adults' performance of L2 phonological production. The large difference in percentages between realization and replacement implies that both groups show slow development in shifting to GA. Thus, considering the LOR as the main predictor for producing the dental fricative is reasonable, since this sound might require significant time and effort to acquire due to its complexity in articulation.

Moreover, the speakers' L1 did have an effect on realizing the dental fricative, though its influence is less strong than the LOR. The current results found that Urdu has an effect on the production of /θ/. Table 39 above is shown again below to facilitate the comparison between the two groups.

Table 39 Variations of the dental fricative /θ/ by Malayalam and Urdu speakers

Group	Percentages of realizing /θ/
Malayalam	/θ/ (GA) 10% (12) /t/ (GPA) 90% (108) /s/ (GPA) 0% (0)
Urdu	/θ/ (GA) 26% (31) /t/ (GPA) 59% (71) /s/ (GPA) 15% (18)

The Urdu speakers had a higher frequency of producing the /θ/ than speakers in the Malayalam group. This finding corresponds to my prediction that Urdu speakers would tend to have better pronunciation for most Arabic marked consonants because

Siraji (2010) pointed out that Urdu and Arabic are close to each other in lexicon and script. The dental fricative is found in Urdu script, specifically in words adopted from Arabic, but is not included in the consonantal system of Urdu. Some Urdu speakers tend to pronounce the Arabic words with Arabic pronunciation as an indication of being well-educated. They also reported that the similarities between Arabic and Urdu script facilitate their reading and learning Arabic. I argue that the existence of any kind of linguistic or cultural diversity between two languages will exert an influence, and thus the Arabic influence gave Urdu speakers an edge in realizing the dental fricative over Malayalam speakers. The current results align with the findings of McAllister, Flege and Piske's (2002) work, in that the L1 plays a role in L2 production, meaning that the speakers take advantage of certain extant features in their L1 and L2 and employ them in the acquisition of the new sound or feature of the L2.

7.2.3 Uvular Fricatives Realization (/χ/ vs. /ɣ/)

Concerning the uvular fricatives /χ/ and /ɣ/, Table 11 above classifies these phonemes as the second category of the most difficult consonants. This classification predicts that these consonants are more likely to be replaced than produced, but the results display the reverse. If we compare the results in Tables 40 and 41with respect to the local variant substitution, we notice that both groups of GPA speakers were able to realize the fricatives /χ/ and /ɣ/ more often than substituting them.

Summary table of the table sets 40 and 41

Group	Percentages of realizing /χ/ and /ɣ/	
	/χ/	**/ɣ/**
Malayalam	/χ/ (GA) 51% (71) /k/ (GPA) 26% (37) /h/ (GPA) 23% (32)	/ɣ/ (GA) 47% (75) /g/ (GPA) 30% (48) /h/ (GPA) 8% (12) /χ/ (GPA) 15% (25)
Urdu	/χ/ (GA) 76% (107) /k/ (GPA) 0% (0) /h/ (GPA) 24% (33)	/ɣ/ (GA) 97% (156) /g/ (GPA) 3% (4) /h/ (GPA) 0% (0) /χ/ (GPA) 0% (0)

But does each group perform similarly in terms of the production rate of uvular fricatives? Subsequently, I discuss the performances of Urdu and Malayalam speakers, respectively.

If we compare the consonantal inventories of both Malayalam (Table 6) and Urdu (Table 7) to that of Arabic (Table 1), we notice that Urdu and Arabic share some consonants that do not appear in Malayalam. The consonants /q, f, z, χ, ɣ/ occur in both Arabic and Urdu. Therefore, the Gulf Pidgin Arabic speakers, specifically those for whom Urdu is their substrate language, are expected to realize the target consonants of Arabic /χ, ɣ/ with more accuracy than the Malayalam speakers do, and the results given in Tables 40 and 41 suggest that this was the case. The Urdu group had a high frequency of producing the local variants /χ/ and /ɣ/, at 76 % and 97 % of tokens, respectively. Thus, it is unsurprising that GPA speakers from the Urdu group performed better in pronouncing the voiceless uvular fricative /χ/ and /ɣ/ than other investigated consonants, reflecting an influence from their L1. Furthermore, as expected, the Urdu group, but not the Malayalam group, was able to realize the Arabic uvular fricatives with acoustic values similar to the values of the Arabic native speakers.

On the other hand, Malayalam speakers lack uvular fricatives in their L1. However, they display a similar pattern to that found among the Urdu speakers with respect to the tendency of pronouncing the local variants (/χ, ɣ/) more frequently than replacing them, though Malayalam speakers did not reach percentages of production as high as those observed among the Urdu speakers. I argue that there is one potential explanation contributing to this case: the indirect effect of Arabic through the influence of the Urdu language, especially on pronouncing /χ/ and /ɣ/, which originally developed from Arabic sound loans. Almoaily (2013:156) claims that Urdu is considered mostly "as a second language for Malayalam and Punjabi speakers." The demographic information collected from the participants' responses confirmed that the majority of Malayalam speakers speak Urdu as a second language. The Malayalam speakers in this study reported that they use Urdu in their home country as a lingua franca to communicate with other Indian people who do not speak Malayalam. This potential effect might provide Malayalam speakers with more training in pronouncing the uvular fricatives /χ/ and /ɣ/, thereby enhancing their familiarity with them, resulting up in successful production.

The current results also acoustically display some variants for the uvular fricatives between both groups. For instance, in producing the uvular fricative /χ/, Malayalam speakers alternate by either producing /k/ or /h/, while the Urdu speakers alternate with only /h/. The variant /k/ in the realization of /χ/ is in accordance with results reported by previous studies on Arabic pidgins (e.g., Smart 1990; Neass 2008; Salem 2013; Al-Haq & Al-Salman 2014). In contrast, the substitute /h/ for the target fricative /χ/ appeared only in the initial context, especially in the interview data, confirming the study of Avram (2010). Avram found that GPA speakers tend to replace the fricative /χ/ with /h/ only word initially.

The voiced uvular fricative /ɣ/, on the other hand, has three realizations among Malayalam speakers and one realization among Urdu speakers. The present results reported that both groups have the substitution variant /g/ for the fricative /ɣ/, as is common in other previous impressionistic studies (e.g., Smart 1990; Neass 2008; Avram 2010; Salem 2013). Nevertheless, the present study observes other realizations of the fricative /ɣ/, particularly among the Malayalam speakers. I argue that the existence of these realizations hints at its difficulty. This sound (i.e., /ɣ/) occupies the position of third most difficult consonant in the current study, in that it has four marked distinctive features inherent to it (see Table 11). Moreover, consonants' rareness rankings, as based on UPSID, show that the voiceless uvular fricative /χ/ is less marked than its voiced counterpart /ɣ/, which appear with frequencies of 8.5% and 4.4% within the UPSID languages, respectively. This finding implies that /χ/ is more common and easier to pronounce than its voiced counterpart /ɣ/. Table 41 displays that the Malayalam group has multiple variants, in that the Malayalam speakers realized the /ɣ/ in 47%, /g/ in 30%, /h/ in 8% and /x/ in 15% of the tokens. Table 11 above shows that the voicing feature of /ɣ/ contributes to its difficulty, which requires an effort to articulate due to the vocal fold vibration, while the /χ/ is voiceless and the vocal folds are apart from each other, which results in a simpler articulation relative to the fricative /ɣ/.

The results also demonstrated that there exist linguistic and non-linguistic independent factors affecting the realization of the uvular fricatives. The logistic regression analysis reported different independent variables for each uvular fricative, for instance, the speakers' L1 and amount of exposure to GA influence on producing the voiceless uvular fricative /χ/. However, production increases in about 43 % and 35 % of tokens for the speakers' L1 and amount of exposure, respectively. In contrast, the realization of /ɣ/ is only affected by speakers' L1, where the realization of /ɣ/ increases by approximately 74 % for speakers' L1.

Therefore, in comparing the effect of amount of exposure with speakers' L1, I found that amount of exposure could not explain the influence on the production of /ɣ/. Based on these results, I argue that the recurrence of the significance influence of Urdu as an L1 on the realization of both uvular fricatives suggests that the speakers' L1 (Urdu) is the strongest predictor in realizing them relative to the amount of exposure. This finding is expected due to the existence of this consonant (i.e., /ɣ/) in the consonantal system of Urdu. Thus, we found that all Urdu speakers and Malayalam speakers, especially those who speak Urdu as a second language, were able to realize the uvular fricatives at a high rate of production. Thus, the speaker's L1 is the more influential factor, at least in the current study, than the amount of exposure in realizing the uvular fricatives.

7.2.4 Pharyngeal Fricatives Realization (/ħ/ vs. /ʕ/)

The last category of the investigated consonants is pharyngeal fricatives: the voiceless pharyngeal fricative /ħ/ and its voiced counterpart /ʕ/. Based on Table 11, these phonemes occupy the highest degree of markedness, as they contain a higher number of marked features than the other investigated consonants. This characteristic entails their rareness and greater difficulty. The pharyngeal fricatives /ħ/ and /ʕ/ occur in 4.1 % and 2.5% of the UPSID languages, respectively. Table 11 classifies the pharyngeal /ħ/ as less marked than its voiced counterpart /ʔ/, suggesting that /ħ/ is easier to pronounce than /ʔ/.

The results demonstrate that GPA speakers of both groups (Malayalam and Urdu) alternated the voiceless pharyngeal fricative /ħ/ with either the local variant /ħ/ or the L1 variant /h/, which is in accordance with impressionistic findings reported by studies on Arabic-based pidgin languages (e.g., Smart 1990; Salem 2013; Al-Haq & Al-Salman 2014). As I predicted from the difficulty ranking of the voiceless pharyngeal fricative (Table 11) and from the inventory systems of Malayalam and Urdu that lack the variant /ħ/, both groups of GPA speakers had very low rates of realizing the local form compared to the other examined consonants in the present study. The GPA group speakers are not considerably different from one another in producing the /ħ/. They produced the target sound /ħ/ and replaced it in an equal way, in the sense that the rate of producing the /ħ/ occurred amongst the participants of the Malayalam group at a rate of 19%, compared to 13% for the participants of the Urdu group.

As expected from the phonological difficulty/markedness, both groups display high rates of substituting the sound /ħ/. The Malayalam and Urdu groups replaced the sound /ħ/ more often with /h/, in 81% and 87% of the tokens, respectively. Typically, non-Arab speakers encounter difficulty in production and perception of the voiceless pharyngeal fricatives (Alotaibi & Muhammad 2010), and thus, they frequently replace them with the /h/ phoneme, which occurs in most languages.

Furthermore, in examining the other factors that may influence the realization of /ħ/, the regression analysis reported that the amount of exposure, LOR and age affect the realization of the pharyngeal fricative. The LOR is the only factor that affects the realization of the voiceless pharyngeal fricative, increasing production by approximately

16% among the speakers who stayed longer in Saudi Arabia, compared to those speakers with short stay. I argue that it is reasonable to consider long LOR as the more informative factor than the other investigated factors, particularly in realizing the voiceless pharyngeal fricative. The GPA speakers who stayed longer in Saudi Arabia are more likely to have high exposure to the target language. Thus, I assume that in spending a significant amount of time in Saudi Arabia, the GPA speakers have to practice the target language, indicating that the speakers are more likely to interact in the L2, which, consequently, increases their success in L2 performance.

In contrast, the voiced pharyngeal fricative /ʕ/, as displayed in Table 11 above, is considered the most marked phoneme within the investigated consonants as it displays six marked distinctive features. Thus, it is expected to be replaced with several variants or to undergo deletion. The present results shown in Table 43 demonstrate that this was the case. The GPA speakers encounter difficulty in articulating the voiced pharyngeal fricative, and hence, they alternate it as local form /ʕ/ or as voiceless glottal stop /ʔ/. Replacing the local form /ʕ/ with the glottal stop /ʔ/ is in agreement with most impressionistic studies on Arabic-based pidgin (e.g., Smart 1990; Avram 2010; Salem 2013), which found that Arabic pidgin speakers replaced the voiced pharyngeal fricative with the glottal stop /ʔ/. Moreover, the current results display that some GPA speakers deleted the local form /ʕ/, a finding that aligns with only the study by Al-Haq and Al-Salman (2014), which found that Bengali Pidgin Arabic speakers deleted the pharyngeal most of the time. Nevertheless, the current study attested another variant to the pharyngeal /ʕ/, in that a few tokens are realized as /h/ at rates of 6% and 3% for the Malayalam and the Urdu group, respectively. Replacing the pharyngeal /ʕ/ with the glottal stop /ʔ/ showed the highest frequency of substitution in both groups of speakers. The participants from the Malayalam and Urdu groups had a tendency to replace the voiced pharyngeal /ʕ/ more often with the glottal stop, in 63 % and 86 % of tokens, respectively. One possible reason behind the higher rate of glottalization comes from the phonetic context. Dilley, Shattuck-Hufnagel and Ostendorf (1996) state that glottalization is more likely to occur in a word-initial context. The present study elicited the voiced pharyngeal fricative in a word-initial context, mostly in stressed syllables, which in turn reinforced the existence of the glottal stop more frequently among the GPA speakers relative to the other variants. This finding was also confirmed by the interview data, in which the GPA speakers of both groups showed no local variant in producing the voiced pharyngeal fricative /ʔ/. Rather, they deleted it in 100% of the tokens medially but glottalized only initially. Regarding the existence of other variants (e.g., /h/ or deletion), most impressionistic studies on Arabic-based pidgin languages have found only one replacement. I argue that the previous studies on Arabic-based pidgin languages, particularly those that claim that the voiced pharyngeal fricative is realized only as a voiceless glottal stop /ʔ/, did not rely on acoustic analysis in their investigations; instead, they mainly relied on impressionistic analysis, which lacks precise judgment. There seems to be some difficulty in hearing the difference between a glottal stop and the following vowel. Thus, the voiced pharyngeal sound in their studies might not be realized as a glottal stop; instead, it might be deleted, as is the case in the current study. The second possible explanation is that they are correct in their judgment, and their participants realized the voiced pharyngeal /ʕ/ as a glottal stop /ʔ/, because the glottal stop might be part of their native phonemic systems. In this case, we could say that the substitution that they made is reasonable and that the L1 influence plays a role in their substitution.

The regression analysis reported only the LOR, amount of exposure and age that affects the realization of the /ʕ/. It is reasonable that only amount of exposure and LOR, among the other factors, can explain the significant influence on the production of the /ʕ/ because Mitchell (1993) mentions that the pharyngealized consonants are quite rare in the world's languages as compared to the other articulators (e.g., labial, coronal, dorsal). Moreover, Mitchell (1993: 56) comments on their difficulty and states that "forcing air through the glottis at the rear of the vocal tract in what has been termed 'stage whisper' produces sounds which, though unusual, are unacceptable as pharyngeal fricatives." Their difficulty is limited not only to their production but also in their perception. Heap (1997) states that non-native Arabic listeners encounter difficulty in perceiving the pharyngeal phonemes because they are articulated in the throat, and this articulation makes it impossible to see visual signals in speech. These elements explain why these sounds are considered as the very most marked phonemes in the present corpus, as illustrated in Table 11. Besides its absence from the substrate languages (Malayalam and Urdu), it also seems very intricate in its articulation; therefore, is difficult to acquire and requires more time and effort for successful realization. Thus, the GPA speakers who use GA much more often as well as immerse themselves in the culture of the target language are more likely to perceive more input of the target language. Consequently, such a high degree of exposure and long LOR will enable GPA speakers to create a new phonetic category for the non-native sound/feature, which ultimately leads to successful realization of the L2 sound/feature. The multiple substitutions of the voiced pharyngeal fricative are not surprising, and as expected, it is produced at a much lower rate of the tokens in both groups of participants. In this case, both GPA speaker groups are still somewhat distant from acquiring the local variant. Therefore, increased exposure through staying longer in Saudi Arabia can facilitate acquiring the pharyngeal fricative. The test displays that production of /ʕ/ increases by approximately 27 % and 57 % for speakers with a high amount of exposure to Arabic and staying longer in Saudi Arabia, respectively. Such a low percentage in realization increase suggests the complexity in the articulation of the voiced pharyngeal fricative, and none of the other factors such as age or L1 can explain the influence. These findings align with research showing that a high amount of exposure to the L2 through staying longer in the host country facilitate successful L2 performance (e.g., Rickford 1977).

Contrary to the findings of Grama (2015), who argued that vowel realization shows some variation across age groups, the current study revealed that age has a minor effect on the realization of uvular fricatives, although age is considered one of the influential factors in the phonological L2 literature. According to the CPH, the ideal time for successful L2 acquisition is before the start of puberty. Thus, I argue that age did not show a major influence on GPA speakers' production because the participants' ages range from 22 to 50 years old, which is far from the ideal age for L2 acquisition. It is clear from the current results we obtained from the regression (Table 51) that the realization increases by roughly 27 % with high amount of exposure, compared to 2 % with age. Thus, the amount of exposure and LOR are the more influential factor, at least in the current study, than age in realizing the voiced pharyngeal fricative. These results supported Flege's (1995) claim that age may not prevent adult speakers from successful

L2 production. He argued that immersion in the L2 environment can overcome age and contribute to the success of adults' performance of L2 phonological realization, and this was confirmed in the current study.

7.3 Summary

This section provides an overview of the general discussion of the current study. The results indicate that there is considerable inter-speaker variation among both groups of GPA speakers across all Arabic marked consonants investigated in the current study. I argue that the alternation of these consonants emerged from the influence of the speakers' L1, degree of difficulty and certain non-linguistic factors, in that both groups tend to alternate by either producing the local variant of Arabic or replacing the target sound with the closest counterpart in their L1.

I find seven consonant alternations (local form vs. L1 form). With respect to the emphatic consonants, two variants were identified as substitutes for [tˤ]: alveolar stop [t] and emphatic stop [tˤ], and three variants were identified as substitutes for [sˤ]: alveolar fricative [s], emphatic fricative [sˤ] and dental fricative [θ]. The dental fricative [θ] has three variants: alveolar stop [t], alveolar fricative [s], and dental fricative [θ]. As for the uvular fricatives, three variants were attested for [χ]: velar stop [x], glottal fricative [h], and uvular fricative [χ], and four variants were identified for [ɣ]: velar stop [g], glottal fricative [h], uvular fricative [χ], and uvular fricative for [ɣ]. Finally, the pharyngeal fricative [ħ] has two variants: glottal fricative [h] and pharyngeal fricative [ħ], and four variants were attested for [ʕ]: glottal stop [ʔ], glottal fricative /h/, local form [ʕ], or deletion.

The degree of alternation is significantly affected by non-linguistic factors (e.g., the length of residency in Saudi Arabia, age, and amount of exposure to GA) and/or linguistic factors (e.g., speakers' L1 and the difficulty of articulation/degree of markedness). The current results reinforce the idea of phonological markedness. There is a negative/indirect relationship between the high rate of production and difficulty of articulation, meaning that if the markedness/difficulty of the sound increases, the high rate of realization decreases and vice versa. The overwhelming majority of substitutions in realizing the Arabic marked consonants took place with the pharyngeal fricatives and dental fricatives, which most GPA speakers substituted to a substantial degree. For instance, the voiced pharyngeal fricative /ʕ/, which is described as most difficult/marked consonant in the corpus, shows the lowest rate of production in the current corpus amongst both groups. Moreover, most non-Arabic speakers struggle with its production and with its perception (Alotaibi & Muhammad 2010), since it is articulated in the throat, which makes it impossible to see visual signals in speech.

The present study displays that the UPSID scores significantly correlate with articulatory complexity, particularly with the following consonants: /χ, ɣ, ħ and ʕ/. For instance, those sounds are characterized by being typologically complex and marked, and they rarely occur in the world's languages. The pharyngeal fricatives such as / ħ, ʕ/ are not common cross-linguistically (Alotaibi & Muhammad 2010), relative to the alveolar fricative /s/. The pharyngeal fricatives involve complexity in their articulation, as they are articulated with a retracted tongue root against the back wall of the pharynx (Alwan 1989); in contrast, the alveolar fricative is articulated with the involvement of tip of the tongue against the alveolar ridge. Therefore, the voiced pharyngeal fricative occurs in only 2.5% of the world's languages, compared to 77% for the alveolar fricative /s/ in the world's languages in UPSID.

The regression results did not identify one or two factors that could affect the production of all the target consonants. For instance, the realization of the emphatic stop and dental fricative are influenced greatly by the LOR factor, the uvular fricatives are influenced by the speakers' L1, and, finally, the pharyngeal fricative is affected by the LOR and amount of exposure to GA. Accordingly, there is a clear shift to the local norm among participants who have a longer LOR in Saudi Arabia and a high amount of exposure to GA, compared to those who have a shorter LOR and low exposure. However, the age factor did not have a significant effect on producing the Arabic marked consonants, as all participants were exposed to GA after the age of twenty, i.e., after the critical period of acquisition. Eventually, the speakers' L1 (Urdu) did have an effect on the realization of the uvular fricatives and dental fricatives. This effect comes from the partial influence of Arabic on Urdu, as well as the fact that uvular fricatives already exist in Urdu grammar. I argue that the Urdu group is closer to the local norm in the production of most Arabic consonants than the Malayalam group. The acoustic comparisons demonstrate that the Urdu speakers produced the Arabic marked consonants (/sˤ/, /χ/, /ɣ/, /ʕ/) with similar values to the control speakers more frequently than the Malayalam speakers did.

CHAPTER 8

CONCLUSION

This chapter reviews the main results of this dissertation. The present study investigates the potential effect of linguistic factors (i.e., speakers' L1 or the degree of markedness/difficulty) and non-linguistic factors (i.e., age, length of residency, and amount of exposure) on the variation and realization of Arabic marked consonants including emphatic (/tˤ, sˤ/), dental (/θ/), uvular (/χ, ɣ/), and pharyngeal (/ ħ, ʕ/) consonants in the speech of GPA speakers.

The GPA is a variety spoken by immigrant workers living in the Gulf States. The GPA emerged under a number of socio-demographic and historical factors, including a continual influx of immigrant workers that appeared after the discovery of oil in 1983, a social gap between Gulf speakers and immigrants, and linguistic diversity among GPA speakers. The current study investigates patterns in the production and variation of uncommon/marked consonants of Arabic by 40 GPA male speakers whose L1 is Urdu (20 speakers) or Malayalam (20 speakers), all of whom work in Qassim, Saudi Arabia, for different periods. Each participant group was divided based on their length of residency (LOR) in Saudi Arabia: a short stay group (those who have lived in Qassim for six years or less) and long stay group (10 years or more).

This dissertation addressed the following research question: How do GPA speakers realize Arabic marked consonants? It also investigates how the realization values of GPA speakers are similar to Arabic control speakers. Moreover, it examines the values of each group of GPA speakers and then compares them to the control group's values. The study also discusses the potential factors (e.g., L1, LOR, amount of exposure, age) that may influence the realization of Arabic marked consonants. Finally, it looks at the association between the variant frequency and degree of markedness/difficulty.

8.1 Summary of the Study

The data was collected by recording short sociolinguistic interviews and a picture-naming exercise. In the picture-naming task, both GPA speakers and control speakers were recorded as they completed a picture task in which they were asked to identify 50 pictures that carry the target consonant /tˤ/, /θ/, /sˤ/, /χ/, /ɣ/, /ħ/ and /ʕ/ in word-initial position, repeated in three times. I adopted auditory analysis and acoustic analysis to analyze the data, using specific relevant acoustic measurements to classify the target consonants and their alternations among the GPA speakers, and also to determine which group of GPA speakers realize the target consonants with acoustic values closer or similar to the value of the local form.

The results indicated that these groups of GPA participants displayed a number of consonant substitutions across investigated words. Moreover, the results indicated that there is considerable inter-speaker variation among both groups of GPA speakers across all consonants. The alternations are most probably accounted for by differences in speakers' L1 and both groups tend to alternate by either producing the local form of Arabic or replacing it with the closest counterpart in their L1. Most of the consonant substitutions attested in previous impressionistic Arabic pidgins studies were noted in the present study. The alternations of GPA speakers include the local form vs. the L1 form (e.g., /tˤ/ vs. /t/, /θ/ vs. /t/or /s/, /sˤ/ vs. /s/or /θ/, /χ/ vs. /k/or /h/, /ɣ/ vs. /g/or /h/ or /x/, /ħ/ vs. /h/, /ʕ/

vs. /h/ or /ʔ/ or deletion). Furthermore, these variants also occurred in the interview data, but some of them restrict their appearance in certain phonetic context. For instance, the voiced pharyngeal fricative /ʔ/ is more likely glottalized initially and predominantly deleted medially. However, several variants that were found in this study were not attested in Arabic pidgins literature (e.g., the realization of /x/ for /ɣ/ and /h/ for /ʕ/).

The majority of these consonant alternations (e.g., /t/ for /θ/) had been observed in most prior, impressionistic studies of Arabic pidgins and other pidgin regardless of their substrate languages and lexifiers. Such similarities in substitutions can be explained by Universalist theory in the sense that pidgins have a simplified system in their structures resultant from the universal tendency of humans as speakers employ their innate ability to simplify language when learning/acquiring new languages.

Regarding the target consonants' performance, each group produced the same target consonants. The speakers' production values are compared to the Arabic control speakers. As I predicted, Urdu speakers display superior performance in most Arabic consonants due to the partial influence of Arabic on Urdu. The comparisons demonstrate that the Urdu speakers similarly produced most of the Arabic marked consonants (e.g., /tˤ/, /χ/, /ɣ/, /ʕ/) with values much like those of native Arabic speakers. The Malayalam speakers, on the other hand, were very close to approximating the control group with the Arabic consonant /θ/, /tˤ/and /sˤ/.

Moreover, the degree of alternation of the marked consonants differs from consonant to consonant. I argue that the high or low rates of frequency linked to the phonological markedness. The target consonants are measured by counting the marked distinctive features inherent to them. Therefore, based on the ranking table (Table 52), the voiced pharyngeal fricative is considered the most difficult consonant in the present study as it has six marked distinctive features. The overwhelming majority of substitutions in realizing the Arabic marked consonants took place at pharyngeal fricatives. Therefore, it can be concluded that both [ħ] and [ʔ] were substituted by the participants to a substantial degree, and the GPA speakers realized them at very low rates, whereas the realization increases as the sound become less difficult (e.g., emphatic fricative). Nevertheless, adopting a variationist perspective, the realization is argued to be influenced not only by the degree of difficulty and L1 but also by non-linguistic/social factors. This dissertation investigated specific non-linguistic factors (e.g., LOR in Saudi Arabia, age, and amount of exposure to GA) that were argued to have an effect on the production/variation of the Arabic marked consonants.

I tested the relationship between each investigated independent variable and the realization of Arabic marked consonants. The results report that there is a correlation between age and the realization of /tˤ/, /θ/, /χ/, /ɣ/, and /ʕ/. Contrary to the common concept found in the previous studies (e.g., Flege et al. 2006; Major 2014), the current results correlate high rate of Arabic consonant realization with increasing age. I believe that this might be due to the correlation between age and LOR in Saudi Arabia. The increasing age is associated with increased length of stay. Most GPA speakers arrived Saudi Arabia after the age of 22. The older they are, the longer their stay in Saudi Arabia will be.

Moreover, there was a relationship between the speakers' L1 (Urdu) and the high realization of the uvular fricatives and dental fricatives. I maintain that this effect comes from the partial influence of Arabic on Urdu, as well as the fact that uvular fricatives are part of Urdu phonemic system. Finally, the test reported that a longer LOR in Saudi Arabia and a high amount of exposure to GA are highly correlated with the high realization of the Arabic marked consonants. The GPA speakers who stayed longer and had high exposure increased the means of all Arabic consonants realization relative to those with a short LOR and low exposure. However, the LOR and amount of exposure correlate significantly with the high realization of /tˤ/, /θ/, /ħ/ and /ʕ/. None of the previous factors (L1, LOR, age, and amount of input) had a consistent influence on all target consonants. Therefore, I ran logistic regression combining all target factors in one model to determine the robust predictor for proper realization.

The results of the regressions report that the LOR only influence the realization of /tˤ/, /ħ/, /ʕ/ and /θ/, confirming the results of correlation above; the age only influenced one consonant (i.e., /ʕ/); the speakers' L1 influenced the realization of /θ/, /χ/, and /ɣ/. The amount of exposure influenced the realization of /χ/, /ħ/, and /ʕ/. These results suggest that age does not play a significant role in the realization of Arabic consonants as the other factors (e.g., LOR and amount of exposure) do. The LOR and amount of exposure are found to be more powerful than age. For instance, the realization of the most difficult Arabic consonants (i.e., /ħ/, /ʕ/) are influenced by only the amount of exposure because these sounds require significant time and effort to acquire.

Accordingly, there is a clear shift to the local norm among participants who have a longer LOR in Saudi Arabia and a high amount of exposure to GA, compared to those who have a shorter LOR and low exposure. Finally, the speakers' L1 (Urdu) did have an influence on the realization of the uvular fricatives and dental fricatives. The influence comes from the partial effect of Arabic on Urdu, as well as the fact that uvular fricatives already exist in Urdu grammar.

8.2 Significance of this Research

The study provides insight to the researcher interested in language variation in general and pidgins specifically. It shows that the production of the target language (i.e., Gulf Arabic) as produced by GPA speakers is influenced not only by linguistic factors (e.g., L1) but also by other non-linguistic factors (e.g., LOR, age and the quantity and quality of the input).

Furthermore, this study is significant because it contributes to the literature on Arabic pidgins. The literature has a shortage of studies employing acoustic measurements for classifying the consonantal system of Arabic pidgins, and there is also a lack of studies discussing the linguistic alternation in GPA. Therefore, adopting acoustic measures in classifying the consonants of GPA and employing quantitative analysis to account for phonological alternation is an important contribution to the field of pidgin research, particularly with respect to Arabic-based pidgins.

The social environment in which GPA has emerged is similar to the social situations of other pidgins around the world; GPA speakers have been culturally isolated and socially distanced from the locals. Moreover, similar to other pidgins, the GPA has a reduced system at the phonological levels compared to its lexifier and shares the typological characteristics of pidgin. Accordingly, this study tells us that GPA should be considered as a variety of pidgin.

8.3 Limitations and Future Study

There are some limitations in this study that I will be addressed in future research.

The sample size of the current research includes only 40 participants from two ethnicities (Malayalam and Urdu) distributed across four factors: LOR, age, amount of exposure to GA and L1. There are various other ethnic groups in Saudi Arabia. A future study needs to expand the data set by including different ethnicities (e.g., Bengali, Panjabi, Sinhala, and Tagalog) for a more comprehensive representation of GPA as well as for exploring substratal differences between the participants. Although 40 participants are a feasible number in the study of sociolinguistics, increasing number of participants would also provide us with more precision and reliable statistical results in detecting the differences between the participants.

Moreover, only a few factors were investigated in the current study, while there are definitely other social factors that may help in understanding the influence of Arabic marked consonant realization/variation. For instance, the study did not include gender as a variable, and the study only includes male speakers for two reasons. First, it is difficult to interview females face-to-face due to religious issues and Saudi culture. Second, the immigrant males outnumbered immigrant females.[23] I surmise that the high number of male workers in Saudi Arabia is because most of the positions available are typically reserved for men, such as contractors and construction workers on buildings and roads.

Moreover, the investigation of motivation has been excluded because examining the motivation precisely requires designing a special tool for measuring the high/low motivation. A future study might consider motivation as a factor because some previous L2 studies have displayed that this factor correlates with successful L2 production. The GPA speakers are viewed negatively by GA speakers and their speech is stigmatized. The

[23] The Central Department of Statistics & Information in Saudi Arabia, 2014.

prestige has played a role in realizing these investigated consonants. Some of the participants answered the following question "Do you think it is important to learn Arabic to be a member of the Arabic society?" as the following:

Table 53 Sample of some participants' responses

S5	ʔiwah darori ʔana swwi kalam katiir swa swa Saudis ʔalaʃan ʔihtiram katiir Yes important I speak a lot with Saudis for respect "Yes, it is important and I tried to speak a lot with native speakers and imitate them to be respected"
S18	ʔiwah ʔana yibga kalam katiir sim sim Saudis ʔalaʃan sawi ʔitifaq kuwais Yes I want speak a lot like Saudis for making contract good with customer swa zabon "Yes, I would like to speak like Saudi speakers because this will help me running my own business and will help me make a great contract if I learn Arabic like Saudi speakers"
S20	ʔiwah hada kuwais ʔalaʃan ʔihtiram min Arabi Yes this good for respect by Arab "Yes, this is good for avoiding disrespect from Arab"
S33	ʔana Muslim ʔana yibga yigra Quran kuwais wa hassil shugul fi Pakistan I am Muslim I want read Quran perfect and get job in Pakistan Arabic muddaris Arabic teacher. "Yes, Because I am Muslim and I need it for reciting Quran perfectly and also I found it important for me to get a job in my country as an Arabic teacher"

Thus, it would be useful to investigate whether high motivation would facilitate the realization of Arabic marked consonants in the speech of GPA speakers.

Also, the sociolinguistic interview portion of the data collection was relatively short. This methodological decision was the result of limited access to participants; more specifically, the sponsor of the workers did not allow his employees to spend much time for interviewing during work hours. Therefore, I took advantage of the short time that I had by focusing mainly on picture elicitation and recording a brief interview. Conducting more extended interviews would cover the whole target consonant of Arabic in all contexts. More extended interviews would assist in providing a more detailed pattern on the variants under investigation and confirm if variants occur in specific phonetic context as found in the current interview data. Having longer interviews would give each participant the opportunity to produce each target consonant in different phonetic context. Perhaps a future study might benefit from having longer interviews as it provides more data for exploring segment frequency as a possible factor for successful realization. With longer interviews, I would able to determine whether high frequency words carrying these marked consonants would facilitate the production/acquisition of these consonants. The appearance of these sounds in high frequency words might make the sounds more salient to the GPA speakers because the speakers are more likely to hear these consonants more often in their daily basis, which results in the successful production of the target consonants.

Finally, this study depended solely on investigating the target consonant in word-initial position, particularly in picture task elicitation. It would be interesting to investigate the same marked consonants that are of interest in this study in the future by examining the target consonants in word-medially and word-finally and determining the factors that explain the observed variation.

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APPENDIX A

MAP OF ARABIAN GULF STATES[24]

[24] Retrieved February 12, 2018, from Google Maps.

APPENDIX B

MAIN DISTINCTIVE FEATURES FOR ARABIC CONSONANTS[25]

	b	t	θ	dʒ	ħ	x	d	ð	r	z	s	ʃ	sˤ	dˤ	tˤ	ðˤ	ʕ	ʁ	f	q	k	l	m	n	h	w	j
consonantal	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-
voice	+	-	-	+	-	-	+	+	+	+	-	-	-	+	-	+	+	+	-	-	-	+	+	+	+	+	+
coronal	-	+	+	-	-	-	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	+	-	+	-	-	-
anterior	+	+	+	-	-	-	+	+	+	+	+	-	+	+	+	+	-	-	-	-	-	+	-	+	-	-	-
continuant	-	-	+	+	+	+	-	+	+	+	+	+	+	+	-	+	+	+	+	-	-	+	+	+	+	-	-
nasal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-
lateral	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
dorsal	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-
distributed	-	-	+	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTR	-	-	-	-	+	-	-	-	-	-	-	-	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-
low	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
back	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	+	+	-	+	+	-	-	-	-	-	-
high	-	-	-	-	-	+	-	-	-	-	-	-	+	+	+	+	-	-	-	+	-	-	-	-	-	-	-

[25] Alotaibi & Meftah 2013; Hassan 2015.

APPENDIX C

PARTICIPANTS' DEMOGRAPHIC INFORMATION

Informant code	Age	Gender	L1	Linguistic background	Length of stay	Career
S1 (Abdulqadir)	35	M	Malayalam	N/A	10 Yrs.	Chef
S2 (Mohamad Bashir)	38	M	Malayalam	N/A	12 Yrs.	Salesman
S3 (Mustafa)	40	M	Malayalam	Tamil	14 Yrs.	Salesman
S4 (Mohamad Mustafa)	38	M	Malayalam	Urdu, Tamil	11 Yrs.	Salesman
S5 (Nizar)	41	M	Malayalam	Urdu, Tamil, Hindi	17 Yrs.	Salesman
S6 (Riyas)	36	M	Malayalam	Urdu, English, Hindi	15 Yrs.	Technician
S7 (Safi)	35	M	Malayalam	Tamil, Hindi	10 Yrs.	Salesman
S8 (Sajo)	43	M	Malayalam	Urdu, Tamil	24 Yrs.	Salesman
S9 (Shan)	31	M	Malayalam	Tamil, Hindi	10 Yrs.	Salesman
S10 (Suneer)	39	M	Malayalam	Hindi, English	20 Yrs.	A/C repairman
S11 (Shamnah)	29	M	Malayalam	Tamil, Hindi	7 Yrs.	Technician
S12 (Suheel)	23	M	Malayalam	Hindi	2 Yrs.	Salesman
S13 (Vido)	28	M	Malayalam	N/A	6 Yrs.	Salesman
S14 (Zain)	27	M	Malayalam	Tamil, Hindi, Urdu	6 Yrs.	Waiter
S15 (Mohammad Shafi)	25	M	Malayalam	N/A	3.5 Yrs.	Private Driver
S16 (Siraj)	25	M	Malayalam	Hindi	5 Yrs.	Salesman
S17 (Bashir)	27	M	Malayalam	N/A	4.5 Yrs.	Salesman
S18 (Shafiq)	22	M	Malayalam	Urdu, Hindi, Tamil	1 Yrs.	Salesman
S19 (Shaijo)	24	M	Malayalam	Urdu, Hindi, Tamil, English	5 Yrs.	Salesman
S20 (Jasim)	28	M	Malayalam	Urdu, English	5 Yrs.	Plumber
S21 (Mohamad Ali)	45	M	Urdu	N/A	24 Yrs.	Marketing specialist
S22 (Shakeel)	45	M	Urdu	Punjabi	16 Yrs.	Builder
S23 (Munir)	42	M	Urdu	Punjabi	13 Yrs.	Builder
S24 (Risat)	50	M	Urdu	Punjabi	19 Yrs.	Truck Driver
S25 (Asif)	34	M	Urdu	N/A	10 Yrs.	Plumber
S26 (Zahid)	31	M	Urdu	N/A	10 Yrs.	Builder
S27 (Siddig)	33	M	Urdu	Saraiki	10 Yrs.	Farmer
S28 (Shahid)	39	M	Urdu	N/A	11 Yrs.	Driver
S29 (Ali Risat)	43	M	Urdu	Punjabi	14 Yrs.	Store Manager
S30 (Mudathir)	40	M	Urdu	Punjabi	11 Yrs.	Carrier
S31 (Ass Ali)	28	M	Urdu	English, Punjabi	6 Yrs.	Truck Driver
S32 (Shanwas)	25	M	Urdu	N/A	5 Yrs.	Truck Driver
S33 (Abdullah)	30	M	Urdu	Punjabi, Saraiki	3 Yrs.	Salesman
S34 (Qisar)	30	M	Urdu	Punjabi	4 Yrs.	Puncher Worker

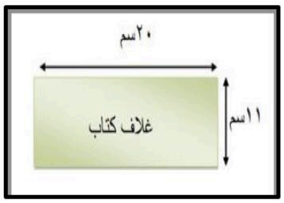
S35 (Mohamad abdo)	24	M	Urdu	English, Punjabi	1.5 Yrs	Driver
S36 (Qasim)	27	M	Urdu	N/A	4 Yrs.	Plumber
S37 (Abdulrahman)	32	M	Urdu	Pashto	3 Yrs.	Farmer
S38 (Shazman)	30	M	Urdu	Pashto, Punjabi, English	5 Yrs.	Carpenter
S39 (Bilal)	27	M	Urdu	Pashto	1.5 Yrs.	Construction Worker
S40 (Ali)	30	M	Urdu	Saraiki	2.5 Yrs.	Marketing specialist

APPENDIX D

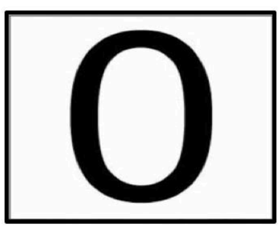
LIST OF TOKENS AND PICTURES







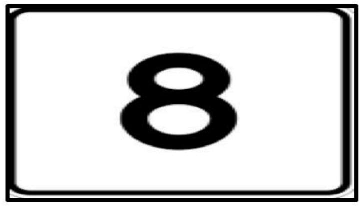

Target consonant in IPA symbol	Words representing the target consonant
/**tˁ**/	**tˁi:**n *‘clay’* **tˁi**r *‘bird’* **tˁi**yarah *‘airplane’* **tˁa**matah *‘tomato’* **tˁa:**biʕah *‘printer’* **tˁu**l *‘length’* **tˁu:**b *‘brick’*





Target consonant in IPA symbol	Words representing the target consonant
/**sˁ**/	**sˁi:**ny *‘China’* **sˁi**fir *‘zero’* **sˁa**bun

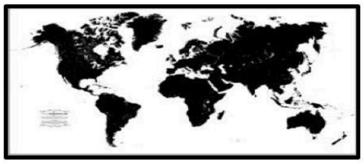
	'soap' **sˤa**muli *'bread stik'* **sˤu**m *'fasting'* **sˤa**ndug *'box'* **sˤu**sˤ *'chick'*

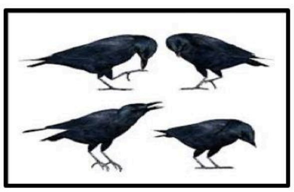



Target consonant in IPA symbol	Words representing the target consonant
/**θ**/	**θi**ran *'ox'* **θa**manyah *'eight'* **θ**alj *'ice'* **θa**lladʒah *'refrigerator'* **θu:**m *'garlic'* **θu**b *'robe'*



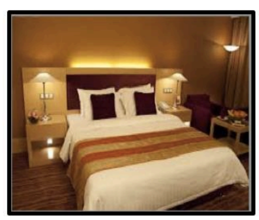



Target consonant in IPA symbol	Words representing the target consonant
/**χ**/	**χi**yar *'cucumber'* **χa**msah *'five'* **χa**ʃab *'wood'* **χa**rit^{ʕ}ah *'map'* **χu**s^{ʕ} *'wickerwork'* **χu**χ *'peach'* **χu**bz *'bread'*

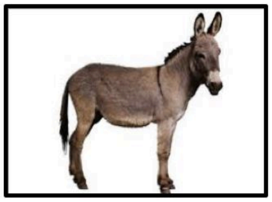
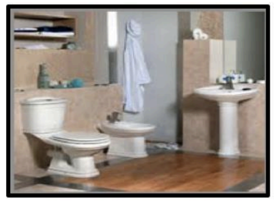






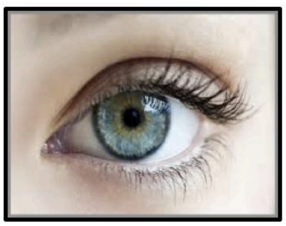


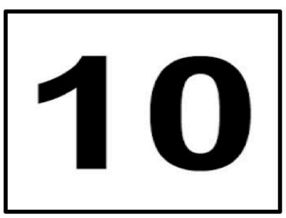

Target consonant in IPA symbol	Words representing the target consonant
/**ɣ**/	**ɣi**rban *'crows'* **ɣa**z *'gas'* **ɣa**nam *'sheep'* **ɣa**salah *'washer'* **ɣa**ra *'glue'* **ɣu**bar *'dust'* **ɣu**rfah *'room'* **ɣu**trah *'head dress for Gulf men'*

Target consonant in IPA symbol	Words representing the target consonant
/**ħ**/	**ħi**s^{ʕ}an *'horse'* **ħi**mar *'donkey'* **ħa**mmam *'bathroom'* **ħa**ddad *'blacksmith'* **ħu**rmah *'woman'* **ħu**t *'whale'* **ħa**diθ *'accident'* **ħu**bub *'pills'*

Target consonant in IPA symbol	Words representing the target consonant
/**ʕ**/	**ʕi**nab *'grape'* **ʕi**n *'eye'* **ʕa**fritah *'jak'* **ʕa**sal *'honey'* **ʕa**rabiyah *'cart'* **ʕa**shrah *'ten'* **ʕa**lam *'flag'*

APPENDIX E

STATISTICAL RESULT TABLES

Table 54 Statistical results for friction noise duration and COG differences between /sˤ/ and /s/ as produced by GPA speakers

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 sˤ +(i)	1	18	475.0743722	75.99800585	17.91290176
	2	63	425.8528596	77.24478352	9.731927965
Ave. F2 sˤ +(i)	1	18	1614.255496	344.4607767	81.19018369
	2	63	1836.582304	322.1397134	40.58578900
Ave. VD sˤ +(i)	1	18	.0822480714	.0390898360	.0092135627
	2	63	.0881513477	.0376232081	.0047400787
Ave. Fric Du sˤ +(i)	1	18	.1143104005	.0293192465	.0069106127
	2	63	.1160677839	.0296594866	.0037367441
Ave. COG sˤ+(i)	1	18	6898.135878	1009.077668	237.8418872
	2	63	7085.150382	1095.542953	138.0254383

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 sˤ +(i)	Equal variances assumed	.215	.644	2.392	79	.019	49.22151257	20.57328794	8.271407276	90.17161787
	Equal variances not assumed			2.414	27.851	.023	49.22151257	20.38583998	7.452972052	90.99005309
Ave. F2 sˤ +(i)	Equal variances assumed	.551	.460	-2.543	79	.013	-222.326808	87.41357157	-396.319170	-48.3344458
	Equal variances not assumed			-2.449	26.111	.021	-222.326808	90.76922494	-408.867171	-35.7864444
Ave. VD sˤ +(i)	Equal variances assumed	.029	.866	-.582	79	.562	-.005903276	.0101408533	-.026088140	.0142815873
	Equal variances not assumed			-.570	26.677	.574	-.005903276	.0103613746	-.027175093	.0153685404
Ave. Fric Du sˤ +(i)	Equal variances assumed	.132	.718	-.222	79	.825	-.001757383	.0079073517	-.017496573	.0139818064
	Equal variances not assumed			-.224	27.744	.825	-.001757383	.0078561965	-.017856764	.0143419973
Ave. COG sˤ+(i)	Equal variances assumed	.552	.460	-.649	79	.518	-187.014504	287.9800136	-760.224383	386.1953742
	Equal variances not assumed			-.680	29.462	.502	-187.014504	274.9905179	-749.050203	375.0211938

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 sˤ+(a)	1	71	589.6623082	79.33031287	9.414776026
	2	51	569.2787497	90.02928084	12.60662089
Ave. F2 sˤ+(a)	1	71	1258.816596	109.3547868	12.97802552
	2	51	1367.738562	107.3971856	15.03861401
Ave. VD sˤ +(a)	1	71	.0787809547	.0330287282	.0039197889
	2	51	.0745746963	.0290058729	.0040616346
Ave. Fric Du sˤ +(a)	1	71	.1007017598	.0233118158	.0027666035
	2	51	.1011066964	.0288367832	.0040379573
Ave. COG sˤ +(a)	1	71	6635.516574	1219.971507	144.7839808
	2	51	6444.924344	1206.414354	168.9317993

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 sˤ+(a)	Equal variances assumed	1.110	.294	1.323	120	.188	20.38355847	15.41017072	-10.1275071	50.89462403
	Equal variances not assumed			1.295	99.270	.198	20.38355847	15.73419518	-10.8354497	51.60256667
Ave. F2 sˤ+(a)	Equal variances assumed	.004	.948	-5.467	120	.000	-108.921966	19.92365971	-148.369426	-69.4745066
	Equal variances not assumed			-5.483	109.017	.000	-108.921966	19.86426585	-148.292228	-69.5517041
Ave. VD sˤ +(a)	Equal variances assumed	1.680	.197	.729	120	.467	.0042062584	.0057664105	-.007210833	.0156233499
	Equal variances not assumed			.745	115.157	.458	.0042062584	.0056446099	-.006974465	.0153869818
Ave. Fric Du sˤ +(a)	Equal variances assumed	2.481	.118	-.086	120	.932	-.000404937	.0047280602	-.009766167	.0089562936
	Equal variances not assumed			-.083	93.279	.934	-.000404937	.0048948130	-.010124682	.0093148092
Ave. COG sˤ +(a)	Equal variances assumed	.008	.931	.855	120	.394	190.5922301	222.8980877	-250.730471	631.9149312
	Equal variances not assumed			.857	108.584	.394	190.5922301	222.4867500	-250.388227	631.5726873

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 sˤ +(u)	1	53	478.3596725	71.66730497	9.844261427
	2	27	451.6174728	76.35128985	14.69381258
Ave. F2 sˤ +(u)	1	53	959.6109716	84.12292949	11.55517304
	2	27	1022.247166	90.75065098	17.46497092
Ave. VD sˤ +(u)	1	53	.1553625190	.0412789780	.0056701037
	2	27	.1421295711	.0403856925	.0077722301
Ave. Fric Du sˤ+(u)	1	53	.1236256134	.0269387880	.0037003271
	2	27	.1215317869	.0317182231	.0061041749
Ave. COG sˤ +(u)	1	53	6505.057599	1233.867739	169.4847685
	2	27	6685.611219	1122.644818	216.0530959

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 sˤ +(u)	Equal variances assumed	.908	.344	1.544	78	.127	26.74219969	17.32221579	-7.74368284	61.22808222
	Equal variances not assumed			1.512	49.583	.137	26.74219969	17.68665065	-8.78988024	62.27427962
Ave. F2 sˤ +(u)	Equal variances assumed	.048	.827	-3.067	78	.003	-62.6361946	20.42593966	-103.301117	-21.9712725
	Equal variances not assumed			-2.991	49.046	.004	-62.6361946	20.94151936	-104.718764	-20.5536253
Ave. VD sˤ +(u)	Equal variances assumed	.067	.796	1.366	78	.176	.0132329479	.0096902046	-.006058767	.0325246632
	Equal variances not assumed			1.375	53.468	.175	.0132329479	.0096206880	-.006059770	.0325256659
Ave. Fric Du sˤ+(u)	Equal variances assumed	.291	.591	.309	78	.758	.0020938266	.0067671564	-.011378547	.0155662000
	Equal variances not assumed			.293	45.544	.771	.0020938266	.0071381630	-.012278429	.0164660824
Ave. COG sˤ +(u)	Equal variances assumed	.300	.585	-.637	78	.526	-180.553620	283.2440138	-744.449135	383.3418941
	Equal variances not assumed			-.658	57.044	.513	-180.553620	274.5979370	-730.417227	369.3099859

Table 55 Friction noise duration and COG differences of /sˤ/ by GPA and control speakers

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 sˤ +(i)	0	10	417.3760761	78.11673740	24.70268136
	1	18	475.0743722	75.99800585	17.91290176
Ave. F2 sˤ +(i)	0	10	1615.038290	387.4302898	122.5162150
	1	18	1614.255496	344.4607767	81.19018369
Ave. VD sˤ +(i)	0	10	.0757226735	.0319294328	.0100969732
	1	18	.0822480714	.0390898360	.0092135627
Ave. Fric Du sˤ +(i)	0	10	.1310333511	.0251955301	.0079675262
	1	18	.1143104005	.0293192465	.0069106127
Ave. COG sˤ+(i)	0	10	6482.357492	1199.315677	379.2569173
	1	18	6898.135878	1009.077668	237.8418872

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 sˤ +(i)	Equal variances assumed	.063	.804	-1.906	26	.068	-57.6982961	30.26588845	-119.910721	4.514128564
	Equal variances not assumed			-1.891	18.278	.075	-57.6982961	30.51384138	-121.735715	6.339123249
Ave. F2 sˤ +(i)	Equal variances assumed	.012	.914	.006	26	.996	.7827937593	141.9527261	-291.005214	292.5708011
	Equal variances not assumed			.005	16.914	.996	.7827937593	146.9764228	-309.431001	310.9965885
Ave. VD sˤ +(i)	Equal variances assumed	.912	.348	-.450	26	.656	-.006525398	.0145020365	-.036334761	.0232839651
	Equal variances not assumed			-.477	22.112	.638	-.006525398	.0136688919	-.034864642	.0218138460
Ave. Fric Du sˤ +(i)	Equal variances assumed	.088	.770	1.516	26	.141	.0167229506	.0110278550	-.005945130	.0393910313
	Equal variances not assumed			1.586	21.264	.128	.0167229506	.0105469446	-.005194067	.0386399686
Ave. COG sˤ+(i)	Equal variances assumed	.179	.676	-.977	26	.337	-415.778385	425.4578739	-1290.31957	458.7627995
	Equal variances not assumed			-.929	16.149	.367	-415.778385	447.6656929	-1364.07677	532.5199979

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 sʕ+(a)	1	71	589.6623082	79.33031287	9.414776026
	0	15	574.8861534	110.9859107	28.65643893
Ave. F2 sʕ+(a)	1	71	1258.816596	109.3547868	12.97802552
	0	15	1161.999062	153.1683213	39.54789049
Ave. VD sʕ +(a)	1	71	.0787809547	.0330287282	.0039197889
	0	15	.0762540940	.0269776813	.0069656073
Ave. Fric Du sʕ +(a)	1	71	.1007017598	.0233118158	.0027666035
	0	15	.1153512878	.0184455396	.0047626178
Ave. COG sʕ +(a)	1	71	6635.516574	1219.971507	144.7839808
	0	15	6503.648282	1343.771283	346.9602534

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 sˤ+(a)	Equal variances assumed	3.343	.071	.609	84	.544	14.77615473	24.27494892	-33.4972434	63.04955282
	Equal variances not assumed			.490	17.145	.630	14.77615473	30.16338011	-48.8219196	78.37422900
Ave. F2 sˤ+(a)	Equal variances assumed	2.273	.135	2.892	84	.005	96.81753383	33.47329259	30.25222059	163.3828471
	Equal variances not assumed			2.326	17.138	.033	96.81753383	41.62288780	9.054710903	184.5803568
Ave. VD sˤ +(a)	Equal variances assumed	.479	.491	.277	84	.782	.0025268607	.0091216441	-.015612529	.0206662502
	Equal variances not assumed			.316	23.793	.755	.0025268607	.0079927736	-.013976993	.0190307148
Ave. Fric Du sˤ +(a)	Equal variances assumed	.032	.858	-2.284	84	.025	-.014649528	.0064147227	-.027405908	-.001893148
	Equal variances not assumed			-2.660	24.485	.014	-.014649528	.0055078693	-.026005308	-.003293748
Ave. COG sˤ +(a)	Equal variances assumed	.036	.850	.374	84	.709	131.8682922	352.7832848	-569.679958	833.4165427
	Equal variances not assumed			.351	19.184	.730	131.8682922	375.9572031	-654.508935	918.2455192

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 sˤ +(u)	1	53	478.3596725	71.66730497	9.844261427
	0	10	438.6024382	76.23634284	24.10804838
Ave. F2 sˤ +(u)	1	53	959.6109716	84.12292949	11.55517304
	0	10	863.4828608	96.08435201	30.38453999
Ave. VD sˤ +(u)	1	53	.1553625190	.0412789780	.0056701037
	0	10	.1166633173	.0392463321	.0124107799
Ave. Fric Du sˤ+(u)	1	53	.1236256134	.0269387880	.0037003271
	0	10	.1328886571	.0114763173	.0036291302
Ave. COG sˤ +(u)	1	53	6505.057599	1233.867739	169.4847685
	0	10	6152.472182	1320.513571	417.5830567

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 sˤ +(u)	Equal variances assumed	.651	.423	1.594	61	.116	39.75723428	24.94757408	-10.1285232	89.64299180
	Equal variances not assumed			1.527	12.193	.152	39.75723428	26.04049692	-16.8807459	96.39521441
Ave. F2 sˤ +(u)	Equal variances assumed	.072	.790	3.242	61	.002	96.12811089	29.64780422	36.84366233	155.4125594
	Equal variances not assumed			2.957	11.749	.012	96.12811089	32.50757287	25.13200386	167.1242179
Ave. VD sˤ +(u)	Equal variances assumed	.059	.809	2.739	61	.008	.0386992017	.0141306364	.0104432479	.0669551556
	Equal variances not assumed			2.836	13.051	.014	.0386992017	.0136446889	.0092333104	.0681650931
Ave. Fric Du sˤ+(u)	Equal variances assumed	2.676	.107	-1.064	61	.292	-.009263044	.0087088964	-.026677558	.0081514710
	Equal variances not assumed			-1.787	31.540	.084	-.009263044	.0051829535	-.019826411	.0013003235
Ave. COG sˤ +(u)	Equal variances assumed	.164	.687	.820	61	.415	352.5854172	429.9414452	-507.135637	1212.306471
	Equal variances not assumed			.782	12.152	.449	352.5854172	450.6669457	-627.970290	1333.141124

Table 56 Statistical results for friction noise duration and COG differences of /θ/ by GPA and control speakers

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 θ+(i)	0	5	340.7255347	19.99634056	8.942635358
	1	17	409.6346309	44.20345126	10.72091168
Ave. F2 θ+(i)	0	5	2218.456976	148.6920420	66.49710270
	1	17	1846.955579	205.2488043	49.78014704
Ave. VD θ+(i)	0	5	.0927488791	.0066708539	.0029832966
	1	17	.0887954300	.0202400761	.0049089395
Ave. Fric Du θ+(i)	0	5	.1059706018	.0164115254	.0073394573
	1	17	.0890182608	.0274425149	.0066557875
Ave. COG θ+(i)	0	5	5445.144330	1554.799658	695.3275455
	1	17	5295.735621	1408.454349	341.6003558

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 θ+(i)	Equal variances assumed	3.432	.079	-3.341	20	.003	-68.9090962	20.62231510	-111.926492	-25.8917007
	Equal variances not assumed			-4.936	15.669	.000	-68.9090962	13.96096968	-98.5559293	-39.2622631
Ave. F2 θ+(i)	Equal variances assumed	.124	.729	3.740	20	.001	371.5013972	99.33410551	164.2940841	578.7087104
	Equal variances not assumed			4.472	9.031	.002	371.5013972	83.06580348	183.6902003	559.3125941
Ave. VD θ+(i)	Equal variances assumed	9.733	.005	.424	20	.676	.0039534491	.0093342061	-.015517364	.0234242618
	Equal variances not assumed			.688	19.410	.499	.0039534491	.0057443664	-.008052468	.0159593658
Ave. Fric Du θ+(i)	Equal variances assumed	.677	.420	1.301	20	.208	.0169523410	.0130336670	-.010235412	.0441400941
	Equal variances not assumed			1.711	11.363	.114	.0169523410	.0099079332	-.004770174	.0386748557
Ave. COG θ+(i)	Equal variances assumed	.001	.976	.204	20	.840	149.4087091	732.0435296	-1377.60734	1676.424754
	Equal variances not assumed			.193	6.075	.853	149.4087091	774.7071696	-1740.54467	2039.362087

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 θ+(a)	1	23	533.6679573	90.23213452	18.81470066
	0	15	530.9290057	80.34630861	20.74532768
Ave. F2 θ+(a)	1	23	1399.548088	157.8991064	32.92423965
	0	15	1656.429824	109.0850404	28.16563631
Ave. VD θ+(a)	1	23	.0536941767	.0165470820	.0034503051
	0	15	.0548441299	.0156635639	.0040443148
Ave. Fric Du θ+(a)	1	23	.0747925312	.0237586314	.0049540171
	0	15	.0872314902	.0209857976	.0054185096
Ave. COG θ+(a)	1	23	5518.135965	1366.877429	285.0136461
	0	15	5040.922819	1576.654446	407.0904275

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 θ+(a)	Equal variances assumed	.754	.391	.095	36	.925	2.738951646	28.71498883	-55.4977449	60.97564822
	Equal variances not assumed			.098	32.507	.923	2.738951646	28.00645607	-54.2734449	59.75134822
Ave. F2 θ+(a)	Equal variances assumed	1.097	.302	-5.492	36	.000	-256.881736	46.77507881	-351.745993	-162.017480
	Equal variances not assumed			-5.929	35.829	.000	-256.881736	43.32791970	-344.769401	-168.994072
Ave. VD θ+(a)	Equal variances assumed	.315	.578	-.214	36	.832	-.001149953	.0053795288	-.012060143	.0097602369
	Equal variances not assumed			-.216	31.258	.830	-.001149953	.0053161158	-.011988615	.0096887089
Ave. Fric Du θ+(a)	Equal variances assumed	.408	.527	-1.650	36	.108	-.012438959	.0075405177	-.027731838	.0028539197
	Equal variances not assumed			-1.694	32.664	.100	-.012438959	.0073418344	-.027381878	.0025039604
Ave. COG θ+(a)	Equal variances assumed	.174	.679	.990	36	.329	477.2131453	481.9119816	-500.149653	1454.575944
	Equal variances not assumed			.960	26.966	.345	477.2131453	496.9460682	-542.496809	1496.923100

Table 57 Statistical results for COG value differences of /x/ by GPA and control speakers

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 X+(i)	1	27	466.0703867	66.20380688	12.74092858
	0	5	380.2476151	44.82345313	20.04565764
Ave. F2 X+(i)	1	27	1900.322983	250.6252858	48.23285874
	0	5	2173.718489	300.9813958	134.6029722
Ave. VD X+(i)	1	27	.0946026653	.0344977916	.0066391031
	0	5	.0830597794	.0144343337	.0064552303
Ave. Fric Du X+(i)	1	27	.0873251844	.0200945869	.0038672051
	0	5	.1239515931	.0132577554	.0059290485
Ave. COG X+(i)	1	27	3158.338577	962.3334935	185.2011672
	0	5	3777.449315	986.2809855	441.0782657

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 X+(i)	Equal variances assumed	.733	.399	2.764	30	.010	85.82277168	31.04667778	22.41699678	149.2285466
	Equal variances not assumed			3.613	7.692	.007	85.82277168	23.75204520	30.66574570	140.9797977
Ave. F2 X+(i)	Equal variances assumed	.001	.974	-2.177	30	.037	-273.395506	125.5663109	-529.836125	-16.9548882
	Equal variances not assumed			-1.912	5.080	.113	-273.395506	142.9838060	-639.206736	92.41572329
Ave. VD X+(i)	Equal variances assumed	1.244	.274	.728	30	.472	.0115428859	.0158451615	-.020817251	.0439030227
	Equal variances not assumed			1.247	14.450	.232	.0115428859	.0092600048	-.008259934	.0313457056
Ave. Fric Du X+(i)	Equal variances assumed	1.057	.312	-3.893	30	.001	-.036626409	.0094078193	-.055839739	-.017413078
	Equal variances not assumed			-5.174	7.907	.001	-.036626409	.0070787633	-.052983476	-.020269341
Ave. COG X+(i)	Equal variances assumed	.069	.794	-1.317	30	.198	-619.110738	470.0972764	-1579.17746	340.9559818
	Equal variances not assumed			-1.294	5.508	.247	-619.110738	478.3821786	-1815.46533	577.2438587

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 X+(a)	0	15	668.9124742	124.3364496	32.10353325
	1	94	605.6940658	97.64295822	10.07110217
Ave. F2 X+(a)	0	15	1398.415383	150.2868872	38.80390741
	1	94	1381.983415	229.0407669	23.62375132
Ave. VD X+(a)	0	15	.0527131682	.0078264888	.0020207907
	1	94	.0594376295	.0162628923	.0016773893
Ave. Fric Du X+(a)	0	15	.1125926799	.0139580319	.0036039483
	1	94	.0845623773	.0204654713	.0021108522
Ave. COG X+(a)	0	15	4851.225569	925.3234987	238.9175000
	1	94	3378.815207	801.8796015	82.70756579

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 X+(a)	Equal variances assumed	2.177	.143	2.239	107	.027	63.21840844	28.23066468	7.254408252	119.1824086
	Equal variances not assumed			1.879	16.867	.078	63.21840844	33.64615796	-7.81159332	134.2484102
Ave. F2 X+(a)	Equal variances assumed	1.104	.296	.268	107	.789	16.43196792	61.26363003	-105.016033	137.8799693
	Equal variances not assumed			.362	25.768	.721	16.43196792	45.42933917	-76.9902934	109.8542292
Ave. VD X+(a)	Equal variances assumed	6.189	.014	-1.568	107	.120	-.006724461	.0042883755	-.015225666	.0017767430
	Equal variances not assumed			-2.560	37.275	.015	-.006724461	.0026262578	-.012044442	-.001404481
Ave. Fric Du X+(a)	Equal variances assumed	2.606	.109	5.108	107	.000	.0280303026	.0054874666	.0171520402	.0389085651
	Equal variances not assumed			6.711	24.813	.000	.0280303026	.0041766183	.0194251151	.0366354901
Ave. COG X+(a)	Equal variances assumed	.308	.580	6.465	107	.000	1472.410362	227.7378098	1020.946715	1923.874009
	Equal variances not assumed			5.824	17.519	.000	1472.410362	252.8282288	940.1898792	2004.630844

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 X+(u)	1	74	469.1877892	70.81149183	8.231668721
	0	15	461.6383636	97.83827888	25.26173498
Ave. F2 X+(u)	1	74	951.1092344	96.06805736	11.16768483
	0	15	878.4500675	124.6748209	32.19090033
Ave. VD X+(u)	1	74	.1035302887	.0438476368	.0050971842
	0	15	.0970388189	.0325210926	.0083969100
Ave. Fric Du X+(u)	1	74	.0970260778	.0280920539	.0032656349
	0	15	.1233235763	.0158700140	.0040976200
Ave. COG X+(u)	1	74	3445.844329	776.6205033	90.28029971
	0	15	5977.455051	5328.589688	1375.835941

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 X+(u)	Equal variances assumed	4.623	.034	.352	87	.726	7.549425599	21.46754556	-35.1196457	50.21849694
	Equal variances not assumed			.284	17.094	.780	7.549425599	26.56907270	-48.4829536	63.58180475
Ave. F2 X+(u)	Equal variances assumed	2.626	.109	2.535	87	.013	72.65916688	28.66120926	15.69191001	129.6264238
	Equal variances not assumed			2.132	17.524	.047	72.65916688	34.07302817	.9347652745	144.3835685
Ave. VD X+(u)	Equal variances assumed	4.162	.044	.543	87	.589	.0064914698	.0119580519	-.017276453	.0302593928
	Equal variances not assumed			.661	25.553	.515	.0064914698	.0098229010	-.013716991	.0266999302
Ave. Fric Du X+(u)	Equal variances assumed	4.989	.028	-3.503	87	.001	-.026297498	.0075061740	-.041216832	-.011378165
	Equal variances not assumed			-5.019	34.744	.000	-.026297498	.0052397387	-.036937539	-.015657458
Ave. COG X+(u)	Equal variances assumed	12.690	.001	-3.969	87	.000	-2531.61072	637.9116766	-3799.52925	-1263.69219
	Equal variances not assumed			-1.836	14.121	.087	-2531.61072	1378.794789	-5486.46035	423.2389092

Table 58 Statistical results for COG value differences of /ɣ/ by GPA and control speakers

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 ɣ+(i)	1	28	497.6537379	77.68270521	14.68065137
	0	5	455.2011368	51.81943151	23.17435428
Ave. F2 ɣ+(i)	1	28	1416.766075	273.5574078	51.69749074
	0	5	1577.381366	433.5747470	193.9005215
Ave. VD ɣ+(i)	1	28	.0547529150	.0146237472	.0027636285
	0	5	.0560515538	.0087939657	.0039327810
Ave. Fric Du ɣ+(i)	1	28	.0617547826	.0218443489	.0041281939
	0	5	.0689727129	.0134122883	.0059981577
Ave. COG ɣ+(i)	1	28	3376.813986	959.7478041	181.3752865
	0	5	3053.699643	509.7536562	227.9687654

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 γ+(i)	Equal variances assumed	1.199	.282	1.168	31	.252	42.45260113	36.33968155	-31.6626680	116.5678703
	Equal variances not assumed			1.547	7.672	.162	42.45260113	27.43304979	-21.2826115	106.1878137
Ave. F2 γ+(i)	Equal variances assumed	1.303	.262	-1.106	31	.277	-160.615291	145.1926093	-456.737569	135.5069883
	Equal variances not assumed			-.800	4.585	.463	-160.615291	200.6739714	-690.811199	369.5806179
Ave. VD γ+(i)	Equal variances assumed	1.827	.186	-.191	31	.850	-.001298639	.0068011920	-.015169761	.0125724837
	Equal variances not assumed			-.270	8.615	.793	-.001298639	.0048067046	-.012246755	.0096494773
Ave. Fric Du γ+(i)	Equal variances assumed	3.245	.081	-.710	31	.483	-.007217930	.0101703107	-.027960416	.0135245551
	Equal variances not assumed			-.991	8.407	.349	-.007217930	.0072814752	-.023868445	.0094325848
Ave. COG γ+(i)	Equal variances assumed	2.454	.127	.728	31	.472	323.1143431	443.8557131	-582.135352	1228.364038
	Equal variances not assumed			1.109	10.069	.293	323.1143431	291.3189876	-325.381760	971.6104460

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 ɣ+(a)	1	130	591.9698723	86.86633667	7.618681718
	0	20	648.3160034	79.81181289	17.84646390
Ave. F2 ɣ+(a)	1	130	1395.734801	172.4173011	15.12199766
	0	20	1316.942760	135.5220007	30.30364059
Ave. VD ɣ+(a)	1	130	.0879191481	.0347929851	.0030515467
	0	20	.0923656789	.0531921322	.0118941223
Ave.Fric Du ɣ+(a)	1	130	.0673984841	.0182076079	.0015969129
	0	20	.0772416643	.0264228891	.0059083376
Ave. COG ɣ+(a)	1	130	3102.578324	703.4299424	61.69488720
	0	20	3428.014413	906.2389147	202.6411817

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 γ+(a)	Equal variances assumed	.146	.702	-2.728	148	.007	-56.3461311	20.65486811	-97.1626806	-15.5295816
	Equal variances not assumed			-2.904	26.427	.007	-56.3461311	19.40465369	-96.2016191	-16.4906431
Ave. F2 γ+(a)	Equal variances assumed	1.056	.306	1.951	148	.053	78.79204033	40.38455990	-1.01279687	158.5968775
	Equal variances not assumed			2.327	29.373	.027	78.79204033	33.86717358	9.564034549	148.0200461
Ave. VD γ+(a)	Equal variances assumed	4.104	.045	-.492	148	.624	-.004446531	.0090459637	-.022322463	.0134294017
	Equal variances not assumed			-.362	21.570	.721	-.004446531	.0122793356	-.029941793	.0210487318
Ave.Fric Du γ+(a)	Equal variances assumed	3.089	.081	-2.106	148	.037	-.009843180	.0046734964	-.019078581	-.000607779
	Equal variances not assumed			-1.608	21.860	.122	-.009843180	.0061203418	-.022540701	.0028543404
Ave. COG γ+(a)	Equal variances assumed	2.495	.116	-1.849	148	.066	-325.436089	175.9682255	-673.170857	22.29867988
	Equal variances not assumed			-1.536	22.657	.138	-325.436089	211.8247097	-763.996383	113.1242058

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 ɣ+(u)	1	90	466.4047797	79.85767992	8.417738573
	0	15	447.6304258	50.44043329	13.02366387
Ave. F2 ɣ+(u)	1	90	1010.214960	116.2173313	12.25038235
	0	15	915.4764071	193.3040737	49.91089720
Ave. VD ɣ+(u)	1	90	.0628947912	.0159295289	.0016791198
	0	15	.0609899868	.0116306189	.0030030129
Ave. Fric Du ɣ+(u)	1	90	.0650645898	.0171866142	.0018116282
	0	15	.0732252393	.0179563237	.0046363028
Ave. COG ɣ+(u)	1	90	3525.668563	867.6279387	91.45601493
	0	15	4043.789432	763.4443504	197.1204837

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 γ+(u)	Equal variances assumed	2.945	.089	.880	103	.381	18.77435396	21.34213363	-23.5527344	61.10144235
	Equal variances not assumed			1.211	27.389	.236	18.77435396	15.50722875	-13.0227396	50.57144750
Ave. F2 γ+(u)	Equal variances assumed	6.204	.014	2.625	103	.010	94.73855305	36.09355454	23.15550047	166.3216056
	Equal variances not assumed			1.843	15.729	.084	94.73855305	51.39231000	-14.3612376	203.8383437
Ave. VD γ+(u)	Equal variances assumed	1.283	.260	.443	103	.659	.0019048044	.0042992532	-.006621750	.0104313591
	Equal variances not assumed			.554	23.757	.585	.0019048044	.0034405711	-.005200028	.0090096372
Ave. Fric Du γ+(u)	Equal variances assumed	.102	.750	-1.692	103	.094	-.008160650	.0048228561	-.017725647	.0014043481
	Equal variances not assumed			-1.639	18.534	.118	-.008160650	.0049776803	-.018596829	.0022755297
Ave. COG γ+(u)	Equal variances assumed	.078	.780	-2.175	103	.032	-518.120869	238.2287834	-990.591474	-45.6502650
	Equal variances not assumed			-2.384	20.526	.027	-518.120869	217.3032161	-970.663448	-65.5782909

Table 59 Statistical results for F1 and F2 value differences of /ħ/ by GPA and control speakers

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 ħ+(i)	0	10	439.8365767	71.74509850	22.68779222
	1	18	478.4709159	103.4194703	24.37620291
Ave. F2 ħ+(i)	0	10	1704.378261	282.1751274	89.23161016
	1	18	1624.677310	337.3116869	79.50512707

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 ħ+(i)	Equal variances assumed	.200	.658	-1.046	26	.305	-38.6343393	36.94600426	-114.577939	37.30926014
	Equal variances not assumed			-1.160	24.493	.257	-38.6343393	33.30067844	-107.290464	30.02178562
Ave. F2 ħ+(i)	Equal variances assumed	.007	.933	.633	26	.532	79.70095125	125.9356717	-179.163529	338.5654318
	Equal variances not assumed			.667	21.716	.512	79.70095125	119.5129511	-168.341684	327.7435863

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 ħ+(a)	0	10	715.6369255	77.64710582	24.55417081
	1	18	658.3804420	90.31299403	21.28697684
Ave. F2 ħ+(a)	0	10	1274.180569	100.6106567	31.81588320
	1	18	1377.360373	122.1201835	28.78400329

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 ħ+(a)	Equal variances assumed	.145	.707	1.685	26	.104	57.25648353	33.97394164	-12.5779537	127.0909207
	Equal variances not assumed			1.762	21.256	.092	57.25648353	32.49681041	-10.2748466	124.7878136
Ave. F2 ħ+(a)	Equal variances assumed	1.235	.277	-2.272	26	.032	-103.179804	45.40798090	-196.517245	-9.84236245
	Equal variances not assumed			-2.405	21.970	.025	-103.179804	42.90418708	-192.164660	-14.1949476

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 ħ+(u)	0	10	478.0811753	87.18060708	27.56892862
	1	18	575.8338931	98.67754686	23.25852084
Ave. F2 ħ+(u)	0	10	1045.516557	162.9539043	51.53054911
	1	18	1080.082254	147.5750541	34.78377382

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 ħ+(u)	Equal variances assumed	.196	.662	-2.613	26	.015	-97.7527178	37.41157783	-174.653317	-20.8521182
	Equal variances not assumed			-2.710	20.794	.013	-97.7527178	36.06944159	-172.808519	-22.6969162
Ave. F2 ħ+(u)	Equal variances assumed	.064	.802	-.573	26	.572	-34.5656971	60.37298323	-158.664141	89.53274725
	Equal variances not assumed			-.556	17.182	.585	-34.5656971	62.17160455	-165.630787	96.49939234

Table 60 Statistical results for friction noise duration and F1 value differences of /ʕ/ by GPA and control speakers

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 ʕ+(i)	1	9	519.9300110	84.87710218	28.29236739
	0	15	484.1803543	98.07709474	25.32339697
Ave. F2 ʕ+(i)	1	9	1650.481236	155.6930184	51.89767281
	0	15	1932.040963	215.7060817	55.69507080
Ave. VD ʕ+(i)	1	9	.0942002640	.0239502943	.0079834314
	0	15	.0800533835	.0496976507	.0128318782
Ave. Fric Du ʕ+(i)	1	9	.0617243487	.0177568286	.0059189429
	0	15	.0578912399	.0107706978	.0027809822
Ave COG ʕ+(i)	1	9	2421.101800	643.1135032	214.3711677
	0	15	2202.633320	287.9788919	74.35583016

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 ʕ+(i)	Equal variances assumed	.011	.917	.907	22	.374	35.74965670	39.42010060	-46.0026283	117.5019417
	Equal variances not assumed			.942	18.989	.358	35.74965670	37.97015258	-43.7260217	115.2253351
Ave. F2 ʕ+(i)	Equal variances assumed	1.129	.299	-3.407	22	.003	-281.559727	82.64956418	-452.964432	-110.155022
	Equal variances not assumed			-3.699	21.069	.001	-281.559727	76.12692923	-439.842722	-123.276732
Ave. VD ʕ+(i)	Equal variances assumed	.941	.342	.795	22	.435	.0141468805	.0177904579	-.022748271	.0510420320
	Equal variances not assumed			.936	21.340	.360	.0141468805	.0151126529	-.017251111	.0455448716
Ave. Fric Du ʕ+(i)	Equal variances assumed	2.532	.126	.662	22	.515	.0038331088	.0057885646	-.008171639	.0158378571
	Equal variances not assumed			.586	11.599	.569	.0038331088	.0065397054	-.010470523	.0181367408
Ave COG ʕ+(i)	Equal variances assumed	2.652	.118	1.150	22	.263	218.4684794	190.0516807	-175.674583	612.6115415
	Equal variances not assumed			.963	9.958	.358	218.4684794	226.9003901	-287.383729	724.3206875

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Ave. F1 ʕ+(a)	1	10	719.4103048	95.94466260	30.34036632
	0	20	717.3902641	81.46932225	18.21709426
Ave. F2 ʕ+(a)	1	10	1399.827267	71.42189136	22.58558515
	0	20	1509.652722	99.26885580	22.19719096
Ave. VD ʕ+(a)	1	10	.0760670733	.0332085038	.0105014510
	0	20	.0641184310	.0141905735	.0031731087
Ave. Fric Du ʕ+(a)	1	10	.0576488985	.0111602063	.0035291671
	0	20	.0655318227	.0189889347	.0042460549
Ave. COG ʕ+(a)	1	10	3068.210781	651.0898455	205.8926873
	0	20	2020.096962	382.1059955	85.44149806

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Ave. F1 ʕ+(a)	Equal variances assumed	.778	.385	.060	28	.952	2.020040691	33.45755547	-66.5146549	70.55473627
	Equal variances not assumed			.057	15.693	.955	2.020040691	35.38926888	-73.1214045	77.16148585
Ave. F2 ʕ+(a)	Equal variances assumed	1.314	.261	-3.108	28	.004	-109.825455	35.34080917	-182.217821	-37.4330891
	Equal variances not assumed			-3.468	24.122	.002	-109.825455	31.66739559	-175.166193	-44.4847175
Ave. VD ʕ+(a)	Equal variances assumed	7.208	.012	1.392	28	.175	.0119486423	.0085829933	-.005632822	.0295301070
	Equal variances not assumed			1.089	10.676	.300	.0119486423	.0109703733	-.012286616	.0361839002
Ave. Fric Du ʕ+(a)	Equal variances assumed	5.703	.024	-1.206	28	.238	-.007882924	.0065350559	-.021269379	.0055035310
	Equal variances not assumed			-1.428	27.058	.165	-.007882924	.0055212320	-.019210423	.0034445748
Ave. COG ʕ+(a)	Equal variances assumed	3.780	.062	5.579	28	.000	1048.113819	187.8832758	663.2523749	1432.975263
	Equal variances not assumed			4.702	12.195	.000	1048.113819	222.9171332	563.2805909	1532.947047

Table 61 One-Way ANOVA results for friction noise duration and COG value differences of /x/ by Malayalam (1), Urdu (2) and control speakers (0)

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Ave. for F1 X+(i) control	0	5	380.2476151	44.82345313	20.04565764	324.5919470	435.9032831	333.2835710	452.3723776
	1	10	432.9120565	48.12796111	15.21939762	398.4833871	467.3407258	366.2592472	490.7833225
	2	17	485.5752869	68.76026813	16.67681461	450.2220192	520.9285545	377.1665553	619.9819661
	Total	32	452.6605787	70.26826917	12.42179241	427.3261660	477.9949913	333.2835710	619.9819661
Ave. for F2 X+(i) control	0	5	2173.718489	300.9813958	134.6029722	1800.000726	2547.436253	1655.172322	2407.065493
	1	10	1809.239560	309.8278253	97.97616104	1587.602086	2030.877035	1386.130904	2158.632979
	2	17	1953.901467	199.5990249	48.40987427	1851.277118	2056.525816	1580.164979	2267.497059
	Total	32	1943.041031	273.0254027	48.26452842	1844.604876	2041.477186	1386.130904	2407.065493
Ave. for Firc Dur X+(i) control	0	5	.1239515931	.0132577554	.0059290485	.1074899155	.1404132707	.1018570305	.1339570475
	1	10	.0886184314	.0181645708	.0057441417	.0756242802	.1016125826	.0595609620	.1121839713
	2	17	.0865644508	.0216542075	.0052519168	.0754308847	.0976980170	.0541464540	.1333469717
	Total	32	.0930480607	.0233218037	.0041227514	.0846396538	.1014564676	.0541464540	.1339570475
Ave for COG X+(i) control	0	5	3777.449315	986.2809855	441.0782657	2552.819723	5002.078907	2684.671937	4694.438973
	1	10	3366.918542	762.1441647	241.0111466	2821.713451	3912.123634	2122.437472	4212.341370
	2	17	3035.644480	1065.348672	258.3850061	2487.892737	3583.396224	1625.557089	4838.934379
	Total	32	3255.074630	976.9318195	172.6987786	2902.853149	3607.296111	1625.557089	4838.934379

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Ave. for F1 X+(i) control	Between Groups	48535.654	2	24267.827	6.733	.004
	Within Groups	104530.865	29	3604.513		
	Total	153066.519	31			
Ave. for F2 X+(i) control	Between Groups	447093.920	2	223546.960	3.478	.044
	Within Groups	1863735.066	29	64266.726		
	Total	2310828.986	31			
Ave. for Firc Dur X+(i) control	Between Groups	.006	2	.003	7.378	.003
	Within Groups	.011	29	.000		
	Total	.017	31			
Ave for COG X+(i) control	Between Groups	2308010.204	2	1154005.102	1.227	.308
	Within Groups	27278258.98	29	940629.620		
	Total	29586269.18	31			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Ave. for F1 X+(i) control	0	1	-52.6644414	32.88394407	.261	-133.876190	28.54730698
		2	-105.327672*	30.54394655	.005	-180.760451	-29.8948923
	1	0	52.66444143	32.88394407	.261	-28.5473070	133.8761898
		2	-52.6632304	23.92658378	.088	-111.753457	6.426996098
	2	0	105.327672*	30.54394655	.005	29.89489230	180.7604513
		1	52.66323039	23.92658378	.088	-6.42699610	111.7534569
Ave. for F2 X+(i) control	0	1	364.478929*	138.8525042	.035	21.56219722	707.3956615
		2	219.8170223	128.9718611	.221	-98.6980049	538.3320494
	1	0	-364.478929*	138.8525042	.035	-707.395662	-21.5621972
		2	-144.661907	101.0300367	.338	-394.170479	104.8466648
	2	0	-219.817022	128.9718611	.221	-538.332049	98.69800488
		1	144.6619071	101.0300367	.338	-104.846665	394.1704790
Ave. for Firc Dur X+(i) control	0	1	.035333162*	.0107519584	.007	.0087796151	.0618867083
		2	.037387142*	.0099868569	.002	.0127231267	.0620511578
	1	0	-.035333162*	.0107519584	.007	-.061886708	-.008779615
		2	.0020539805	.0078231989	.963	-.017266563	.0213745236
	2	0	-.037387142*	.0099868569	.002	-.062051158	-.012723127
		1	-.002053981	.0078231989	.963	-.021374524	.0172665625
Ave for COG X+(i) control	0	1	410.5307726	531.2145385	.722	-901.381855	1722.443400
		2	741.8048346	493.4136987	.304	-476.753045	1960.362714
	1	0	-410.530773	531.2145385	.722	-1722.44340	901.3818548
		2	331.2740620	386.5153504	.671	-623.282585	1285.830709
	2	0	-741.804835	493.4136987	.304	-1960.36271	476.7530453
		1	-331.274062	386.5153504	.671	-1285.83071	623.2825852

*. The mean difference is significant at the 0.05 level.

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Ave. for F1 X+(a) control	0	15	668.9124742	124.3364496	32.10353325	600.0572435	737.7677050	534.9388226	882.8612938
	1	38	611.3479437	82.16465092	13.32886644	584.3410950	638.3547924	374.9689693	813.6346132
	2	56	601.8575057	107.4369665	14.35686855	573.0856982	630.6293133	363.5406525	947.7655884
	Total	109	614.3938468	103.4053579	9.904436984	594.7615344	634.0261591	363.5406525	947.7655884
Ave. for F2 X+(a) control	0	15	1398.415383	150.2868872	38.80390741	1315.189279	1481.641487	1191.562293	1646.269523
	1	38	1317.275251	195.3519196	31.69026602	1253.064673	1381.485829	1082.430790	1851.843129
	2	56	1425.892526	241.1963239	32.23121454	1361.299729	1490.485324	1071.122991	2546.652076
	Total	109	1384.244695	219.3941245	21.01414593	1342.591012	1425.898378	1071.122991	2546.652076
Ave. for Firc Dur X+(a) control	0	15	.1125926799	.0139580319	.0036039483	.1048629795	.1203223803	.0868509015	.1395606230
	1	38	.0909278933	.0198234393	.0032157865	.0844120909	.0974436956	.0485314530	.1436881270
	2	56	.0802429200	.0199213341	.0026621002	.0749079519	.0855778881	.0408104135	.1511558245
	Total	109	.0884197584	.0219095131	.0020985508	.0842600667	.0925794500	.0408104135	.1511558245
Ave for COG X+(a) control	0	15	4851.225569	925.3234987	238.9175000	4338.798495	5363.652642	2803.641191	5784.072870
	1	38	3578.054344	686.9118067	111.4318095	3352.272052	3803.836637	1826.085868	5336.834397
	2	56	3243.617221	850.7706764	113.6890138	3015.779346	3471.455096	1829.103522	5133.583654
	Total	109	3581.440486	961.4409231	92.08933878	3398.903441	3763.977532	1826.085868	5784.072870

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Ave. for F1 X+(a) control	Between Groups	53737.708	2	26868.854	2.587	.080
	Within Groups	1101070.440	106	10387.457		
	Total	1154808.149	108			
Ave. for F2 X+(a) control	Between Groups	270572.915	2	135286.457	2.910	.059
	Within Groups	4927875.528	106	46489.392		
	Total	5198448.443	108			
Ave. for Firc Dur X+(a) control	Between Groups	.013	2	.006	17.283	.000
	Within Groups	.039	106	.000		
	Total	.052	108			
Ave for COG X+(a) control	Between Groups	30576723.33	2	15288361.66	23.400	.000
	Within Groups	69255090.72	106	653349.912		
	Total	99831814.04	108			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Ave. for F1 X+(a) control	0	1	57.56453050	31.07814768	.158	-16.3108253	131.4398863
		2	67.05496847	29.63085276	.066	-3.38004625	137.4899832
	1	0	-57.5645305	31.07814768	.158	-131.439886	16.31082527
		2	9.490437978	21.42065439	.898	-41.4282487	60.40912463
	2	0	-67.0549685	29.63085276	.066	-137.489983	3.380046248
		1	-9.49043798	21.42065439	.898	-60.4091246	41.42824868
Ave. for F2 X+(a) control	0	1	81.14013204	65.74722680	.436	-75.1465238	237.4267878
		2	-27.4771434	62.68540895	.900	-176.485602	121.5313153
	1	0	-81.1401320	65.74722680	.436	-237.426788	75.14652377
		2	-108.617275*	45.31636301	.048	-216.338060	-.896491291
	2	0	27.47714344	62.68540895	.900	-121.531315	176.4856022
		1	108.617275*	45.31636301	.048	.8964912910	216.3380597
Ave. for Firc Dur X+(a) control	0	1	.021664787*	.0058560729	.001	.0077444117	.0355851615
		2	.032349760*	.0055833583	.000	.0190776504	.0456218694
	1	0	-.021664787*	.0058560729	.001	-.035585162	-.007744412
		2	.010684973*	.0040363060	.025	.0010903365	.0202796101
	2	0	-.032349760*	.0055833583	.000	-.045621869	-.019077650
		1	-.010684973*	.0040363060	.025	-.020279610	-.001090336
Ave for COG X+(a) control	0	1	1273.17122*	246.4753123	.000	687.2787971	1859.063652
		2	1607.60835*	234.9970714	.000	1049.000659	2166.216037
	1	0	-1273.17122*	246.4753123	.000	-1859.06365	-687.278797
		2	334.4371234	169.8834349	.125	-69.3900069	738.2642538
	2	0	-1607.60835*	234.9970714	.000	-2166.21604	-1049.00066
		1	-334.437123	169.8834349	.125	-738.264254	69.39000690

*. The mean difference is significant at the 0.05 level.

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Ave. for F1 X+(u) control	0	15	461.6383636	97.83827888	25.26173498	407.4573307	515.8193965	332.4338164	652.4870753
	1	40	477.0710538	72.21636023	11.41840913	453.9751414	500.1669663	182.1731888	617.9662062
	2	34	459.9133602	69.02750177	11.83811889	435.8285262	483.9981942	360.3339728	653.3597405
	Total	89	467.9154141	75.43547390	7.996144242	452.0247577	483.8060705	182.1731888	653.3597405
Ave. for F2 X+(u) control	0	15	878.4500675	124.6748209	32.19090033	809.4074530	947.4926820	675.5705887	1054.595573
	1	40	993.4363114	84.06639665	13.29206441	966.5505735	1020.322049	734.1504979	1180.248996
	2	34	901.3126732	85.65789141	14.69020718	871.4252219	931.2001244	725.3982717	1052.635250
	Total	89	938.8633074	104.2930323	11.05503931	916.8937398	960.8328750	675.5705887	1180.248996
Ave. for Firc Dur X+(u) control	0	15	.1233235763	.0158700140	.0040976200	.1145350555	.1321120972	.0926958425	.1520846735
	1	40	.1018095669	.0264451819	.0041813504	.0933519874	.1102671464	.0548424370	.1769073930
	2	34	.0913984436	.0293062807	.0050259857	.0811729989	.1016238884	.0308897850	.1452211250
	Total	89	.1014582405	.0281554113	.0029844676	.0955272382	.1073892428	.0308897850	.1769073930
Ave for COG X+(u) control	0	15	5977.455051	5328.589688	1375.835941	3026.580439	8928.329663	3142.041534	25078.50409
	1	40	3542.473250	816.8586716	129.1566964	3281.229173	3803.717328	1994.360947	5551.884957
	2	34	3332.163246	721.8081254	123.7890722	3080.312484	3584.014007	2270.302541	4776.018083
	Total	89	3872.520294	2434.310759	258.0364244	3359.727123	4385.313464	1994.360947	25078.50409

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Ave. for F1 X+(u) control	Between Groups	6121.167	2	3060.584	.532	.589
	Within Groups	494643.776	86	5751.672		
	Total	500764.944	88			
Ave. for F2 X+(u) control	Between Groups	221816.609	2	110908.304	12.971	.000
	Within Groups	735362.610	86	8550.728		
	Total	957179.219	88			
Ave. for Firc Dur X+(u) control	Between Groups	.011	2	.005	7.719	.001
	Within Groups	.059	86	.001		
	Total	.070	88			
Ave for COG X+(u) control	Between Groups	80746012.15	2	40373006.08	7.878	.001
	Within Groups	440730448.4	86	5124772.656		
	Total	521476460.6	88			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Ave. for F1 X+(u) control	0	1	-15.4326903	22.96163285	.780	-70.1952820	39.32990154
		2	1.725003405	23.50769248	.997	-54.3399192	57.78992596
	1	0	15.43269025	22.96163285	.780	-39.3299015	70.19528205
		2	17.15769366	17.69063632	.598	-25.0337786	59.34916592
	2	0	-1.72500341	23.50769248	.997	-57.7899260	54.33991915
		1	-17.1576937	17.69063632	.598	-59.3491659	25.03377861
Ave. for F2 X+(u) control	0	1	-114.986244*	27.99672723	.000	-181.757338	-48.2151499
		2	-22.8626057	28.66252843	.705	-91.2216093	45.49639801
	1	0	114.986244*	27.99672723	.000	48.21514994	181.7573379
		2	92.1236383*	21.56989109	.000	40.68029587	143.5669807
	2	0	22.86260566	28.66252843	.705	-45.4963980	91.22160933
		1	-92.1236383*	21.56989109	.000	-143.566981	-40.6802959
Ave. for Firc Dur X+(u) control	0	1	.021514009*	.0079397663	.022	.0025779788	.0404500400
		2	.031925133*	.0081285850	.001	.0125387769	.0513114885
	1	0	-.021514009*	.0079397663	.022	-.040450040	-.002577979
		2	.0104111233	.0061171398	.210	-.004178015	.0250002613
	2	0	-.031925133*	.0081285850	.001	-.051311489	-.012538777
		1	-.010411123	.0061171398	.210	-.025000261	.0041780148
Ave for COG X+(u) control	0	1	2434.98180*	685.3982979	.002	800.3338007	4069.629800
		2	2645.29181*	701.6980247	.001	971.7695978	4318.814013
	1	0	-2434.98180*	685.3982979	.002	-4069.62980	-800.333801
		2	210.3100049	528.0605306	.916	-1049.09360	1469.713614
	2	0	-2645.29181*	701.6980247	.001	-4318.81401	-971.769598
		1	-210.310005	528.0605306	.916	-1469.71361	1049.093604

*. The mean difference is significant at the 0.05 level.

Table 62 One-Way ANOVA results for F1, F2, rriction noise duration and COG value differences of /ħ/ in the context /i/ by Malayalam (1), Urdu (2) and control speakers (0)

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean: Lower Bound	95% Confidence Interval for Mean: Upper Bound	Minimum	Maximum
Ave. for F1 ħ+(i) control	0	10	439.8365767	71.74509850	22.68779222	388.5132250	491.1599284	328.6833188	544.2754691
	1	13	487.1124502	68.56760097	19.01723086	445.6774636	528.5474367	366.8291219	604.2468297
	2	5	456.0029270	174.5794541	78.07430537	239.2339040	672.7719500	215.6266833	708.1911225
	Total	28	464.6729376	93.83724533	17.73357249	428.2866524	501.0592228	215.6266833	708.1911225
Ave. for F2 ħ+(i) control	0	10	1704.378261	282.1751274	89.23161016	1502.522335	1906.234187	1369.827931	2127.278287
	1	13	1742.837744	234.8546651	65.13696439	1600.916490	1884.758998	1394.159420	2065.330603
	2	5	1317.460181	393.3665680	175.9188772	829.0310750	1805.889286	663.3166111	1695.912432
	Total	28	1653.141935	315.7405769	59.66936039	1530.710521	1775.573350	663.3166111	2127.278287
Ave. for Firc Dur ħ+(i) control	0	10	.1035464372	.0223637796	.0070720481	.0875483530	.1195445213	.0684558270	.1294890405
	1	13	.0953555488	.0135231103	.0037506360	.0871836150	.1035274826	.0717168067	.1215556610
	2	5	.0840926204	.0300384115	.0134335860	.0467950063	.1213902345	.0584562500	.1251035780
	Total	28	.0962696289	.0207156638	.0039148925	.0882369330	.1043023247	.0584562500	.1294890405
Ave for COG ħ+(i) control	0	10	2566.205566	416.6159915	131.7455443	2268.176440	2864.234693	1821.018701	3385.841159
	1	13	2986.062238	470.0172541	130.3593315	2702.033654	3270.090822	2317.283660	3825.594362
	2	5	2734.773382	344.2387714	153.9482587	2307.344493	3162.202271	2153.838999	3057.598611
	Total	28	2791.240417	459.5846527	86.85333553	2613.032092	2969.448741	1821.018701	3825.594362

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Ave. for F1 ħ+(i) control	Between Groups	13090.206	2	6545.103	.728	.493
	Within Groups	224656.366	25	8986.255		
	Total	237746.573	27			
Ave. for F2 ħ+(i) control	Between Groups	694252.208	2	347126.104	4.345	.024
	Within Groups	1997434.814	25	79897.393		
	Total	2691687.022	27			
Ave. for Firc Dur ħ+(i) control	Between Groups	.001	2	.001	1.555	.231
	Within Groups	.010	25	.000		
	Total	.012	27			
Ave for COG ħ+(i) control	Between Groups	1015771.516	2	507885.758	2.709	.086
	Within Groups	4687115.916	25	187484.637		
	Total	5702887.431	27			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Ave. for F1 ħ+(i) control	0	1	-47.2758735	39.87324697	.472	-146.593358	52.04161114
		2	-16.1663503	51.92182968	.948	-145.494808	113.1621071
	1	0	47.27587348	39.87324697	.472	-52.0416111	146.5933581
		2	31.10952320	49.88488037	.809	-93.1452395	155.3642859
	2	0	16.16635028	51.92182968	.948	-113.162107	145.4948076
		1	-31.1095232	49.88488037	.809	-155.364286	93.14523947
Ave. for F2 ħ+(i) control	0	1	-38.4594830	118.8936186	.944	-334.603289	257.6843234
		2	386.918080*	154.8199528	.049	1.287878441	772.5482821
	1	0	38.45948299	118.8936186	.944	-257.684323	334.6032894
		2	425.377563*	148.7461992	.022	54.87604963	795.8790769
	2	0	-386.918080*	154.8199528	.049	-772.548282	-1.28787844
		1	-425.377563*	148.7461992	.022	-795.879077	-54.8760496
Ave. for Firc Dur ħ+(i) control	0	1	.0081908883	.0085397574	.609	-.013080197	.0294619732
		2	.0194538167	.0111202338	.207	-.008244796	.0471524299
	1	0	-.008190888	.0085397574	.609	-.029461973	.0130801965
		2	.0112629284	.0106839750	.551	-.015349038	.0378748952
	2	0	-.019453817	.0111202338	.207	-.047152430	.0082447964
		1	-.011262928	.0106839750	.551	-.037874895	.0153490383
Ave for COG ħ+(i) control	0	1	-419.856672	182.1273148	.074	-873.504873	33.79152996
		2	-168.567816	237.1611077	.759	-759.295847	422.1602147
	1	0	419.8566717	182.1273148	.074	-33.7915300	873.5048734
		2	251.2888557	227.8570219	.521	-316.264278	818.8419894
	2	0	168.5678161	237.1611077	.759	-422.160215	759.2958468
		1	-251.288856	227.8570219	.521	-818.841989	316.2642781

*. The mean difference is significant at the 0.05 level.

Table 63 Results of the independent-sample t-test showing the influence of LOR in realizing the Arabic marked consonants by GPA speakers

Independent Samples Test

		Levene's Test for Equality of Variances							95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
θ	Equal variances assumed	14.557	.000	-3.481	38	.001	-21.91919	6.29623	-34.66525	-9.17313
	Equal variances not assumed			-3.743	29.191	.001	-21.91919	5.85645	-33.89358	-9.94480
tˤ	Equal variances assumed	.712	.404	-4.091	38	.000	-30.86869	7.54482	-46.14238	-15.59500
	Equal variances not assumed			-4.164	37.957	.000	-30.86869	7.41405	-45.87821	-15.85916
sˤ	Equal variances assumed	.001	.973	-.695	38	.491	-5.65152	8.13312	-22.11617	10.81314
	Equal variances not assumed			-.690	35.264	.495	-5.65152	8.19431	-22.28241	10.97938
χ	Equal variances assumed	8.991	.005	-1.286	38	.206	-11.00000	8.55200	-28.31261	6.31261
	Equal variances not assumed			-1.233	28.037	.228	-11.00000	8.91779	-29.26619	7.26619
ʁ	Equal variances assumed	4.138	.049	-.621	38	.539	-6.26768	10.09814	-26.71030	14.17495
	Equal variances not assumed			-.601	30.336	.552	-6.26768	10.42140	-27.54114	15.00578
ħ	Equal variances assumed	1.177	.285	-.886	38	.381	-5.57576	6.29587	-18.32108	7.16957
	Equal variances not assumed			-.896	37.703	.376	-5.57576	6.22084	-18.17245	7.02093
ʕ	Equal variances assumed	41.101	.000	-2.730	38	.010	-11.00000	4.02874	-19.15575	-2.84425
	Equal variances not assumed			-3.026	21.000	.006	-11.00000	3.63544	-18.56032	-3.43968

Table 64 Results of the independent-sample t-test showing the influence of L1 in realizing the Arabic marked consonants by Urdu and Malayalam speakers

Independent Samples Test

		Levene's Test for Equality of Variances								
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper
/θ/	Equal variances assumed	3.523	.068	-2.367	38	.023	-15.90000	6.71642	-29.49668	-2.30332
	Equal variances not assumed			-2.367	33.609	.024	-15.90000	6.71642	-29.55525	-2.24475
/tˤ/	Equal variances assumed	.044	.836	.613	38	.543	5.50000	8.96571	-12.65013	23.65013
	Equal variances not assumed			.613	37.997	.543	5.50000	8.96571	-12.65018	23.65018
/sˤ/	Equal variances assumed	.031	.861	.080	38	.937	.65000	8.14293	-15.83449	17.13449
	Equal variances not assumed			.080	37.627	.937	.65000	8.14293	-15.83986	17.13986
χ/	Equal variances assumed	16.282	.000	-3.235	38	.003	-24.90000	7.69686	-40.48147	-9.31853
	Equal variances not assumed			-3.235	31.055	.003	-24.90000	7.69686	-40.59671	-9.20329
/ʁ/	Equal variances assumed	28.523	.000	-8.577	38	.000	-50.55000	5.89334	-62.48044	-38.61956
	Equal variances not assumed			-8.577	20.497	.000	-50.55000	5.89334	-62.82421	-38.27579
/ħ/	Equal variances assumed	1.909	.175	.992	38	.327	6.20000	6.24820	-6.44882	18.84882
	Equal variances not assumed			.992	36.415	.328	6.20000	6.24820	-6.46692	18.86692
/ʕ/	Equal variances assumed	5.771	.021	1.161	38	.253	5.00000	4.30847	-3.72204	13.72204
	Equal variances not assumed			1.161	31.929	.254	5.00000	4.30847	-3.77683	13.77683

Table 65 Results of the independent-sample t-test showing the influence of amount of exposure in realizing the Arabic marked consonants by GPA speakers

Independent Samples Test										
		Levene's Test for Equality of Variances								
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
/θ/	Equal variances assumed	.884	.353	-.572	38	.570	-4.10000	7.16385	-18.60246	10.40246
	Equal variances not assumed			-.572	33.570	.571	-4.10000	7.16385	-18.66557	10.46557
/tˤ/	Equal variances assumed	.000	.989	-2.151	38	.038	-18.30000	8.50689	-35.52129	-1.07871
	Equal variances not assumed			-2.151	37.933	.038	-18.30000	8.50689	-35.52229	-1.07771
/sˤ/	Equal variances assumed	.003	.954	-.976	38	.335	-7.85000	8.04343	-24.13307	8.43307
	Equal variances not assumed			-.976	37.844	.335	-7.85000	8.04343	-24.13528	8.43528
/χ/	Equal variances assumed	2.698	.109	-.753	38	.456	-6.50000	8.62820	-23.96687	10.96687
	Equal variances not assumed			-.753	35.949	.456	-6.50000	8.62820	-23.99966	10.99966
/ʁ/	Equal variances assumed	1.896	.177	1.195	38	.239	11.85000	9.91367	-8.21918	31.91918
	Equal variances not assumed			1.195	35.182	.240	11.85000	9.91367	-8.27211	31.97211
/ħ/	Equal variances assumed	6.233	.017	-2.835	38	.007	-16.30000	5.74976	-27.93978	-4.66022
	Equal variances not assumed			-2.835	33.168	.008	-16.30000	5.74976	-27.99573	-4.60427
/ʕ/	Equal variances assumed	49.357	.000	-3.087	38	.004	-12.10000	3.92019	-20.03601	-4.16399
	Equal variances not assumed			-3.087	19.000	.006	-12.10000	3.92019	-20.30505	-3.89495