NEW MODEL FOR ANALYZING SOCIOLINGUISTIC VARIATION: THE INTERACTION OF SOCIAL AND LINGUISTIC CONSTRAINTS

By

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To my parents: Ibrahim and Amira
To my sister: Suzi
To my brothers: Husam and Faraj
I love you ….

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AKR	Akrama
ECDA/CDA	Error-driven Constraint Demotion Algorithm
F	Female
FC(s)	Floating constraint(s)
GLA	Gradual Learning Algorithm
HAM	Al-Hameeddieh
HCA	Himsi Colloquial Arabic
L1	Mother/first language
L2	Second language.
LM(C)	Lower middle (class)
LWC	Lower working class
M	Male
MGLA	Minimal Gradual Learning Algorithm
NR	Non-prestigious area
OT	Optimality Theory
PF	Prestigious form
PR	Prestigious area
RCA	Rural Colloquial Arabic
SA	Standard Arabic
SF	Stigmatized form
SG	Stratified Grammars or partially-ordered grammar
UG	Universal Grammar
UM(C)	Upper middle (class)
UWC	Upper working class

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In this study, I present a new model for analyzing sociolinguistic variation within the framework of Optimality Theory (OT) and the Gradual Learning Algorithm (GLA). This model contributes to the advancement of sociolinguistic methodology as well as to OT and the GLA, unifying both linguistic and social factors. I propose a number of social constraints and incorporate them with linguistic constraints in the GLA. I show that incorporating social constraints yields variant-usage percentages that match real life occurrences. I follow the evaluation process of stochastic grammar in which social constraints are treated like linguistic constraints on a continuous scale of ranking strictness. Their ranking values may differ from one speaker or group of speakers to another. These differences in the ranking values may result in intra- and inter-speaker, intra- and inter-group, intra- and inter-community, or intra- and inter-dialect variation. The number and type of social constraints involved influence the percentage of occurrence of each variant and affect the ranking values of other constraints and the grammar chosen by a speaker or a group of speakers at a particular time and place.

This model enables us to show the effect of linguistic and social constraints simultaneously. It allows us to investigate individual as well as group grammars and shows that

those grammars may act independently from each other. It also enables us to project expected percentages of variation by manipulating either the ranking values of constraints or the pair distribution of the output. Evidence comes from the study of the naturally occurring speech of migrant rural speakers of Colloquial Arabic to the city of Hims, Syria. These speakers show different degrees of variation, particularly regarding the use of the two variants [q] and [ʔ], based on various social factors, such as age, gender, residential area, and social class.

The aim of the study is to show how rural migrants adopt the new phonological system of the urban dialect to appear prestigious. The study will focus on the sound change of [q] to [ʔ] and the four stable variants [t] and [s] and [d] and [z]. It will show that variation may be influenced by different factors. The variable use of [q] and [ʔ] is attributed to prestige and social factors. The use of [t] and [s] and [d] and [z] is not social in nature; it has developed historically from the Standard Arabic (SA) [θ] and [ð] respectively as a response to markedness constraints. Today, this variation is stable and each of the four variants is used in specific lexical items. Faithfulness constraints play a major role in maintaining the pronunciation of the input as [t] and [s] and [d] and [z] in the output. This stable phenomenon is further explained in terms of the two opposing effects of frequency (Bybee 2001).

In a situation where prestige plays a role in adopting a new variant, as in the case of rural migrants to the city of Hims, social constraints are viewed as the motivating force behind changing a grammar at a particular time and place. However, one should take into account that the activation of social constraints depends on the speaker's selection or choice to activate them or not. Hence, these constraints may rank very high in the speech of a speaker who is highly aware of the social values attached to a certain sound. On the other hand, they may rank very low in the speech of a person who, for example, does not care to adopt a new form.

A theory that can take into account all the factors that lead to variation is a better theory than one that takes into account social factors in isolation and ignores grammatical factors or vice versa. Integrating social constraints into formal theory and showing that social constraints can have equal weight or even more weight than grammatical constraints in conditioning variation and change is essential in this study. Including social constraints in the computation provides explanation of the observed sociolinguistic variation between [q] and [ʔ] among members of the same social group or among different speakers or social groups. Interacting social constraints with linguistic constraints in the same framework is a simple comprehensive method to depict and explain the mental process of a speaker at a certain time and/or place. Feeding the GLA with the right output distribution gives the specific ranking values or grammar of each speaker or group of speakers. In other words, the model takes advantage of the stochastic grammar embedded in the GLA to generate grammars that match real life output percentages without trying all the possible rankings of constraints and counting the times those rankings give a certain output. Furthermore, where a statistical analysis fails to indicate the interaction between one social factor and others, the specificity implemented in the GLA by dividing a social factor into a number of social constraints enables us to see interaction among the same social constraints that emerged as insignificant in the statistical analysis. In this sense, implementing social factors as constraints and accounting for sociolinguistic variation within the framework of OT and the GLA has an advantage over other theories.

CHAPTER 1
INTRODUCTION

1.1 Proposal

In this study, I present a new model for analyzing sociolinguistic variation, employing Optimality Theory (OT) (Prince and Smolensky 2004 [1993]) and the Gradual Learning Algorithm (GLA) (Boersma and Hayes 2001). This model contributes to the advancement of sociolinguistic methodology as well as to OT and the GLA, unifying both linguistic and social factors. I propose a number of social constraints and incorporate them into the GLA, where they intersect with linguistic constraints, and show that incorporating social constraints with linguistic constraints in the GLA yields results that reflect real life performances. Introducing social constraints, for the first time, as integral part of linguistic theory could be considered an advancement to OT and the GLA, which so far dealt only with linguistic constraints. As the GLA is based on continuous ranking and stochastic constraints, these social constraints will be treated as continuous constraints whose ranking values differ from one speaker to another, from one group of speakers to another, and from one community to another. These differences in the ranking values may result in inter-speaker, intra- and inter-group, intra- and inter-community, or intra- and inter-dialect variation. These ranking values may even differ within the same speaker yielding intra-speaker variation. The number and type of social constraints involved influence the percentage of occurrence of each variant and affect the weight of other constraints and the grammar chosen by a speaker or a group of speakers at a particular time and place.

This model enables us to show the effect of linguistic and social constraints simultaneously. It gives a mental representation of the grammatical process that takes place in the speaker's mind as a result of the integration of social and linguistic constraints. It allows us to investigate individual as well as group grammars and shows that those grammars may act independently from each other. In this sense, the model allows us to see that certain social constraints, for example, may be activated by a certain speaker, but not others, and by one group of speakers or more, but not others. Thus, in the same way that linguistic constraints have their language specific ranking, social constraints maintain their relativity and specificity in the particularity of the individual grammars and constraint rankings of individual speakers or groups of speakers. The model also enables us to project expected percentages of variation by manipulating the weight of the various constraints or the output pair distribution. Interestingly enough, when constraints are set at an initial equal ranking value, the addition of one or more social constraint(s) changes the ranking value of other constraints and gives us predictions on what variation will look like if those social constraints are involved. Certain social constraints give us expectations on what the speech of a particular speaker or group of speakers should sound like. Furthermore, feeding the GLA with the right output distribution generates grammars that match real life output percentages of each speaker or group of speakers without trying all the possible rankings of constraints and counting the number of rankings that give each output. Evidence comes from the study of the naturally occurring speech of migrant rural speakers of Colloquial Arabic to the city of Hims, Syria. These speakers show different degrees of variation, particularly regarding the use of the two variants [q] and [ʔ], based on various social factors, such as age, gender, residential area, and social class. Their variation may also depend on the interlocutor: a family member or a stranger.

The ability of the model to give a mental representation of what goes on in the speaker's mind and the conscious choice of a ranking value at a certain time and place endow the model and the proposed linguistic and social constraints with psychological reality. The psychological reality of grammars is a broad issue that is hard to determine or support completely. The idea of the psychological reality of rules and representations goes back to Chomsky. However, many expressed skepticism about Chomsky's (1980) argument that rules and representations are part of a grammar and a mental process (i.e., rules are psychologically real). Devitt (2006a), for example, is skeptic of rules and principles and believes that they are not psychologically real. Devitt (2006b) believes that there is only a "linguistic reality" that is mainly associated with what is produced (whether spoken, signed, or written) (i.e., "the real subject matter of grammars" (Slezak 2007)). Devitt's (2006a) objection to Chomsky's view of the psychological reality of grammars as mental representations was critiqued by Slezak (2007) who observed that the difference between Devitt's view and Chomsky's is merely terminological. Furthermore, Aske (1990), in testing the psychological reality of Spanish stress rules, arrived at results that contradict the traditional idea of the mental representation of rules (i.e., rules are not psychologically real). Rather speakers access their lexicon when assigning stress to new words they never heard before. They assign stress by analogy to existent patterns in the brain/lexicon. Thus, patterns, not rules, are mentally represented. Similarly, Bybee and McClelland (2005) argue against rule-based systems and the mental representation of rules in support of exemplar models and connectionist models. They adopt the view that "specific experiences" have an impact "on the mental organization and representation of language" (p. 381). For them,

> language use has a major impact on language structure. The experience that users have with language shapes cognitive representations, which are built up through the application of general principles of human cognition to linguistic input. The structure that appears to underlie language use reflects the operation of these principles as they shape how individual speakers and hearers represent form and meaning and adapt these forms and meanings as they speak. (p. 382)

Bybee and McClelland's view does not eliminate a cognitive representation of some kind of form and meaning that are influenced by language use rather than by innate universal rules. In this sense, language use may influence the mental representation of language. This view is not very far apart from the influence that social factors could exert on the mental representation of language in a sociolinguistic variation situation. In a sociolinguistic contact situation, speakers are most likely aware of a linguistic change around them. For example, the Casablancan dialect, which developed because of the extensive contact between different regional dialects of migrants from rural and urban areas, was described towards the end of the twentieth century as an "interdialect" that has psychological reality for Moroccans (Moumine 1990, cited in Hachimi 2007). Furthermore, Milroy (2006:151) espouses the view that "linguistic change is a process" and some aspects of this process are "related to social factors". For Milroy, language cannot change on its own. It is a social phenomenon that involves a speaker and a listener. There is a distinction between speaker innovation and linguistic change. Social factors constitute part of any type of linguistic change because even internal changes involve production on the part of the speaker and perception on the part of the listener. If we take Milroy's argument into consideration, we can conclude that in a sociolinguistic variation situation, people are aware of the linguistic changes surrounding them and are most likely involved in them.

Returning to my initial assumption that the model and constrains proposed in this study are psychologically real, I add that the speaker's awareness of the social significance of a sound and the change of the ranking values of constraints to sound prestigious involves learnability of new ranking values. Learnability is usually associated with some mental grammatical processes. This idea may contradict with Rumelhart and McClelland's (1987) idea that learnability and language use do not involve rules because of the probabilistic nature of natural language and the variability in language use. However, I argue that variability in language use could be the result of external factors that influence the choice of one ranking value over another. Choice is related to consciousness (of grammatical processes and the likes), and thus has some mental realization and psychological understanding of what is going on in a social situation in which a speaker switches from one form to another and is noticed by listeners. In support of this view, I present Cutillas-Espinosa's (2004) view that a speaker can control the ranking values of his/her grammar consciously (Section 1.3.2.2). For him, variation is not mechanical or automatic; rather, it is based on personal conscious choices. In this way, Cutillas-Espinosa opposes the Neogrammarian view that change is mechanical and automatic. Many researchers have argued, however, that repetition and frequency may lead to the automatization of words and sequences of words (e.g. Bybee 2001, 2003). That is, words or sequences of words form chunks in the brain and become entrenched in their own representation and thus easier to access and use. This automatization is applied also to social identity and information about the interlocutor and social settings. In other words, speakers access this stored information along with the form or structure suitable for the social setting or situation. Labov (1994:604), on the other hand, supports the Neogrammarian view that language change is mechanical and automatic when it is "outside the range of conscious recognition and choice." In this way, any conscious attempt to change language is subject to "higher-level stylistic options" or adherence to social factors and pressures. In this sense, sociolinguistic change is mainly conscious and involves choice. Whether this change becomes automatic or not later on in life is beyond the scope of this study and is worth investigating in further research. However, it is noteworthy that for a sound change to be considered automatic, it should not be the "goal of anyone at any time" (Boersma 1997b:2). Since the change from [q] to [ʔ] is driven by prestige, it is teleological, and thus follows a conscious process at least in the initial stages of learnability of the new prestigious form [ʔ]. In addition, the stigma that is associated with the rural form [q] encourages its users to abandon it and adopt the prestigious form instead. Stereotype variables such as (q) which are avoided by their own native speakers are indicative of the social awareness of them and their stigma as well as of the prestige of the form those speakers switch to, in our case [ʔ].

Moreover, the social awareness that leads to learnability of new ranking values of constraints provides evidence of the speaker's consciousness of those constraints and the process that accompanies them, not only in him/herself but also in other speakers or interlocutors who tend to switch to a different sound or dialect or maintain his/her native sounds or dialect. A rural migrant speaker to the city of Hims, for example, is aware of the accommodation to the Himsi prestigious form, [ʔ]. This awareness is expressed by many speakers in the recorded conversations. Those speakers notice their own shift as well as the shift of others towards the use of [ʔ] with strangers or non-family members. A number of speakers mentioned their observations of other speakers changing their speech and using [ʔ] instead of [q] outside the family sphere (Habib 2005, Sections 5.2 and 5.3). This awareness reflects on the psychological reality of the different grammars and ranking values of constraints in each individual or group of individuals. Awareness of such grammatical change in the other is a further reflection on the psychological reality of the model and constraints. What makes this model interesting is that it does not separate the social reality of language from the psychological reality of language. It integrates both realities in the same framework, presenting the external influence on language as part of a speaker's internal process to sound externally prestigious.

The aim of the study is to show how rural migrants adopt the new phonological system of the urban dialect to appear prestigious. The study will focus on the sound change of [q] to [ʔ]; [ð] to [d], [z], or [ð]; and [θ] to [t], [s], or [θ]. It will show that variation may be influenced by different factors. Variation in the use of [q] and [ʔ] is attributed to prestige and social factors.

Variation in the use of [d] and [z] and [t] and [s] is not social in nature; it has probably developed historically as a response to markedness constraints. Today, this variation is stable and each of the four variants is used in specific lexical items. Consequently, the underlying form of these four variants is /d/ and /z/ and /t/ and /s/ respectively. Faithfulness constraints play the major role in maintaining the pronunciation of the input as [d] and [z] and [t] and [s] in the output to preserve the specificity observed in lexical items, in that each variant is designated a particular phoneme with its correspondent allophone. Thus, the historical development led to the disappearance of /ð/ and /θ/ from the phonemic system of speakers; they rarely appear as [ð] and [θ] in colloquial speech. If they do, they appear as lexical borrowings from SA. Even then, they may appear as [z] and [s] respectively. This is further attributed to markedness.

In a situation where prestige plays a role in adopting a new variant, as in the case of rural migrants to the city of Hims, I view social factors as constraints that were inactive when the speaker was living in his/her hometown. When this speaker moves to the city, s/he starts activating those social constraints in addition to linguistic constraints based on positive evidence or negative comments that s/he may hear from city people. The situation is analogous to a child who is born with no previous knowledge of his/her mother tongue and based on positive evidence, s/he starts activating the appropriate constraints and changing the ranking of those constraints as s/he receives more input (e.g., Demuth 1995; Gnanadesikan 1995; Smolensky 1996). The difference between a child and an adult is that the child is not yet influenced by society and social factors. In the case of the adult, social factors, such as prestige, societal attitude, age, gender, social class, residential area, education, occupation, and social networks potentially influence linguistic performance. Thus, I view social constraints as the motivating force behind changing a grammar at a particular time and place. In this sense, the two types of constraints – linguistic and social – interact to arrive at the desired result. However, one should take into account that the activation of social constraints depends on the speaker's selection or choice to activate them or not. If the speaker chooses not to activate them or to activate just some of them, s/he may continue to use his/her mother dialect or rather vary his/her speech, resulting in intra- and inter-speaker variation. Many researchers emphasize the role of social factors in affecting a change (e.g., Labov, 1963, 1966, 1972a, 2001; Trudgill 1974; Milroy 1980; Eckert 1991a; Haeri 1996). For example, Labov (2001:498) emphasizes that social factors are "the forces that move and motivate change, and are responsible for incrementation and transmission across generations." Since social constraints can be the impetus for grammatical change, then we can assume that they can play a major role in intra- and inter-speaker variation. Hence, these constraints may rank very high in the speech of a speaker who is highly aware of the social values attached to a certain sound. On the other hand, they may rank very low in the speech of a person who, for example, does not care to adopt a new form or is too old to think about changing his/her speech or his/her identity for this matter. Cases such as these have been observed in some studies, such as Labov's study of Martha's Vineyard (1963). In Martha's Vineyard, the Chilmark fishermen, for example, showed strong defiance to forms from the mainland of New England; they clung to the island's old ways of pronouncing (ay) and (aw). That is, they maintained the island's centralized features. The younger age group also showed more centralization than most age groups to show strong identification with the island and to distinguish themselves from the summer tourists who come from the mainland. In addition, situations in which linguistic behavior differs with age are very common. For instance, Miller (2005) found that there is a great difference of accommodation to the Cairene forms between the first generation migrants to Cairo and the second generation migrants who were born in Cairo. The second generation shows complete accommodation to the Cairene forms, whereas the first generation migrants show variation in their accommodation to the new forms. Furthermore, since those social constraints will be considered on a continuous scale, they may lead to variation even within the same person, leading to oscillation in the choice between two variants in the same conversation regardless of the interlocutor. In this case, the speaker is trying to adjust his/her social constraints to fit in the community. At the same time, s/he is also trying to adjust her/his grammatical constraints to fit the social requirement. The result is that the speaker is probably confused and is unable to have a good grip on one particular grammar and s/he will continue to oscillate in selecting different ranking values and rankings for the various constraints.

Consequently, a theory that can take into account all the factors that lead to variation is a better theory than one that takes into account social factors in isolation and ignores grammatical factors or vice versa. Integrating social constraints into formal theory and showing that social constraints can have equal weight or even more weight than grammatical constraints in conditioning variation and change is an important development in this study. Including social constraints in the computation provides explanation of the observed sociolinguistic variation between [q] and [ʔ] among members of the same social group or among different speakers or groups of speakers. Interacting social constraints with linguistic constraints in the same framework is a simple comprehensive method to depict and explain the grammatical mental process that takes place in the mind of a speaker at a certain time and/or place. Furthermore, where a statistical analysis fails to indicate the interaction between one social factor and others, the specificity implemented in the GLA by dividing a social factor into a number of social constraints enables us to see interaction among the same social constraints that emerged as insignificant in the statistical analysis. In this sense, combining OT and the GLA and including social constraints in the computation have an advantage over other theories in accounting for sociolinguistic variation and change. Traditional generative phonology manipulated grammatical rules to deal with variation, which have their problems (Section 1.3). Traditional OT only manipulated the rankings of linguistic constraints to analyze variation (e.g., Kochetov 1998 on variation among four Polish dialects; Morris 2000 on variation among three Spanish varieties). Sociolinguistic methods of analyzing linguistic variation focused on correlations between social factors and linguistic variables with more emphasis on the development of methods of data collection. In Section 1.2, I will give a brief background on the sequential development of sociolinguistic methodology before presenting my model to allow the reader to compare my model with previous ones.

1.2 Correlation between Linguistic Variables and Social Factors in the Course of the Development of Sociolinguistic Methodology

Since the mid 1960s and with the foundation of sociolinguistics by William Labov, social factors started to gain importance in the field of linguistics and to play an important role in analyzing and modeling speech. In *Sociolinguistic Patterns* (1972a:163), Labov stresses that "[t]he process of sound change is not an autonomous movement within the confines of a linguistic system, but rather a complex response to many aspects of human behavior." Further, in *Principles of Linguistic Change* (1994:1), Labov asserts that "[t]he separation of 'internal' from 'external,' 'linguistic factors' from 'social factors' may not seem practical to those who view language as a unified whole where *tout se tient*, or those who believe that every feature of language has a social aspect." Throughout decades of sociolinguistic studies of variation, a great shift in views took place, a shift from viewing language as reflection of the social to viewing language as creator of the social (Rickford and Eckert 2001). The shift starts with Labov's (1966, 1972a; Trudgill 1974) view of style variation as different levels of attention paid to speech and ends with the constructivists' view of the use of style to project a self-image and to construct identity and social meaning (e.g., Eckert 1991b; Coupland 1985, 2001; Shilling-Estes 1999, 2002; Cameron 1998). Other views were also formed, such as Bell's (1984, 1991) model of 'audience design' in which a speaker's style is seen as a response to an audience. Bell viewed style as a reflection of social variation, whereas Finegan and Biber (1994) viewed social variation as a reflection of style. This is not to mention accommodation theory (Giles and Powesland 1975; Giles, Coupland and Coupland 1991) which draws on the speaker's orientation and attitude to the interlocutor and on the role of identity (Coupland 1980) in determining speakers' style and their perception of style. In recent formal models, stylistic variation is starting to be viewed as gradual, not abrupt (Boersma and Hayes 2001); it involves optionality and learnability.

1.2.1 Quantitative Methods

Linguistic and stylistic variation was mainly measured by correlating various social factors with the production of a certain linguistic variant in a particular way. Being the founding rock of sociolinguistics, Labov's quantitative methods of data analyses and modeling have influenced many Arabic sociolinguists (e.g., Abd-el-Jawad 1981; Holes 1986; Walters 1989; Haeri 1991; Abu-Haidar 1992; Daher 1998; Habib 2005). In his study of New York City (r) (1966, 1972a), Labov correlated a number of social factors – age, sex, social class – with the pronunciation of postvocalic *r* as (r-1) or (r-0)[1], using various statistical methods. To examine the social stratification of (r) in the speech of New Yorkers, Labov conducted a rapid and anonymous survey to avoid the observer's paradox. He selected three department stores in three different locations in Manhattan, which are socially stratified: Saks Fifth Avenue (a high-status store with

[1] (r-1) stands for r-full or the pronunciation of the variable (r) as [r]; (r-0) refers to the deletion of the variable (r) in pronunciation, that is it is realized as null or not realized at all, [Ø].

high prices), Macy's (middle-class with middle prices), and Klein's (a store with cheaper prices for less affluent customers). In order to show that his hypothesis is general, he chose one occupational group, salespeople, to show that social differences occur even within the same occupational group, based on the status of the store and the customers. His prediction that the use of (r-1) is socially stratified was confirmed. Saks' employees used (r-1) sixty percent; Macy's employees fifty one percent; and Klein's employees twenty percent. However, in the more deliberate answer, all groups showed an increase in (r-1). What was striking is that the middle-class store showed the highest degree of increase, which was attributed to hypercorrection among the middle class. The study showed minor differences between men's and women's linguistic behavior. There was also no strong correlation with age. While the younger generation in Saks showed higher use of (r-1), the same was not observed in Macy's and Klein's. Rather, the middle-aged group of the lower-middle class showed hypercorrection; it used more (r-1) than the upper class, which is a sign of 'linguistic insecurity' (Labov 1972a, 2001). This survey was the starting point for a larger project, expanding to the Lower East Side of New York, in which the findings were no different.

In the Lower East Side of New York study (1972a), Labov sought to gather a more representative sample of the city than its salespeople, using extensive interviews. He used a ten-point scale to classify the various social classes. Labov assigned 0-1 for lower working-class (LWC), 2-4 for upper working-class (UWC), 5-8 for lower middle-class (LMC), and 9 for upper middle-class (UMC). In Labov's study, the division among social classes was most evident concerning the variable (th) that is realized as [θ], [tθ], and [t]. The latter is the most stigmatized form and the most common among the LWC, whereas [θ] emerged as the most common among the UMC. This is evident in the increase in the use of [θ] with the shift of style from casual speech to word lists. The (r) variable showed similar results, but slightly smaller division among social classes. There was also increase in the use of (r-1) in the speech of participants along the style shift towards the most formal or minimal pairs. In this study, Labov used the “matched guise” technique that was developed by Wallace Lambert (Lambert, Hodgson, and Fillenbaum 1960), which is a subjective reaction test, in order to see if all social classes evaluated the (r-1) in the same way and whether New York City constitutes a speech community. Participants were asked to listen to a tape, containing 24 sentences from five female readers. The same reader pronounced the same sentence twice: once with [r] and once without it, but listeners were not aware that the same speaker had said both utterances because sentences were randomized. Participants were asked to judge the readers on a scale of occupational suitability (i.e., will the speaker be acceptable as a television personality, secretary, factory worker, etc). All participants age 18-39 positively evaluated (r-1). Based on the uniformity of those subjective evaluations, Labov concluded that New York City forms a speech community and that (r-1) is the prestige marker of the city.

1.2.2 Long Term Participant Observation Methods

Rapid surveys and individual interviews are not the only techniques advocated by Labov; rather, in later work, Labov (1972b) conducted with the help of fieldworkers a long-term participant observation of adolescent gangs in Harlem, an African American neighborhood in New York City. He also applied this method in his ‘neighborhood studies’ in Philadelphia (starting in the 1970s). Such neighborhood studies aimed to obtain a large amount of social and linguistic data, treating individual neighborhoods as social units, maintaining the sociolinguistic interview, but abandoning random sampling. Regardless of the method of data collection, consequent work proceeded with correlating linguistic variables with social constraints (e.g., Milroy 1980; Gal 1979; Eckert 1989, 1991b). While studies like Milroy’s (1980) employed quantitative methods of analyses, studies like Gal’s employed qualitative methods of analyses. Other studies such as Eckert’s incorporated both qualitative and quantitative methods of analyses. The combination of the two types of analyses may be preferable for a better understanding of a community in ethnography-of-communication studies (Hymes 1972) that involve becoming an in-group member, gaining acceptance and integrating into the community.

1.2.2.1 Participant observation (ethnography of communication) and quantitative analysis

The ethnography of communication approach to data collection was developed by Milroy and Milroy (1985, 1992) in their investigations of speech in Belfast. Their concern was vernacular maintenance and their hypothesis held that the use of vernacular forms is related to the speaker’s integration into the community’s social network. The two major concepts in the model of social networks (Milroy 1980) were density and multiplexity. High-density and multiplex networks exhibit stronger relationships among their members in contrast to low-density and uniplex networks. Usually dense and multiplex networks are characteristic of rural villages and working-class areas. Milroy (1980) carried out her fieldwork between 1975-6 in three working-class areas in Belfast: Ballymacarrett, the Clonard, and the Hammer, all of which were characterized as dense and multiplex networks. Milroy’s concern was how to access the most natural speech from these social networks. She successfully entered the community as the friend of a friend, claiming connections with students from the area. She was able to meet more informants through her original contacts. Her use of the participant observation strategy of data collection prompted her to become part of the community. Consequently, Milroy was able to collect a variety of natural speech styles in different situational contexts. Rather than conducting the formal sociolinguistic interviews that were implemented by Labov (1972a), she recorded natural conversations among informants. Milroy applied quantitative analysis to the data collected from forty-six participants. The analysis showed that a number of phonological variables were stratified according to gender in the three working-class areas. The effect of gender was particularly evident in the use of the variable (th); the vernacular was characterized by deletion of (th) intervocalically (e.g., *Mother* becomes [mɔər]). In both age groups (18-25 and 40-50), women used fewer vernacular forms than men, particularly younger women. This difference between men and women within the same community was attributed to their social networks, strong ties with the local people, and degree of integration into the community. To calculate the degree of integration into the community, Milroy (1980) developed a six-point scale from 0-5 to measure the degree of density and multiplexity of each individual network. This method is called Network Strength Scale or NSS. The analysis showed that male network scores were higher than those of female networks, indicating that men had stronger ties with the local community than women and that their use of the vernacular is a way of showing solidarity. The Milroys (1985, 1992) found that language use is affected by status and solidarity and that the use of standard language is associated with high social status, whereas the use of the vernacular, and thus covert prestige, is an instantiation of solidarity with the local community's linguistic and social norms and customs. The norms do not have to be prestigious; they are the dominant ones in the community.

1.2.2.2 Participant observation and qualitative analysis

Like Milroy's study in Belfast, Gal (1979) conducted a one-year participant observation in Oberwart, a town in eastern Austria, near the Hungarian borders. She also had to become part of the community, observing people's behavior and recording examples of language use. In contrast to Milroy's use of quantitative analysis, she used qualitative analysis of the data. The majority of the inhabitants of Oberwart were Hungarians who were bilingual in German. Language, according to Gal became an indicator of social status: Hungarian was associated with “peasantness”, as Gal terms it, and German was associated with higher status: the language of prestige, money, modernity, and economic prosperity. From closely studying the linguistic habits of individuals and groups, she was able to identify the motivating factors for the shift from Hungarian to German. The informants came from eight households and their visitors. 68 speakers constituted her sample: 37 women and 31 men. Gal observed when they used Hungarian, when they used German, and when they used both. Initially, she used the traditional sociolinguistic interview devised by Labov, but she was only able to elicit a narrow range of styles. She used the interviews to elicit information about informants’ language use in different contexts and their daily contacts with others. After spending more time in the community, she was able to record naturally occurring conversations among her informants in a variety of settings. Using an ethnographic approach, Gal observed and tried to make sense of naturally occurring linguistic behavior of the participants. For this reason, her study contrasts with survey studies and those based on the formal interview. Gal found that the two factors that strongly correlated with the choice of a language were age and peasantness. The latter reflects the individual’s social status: a peasant or a waged worker. Age played a role in the choice between German and Hungarian: the younger generation preferred the use of German, whereas older speakers preferred the use of Hungarian. However, the choice of language also depended on the person spoken to: peasant or Austrian/urban. Younger speakers are associated with urbanization and since German is associated with urbanism, it is the language chosen when speaking to persons associated with ‘urbanization’ or ‘Austria’. Gal also found that social networks played a role in language choice and noticed the great difference in men’s and women’s behavior with respect to such choices. Women in general were faster to adopt the German language as a sign of their rejection of peasant life. They preferred marriage to a wage laborer than to a peasant because they “do not want to be peasants; they do not present themselves as peasants in speech” (Gal 1978:13). This forced peasant men to look for marriage outside Oberwart where peasant life is less stigmatized. These marriages accelerated language shift because the outsider women were usually monolingual German speakers and children of such marriages became monolingual German speakers. This behavior is reflected in the younger generation’s preference for German. Thus, both local young women and incoming women prompted the language shift from Hungarian to German in the community.

1.2.2.3 Participant observation and combining quantitative and qualitative analyses

Other works that used the participant observation technique are Eckert’s (1989, 1991b) studies of high-school adolescents in Detroit (i.e., the two adolescent groups: the Jocks and the Burnouts). Rather than assuming a class continuum, like Labov, she applied previous social grouping in the community under investigation. Eckert (1991b:213) believed that the best way to understand membership in a social group and the influence of such membership on the linguistic behavior of the members of that social group was through long-term observation and ethnographic methodology in studying variation:

> The use of ethnography in the study of variation allows the researcher to discover the social groups, categories, and divisions particular to the community in question, and to explore their relation to linguistic form. It is in these small-scale studies, ultimately, that we can directly observe social process at work in linguistic variation and change. (1991b:213)

Eckert spent two years observing a graduating class of a Detroit suburban high school. The ages of those participants did not exceed 20. The differential linguistic behavior of these two social groups is manifested not only quantitatively but also qualitatively to show the opposed directions in variant choice between the two groups in a situation of sound change in progress. One would expect the adolescents’ identity and variation to correlate with their parents’ socioeconomic status; rather, their identity and variation correlated with “adolescent social group affiliation", as Eckert commented (1991b: 214) "[t]he main business of adolescence is the accomplishment of separation from the family and the development of a social identity defined in terms of the larger society". The Jocks are representative of the social category whose lives revolve around the school and who gain status by participating in the school's activities and extracurricular activities. In contrast, Burnouts reject the school's and their parents' domination over their lives. The two categories differ in every aspect of life: appearance, the music they listen to, clothing, behavior, etc. Because of this social and identity polarization, one would expect difference in their linguistic behavior.

One of the variables that was under investigation was (e) which is realized as two backed variants [ʌ] or [a], in addition to the less conservative form [ɛ] and the two front variants [æ] and [ɪ]. The Burnouts exhibited more backing of (e) to [ʌ] than the Jocks. On the other hand, the Jocks led in the lowering of (e) to [æ]. The Burnouts' urban contacts and orientation made them adopt urban forms, whereas the Jocks' suburban association prevented them from adopting such forms. Hence, they were seen by the Burnouts as conservative and "talk just like their parents" (1991:220). As a result, the Jocks decided to develop their own innovative form, [æ], in order not to appear conservative and to establish a signaling identity. None of the groups rejected each other's variant; rather they developed their own as a signal of their identity and preservation of the split and distinction between the two groups. The centralized variant and the fronted one also corresponded to each group's demeanor. The Jocks were known for their juvenile nature; they were always smiling and making a point in greeting and smiling to people in the halls. On the other hand, the Burnouts were always somber and always looked at the Jocks as privileged. Because of their parents' low socioeconomic status, they perceived themselves and were perceived by others as people with problems. Eckert commented:

> The open-faced, smiling demeanor of the Jocks and the more somber aspect of the burnouts correspond to their choice of variants: the fronted, spread [æ] variant for Jocks and the central, unspread [ʌ] for burnouts. (1991b:230)

The VARBRUL analysis showed that sex differences were insignificant. Eckert's conclusion was that gender should not be separated from social class; rather, gender and social status interacted as a Jock or a Burnout and urban-suburban orientation. For example, the Burnouts led slightly in backing of (e) to [ʌ] before /l/, but the Jock girls showed a slight lead in backing in the same environment. In other environments, the Burnout girls highly exceeded the backing of the Jock girls, which is a strong indication that this variant is related to Burnout identity. On the other hand, Jocks led in lowering to [æ] more than the Burnouts led in backing. Girls led in the use of this variant, which meant that Burnout girls also showed use of the variant [æ], though their use is less than that of the Jock girls. One can, thus, observe the "powerful social symbolic role for variation" (1991: 227) in the existing correlation between social groups, their sex, and the linguistic variants.

1.2.3 Summary of the above Sociolinguistic Methods

In the last three reviewed studies, the sample might have been smaller than those presented in survey and individual-interview studies. Nonetheless, this does not necessarily jeopardize the validity and reliability of the results because the researchers took upon themselves the task of becoming part of the community to have a better understanding of the social and linguistic behavior of those communities and to be able to arrive at carefully investigated conclusions. However, the three studies differed in their choice of data analysis methods. Milroy (1980) took a quantitative approach to measure the density and multiplexity of the working-class networks that she studied and based her conclusions on it. In contrast, Gal (1979) adopted a qualitative approach in her evaluation of the language shift observed in Oberwart from Hungarian to

German. Eckert (1989, 1991b), on the other hand, combined both approaches, which I view as essential for a more comprehensive understanding of the interaction of the social and the linguistic. When the qualitative analysis and the quantitative analysis complement each other, we have better confirmation of the results and stronger observations to report.

One observation of all the reviewed studies and other similar studies is that they only focus on the social aspect of variation and the correlation of linguistic variants with social factors. They do not take into account how the human mind works and the grammars that are interchanged and exchanged as those social factors exert pressure and play a role in initiating, implementing, or advocating a change. Language change without doubt involves the social but one has to look behind the scenes to observe the grammatical changes that take place as a result of the social as well as the internal/linguistic aspect of language change. Mufwene (2005), for example, argues that both the internal and the external are involved in language change. For him, the interaction of “linguistic ecology” and “social ecology” should reveal the causes of linguistic change and its spread. Mufwene compares linguistic species to viral species whose change occurs as a result of the social practices of their host. In this sense, internal selection of one variant over another is related to the speaker’s relationship with his/her social environment, the speaker’s personality, and the social group that the speaker would like to associate and fit in with. This implies that internal change is affected by external or social factors. At the same time, internal change is constrained by the relationship of one variant with other variants with which it coexists.

The studies presented so far are representative of the sequential methodological developments in sociolinguistics. As we have seen, each method of data collection and analysis has its advantages and disadvantages. While surveys enable us to gather a large sample in a short period of time and in a cost effective manner, the data transcription might suffer from unconscious bias. Interviews, on the other hand, allow us to gather a sizable sample, but it may suffer from superficiality unless one is an in-group participant or becomes one. While quantitative analyses require a large sample, qualitative analyses are less demanding in this respect but may suffer from generalizability. However, qualitative analyses are recommended in cases where one needs to understand the cultural and social relations and processes in a certain community. Thus, the quantitative and the qualitative could complement each other and provide a comprehensive understanding of language variation and change. The choice among these methods of data collection and analyses depends on the purpose of the study and what the researcher is trying to establish and account for. In this study, my intention is to depict how the human mind deals with social and linguistic constraints simultaneously. I would like to show the interaction of both types of constraints within one theoretical framework and observe the degree of influence that each one of them exerts on the degree of language variation.

Many researchers have stressed the role of both external and internal factors in language change (e.g., Labov 1972a, 1994, 2001; Bell 1984; Eckert 1991a; Finegan and Biber 1994:316; Mufwene 2005) and the importance of taking both of these components into consideration when choosing a method of data analysis. For example, Eckert indicates that

> Any theory of language must account for this association, and any theory of linguistic change must account for the social meanings involved in the patterns of variation that constitute change. (1991a:xii)

She adds stressing her previous conviction:

> The study of sound change, then, needs not only a theory of linguistic constraints, but a social theory that deals with the limits of the symbolic function of linguistic variation. Indeed, what we think of as internal (linguistic) and external (social) constraints in linguistic change may not be as separable as conventional practice suggests. (1991a:xiii)

Eckert's strong convictions show the importance of combing the social and the linguistic in one comprehensive theory. While some phonologists reject the idea of incorporating external factors into phonological theory (e.g., Anttila 2002), others encourage future research that incorporates sociolinguistic or external factors in phonological theory (e.g., Gess 2003, Holt 2003). Reynolds (1994) also advocates the idea that sociolinguistics should make use of phonological theory and vice versa. Recently, many linguists call for unifying sociolinguistics with other linguistic theories; they would like to see more research focusing on the intersection of various linguistic subfields with sociolinguistics. For example, Hume and Nagy (2008) call for such unification with phonological theory; Johnson and Niedzielski (2008) call for unification with phonetics as well as working at the phonetic-phonology interface; and Gundel and Sankoff (2008) call for unification with pragmatics. However, in order to combine both the social and the phonological, it is important to find a model that can integrate both of them and can reveal the inner workings of the various constraints: linguistic and social. The choice of an approach to data analysis should be geared towards a method that instantiates the real, gradual and natural life learning processes, a method that could integrate the social and the linguistic.

For this reason, I adopt a formal model, OT and the GLA, to account for sociolinguistic variation and change to delve into the inner works of our linguistic system in pursuit of a better understanding of the interaction between the social and the linguistic. I believe that a linguistic theory should be comprehensive enough to be able to account for the phonological processes accompanying language variation and change, which are influenced by social factors. This prompts us to review the working mechanisms of OT and the GLA as well as to review the developments that have been made towards accounting for sociolinguistic variation in phonological theory (Reynolds 1994; Nagy and Reynolds 1996 applying FCs; Cutillas-Espinosa

2004 applying GLA). The advantages of GLA over other accounts or formal models will be made clear within the course of this development.

1.3 Introduction to Optimality Theory (OT)

OT (Prince and Smolensky 2004 [1993]) is a non-derivation model that depends on the application of markedness and faithfulness constraints to an input. The ranking of these constraints determines the most optimal output among a set of generated output candidates. Constraints are universal, but the ranking of these constraints is language specific and determines the grammar of that language or dialect. With the emergence of this non-derivational model, OT, researchers began to point out its many advantages over rule-based models (e.g., Bermúdez-Otero and Hogg 2003). First, it avoids the conspiracy effect that is attributed to rules (Kisseberth 1970) that have no output goal (Kager 1999): a rule determines the structural change based on a structural condition. On the other hand, OT exhibits unification of interaction among constraints in one parallel step, aiming at a particular output goal. Second, in rule-based models, intermediate levels take place in the derivation. Rules are based on serial/linear ordering; each step results in an output that becomes the input for the next rule and so on. Thus, there are many mappings from various inputs to various outputs. These intermediate levels do not exist in OT; there is a single mapping from input to output, which is more economical. The role of the interaction of markedness and faithfulness constraints is to shape the output in a manner satisfactory to Universal Grammar (UG) and to the input. A further advantage of OT over derivational models, in which the underlying form should be as underspecified as possible because of the principle of lexical minimality, is that the input can be fully specified without recourse to lexical minimality or underspecification (e.g., McMahon 2000; Bermúdez-Otero and Hogg 2003; Holt 2003). Lexical minimality and underspecification “presuppose an overpowerful learner” (Bermúdez-Otero and Hogg 2003:93). Thus, in a rule-base model, a learner has to figure out the rules and work his/her way through to arrive at the fully specified and correct output. In OT, what is important is the relationship between the input and the output and how harmonious is the output with the input. The learner hypothesizes the input and tries to adjust the ranking of his/her constraints to match the output with the input. In this sense, it does not matter how specified or underspecified for features an input is. For example, in the case of a child's acquisition of L1, the surface form of the adult is fully specified. It is this surface form that is considered the L1 input, and from this input, the child develops an underlying form that mirrors the adult surface form (Smolensky 1996).

One example of the OT superiority over a rule-based model was explored by Lombardi (2003), who investigated the acquisition of the English interdental fricatives, which are marked and uncommon sounds, by speakers of Thai and Russian who used [t] instead of [θ] and German and Japanese who used [s] in place of [θ]. Lombardi pointed out that in the absence of the [θ] sound from the inventory of those speakers, it is impossible for them to apply or come up with rules to account for the replacement of [θ] with [t] or [s], putting OT at an advantage with its dependence on constraints and positive evidence. In OT, the change of [θ] into [t] or [s] is ascribed to the interaction of faithfulness and markedness constraints, and "some L1 phonology has forced reranking, making this an effect of L1 transfer" (2003:225).

However, traditional OT (Prince and Smolensky 2004 [1993]) ran into problems when accounting for opacity, absolute ungrammaticality, free variation, positional faithfulness, and allomorphy vs. underlying representations. Some of these problems, such as free variation and absolute ungrammaticality, are due to its strict ranking principle. For these reasons, researchers started proposing various improvements to OT, which could provide better accounts of learnability and variation. One approach that has been gaining momentum in the last few years is the Maximal Gradual Learning Algorithm (GLA). Since the GLA must be coupled with OT (Section 1.3.2), it gains the same advantages that OT has over rules, and since the GLA can account for free variation without the addition of rules, loss of rules or inversion of rules, as were necessary in traditional rule-based theory, it certainly excels in this aspect over rules. This is not to mention the idea of Lexicon optimization (e.g., Stampe 1972 cited in Kager 1999; Prince and Smolensky 2004 [1993]) and restructuring (e.g., Boersma 1997a,b, 1998, 2000; Boersma and Hayes 2001) of the input based on positive evidence. The GLA not only can learn and account for categorical outputs but also can account for free variation, optionality, and gradient well-formedness[2] (Boersma and Hayes 2001).

1.3.1 Constraint Demotion Algorithm (CDA), Floating Constraints (FCs), and Stratified Grammars (SG)

Before exploring in detail the working mechanism of the GLA and its applications and advantages over other approaches, I will briefly review in the next three sections the operating mechanism of the following approaches that were developed to account for learnability or variation within the framework of OT: Error-driven Constraint Demotion Algorithm (ECDA) or (CDA) (Tesar 1995; Tesar and Smolensky 1993, 1996, 1995,1998, 2000), Floating Constraints (FCs) (Reynolds 1994; Nagy and Reynolds 1996, 1997; Morris 1998), and Stratified Grammars (SG) or partially-ordered grammar (Anttila 1997a,b, 2002; Anttila and Cho 1998).

[2] Gradient or intermediate well-formedness is used to describe forms that occur in speech, which cannot be judged as totally ill-formed or totally well-formed. These forms are neither perfect nor impossible; hence, judging them is intermediate or gradient. These forms are different from speech errors that may occur rarely in speech. They may be rare but they occur more frequently than speech errors and may have an effect on the learning process of a certain form in addition to the well-formed forms because they can also be considered positive evidence. In other words, the GLA can learn intermediate well-formedness judgments based on the frequencies of those forms, because those judgments are "the result of frequency effects in the learning data" (Boersma and Hayes 2001:76). In this sense, the GLA learns those judgments by learning those frequencies.

1.3.1.1 Constraint Demotion Algorithm (CDA)

Tesar and Smolensky (1993, 1995, 1996, 1998, 2000) proposed the CDA to account for learnability. In the initial state of acquisition in the CDA, ranking is random, and the process of language acquisition of rankings follows incrementally from positive evidence. However, one observable fact in real life is that the task of acquisition may not be complete and some degree of randomness is carried out in adult grammars. This creates one problem for the CDA. Hayes (2000) pointed out that the CDA is very successful in accounting for language learning but not free variation. The CDA's main principle of acquisition is constraint demotion, never promotion: demote the constraints violated by the intended winner below the highest constraint violated by the intended loser. On the next evaluation, the CDA makes sure that the learner will learn the correct form. Thus, the learning process is drastic, although in the real world a child does not change his/her constraint ranking unless s/he has heard sufficient amount of data to do so. For example, hearing [dl] that is an illegal onset in English once or twice does not suffice to change the child's constraint ranking. In addition, the CDA cannot account for free variation because a demotion of one constraint to generate a variant may lead to the generation of another unattested output that will lead to another demotion and so on. The constant constraint demotion where one demotion may lead to the demotion of other constraints causes irreparable damage to the grammar or leads to what is referred to as entering into an eternal loop (Kager 1999).

1.3.1.2 Floating Constraints (FCs)

To account for variation, a second approach, FCs (Reynolds 1994; Nagy and Reynolds 1996, 1997; Morris 1998), was developed. It holds that one constraint can be ranked freely with respect to all the other constraints. Nagy and Reynolds (1996:151) used FCs to account for "the rates of inter- and intra-speaker variation" in "Faeter, a branch of Francoprovençal spoken in two farming villages in southern Italy", taking into account the influence of social factors (age, speaker, and sex) on the occurrence of a certain form more frequently than others. In Faeter, variation results from deleting a syllable or more from the word. To elicit a controlled number of tokens, they recorded natural speech by showing a picture book to 40 speakers. They first asked the speakers to name the objects that are at the bottom of the page to see how they pronounced them in isolation. Then, they asked them to give a description of the picture to see how they used the same word in context. They considered the following phonological variants: "(1) full form surfaced, (2) final schwa didn't surface, (3) final syllable didn't surface, (4) final syllable plus preceding schwa didn't surface, and (5) more than schwa + onset + schwa didn't surface" (1996:153). The problem with their use of FCs is that you could have in their case twelve possible rankings, where you only have two to four optimal outputs. Thus, the model may predict some unattested outputs to be optimal when they are not. Though they showed that the number of rankings that give a particular output corresponds with the observed number of its occurrence in real speech, their data showed exceptions to this observation. For example, /kut.ˈte.jə/ 'knife' is predicted to surface more as [kut.ˈte], but in reality [kut.ˈte.je] is used more. They attributed this to analogy to similar forms such as /kəˈʎi:jə/ 'spoon'. A further explanation offered by them is that each of the surface forms, [kut.ˈte.je] and [kut.ˈtei] (this is the Italian cognate), has its own underlying form, /kut.ˈte.je/ and /kutˈtei/ respectively, and surfaces one hundred percent of the time. Thus, some speakers, particularly young females, use the Italian cognates (the two syllable forms) more than the Faeter forms (the trisyllabic forms). They found that social factors exhibit influence on "the relative likelihood of the various rankings possible for a Floating constraint" (1996:158). For example, the FC might be closer to the high end of a set of constraints in the older age group while closer to the lower end of a set of constraints in the younger age group. They themselves emphasized that much work has to be done to give weight to the various social factors in order to “restrict where they float” (1996:158). Thus, FCs could not give a complete account of their Faeter data.

1.3.1.3 Stratified Grammar (SG)

FCs is one instance of a model that accommodates multiple grammars. Another instance of such a model is the third approach I discuss here, SG or partially-ordered grammar (Anttila 1997a,b, 2002; Anttila and Cho 1998). This approach is based on the traditional view of Weinreich, Labov, and Herzog (1968) and Kroch (1989, 1994) that variation is the result of multiple grammars in the individual or society, and that there is the possibility of the existence of an intermediary dialect between the two dialects (Anttila and Cho 1998). According to this approach, the grammar consists of sets of constraints; each set constitutes a stratum and each stratum has a fixed ranking with respect to the other strata, but the constraints are freely ranked with respect to each other within the same stratum. If a stratum contains 5 constraints, then there are 120 possible ranking, calculated using factorial typology as follows: $5 \times 4 \times 3 \times 2 \times 1 = 120$. According to this approach, the speaker has a pool of grammars from which s/he selects a grammar and the role of social factors is limited to the choice among grammars. In this sense, Anttila adopts the modular approach to grammar, which views internal factors as separate entities from external factors. This is evident in his remark “it is not the business of grammatical theory to explain the effects of sex, age, style, register and social class” (2002:212). For Anttila (2002:231), SG constitutes of one grammar rather than multiple grammars. His conclusion is based on his adoption of Liberman’s (1994) definition of grammar “as a set of input/output pairs where for every input there is some fixed output” (Anttila 2002:220) and on his regard of SG “as a relation, i.e. as a set of ordered pairs of constraints” (2002:231). While Anttila’s (1997a,b) strata model may account for free variation and predict accurately frequencies of outputs, it will face problems if there is a large disparity among output frequencies, as Boersma and Hayes (2001) showed in their reanalysis of Anttila's (1997a,b) Finnish genitives. The strata model assumes fixed rankings among strata and free ranking within a stratum. If the frequency disparity is 99 to 1, then within one stratum, 99 constraints should favor one output and only one favors the other. If the stratum has five constraints, then "only one of the 120 possible total rankings gives rise to the rare outcome" (Boersma and Hayes 2001:72).

1.3.2 Working Mechanism and Advantages of the GLA over CDA, FCs, and SG

Now we direct our attention to the GLA and its advantages over the mentioned approaches. Some of these advantages are: the GLA "can learn free variation, deal effectively with noisy learning data, and account for gradient well-formedness judgments" (2001:45). In other words, the GLA can handle "optionality"; it is also "robust"; and it is capable of accounting for "intermediate well-formedness" (2001:46). The GLA must be coupled with OT because it is a "constraint-ranking algorithm" whose purpose is "learning optimality-theoretic grammars" (Boersma and Hayes 2001:45). It is based on the frequency of an output, which affects the ranking values of constraints. The two main components of the GLA are a continuous scale of ranking strictness and a stochastic grammar, that is "a small noise component" is added at every evaluation of the candidate set, "so that the grammar can produce variable outputs if some constraint rankings are close to each other" (2001:45-46). The GLA is error driven, in that it only alters its ranking if it is faced with a mismatch (i.e., the input conflicts with the output. In other words, the optimal output generated by the constraint ranking conflicts with the real life or actual output a learner is learning from). The gradual learning of the GLA involves learning a categorical ranking at every step, which also makes it able to account for non-variable data. The "ranking value" of the constraint is in the center of the range, but "the value used at evaluation time” is called the “selection point” (2001:47). Categorical ranking of constraints results from non-overlapping of the ranges, as Figure 1-1 depicts:

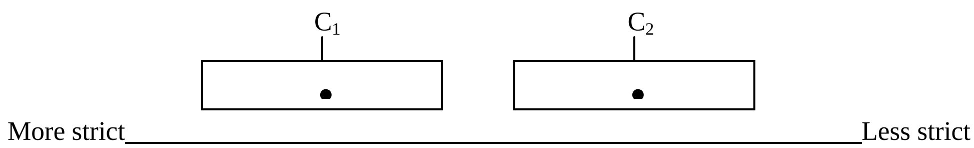

Figure 1-1. Categorical Ranking

However, overlapping of ranges results in free variation or variable ranking, as Figure 1-2 depicts:

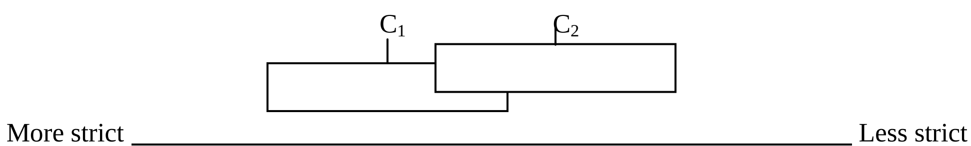

Figure 1-2. Free Ranking

At evaluation time, “it is possible to choose the selection points from anywhere within the ranges of the two constraints” (2001:48). If the selection point is chosen at the lower end of C1 and the upper end of C2, the common result is C2>>C1 in an overlapping situation, as Figure 1-3 shows:

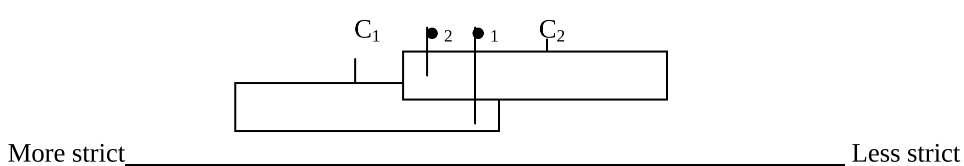

Figure 1-3. $C_2 >> C_1$

If the selection point is chosen at the upper end of C1 and the lower end of C2, the common result is C1>>C2 in an overlapping situation, as Figure 1-4 shows:

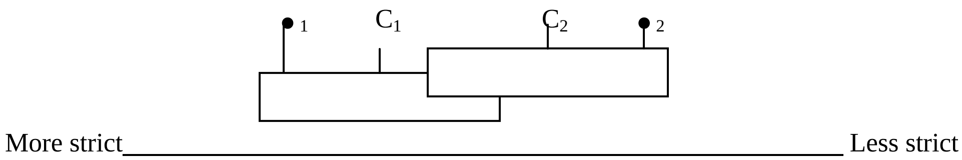

Figure 1-4. $C_1 >> C_2$

Thus, each of the last two rankings may yield variable outputs. This process happens at one single evaluation time. Boersma and Hayes (2001) use “probability distribution” (Boersma 1997, 1998; Hayes and MacEachern 1998) to depict each constraint range and to make predictions on the relative frequencies of each output. All constraints are treated equally; they all have the same width and standard deviation (i.e., 2.0). This value itself is the “evaluation noise” value and the behavior of a constraint relies on “its ranking values alone” (2001:49). The width and standard deviation are the same in all constraints because overlapping among constraints should not occur unless their ranking values are close to each other. If one constraint is wider or has a higher standard deviation, even when the ranking values of constraints are far apart, overlapping may occur, and thus variation, which may not always be the case. It is this equal treatment of constraints and ability to predict the ranking values of constraints that make the GLA more restrictive and reliable than other less restrictive models such as strictness bands that have their own width with parts of them designated as “fringes” (Hayes and MacEachern’s 1998) and FCs (Reynolds 1994) that do not have control over where a constraint could fall or be ranked (2001:50 & 73). Boersma and Hayes (2001) argued that the GLA predicts that FCs are impossible because this would require a very large standard deviation for one of the constraints with respect to the others. FCs are impossible because all constraints should be treated equally regarding their standard deviation.

Boersma and Hayes (2001) explained the process of the GLA in 4 steps. In the "initial state" of the GLA, each constraint is given a value specified by the linguist. The value could be the same for all constraints or different; the grammar that results after learning nonetheless will be the same but the amount of input data and computation necessary to learn it differ. The first step is to present the GLA with a learning datum (i.e., the input) that is the surface form of the adult, not the learner. The GLA was first used for L1 acquisition. Thus, the child has access only to the adult surface forms from which s/he learns his/her L1. From those surface forms, the child learns the L1 grammar and develops an underlying form that mirrors the adult's surface forms. However, when using the GLA to model L2 acquisition, in our case a second dialect, the learner has already developed an underlying form of his L1 in childhood. It is this underlying form that is used as the input in the GLA and it is this form that undergoes change in the learning process. This is the core principle of Prince and Smolensky's (2004 [1993]) idea of Lexicon Optimization. A learner may or may not be able to restructure his/her underlying form from exposure to a surface form that does not match his/her underlying form.

The second step is to generate outputs by adding a noise value to the current ranking value of the constraint to obtain the selection point at every evaluation time. The third step constitutes comparison. If the generated output matches the learning datum, nothing further is done. If a mismatch between the learning datum and the generated output occurs, the grammar must be adjusted; the algorithm takes a learning step and thus alters the grammar. The next step is "mark cancellation" if the same constraint is violated by both candidates. The fourth step constitutes "moderate adjustments of the ranking values" (2001:52) to obtain the right result. Since there is no certainty on whether the constraints with uncancelled marks for the learning datum are too high or those for the learner's output are too low, both promotion and demotion take place. The adjustment of the ranking values of constraints involves increasing or decreasing the constraint's value by the amount of the plasticity value. *Plasticity* refers to "the numerical quantity by which the algorithm adjusts the constraints' ranking values at any given time" (2001:52). In the "final state", the algorithm arrives at the appropriate grammar that generates the adult's surface form after cycles of repeating steps 1-4.

Boersma (1998) and Boersma and Hayes (2001) realized the incorrectness of the predictions of the earlier version of the GLA that was referred to as the Minimal Gradual Learning Algorithm (MGLA), in which only one constraint, the highest violated constraint by the intended winner, is demoted and only one constraint, the highest violated constraint by the intended loser, is promoted. In the GLA, all constraints violated by the correct form are demoted and all the constraints violated by the incorrect form are promoted. Although Boersma and Hayes (2001) do not deny that other methods of evaluation, such as the CDA may work well for non-variable data, they point out that the GLA has many advantages over other models. To test the GLA and to show that it has advantages over the CDA, they provide empirical evidence by reanalyzing Hayes and Abad's (1989) data of metathesis in Ilokano and Hayes and MacEachern's (1998) data of English light and dark /l/. What makes the GLA advantageous over the drastic learning process of the CDA is that it does its job gradually, continuously generating more correct outputs without causing any damage to the grammar.

To test the GLA against the SG approach to free variation, Boersma and Hayes (2001) reanalyzed Anttila's (1997a,b) data of Finnish genitives. They found that SG runs into problems when faced with large disparity among output frequencies. This makes the GLA more advantageous than SG. In addition, Antilla thinks that Boersma and Hayes's (2001) model of continuous ranking and stochastic constraints may have advantages over other models because of its use of the GLA that enables us to arrive at the right ranking from the surface forms and the corresponding underlying form. While the multiple grammars model and its derivatives (e.g., SG) rely on frequencies and grammar-counting, the continuous ranking approach moves OT in the direction of quantification.

1.3.2.1 Pure linguistic applications of the GLA

Boersma and Hayes's (2001) first test of the GLA was Hayes and Abad's (1989) Ilokano metathesis data: /ʔw/ optionally becomes [wʔ], where [w] is not an underlying segment, rather derived from /o/. The process includes: 1) computing "the factorial typology of the constraint set over the candidates given" and 2) then add gradually "pairwise constraint rankings, recomputing the factorial typology as constrained a priori by these rankings, until the output set had shrunk to include only the attested cases of free variation" (2001:61). The CDA could not converge on the same data, concluding that it cannot account for free variation because, as mentioned above, this leads to constant demotions of constraints and damaging of the grammar. In contrast, The GLA was able to converge, did its job gradually without damaging the grammar, and continued to generate correct outputs.

Another advantage of the GLA is that it can account for intermediate well-formedness without recourse to different width of ranges or to fringes (Hayes 2000). Hayes and MacEachern's (1998) model of strictness bands and fringes is "less restrictive" because "it permits individual constraints to be affiliated with "bands", each with its own width, that specify the range of selection points". The model also "permits parts of each band to be designated 'fringes'," which lead to intermediate well-formedness if a selection point falls within them" (Boersma and Hayes 2001:73). Being a less powerful theory and being able to account for the same data, the GLA is advancement to other approaches as it generates its own learning algorithm. To account for intermediate well-formedness, Boersma and Hayes 1) "use one equation to convert gathered gradient well-formedness judgments into conjectured frequencies; 2) then, they feed these conjectured frequencies into the GLA, "which will produce (if all goes well) a grammar that closely mimics them" (2001:76) (i.e., predicted frequencies); 3) "by feeding the predicted frequencies into the mathematical inverse of the first equation", they get predicted judgments; and 4) finally, make comparison between the observed judgments and the predicted judgments. These comparisons show that the grammar learned by the GLA is very close in form to Hayes's (2000) fringes.

1.3.2.2 Example of a sociolinguistic application of GLA

After discussing the advantages of the GLA over other models, it would be of interest to review the only application of it, to the best of my knowledge, to sociolinguistic variation and change (Cutillas-Espinosa 2004). Like Boersma and Hayes (2001), Cutillas-Espinosa emphasized two main points: variation is gradual and continuous (2004:171), designating a special weight to personal choice in variation. His approach involves: (i) a continuous ranking approach to constraints (Boersma 1997, 2000; Hayes 2000; Boersma and Hayes 2001) and (ii) a limited number of available grammars, (2004:171) (i.e. his model consists of three grammars to account for sociolinguistic variation). The first grammar G_1 is the standard one that is associated with prestige, education and propriety. The third grammar G_3 is the local grammar that is used by the community. The second grammar G_2 is the default grammar or intermediate grammar that could be closer to either the first or the third grammar due to various social, personal, or contextual factors; it is the everyday, informal, and 'in use' grammar, characterized as "dynamic" because it changes according to the speaker's need (2004:172). Cutillas-Espinosa suggests that the GLA could account for one of the three grammars that every person has (i.e. the second/default grammar). In this sense, G_2 is assumed to be a continuous ranking of constraints, based on conscious choice of the speaker of the appropriate ranking for the appropriate output in a particular context. Cutillas-Espinosa assumes that a speaker who is exposed to two different grammars tends to build his/her own constraint ranking to accommodate the social context, to build an identity, or to project a self-image. In this sense, grammar is no longer observed as a mechanism in which personal decisions are not taken into consideration. Rather, a speaker can control the ranking values of his/her grammar consciously. To quote him "Grammar is no longer seen as a fully automated mechanism; personal and *meaningful* decisions are granted a place" (2004:175).

Cutillas-Espinosa applied the GLA model to both Labov's (1966) study of the English (r) that can be realized as [ɹ] or Ø in the speech of New York City and to the Castilian Spanish (s) in Murcia, which can be realized as either [s] or Ø (Hernández-Campoy and Trudgill, 2002). He examined the case of Susan Salto from Labov's (1966) study, who showed great stylistic shifts for the variable (r). She used [ɹ] 100% of the time in her most careful style, minimal pairs, and suppressed it 98% of the time in casual speech. Starting with the fixed ranking value 80 for the markedness constraint *CODA/r, the results showed that MAX would have the ranking value 91.31 in minimal pairs, ensuring that MAX will be higher ranked than *CODA/r, whereas it will have the ranking value 68.69 in casual speech, guaranteeing a higher ranking of *CODA/r. Cutillas-Espinosa also examined the case of a radio presenter at a local station in Murcia (Spain) from Cutillas-Espinosa and Hernández-Campoy's (2004) study of the differences in (s) deletion in the speech of the presenter in two different settings: 1) in broadcasting, talking to non-standard speaking audience on the phone, whose speech is characterized with suppression of (s), and 2) in a formal interview with the researchers (Cutillas-Espinosa 2004:176). Cutillas-Espinosa and Hernández-Campoy (2004) had found that the presenter used the [s], the standard variant, 89% in broadcasting and only 1% in the interview. Cutillas-Espinosa conducted the same analysis done on the previous study and found that the ranking value of MAX correlated with the style chosen by the presenter: 83.46 in broadcasting and 73.4 in interview. Thus, he assumed fixed ranking for markedness constraints and that faithfulness constraints are the ones that change ranking value and move around to arrive at the desired output. For him, the continuous ranking scale overrides all other models (FCs, CDA, and SG), in that it can feature a continuum of grammar where style can shift gradually, rather than abruptly. His approach is more of the antimodular type because it takes both internal and external factors into consideration in opposition to Anttila's (1997a,b, 2002) modular approach that only takes internal factors into consideration.

Cutillas-Espinosa's model is insightful and it opens a field of sociolinguistic investigation within an Optimality-Theoretic approach, embellished with the numerical and functional workings of the GLA. In this study, I will elaborate on this insightful model by taking into account that the human mind may not be limited to three particular grammars and the observed intra-speaker oscillation and inter-speaker differences in adopting or acquiring a new grammar. I also introduce social factors as constraints to the GLA and interweave them with linguistic constraints to show their immediate effect on the ranking values of linguistic constraints and the choice of one grammar over another at a certain time and place. One further advancement is showing which social constraints are activated or not, and to what extent, by certain speakers or groups of speakers at a certain time and place. In addition, I would like to stress the differences that may be observed among individual grammars within the same community or the same group of speakers. In this study, I am also using my own original data that is based on naturally occurring speech to see if all speakers behave in the same way regarding choices made among grammars, and if the pattern is uniform throughout the community. A larger sample of speakers and a comparison among the different grammars used by the speakers may give us a better understanding of these differences. Furthermore, G_1 and G_3 may not be stable as well; they may be variable and might be presented on a continuous ranking scale. In Arabic, for example, the standard language itself is variable: not all speakers use the same level of Case marking or their degree of reverting to the vernacular may vary within the same formal setting.

1.3.2.3 Concluding remarks about the GLA

The discussion above reveals many advantages of the GLA over other models. The last example shows the possibility of applying it to sociolinguistic variation and change and naturally occurring speech. It remains to be seen if one can include social factors in the computational process of the GLA as ranked constraints. In addition, the non-teleological approach (Boersma 1997b) to the GLA may need some revision, in my opinion, because if selection and choice play a role in determining the ranking value of constraints, then there might be some teleological effects in the adults' acquisition of a second grammar. The non-teleological approach to the GLA might work well in its application to L1 acquisition, not to dialectal and sociolinguistic variation where social factors can be involved and play a selective role. Thus, social factors may influence the ranking values and rankings of linguistic constraints. In applying the GLA to sociolinguistic variation, one can predict the ranking values of constraints and depict the intrapersonal and interpersonal oscillation that one may observe in the speech of those who try to change the way they speak in attempt to sound city-like, more prestigious, or probably more or less formal. The stochastic feature of constraints and the continuous feature of ranking should be applicable to social factors because sociolinguistic variation is gradual and stochastic in nature. Not all speakers behave in the same way or have the same level of sociolinguistic competence. Even the same speaker may vary his/her speech along a continuous scale of values. Sometimes, there is a kind of internal conflict between grammars, leading to confusion regarding the choice of one grammar over another or a kind of stalemate situation where the speaker/learner is in an intermediate position from which s/he cannot escape.

In the same way that social factors should be included in formal theory, sociolinguistics should take markedness into account, because markedness, in addition to social factors, does sometimes play a major role in language variation and change (Reynolds 1994). This markedness could have played a major role historically in producing the SA [θ] and [ð] as [t] as [d] respectively. The merger of [θ] and [ð] with [t] and [d] respectively was completed around the 14^{th} century (Daher, 1998a, 1999). This is comparable to the use of Thai, Russian, German, and Japanese learners of English of [t] and [s] instead of [θ] because of the absence of this sound from their inventory, which is attributed to the interaction of faithfulness and markedness constraints (Lombardi 2003).

1.4 Conclusion

A number of studies have employed OT in one way or another to account for language variation from various perspectives. While most researchers agree that sound systems change continuously (Boersma 1997b; Labov 1994; Ohala 1993), even if the change only results from “internal factors” (Boersma 1997b: 1), they may disagree on the reason behind sound change. Sound change does not have to be teleological (Boersma 1997b; Ohala 1993), facilitative or based on meaning preservation (Labov 1994). It could be based on historical factors (Adam 2002) or perceptual and lexicon optimization reasons (Holts 1997). However, Boersma (2000) argues that optimization is not the main “internal factor” (Boersma 2000: 1) for sound change. Thus, most of the language variation studies that implement OT do not deal with sociolinguistic variation and do not refer to the social interface with the linguistic and historical factors that commonly involve internal, perceptual, or lexicon optimization factors. Unlike other studies, this study deals with variation from a social perspective where social factors play a major role in the change. They are integrated into the mental computing system of the speaker in the form of constraints that intersect with linguistic constraints to account for real life occurrences of particular variants. The study reflects the intra- and inter-speaker preference for certain sounds according to the interlocutor, although the speaker is capable of pronouncing both sounds of both dialects perfectly. The situation is similar to knowing two languages and switching between the two according to the interlocutor. The difference is that the switch is not done for the sake of comprehension on the part of the interlocutor but for the sake of competing with the interlocutor for prestige. This is the case that we will observe concerning the two variants [q] and [ʔ].

It would thus be of interest to see how one can model this sociolinguistic variation within the framework of OT and the GLA and how one can incorporate social constraints into the human mind computing system. This may give us an answer to how speakers oscillate between two different dialects and how the degree of social success that those speakers achieve depends on the level of acquisition of the new dialect. It may also explain the intra- and inter-speaker variation observed among speakers who use more than one variety, in an attempt to accommodate the speech of the interlocutor. Thus, at the core of this study is the development of a model for variation and change that could have cross-linguistic implementations. The model will present how the intersection of linguistic constraints with social constraints can model and predict real life variable use of variants as well as predict the direction of change when constraints are given specific values. This model will also highlight the importance of social constraints in determining the ranking values of other constraints as well as the chosen grammar at a certain time and place. The model will show that variation within the speech of a community could be driven by various factors at the same time. While one variation may be led by social factors, another variation could have been led by markedness diachronically and be maintained by faithfulness constraints synchronically. I will also show that this model can account for these different types of variation within the same dialect. It can deal with these different variations independently from each other since these variations are the result of different factors and act independently from each other. This discussion provokes a number of research questions that will be stated in Section 1.5.

1.5 Research Questions

The research questions that guide this study are:

1. How can Optimality Theory account for speakers' switches between two different dialects and their intrapersonal and interpersonal variation in the use of particular sounds (e.g., the use of [ʔ] in place of [q]) based on their interlocutor's background?
2. How can social factors be incorporated into the GLA?
3. To what degree do social factors play a role in building our grammars, or rather developing new grammars?
4. How consistent is the pattern of variation and sound change within and among rural migrant speakers to the city of Hims?
5. Which factors are stronger in leading a sound change: markedness constraints or social constraints?

1.6 Structure of the Study

The study is organized as follows. Chapter 2 presents the methodology used in data collection and analysis. It includes a brief description of the community under investigation. It introduces the city of Hims, the speech sample, the linguistic and social variables, and a brief description of data analysis, including the statistical models and other quantitative methods employed.

Chapter 3 introduces the theoretical analysis of the study. In this chapter, the new model proposed in this study will be explored in detail. The chapter begins with descriptions of the Himsi and rural grammars and the change that the rural migrant speaker grammar undergoes in his/her attempt to appear prestigious. Then, social constraints and the stochastic process that is followed in examining the simultaneous effect of social and linguistic constraints on the choice of a grammar at a certain time and place are introduced. This chapter shows that social constraints should constitute an essential part of our grammar. The inclusion of social constraints in OT and the GLA yields results that match real life occurrences. These social constraints play a major role in determining the grammar chosen by certain speakers from a certain age group, gender, residential area, and social class, particularly in the use of socially conditioned variants, such as [q] and [ʔ]. Including social constraints in the computation explains the variability in the use of [q] and [ʔ] among speakers from the same social group or different social groups. Chapter 3 also shows that certain social constraints give us expectations on what the speech of a certain speaker or a group of speakers should sound like. The same model deals with other types of phenomena independently from the sociolinguistic variation between [q] and [ʔ]. It shows that social constraints do not play a role in the stable use of [t] and [s] and [d] and [z]. The chapter shows that each of these four sounds has an underlying form that is identical to its surface form. Faithfulness constraints play a major role in maintaining the input in the output.

Chapter 4 presents the quantitative analysis regarding the use of the two sociolinguistic variants [q] and [ʔ]. In this chapter, I explore the association between social class and education, income, occupation, and residential area. Income, occupation, and residential area emerge as significant indicators of social class, whereas education emerges as insignificant. These findings correspond with my predictions of how social class should be determined in Syria and other Arab countries. I show that there is correlation between the two variants [q] and [ʔ], using a Chi-squared Bivariate test. I also explore the distribution of the data with respect to each of the independent variables to determine the type of statistical tests that should be implemented. The non-normality of the distribution and the overdispersion of the data called for the use of Negative Binominal regression procedures. In the main effects tests on both [q] and [ʔ], age, gender, and residential area emerged as significant factors in determining the use of [q] and [ʔ]. However, in the interaction tests, residential area emerged as insignificant regarding the use of [ʔ]. This result added one advantage to the model proposed in Chapter 3. Making social factors more specific by dividing them into a number of social constraints and implementing them in the GLA enables us to see interaction between one of the constraints of a social factor and other constraints. This specificity shows that the whole social factor does not have to be involved in the variation, but part of it may. Chapter 4 further examines whether frequency plays a role in acquiring certain words before other words. Frequency emerges as a facilitative factor in the acquisition of the prestigious form. Highly frequent words appear with [ʔ] in the speech of varying speakers more than less frequent words.

Chapter 5 presents a quantitative analysis of the use of [t] and [s] and [d] and [z]. Because this stable phenomenon is not socially conditioned, frequency effects are explored against two diachronic changes that led to the replacement of the SA [θ] and [ð] with [t] and [d] first and later with [s] and [z] respectively. Today, the use of the four variants is stable due to two opposing frequency effects (Bybee 2001). The first frequency effect led to the first diachronic change and the merger with [t] and [d]. The second frequency effect made highly frequent words resistant to the new creeping change: the use of [s] and [z] in place of [θ] and [ð] in borrowed words from SA. That is why we observe the use of [t] and [d] in highly frequent words in comparison to the use of [s] and [z] in less frequent words.

Chapter 6 concludes this work. It gives a brief answer to each of the five research questions that led this research. It also highlights other findings of the study such as the role frequency plays in both the use of [q] and [ʔ] and [t] and [d] and [s] and [z]. It also lists the advantages of and caveats about the new model. It gives suggestions and recommendations for future research, showing the possibilities of expanding on the social constraints proposed in this study. In general, the conclusion calls for exploring the possibility that social constraints could be universal in the same way that linguistic constraints are.

CHAPTER 2
METHODOLOGY

2.1 Setting: The City of Hims

The city we are concerned with in this study is Hims or Homs, as some people refer to it as a result of rounding the first vowel that is also a feature of the Himsi dialect. Hims is the third most important city in Syria and it is strategically located in the fertile Orontes River Valley in the central western part of Syria (Figure 2-1) on a hill approximately 450 meters above sea level. It is a crossroad between the capital Damascus 160 km to the south and the second major city Aleppo 190 km to the north and between coastal cities to the west, such as Tartus and Latakia and the eastern cities of Syria, such as Palmyra (in Arabic Tadmur) and Dayr az Zawr. Hims, known in Roman times as Emesa, is an ancient city dating back to the year 2300 B.C. (The Colombia Encyclopaedia 2007). The population of the City of Hims, according to 2002 estimates provided by the Homs City Council (2008), is 1,033,000. The city of Hims is the capital of the Hims Governorate, which is the largest among other Syrian governorates (40,940 square kilometer) (Syrian Arab Republic Central Bureau of Statistics 2002). The population of the Hims Governorate according to civil registration records is 1,791,000 (Arab Republic Central Bureau of Statistics 2004). This number includes both urban and rural areas (i.e., the city of Hims and the surrounding villages respectively). Excluding those who live outside Syria, the number of physically present residents of the Hims Governorate is estimated at 1,577,000.

The important strategic location and size of the Hims Governorate distinguish it from other Syrian governorates. It is the third governorate in industry, trade, and agriculture. The city itself is the “third largest industrial city in Syria” (Gilford 1978). The centrality of the city of Hims makes it an attractive center to a large number of rural people from the neighboring countryside. Those rural migrants find haven in Hims’ Al-Baath University, the third major public university in Syria, job market, and shopping and trading centers. From the late sixties and early seventies, a larger influx of rural migrants to major cities in Syria, particularly Hims, started taking place. Rural people started abandoning agriculture and their lands in their villages. With the government facilitating education and making it available free to everyone, they sought higher education to obtain governmental jobs, such as teaching, construction, and industry that includes the refinery and other major phosphate and chemical plants all of which are situated in Hims. However, Zakaria and Sibai (1989 cited in Mahayni 1990) suggest that migration was not only a response to industrialization but also to the dire socioeconomic situation in many rural areas of Syria. Thus, they suggest that the search for better life style and higher level of income motivates many to move to the city, particularly those with higher levels of education. In addition to the growth of sectors such as building and construction and social and personal services, the higher growth in the government sector provided more employment opportunities for the educated from the rural areas, inducing more migration (Mahayni 1990). Mahayni (1990) traced the population growth of both urban and rural areas in the Syrian governorates between the years 1960 and 1986 based on statistics from the Syrian Arab Republic Central Bureau of Statistics (1960, 1986). He found that the population of the city of Hims increased annually by 4.76% from 150,000 in 1960 to 502,000 in 1986, whereas the annual population growth of rural areas increased by 2.43% from 251,000 in 1960 to 469,000 in 1986. The higher growth rate of the population of the city of Hims is not ascribed to higher birth rate in the city; rather, it is the result of the migration of huge numbers of rural dwellers to the city of Hims. The proportion of rural migrants who lived in the city of Hims in 1970 was 25.4% of the total city population according to the Syrian Arab Republic Central Bureau of Statistics (reported in UNCEWA 1980).

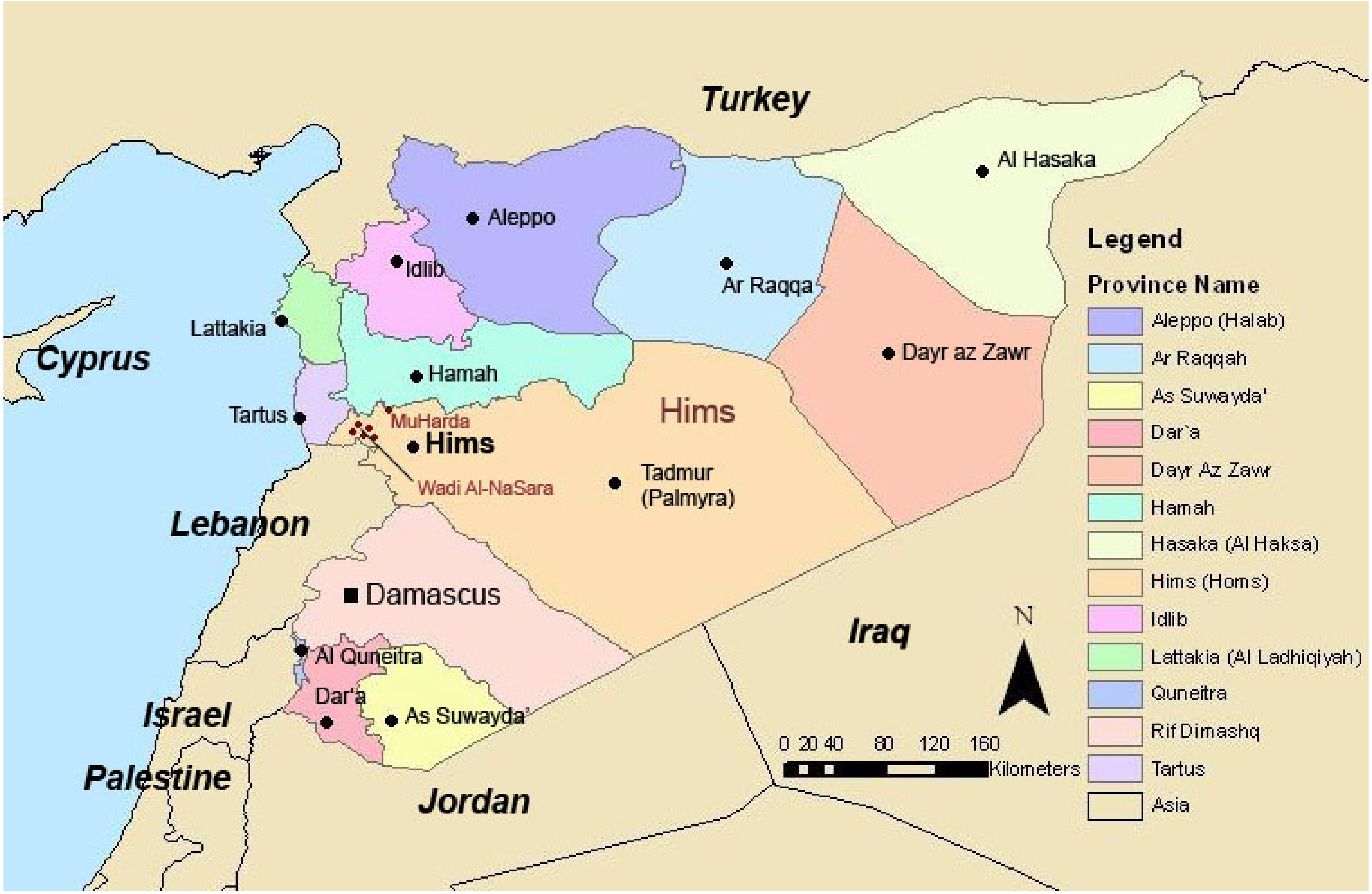

Figure 2-1. Map of Syria and neighboring countries.

Rural migration to big urban centers, such as Hims, is not only a Syrian phenomenon but also a phenomenon of many Arab countries that were developing and growing industrially. For example, Casablanca in Morocco has seen a huge influx of rural migration in the second half of the twentieth century because of industrialization (Hachimi 2005, 2007). This migration also resulted in “social, cultural and linguistic changes” (Hachimi 2007: 97). Thus, rural migration to urban (e.g., Hims) or urbanized (e.g., Casablanca) centers seems to be a wide spread phenomenon in the Arab world and usually results in linguistic variation because of language contact among various language varieties.

Hims, like other Syrian cities, is home to a diverse population of Sunnis, Alawites, and Christians as well as Armenians and Palestinian refugees. Before the Arab conquests after the birth of Islam in 622 A.D., Hims was mainly populated by Christians. It was taken by Muslims in 636 A.D. and the large Christian element of the city was eliminated after the rebellion in 855 A.D. (Encyclopedia Britannica 2008). However, Hims continues to have smaller concentrations of Christians in different residential areas and contains historically significant ancient churches from early Christianity, such as Umm Al-Zunnar (The Virgin Mary’s Girdle) and Mar Elian (St. Elias). These churches are situated in Al-Hameeddieh, one of the residential areas from which most of the participants (39 speakers) in this study come. Hims is also surrounded by a collection of Christian villages called Wadi Al-Nasara ‘The Valley of the Christians’ from which almost all of the study participants come (Section 2.1.2).

The Himsi people are known for their pride in their dialect, which is characterized by the use of [ʔ]. For this reason, they usually stigmatize other dialects, particularly the ones that contain the [q] sound such as many nearby rural dialects. The stigmatization of the use of [q] leads the rural people to adopt the [ʔ] and other speech features of the city people, so they can integrate into and be accepted as part of the urban community. The use of [ʔ] instead of [q] is considered more urbane in major Syrian cities, such as Damascus (Daher 1998a, 1998b) and Aleppo. Thus, many rural migrants start switching to the use of [ʔ] instead of [q] and consequently switch to other speech features.

2.2 Speech Sample

Thus, the center of investigation is the speech community of the city of Hims to which many rural speakers have migrated at one point in their life. The study greatly depends on naturally occurring speech from speakers who are not picked at random. According to Labov (1966: 43), the effects of the “observer’s paradox” may be partially overcome by obtaining samples from natural social interactions among in-group members (e.g., interacting with family members or “peer group”). The speech sample is taken from rural migrant speakers who belong to the Christian community at large to which I myself belong. They reside in two residential areas in Hims: Al-Hameeddieh and Akrama (Section 2.3.2 and Figure 2-2).

One important criterion when choosing the participants was being rural migrants to the city of Hims, representing the first generation, or the sons and daughters of those migrants who were born in the city of Hims, representing the second generation. In this sense, the study focuses on two generations or age groups: older and younger. Both male and female speakers were chosen from different economic and social background. With the exception of Speakers 19 & 5, all other participants come from the collection of the Christian villages called Wadi Al-Nasara (Figure 2-1) and mainly from the village of Oyoun Al-Wadi (thereafter Oyoun) ‘The Springs of the Valley’. The reason for choosing the village Oyoun and other neighboring villages is that I am originally from that village and familiar with the surrounding villages. Being an in-group member adds more naturalness to the conversations, having the opportunity to interview people who are relatives, friends, family members, and neighbors. Being an in-group member has been emphasized by many researchers as the most preferable method to obtain the most naturalistic speech data (e.g., Labov 1972a; Eckert 1991; Milroy & Milroy 1992). Hence, integrating into the investigated speech community has been the focus of many ethnographic studies, which required researchers to spend a long period getting to know the community (e.g., Gal 1978; Eckert 1989; Milroy 1980). Fortunately, I have had the advantage of being part of the community under investigation in this study. My own family is from the village of Oyoun, and I moved to Hims at the age of two years and two months. Most of the speakers moved to the city around the same time like my parents in the mid seventies, and we have strong social ties with them in one way or another. At home, my family uses the village dialect, but with distant friends and acquaintances, there is a switch to the Himsi dialect. Thus, I am acquainted with both dialects. This phenomenon of switching between two forms or two dialects is apparent in the speech of many rural migrants who live in the city and occasionally go back to visit the countryside.

A sample of fifty-two interviews comprises the data set (Table 2-1). The data were collected on two separate field trips to Syria. One trip took place in 2004; the other one was in 2006. In my first trip to Syria, I recorded forty-two speakers of whom I only investigate twenty-six speakers, those who fall within the age ranges that I am investigating in this study. During my second trip to Syria, I recorded thirty-six participants of whom I only investigate twenty-six speakers. Ten of the twenty-six speakers, who were recorded in 2004, were rerecorded in 2006 with the purpose of obtaining better sound quality as I was using a more advanced digital recorder with better voice reception equipment. Their recordings from 2006 are used in this study. The other sixteen speakers constitute new participants. In my first trip to Syria, I was able to record more participants because I went in a time of the year – May and June – when it was easy to find participants and record them; people had not yet started their summer vacations. Most of the people were still in the city because schools and universities were still open; university and school exams usually finish by the end of June. On my second trip, it was more difficult to get in touch with participants because July and August are the main vacation months for people in Syria. Most people commute a great deal more in these two months between the city and the village as well as take trips to the beach and other excursion trips. The fifty-two speakers are almost equally distributed between males (24) and females (28); lower middle class (29) and upper middle class (23); and younger age group (18-35) (24) and older age group (52+) (28). It is important to have a varied sample to examine the variable use of [q] and [ʔ]; [ð], [d], and [z]; and [θ], [t], and [s]. Most of the participants – fourty participants – come from the village of Oyoun where [q] is dominant. The other twelve participants come from the neighboring Christian villages, Wadi Al-Nasara, in which [q] is dominant. In addition, those twelve participants are either married to someone from Oyoun or are the son or daughter of one parent from Oyoun, and his/her other parent is from a neighboring village that has the same speech characteristics of Oyoun. For example, Speaker-1 is from Tin Sbil and married to Speaker-14 from Oyoun; Speaker-8 is from Juwaikhat and married to Speaker-20 from Oyoun; Speakers 33, 34, & 43 are the two sons and daughter of Speakers 8 & 20; Speakers 9 & 26 are from Ain Al-Ajooz and are husband and wife; Speaker-17 is from Habb Nimra; Speaker-21 is from Treez and married to Speaker-6 from Oyoun; and Speaker-42 is the daughter of a man from Oyoun. Speaker-19 is from Muharda; Speaker-5 is from Ilbi and married to Speaker-22 from Oyoun. Muharda and Ilbi are not in Wadi Al-Nasara, but they are also Christian villages characterized by the use of [q].

Table 2-1. Distribution of study participants

Speaker	Sex	Age	Social class	Occupation	Income	Education	Area
1	M	77	LM[3]	Retired Gov. employee	Low	Middle[4]	Akrama
2	M	67	LM	Retired Gov. employee	Low	Middle	Akrama
3	M	64	LM	Retired officer	Low	Middle	Al-Hameeddieh
4	M	60	LM	Retired Gov. employee	Low	High school	Al-Hameeddieh
5	M	70	LM	Retired Gov. employee	Low	Elementary	Al-Hameeddieh
6	M	67	LM	Retired Gov. employee	Low	High school	Al-Hameeddieh
7	M	64	LM	Retired Gov. employee	Low	High school	Al-Hameeddieh
8	M	53	LM	Teacher	Mid	B.A. Economics	Akrama
9	M	70	UM	Retired Director of Customs (also published a historical book)	High	B.A.	Al-Hameeddieh
10	M	69	UM	Unemployed	Mid	Middle	Al-Hameeddieh
11	M	62	UM	Civil Engineer	High	B.A.	Al-Hameeddieh
12	M	62	UM	Business man	High	High school	Al-Hameeddieh
13	M	64	UM	Teacher	Mid	High school	Al-Hameeddieh
14	F	75	LM	Housewife	Low	Elementary	Akrama
15	F	61	LM	Housewife	Low	Elementary	Akrama
16	F	61	LM	Teacher	Low	A.A.	Al-Hameeddieh
17	F	61	LM	Teacher	Low	A.A.	Al-Hameeddieh
18	F	59	LM	Gov. employee	Low	Middle	Al-Hameeddieh
19	F	56	LM	Teacher	Mid	A.A.	Al-Hameeddieh
20	F	52	LM	Teacher	Mid	B.A. Fr. Lit	Akrama
21	F	53	LM	House wife	Low	Middle	Al-Hameeddieh
22	F	67	LM	House wife	Low	Elementary	Al-Hameeddieh
23	F	58	LM	Teacher	Low	A.A.	Al-Hameeddieh
24	F	58	UM	Housewife	Mid	Middle	Al-Hameeddieh
25	F	57	UM	Housewife	High	High School	Al-Hameeddieh
26	F	61	UM	Housewife	High	High School	Al-Hameeddieh
27	F	58	UM	Teacher	Mid	A.A.	Al-Hameeddieh
28	F	57	UM	Housewife	High	Middle	Al-Hameeddieh
29	M	31	LM	Medical doctor	Low	Professional	Akrama
30	M	25	LM	Civil Engineer	Low	B.A.	Akrama
31	M	35	LM	Assistant engineer	Low	A.A.	Akrama
32	M	30	LM	Salesman	Low	A.A.	Al-Hameeddieh
33	M	23	LM	Medical student	Mid	Medical student	Akrama
34	M	19	LM	Medical student	Mid	Medical student	Akrama
35	M	24	UM	Medical doctor	High	Professional	Al-Hameeddieh
36	M	23	UM	Salesman	High	High school	Al-Hameeddieh
37	M	24	UM	Dentist	Mid	Professional	Al-Hameeddieh
38	M	36	UM	Medical doctor	Mid	Professional	Al-Hameeddieh
39	M	27	UM	Dentist	High	Professional	Al-Hameeddieh
40	F	35	LM	Gov. employee	Low	A.A.	Al-Hameeddieh
41	F	28	LM	T.A. architecture	Low	M.A.	Al-Hameeddieh
42	F	24	LM	Agricultural engineer	Low	B.A.	Al-Hameeddieh
43	F	18	LM	Student	Mid	High school	Akrama

[3] LM and UM refer to lower-middle class and upper-middle class respectively.

[4] ‘Middle’, ‘High’, and ‘Elementary’ in Table 2-1 refer to the type of school they have completed. ‘A.A.’ refers to associate degree or some college. ‘B.A.’ refers to Bachelor’s of Art.

Table 2-1. Continued.

Speaker	Sex	Age	Social class	Occupation	Income	Education	Area
44	F	29	LM	Gov. employee	Low	A.A.	Akrama
45	F	28	UM	Agricultural engineer	Mid	B.A.	Al-Hameeddieh
46	F	33	UM	Private sector employee	High	B.A. E. Lit.	Al-Hameeddieh
47	F	32	UM	House wife	High	A.A.	Al-Hameeddieh
48	F	28	UM	Housewife	High	B.A. Law	Al-Hameeddieh
49	F	23	UM	Civil engineer	High	B.A.	Al-Hameeddieh
50	F	25	UM	English teacher	High	B.A. E. Lit.	Al-Hameeddieh
51	F	21	UM	Pharmacy student	High	B.A.	Al-Hameeddieh
52	F	26	UM	Food Engineer	High	B.A.	Al-Hameeddieh

Informal conversations in Colloquial Arabic, lasting between 30-45 minutes with each individual, are audio-recorded, transcribed and analyzed. On my first trip to Syria, I used an analog tape recorder that was placed close to the participant to capture the whole conversation as clearly as possible. I, then, digitized the tapes, so I can listen to them on my computer. On my second trip, I used a good quality digital recorder (marantz Professional Solid State Recorder PMD660) and a small microphone that is pinned to the blouse or shirt of the participant to have a better sound quality recording for the sake of phonetic transcription. The recordings took place either in my family home in Hims or in the informants' homes, whichever was more convenient at the time. In the interviews, I used the [ʔ] sound with all the interviewees, some of whom were very open to using their village dialect with me despite my use of [ʔ]; probably, they felt comfortable using their mother tongue because they know that I come from the same hometown. Had someone from the city led the interviews, I would think that more variation and thus more use of [ʔ] would have been observed. As for the other variants, I talked naturally, so they will be pronounced as I would usually use them in natural speech. It is difficult to specify which variable I was using because I myself may vary in using the other variants. This is not a problem because all speakers behave in the same way regarding the four variants, [t] and [s] and [d] and [z]; each of the four variants is used in specific lexical items or words (Chapter 5). There is barely any doubt or rather it is predictable which variant will occur in a certain word. No one was informed of the exact focus of the study. When they asked about the purpose of the study, they were informed that it deals with the social influence on sound change, but no specific details were added. However, the participants were instructed that the interviews were intended to be as natural and as informal as possible, so they should not put any effort into thinking about what they should or should not say. In addition, they were informed that their identity as well as their conversation would be highly confidential. All of the conversations were natural and did not follow any preconceived format. Topics of the conversations varied, allowing the speaker to talk about any subject that appealed to him/her (e.g., telling jokes; funny, sad, or frightening stories; relating dreams; work, love, marriage, and relationships stories; family issues; and other personal interests). Thus, the interviewees were free to speak about any topic they wanted. Conversations mostly started by my asking the participant about his/her family, children and other matters of mutual interest. After some questions and answers, if the conversation slowed down or there was not much to say, informants were asked to tell a happy or sad story, a dream, or an experience that they had experienced. To maintain the naturalness of the conversation, other family members were allowed to be present during the recording of all the participants. Thus, occasional intervention from other attendees sometimes heated the conversation and made the speaker more oblivious of the tape recorder.

It is worth noting that some of the speakers are related to each other. Speakers 35, 36, 46, 47, & 48 are respectively the two sons and three daughters of Speakers 12 & 28. Speaker-52 is the daughter of Speaker-25. Speakers 49, 50, & 51 are sisters. Speakers 45, 37, & 38 are respectively the daughter and two sons of Speakers 27 & 13. Speakers 44, 29, 30 & 31 are respectively the daughter and three sons of Speakers 15 & 2. Speakers 33, 34 & 43 are respectively the two sons and daughter of Speakers 20 & 8. Speaker-41 is the daughter of Speakers 3 & 16. Speaker-40 is the daughter of Speakers 24 & 10. Speaker-39 is the son of Speaker-11. Speaker-32 is the son of Speakers 1 & 4. The following sets of speakers are married: 27 & 7; 26 & 9; 22 & 5; 21 & 6; and 14 & 1. Only Speakers 17 & 19 do not have relations in the subject set, but they are very good friends of my mother.

2.3 Variables under Investigation

2.3.1 Linguistic Variables

This study investigates three variables, (q), (θ) and (ð)[5], whose realizations in the speech of non-migrant rural speakers or rural colloquial Arabic (RCA), native Himsi speakers or Himsi colloquial Arabic (HCA), and migrant rural speakers are illustrated in Table 2-2. Note that Table 2-2 includes an extra variable, (ʔ), because /ʔ/ is a separate phoneme in all varieties and it is realized as [ʔ] in all varieties. This information will become useful when we study the contrast between [q] and [ʔ] in RCA in comparison to the neutralization that takes place in HCA in Section 3.2.1.

Table 2-2. Variants of the variables (q), (θ), and (ð) in the speech of non-migrant rural speakers, native Himsi speakers, and migrant rural speakers

Variable	Variants of non-migrant rural speakers (RCA)	Variants of native Himsi speakers (HCA)	Variants of migrant rural speakers
(q)	[q]	[ʔ]	[q] ~ [ʔ]
(ʔ)	[ʔ]	[ʔ]	[ʔ]
(θ)	[t] ~ [s]	[t] ~ [s]	[t] ~ [s]
(ð)	[d] ~ [z]	[d] ~ [z]	[d] ~ [z]

[5] Check Appendix F for tables that include the IPA symbols of SA, RCA, and HCA. These tables will help throughout this study in understanding the sounds used in phonetically transcribed words.

2.3.1.1 The variable (q)

One of the dependent variables of the study is (q), which is realized in the speech of the Himsi community, including native Himsi speakers and rural migrants, as two variants: [q] and [ʔ] (Table 2.2). Native Himsi speakers always use [ʔ], whereas rural migrants may vary between [q] and [ʔ], taking into account that [q] is their native form. There is no specific phonological context in which [ʔ] occurs as a replacement for [q] in the speech of rural migrants. It can occur in many phonological contexts except in certain lexical borrowings from SA, such as [qurʔaan] ‘Qur’an’, [liqaaʔ] ‘meeting’, and [θaqaafe] ‘cultural’. For example, the rural migrants’ words [qalem] ‘pen’, [raqbi] ‘neck’, and [wareq] ‘paper’ become [ʔalam], [raʔbi], and [waraʔ] respectively in the speech of those who adopt the Himsi variant [ʔ]. These examples show that the change could occur word-initially, word-internally, and word-finally. One can also observe in the given examples that the change from [q] to [ʔ] could also be accompanied by vowel changes, such as the change of [e][6] to [a] in [qalem] and [ʔalam] and [wareq] and [waraʔ]. This is not the case with all speakers. The change from [q] to [ʔ] could act independently from vowel changes. However, this is beyond the scope of this study.

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[6] This is what is called an *ʔimala*. This feature exists in some Arabic dialects; it is defined as the use of [e] instead of [a] or [ee] instead of [aa]. *ʔimala* is a feature of the rural dialects under investigation, and it usually undergoes change in the speech of rural migrant speakers who accommodate the Himsi forms, [a] and [aa], to appear prestigious. *ʔimala* exists in some central Syrian dialects (Versteegh 1997:153), which include the rural dialects under investigation. It is a historical change from a > e in different linguistic environments. In Northern Syrian dialects, such as the dialect of Aleppo, this change takes place in the neighborhood of an [i] vowel or when the [a] vowel occurs after consonants (e.g., lisan > lsen ‘tongue’, ʒamiʔ > ʒemeʔ ‘mosque’, kateb > keteb ‘writing’, and ṭaleb > ṭeleb ‘striving’) (Versteegh 1997). The change in the speech of migrant rural speakers takes the opposite direction of that historical change, i.e. [e] becomes [a], in order to sound urbane. Nonetheless, this vowel change is beyond the scope of this study and requires further investigation.

It is worth noting that lexical borrowings are excluded from this study because rural and urban people pronounce them the same. Including them may skew the results, particularly in the speech of professionals who use a number of jargon words from their own profession and repeat them many times in their speech. Hence, excluding lexical borrowings from the data yields better results and gives a better picture of the variation among the various groups of speakers. Ferguson (1997) and Daher (1998a, 1998b) emphasize that the use of [q] in some words in Damascene Arabic, which is characterized by the use of the glottal stop as a replacement to the /q/ sound in Classical/Standard Arabic, is the result of lexical borrowing. Haeri (1991, 1996) also attributes the existence of [q] in some words in Cairene Arabic to lexical borrowing. In a study (2005) of 'The role of social factors, lexical borrowing and speech accommodation in the variation of [q] and [ʔ] in the colloquial Arabic of rural migrant families in Hims, Syria', I investigated lexical borrowings in Himsi colloquial speech. I found that a native Himsi speaker also uses [q] in borrowed words from SA. I compared the words produced by that Himsi speaker with the [q] sound with other studies and found that they are similar to the borrowed words used in Cairene Arabic (Haeri 1991, 1996) and they are similar to the words produced with the [q] sound by the younger generation. Given the similarity among urban dialects characterized with [ʔ] and based on my (2005) study of lexical borrowings in HCA, I have no reason to believe that lexical borrowings should be included in this study.

2.3.1.2 The variable (θ)

The second dependent variable is (θ), which occurs in the colloquial speech of the Himsi community as either [t] or [s] (Table 2.2) (e.g., [θalʒ] 'snow' in SA is pronounced as [talʒ] in HCA and RCA, whereas [θaʕlab] 'fox' in SA occurs as [saʕlab] in HCA and RCA). Some words may occur using either variants (e.g., [θaaluuθ] 'Trinity' in SA could occur as either [taaluut] or [saaluus] in HCA and RCA). One can observe that when one [θ] changes to [t], the other [θ] also changes to [t] and so is the case with respect to [s]. Since conversations were very natural, the SA variant [θ] rarely occurred and was mostly in lexical borrowings from SA. Even then, it was mostly produced as [s], rather than [θ]. For example, the form [saaluus] 'Trinity' could be considered an attempt on the part of the speaker to imitate the SA form. The lack of [θ] in the speech of speakers results in the choice of the closest less marked form possible, in this case [s] that has a phonemic representation, /s/, in the speakers' repertoire. This is comparable to the Thai and Russian use of [t] and German and Japanese use of [s] instead of [θ] because of the absence of this sound from their inventory. Lombardi (2003) attributes this phenomenon to the interaction of faithfulness and markedness constraints. Similarly, markedness could have played a major role historically in producing the SA [θ] and [ð] as [t] and [d] respectively. The merger of [θ] and [ð] with [t] and [d] respectively was completed around the 14th century (Daher, 1998a, 1999). We know that fricatives are more marked than stops cross-linguistically, and interdental fricatives are even more marked than other fricatives because of the extra distributed feature [+Distributed] they have. Consequently, people in the past apparently preferred to use the less marked forms in their colloquial dialects, deviating from the SA pronunciation. Recently, the minor reappearance of [θ] and [ð] in the speech of some Damascene speakers who hold writing jobs is attributed to increased education and lexical borrowings from SA (Daher, 1998a, 1999). Daher's hypothesis may also apply to the production of [θ] and [ð] as [s] and [z] respectively in the speech of some speakers. In their attempt to imitate the SA variety, speakers fail to produce the more marked sounds [θ] and [ð], replacing them instead with the less marked sounds [s] and [z] respectively. This can be evidence of the absence of the two sounds /θ/ and /ð/ from their inventory, given the fact that those speakers have the two phonemes /s/ and /z/ in their inventory. In this case, education as a social factor may play a role alongside markedness to yield an output that is close to the input, but lacking a feature that adds markedness to it (i.e., [+ Distributed]). This situation mirrors a struggle between markedness and faithfulness constraints that might be militating against the change of the continuant feature in [θ] and [ð] but not against the change of the distributed feature, resulting in [s] and [z] respectively instead.

2.3.1.3 The variable (ð)

The third dependent variable is (ð), which often occurs as either [d] or [z] in HCA and RCA (Table 2.2) (e.g., [ðaqn] in SA occurs as [daʔn] in HCA and [daqn] in RCA, whereas [ðauuq] ‘taste, propriety’ in SA occurs in HCA as [zooʔ] and in RCA as [zooq]). Notice also the vowel differences between the two words. Some words may occur using either variants (e.g., [ðiʔb] ‘wolf’ in SA is pronounced [diib] or [ziʔb] in HCA and RCA). Notice when the [ð] changes to [d], vowels tend to change too. On the other hand, when [ð] changes to [z], vowels and other sounds existent in the words are retained. This might be an indication that the speaker is trying to imitate the SA pronunciation but because of the high markedness of [ð] or the lack of this sound in the HCA and RCA phonemic repertoire, s/he tends to resort to the closest sound possible (i.e., [z]), which exists in their phonemic inventory. At the same time, they maintain the vowel system and possibly other sounds in that word. One can observe in words such as the SA [ðabðaba] ‘vibration, oscillation’, which are produced as [zabzabi] in HCA and RCA, that when one [ð] is produced as [z], the other [ð] is also produced as [z]. Since conversations were very natural, the SA variant [ð] rarely occurred and was mostly in lexical borrowings from SA. Even then, it was mostly produced as [z], rather than [ð]. As in the case of the variable (q), the very few lexical borrowings with [θ] and [ð], which occur in the data are excluded for better understanding of this phenomenon.

2.3.2 Social Variables

Independent or extralinguistic variables included are as follows:

1. Sex (24 males and 28 females).
2. Age (two age groups: 18-35 and 52+). Twenty-four participants are in the younger age group, and twenty-eight participants are in the older age group. The older age group consists of 13 males and 15 females; the younger age group consists of 11 males and 13 females.
3. Social class (two social classes: lower-middle and upper-middle). The social class of participants is determined based on the community's general classification of them as somewhat rich or somewhat poor (Section 4.2). This social classification will be examined in Section 4.2 against the following social indicators: family income (mainly breadwinner income), education, occupation and residential area. Twenty-three participants are in the upper-middle class, and twenty-nine participants are in the lower-middle class. However, education and occupation may affect the person's social class with time. If a person is a medical doctor or an engineer who comes from a poor family, his/her social status may change when s/he becomes more known and starts making more money. This kind of social mobility (Haeri 1991, 1996) is taken into account.

4. Residential areas (two residential areas in the City of Hims: Al-Hameeddieh and Akrama). Only 13 speakers are from Akrama; the remaining 39 speakers are from Al-Hameeddieh.

2.3.2.1 Overview of Al-Hameeddieh

Al-Hameeddieh is one of the oldest residential areas in Hims connected to the central downtown area of Hims (Figure 2-2). It is in the center of the old city of Hims, which is surrounded by a wall that has seven gates that connect the old part of the city to the newer one. Very few remains of the wall exist on the eastern side of the old city. The gates surround the Al-Hameeddieh area and continue to play symbolically the role of a connecting passageway between the old city and the new extensions of the city of Hims. Al-Hameeddieh is mainly a Christian residential area with cultural and traditional values, which include the linguistic behavior of the native Himsi inhabitants (i.e., the use of [ʔ]). It obtains many of its cultural and traditional values from the many historical and residential palaces and historical sites, which exist in it and surround it. These sites include Umm Al-Zunnar (The Virgin Mary's Girdle) Church; Mar Elian (St. Elias) Church; Al-Arbaʻin Shahid (Forty Martyrs) Church; Al-Zahrawi Palace, a tourist site; Farkouh Palace among others that are turned into beautiful restaurants that maintain traditional decoration traits; Hims Citadel; Al-Nour Mosque; and the Mosque of Khalid Ibn Al-Walid, the Muslim conqueror to whom the city fell in 636 A.D. This mosque is also used as a logo to represent the city of Hims. The residential houses, or, as referred to, palaces, stand witness to the prominent people that have lived historically in this area. Up to this day, people who live in Al-Hameeddieh are conceived of by other inhabitants of the city of Hims as upper class; thus, as a residential area, it is imbued with prestige. The cultural richness of Al-Hameeddieh contributes to this general view. Being a Christian residential area, many of the Christian rural migrants, who constitute the participants of this study, prefer living in it to living in the suburbs. Furthermore, kinship, family ties, and social ties with friends, relatives and neighbors are highly valued in most of the Arab countries and particularly for rural people. Hence, it is important for most rural migrants to the city to live in an area, such as Al-Hameeddieh, where they can maintain connection with their own Christian tradition, practices and rituals as well as keep their strong ties with relatives and friends who come from the same background and live in the same area. Living in the same area enables them to see each other more often and keep up with each other's life as well as have a solid support system.

2.3.2.2 Overview of Akrama

On the other hand, Akrama is a newly developing residential area in the suburbs of Hims (Figure 2-2). It started developing and growing about thirty years ago. Its development is concurrent with the establishment and development of Al-Baath University (founded 1979), which is located in that suburban area. Akrama is mainly occupied by rural migrants, mainly Alawites whose speech is characterized by the use of [q][7]. Hence, it is more diverse in terms of inhabitants than Al-Hameeddieh. Therefore, the two residential areas differ with respect to their history. As a new residential area, Akrama has not yet acquired the prestige associated with Al-Hameeddieh. The well-established linguistic tradition and prestige associated with Al-Hameeddieh are expected to have a greater influence on the newcomers, especially since the majority of the residents are native Himsis. This influence not only includes cultural and

[7] Religion could be considered a variable, as there is always the possibility that Christian rural migrants may behave differently from other rural migrants from other religions, such as Alawites. This variable is not tested in this study, but it could be a good source of information in future studies and comparisons among various rural migrant speakers to the city of Hims or any other urban area in Syria. It is also worth noting here that the [q] sound used by the Alawites is observed to be stronger and more prominent than the [q] sound produced by the Christians whose speech is characterized with [q]. Some people ascribe the strength of the [q] sound of the Alawites to their desire to distinguish themselves as Alawites. They feel proud to be Alawites because the leader of Syria is Alawite; they feel that they could obtain power over others through their speech. If they sound like an Alawite, other people may fear them or surrender to their wishes. Consequently, one would expect Alawites to behave differently from Christian rural migrants. In other words, they may cling to their native linguistic features more than Christian rural migrants. Thus, one may find that the Alawite rural migrants' use of [q] is higher than that of Christian rural migrants.

traditional values, but also salient linguistic features and values. This influence might be minor in Akrama, since the majority of the residents are not originally Himsis. Those residents have moved in recently and most of them maintain their native linguistic features since they come from diverse backgrounds. This, however, does not exclude the possibility that there may be some influence of the city linguistic features on some residents in Akrama. This could be due to exposure to the city linguistic features through school, university, workplace and acquaintances from different parts of the city.

2.4 Analysis

I listened to all recordings more than once for intra-rater reliability, transcribing all the words that contain the variants under investigation. Since the study deals with quantitative analysis of the data, there was no need to transcribe all the recordings; it was sufficient to transcribe features that are relevant to the study.

After transcribing all the relevant words, the number of occurrences of [q] and [ʔ] (Chapter 4); [ð], [d], and [z]; and [θ], [t], and [s] (Chapter 5) in the speech of each informant is calculated. The raw numbers of observations are transformed into percentages to have balanced comparisons among individuals. Percentages within groups and among groups are also calculated to have an estimate of the difference in variation between males and females, the two age groups, the two residential areas, and the two social classes. An SPSS program is used to enter the various dependent and independent variables. The independent variables are classified using a nominal measure that is assigned a numeric value in SPSS. For example, females and males are given the numbers 1 and 2 respectively and so is the case with respect to the two age groups, the two social classes, and the two residential areas. The numbers of observations of each of the dependent variants for each informant are entered as a scale measure. For example, if the [q] sound occurs

100 times in the speech of a participant, the number 100 is entered as it is for that participant under the variant column specified for [q] and so is the case for the other variants and for all the participants. These raw observations are entered into a Generalized Linear Model (GZLM) to determine the effect of all of the extralinguistic variables on the usage of the linguistic variants. The GZLM is used when the dependent variable is quantitative and the independent variables are quantitative and/or qualitative. These models are regression models in which dummy variables are used for qualitative variables (Agresti and Finlay 1997). The GZLM has an advantage over the multivariate procedure of the General Linear Model (GLM), which only assumes a normal distribution of the data. The GZLM does not assume normal distribution, which may not be the case in variable data. The GZLM can deal with both normally and non-normally distributed data. Like the GLM, the GZLM enables us to enter more than one independent variable at the same time and see the effect of each of the social factors on each of the dependent variants. It also enables us to select the most significant social factors in fomenting the change and to exclude the non-significant ones. Further, within the same model, we are able to measure the main effects of each social variable as well as the interaction among those variables. Thus, the results will show which independent variable(s) is(are) the most significant and which one(s) is(are) the least significant. Chapter 4 gives more details about the use of these statistical models.

Other analyses were performed, such as investigating the linguistic environment for each of the four variants, [t] and [s] and [d], and [z], to see if the linguistic environment influences the choice of one variant over another (Section 3.3). I also manually entered the transcribed words for each variant for each speaker into the computer. I then calculated the occurrence of each word in the speech of each individual. I tabulated this information for each of the fifty-two speakers, including the words, their meaning, the number of occurrence of each word, the total number of words for each variant, and the total number of words for each set of alternating variants (i.e., for [t] and [s] and for [d] and [z]). I also calculated the percentages of the total number of words for each variant with respect to the total number of words for each set of alternating variants. Then, I manually calculated the number of occurrence of each word in the speech of the fifty-two speakers to check if frequency plays a role in determining the choice of one variant over another. I tabulated this information separately, including the words, their meaning, the number of occurrences of each word, and at the end the total number of words for each variant. This information forms a small corpus of words for the four variants. I performed this process first for the variants [t] and [s] and [d], and [z] (Chapter 5). Then, I performed the same process for the variants [q] and [ʔ] (Chapter 4).

The following chapter will present a theoretical analysis of the data, applying OT and the GLA. I will introduce a number of social constraints and incorporate them with linguistic constraints to explore the possibilities that this model can offer us in accounting for sociolinguistic variation and change.

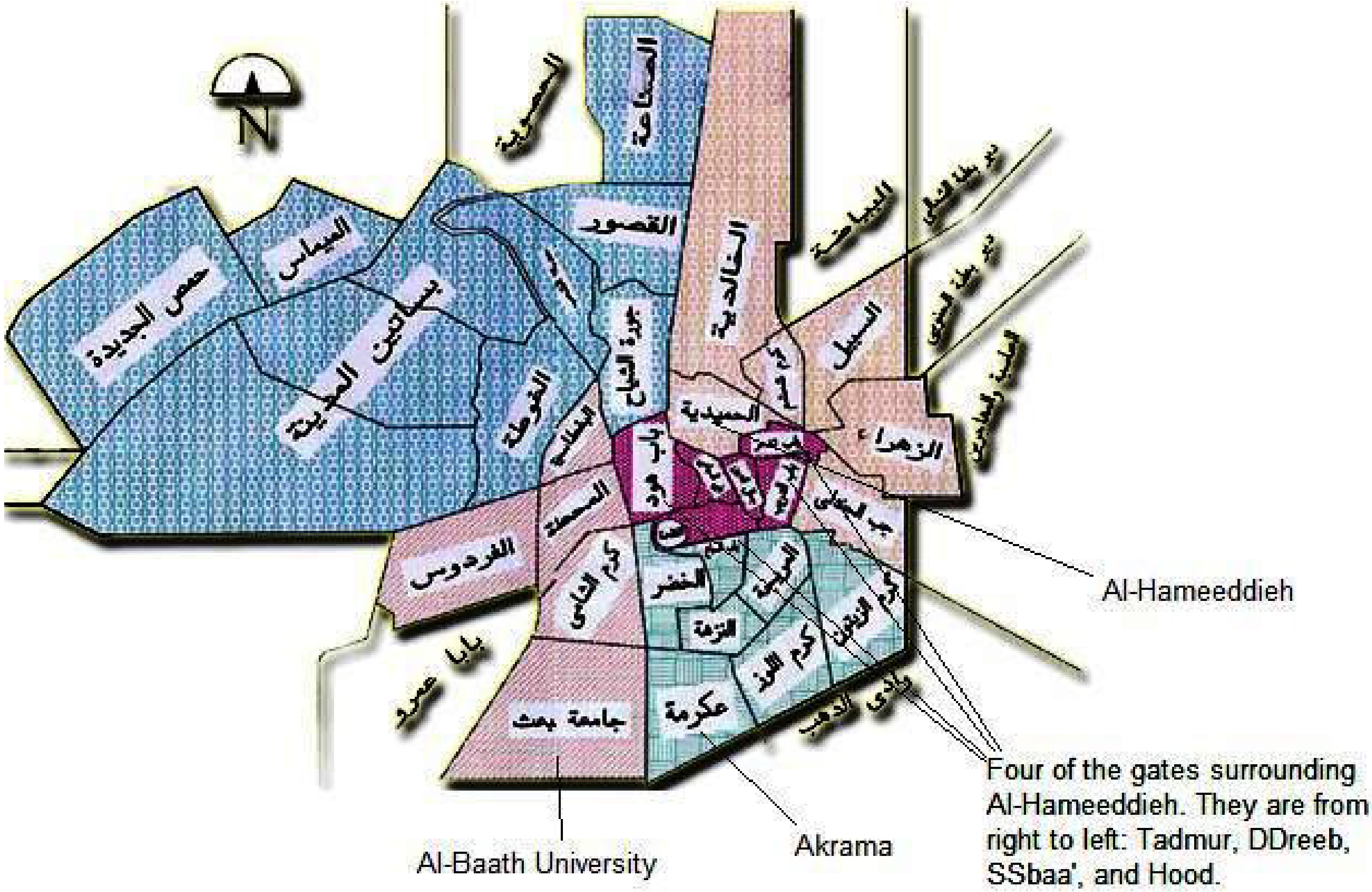

Figure 2-2. City Plan of Hims. Adopted from the Homs City Council (2008). I point to the areas of concern in this study and give their name in English, as a point of reference.

CHAPTER 3
THEORETICAL ANALYSIS

3.1 Introduction to the Theoretical Analysis of the Data

Having discussed the working mechanism of the GLA and its advantages over other approaches to language variation, I will now present the theoretical analysis that motivated this study. In the GLA and OT, mainly linguistic, phonetic, phonological, morphological, or syntactic constraints have been taken into account. Thus, to answer the question about how we could model sociolinguistic variation using these theoretical frameworks and how we could intersect the social and the linguistic within the same theory or framework, I propose a number of social constraints and integrate them into the GLA. These constraints will interact with linguistic markedness and faithfulness constraints that militate against a certain sound or against the change of a certain sound respectively.

I will start with modeling the observed variation between [q] and [ʔ] in the speech of rural migrant speakers to the city of Hims, proposing and implementing linguistic constraints and social constraints that are pertinent to this variation, stating the motivation behind them. I will show examples with and without the intersection of social constraints with phonological constraints. This will allow the reader to see different results when social constraints are involved, results that match or approximate real life occurrences. The inclusion of social constraints in the computation will provide an explanation of the observed intra- and inter-speaker variation (i.e., the speakers' different grammars within the same social group or community or among different social groups).

Then, I will take on the constraints that are required to model the stable variation we observe with respect to [t] and [s] and [d] and [z] in the speech of all speakers. With stable variation, I mean that certain words are consistently pronounced with one of the four variants and never with one of the other variants; thus, the four variants are not interchangeable. I will explain this point more when I explore these four variants in depth in Section 3.3. We will observe later on that the latter variation is led by different factors from the former variation, in that the interaction between social constraints and linguistic constraints does not make a difference. What are at work in this type of variation are mainly faithfulness constraints that militate against the change of some sound features to maintain contrast in pronunciation among various words that historically stemmed from SA [θ] and [ð].

3.2 Modeling Variation between [q] and [ʔ]

In this section, I will first explore the linguistic constraints that are required to account for the observed variation between [q] and [ʔ] in the speech of rural migrant speakers to the city of Hims. Then, I will propose a number of social constraints and intersect them with the proposed linguistic constraints to account for the intra- and interpersonal variation observed in my data. The proposition of social constraints and intersecting them with linguistic constraints will show that the social and linguistic can be intertwined in one linguistic theory. It will also show that social factors do influence our choice of a grammar at a certain time and place. Above all, social constraints determine the degree of intra- and interpersonal speech variation, the ranking value of other constraints, and the percentages of the occurrence of each of [q] and [ʔ]. They provide explanation of the speakers' different grammars and give us expectations on what the speech of a certain speaker or group of speakers should sound like. In this study, we will see tangible evidence of the influence of social constraints on our grammar, evidence that makes them not only influential but also part of our grammar.

3.2.1 Linguistic Constraints Pertinent to the Variation between [q] and [ʔ]

In SA, the two sounds /q/ and /ʔ/ are contrastive; /q/ is pronounced [q] (Haeri 2003) in speaking, writing and reading, while /ʔ/ is pronounced [ʔ]. The case is similar in the original/native dialect of rural migrant speakers to the city of Hims, which I will refer to hereafter as the rural colloquial Arabic (RCA). Thus, in RCA, /q/ and /ʔ/ are also two contrastive sounds; each is pronounced as [q] and [ʔ] respectively. In the speech of original/native speakers of Hims, however, these two sounds are neutralized. I will refer to the dialect spoken by Himsi people hereafter as the Himsi colloquial Arabic (HCA). This difference between HCA, on the one hand, and RCA and SA, on the other hand, is illustrated in Table 3-1.

Table 3-1. Variants of the variable (q) in SA, HCA, and RCA

Variable	Variants in SA	Variants in RCA	Variants in HCA
(q)	[q]	[q]	[ʔ]
(ʔ)	[ʔ]	[ʔ]	[ʔ]

The absence of the [q] sound in the speech of Himsi speakers can be considered an indication of the absence of /q/ form their phonemic inventory. In other words, only the phoneme /ʔ/ is present in their phonemic repertoire. For example, the SA words /ʔalam/ 'pain' and /qalam/ 'pen' are pronounced the same in the Himsi dialect, [ʔalam][8]. Where the two words are phonologically distinct in SA and RCA, they are neutralized in HCA. The meaning of *ʔalam* is inferred from the context (Appendix F, Himsi Colloquial Arabic Phonemic System in IPA):

(1) *ʕindi ʔalam ʔaħmar*. 'I have a red pen.'

[8] Other examples of words that can have the same pronunciation in HCA are: /qiʈaar/ 'train' and /ʔiʈaar/ 'frame' are pronounced as [ʔiʈaar]; /qamar/ 'moon' and /ʔamar/ 'ordered' as [ʔamar]; /qisim/ 'department, part' and /ʔisim/ 'name'; [qaal] 'he said' and [ʔaal] 'lineage, the family of'; /qalb/ 'heart' and /ʔalb/ 'Alps Mountains' as [ʔalb]; and [daaq] 'taste' and [daaʔ] 'illness'. [daaq] 'he tasted' is in SA [ðaaq]. Compare the colloquial [d] to the SA [ð].

(2) *ʕindi ʔalam maa maʕʔuul*. ‘I have an unbelievable pain.’

The supposition that /q/ is absent from the phonemic inventory of HCA speakers is consonant with Haeri’s (1991, 1996) findings which were based on an experiment that was performed on twenty-seven children, ages five to twelve. Although the experiment was done on Cairene children, it shows that it is very difficult to elicit words containing [q] from children who are exposed only to the [ʔ] in childhood. Haeri concludes that the reappearance of [q] in Cairene colloquial speech is the result of lexical borrowings from SA, and that children acquire [q] later on in life through formal education. The situation regarding the use of [q] in lexical borrowings from SA and [ʔ] in all other lexical items seems to be an urban phenomenon that applies in major urban centers, such as Damascus (Daher 1998), Amman (Abdel-Jawad 1981), and Hims (Habib 2005) just to mention a few. Given the similarities among urban Arabic dialects of which [ʔ] is the prestige marker, there is no reason to believe that HCA is different. In this sense, HCA speakers lack /q/ in their phonemic system and tend to acquire it later on in life and use it only in lexical borrowings from SA that are adopted through formal education (Habib 2005, Section 4.1). The difference between HCA and RCA regarding their phonemic systems is illustrated in Table 3-2. All other consonants are the same in both dialects (Appendix F).

Table 3-2. Phonemic difference between HCA and RCA speakers

Dialect	Phoneme	Corresponding Realization
RCA	/q/	[q]
	/ʔ/	[ʔ]
HCA	/ʔ/	[ʔ]
RCA migrant speech	/q/	[q] ~ [ʔ]
	/ʔ/	[ʔ]

Moreover, the two words /ʔalam/ and /qalam/ contrast in their underlying and surface representation in SA and RCA, but their surface representation is the same in HCA, [ʔalam], indicating neutralization. Thus, an RCA speaker who has the underlying form /qalem/[9] neutralizes the /q/ sound of his/her surface form [qalem] into [ʔ] if s/he adopts the HCA grammar. In order to understand the mechanism of acquiring the new form [ʔ] by RCA speakers who migrate to the city, I will present first the individual grammar of each dialect pertinent to the use of [q] and [ʔ]. Then, I will show what happens when an RCA speaker tries to adopt the new form and make it part of his/her own grammar.

3.2.1.1 Grammar of RCA

As mentioned earlier, in RCA, like SA, the two sounds [q] and [ʔ] are contrastive. In order to preserve this contrast, we need a set of constraints to depict the RCA grammar. Since we are dealing with the two sounds [q] and [ʔ], I propose that there should be two context-free markedness constraints pertaining to the two sounds in question. These two constraints are *q (Voiceless uvular stop is marked) and *ʔ (Glottal stop is marked). Each of the two constraints militates against one of the two sounds. The preservation of the contrast requires some faithfulness constraint(s). The feature Retracted Tongue Root (RTR) is characteristic of the [q] sound, as indicated in Davis (1993, 1995), Shahin (1998), and Zawaydeh (1998). Hence, to preserve this feature in /q/, we need the faithfulness constraint IDENT-IO (RTR) (Let α be a segment in the input, and β a correspondent of α in the output. If α is [γRTR], then β is [γRTR]).

[9] Notice here that the underlying form is /qalem/, not /qalam/ that is the underlying form in HCA, because this is the surface form in RCA. Speakers change the [e] to [a] when they switch from RCA to HCA. Explanation of this change is beyond the scope of this study.

We may need one further faithfulness constraint to protect the change of /ʔ/ into [q] in RCA, since /ʔ/ exists alongside /q/ as an underlying form that has the surface form [ʔ]. This constraint should be related to the maintenance of the glottal feature in the underlying form or to the place of articulation in general. We can call this constraint IDENT-IO (Glottal/Place) (Let α be a segment in the input, and β a correspondent of α in the output. If α is [γGlottal/Place], then β is [γGlottal/Place]). Thus, the four main constraints that are of concern to us are repeated here:

(3) *q	Voiceless uvular stop is marked
(4) *ʔ	Glottal stop is marked
(5) IDENT-IO (RTR)	Let α be a segment in the input, and β a correspondent of α in the output. If α is [γRTR], then β is [γRTR]
(6) IDENT-IO (γGlottal/Place)	Let α be a segment in the input, and β a correspondent of α in the output. If α is [γGlottal/Place], then β is [γGlottal/Place]

However, the constraint IDENT-IO (Glottal/Place) may be redundant, because the constraint IDENT-IO (RTR) can be construed in a way that the addition or deletion of the [RTR] feature is a violation of that constraint. Al-Khatib (2008) also calls this phenomenon in urban dialects such as the one in Amman “depharyngealization”. That is, those who use the urban form [ʔ] lose the feature [RTR] in their speech. In this sense, we can depict the grammar of RCA by using only the three constraints in (3, 4, & 5). To maintain the contrast between [q] and [ʔ] in RCA, we need the faithfulness constraint IDENT-IO (RTR) to be higher ranked than the other two constraints, *ʔ and *q. The ranking between *ʔ and *q is irrelevant because both sounds are possible in RCA and both constraints are violable; hence, the ranking in (7) represents the grammar of RCA.

(7) IDENT-IO (RTR) >> *ʔ, *q

The ranking in (7) guarantees a corresponding output form equal to the input. Violation of IDENT-IO (RTR) is fatal. If the input contains /q/ as depicted in Tableau[10] 3-3, using the word /qaraabi/ 'kinship', the output will contain [q]. In contrast, if the input contains /ʔ/, the output will contain [ʔ] as illustrated in Tableau 3-4, using the word /ʔalem/ 'pain'. Thus, a contrast is maintained in RCA by employing the ranking in (7).

Tableau 3-3. Ranking of RCA: Underlying form /qaraabi/

/qaraabi/	IDENT-IO (RTR)	*ʔ	*q
☞ a. qaraabi			*
b. ʔaraabi	*!	*	

Tableau 3-4. Ranking of RCA: Underlying form /ʔalem/

/ʔalem/	IDENT-IO (RTR)	*ʔ	*q
☞ a. ʔalem			*
b. qalem	*!	*	

3.2.1.2 Grammar of HCA

For the HCA grammar, we will use the same set of constraints that were employed in Section 3.2.1.1 to be able to compare how the two grammars differ with respect to the ranking of the three pertinent constraints in (3, 4, & 5). As HCA exhibits neutralization, a different ranking of the constraints in (3, 4, & 5) is required. Since the [q] sound is not desirable in HCA and is absent from the speech of Himsi speakers with the exception of lexical borrowings from SA, the constraint *q should be higher ranked than the constraint *ʔ that is violable in HCA. Consequently, *ʔ should have a very low ranking in HCA grammar[11]. The constraint IDENT-IO

[10] Tableau is the name for table in Optimality Theory. The plural is tableaux. These tableaux show which constraints are relevant in the analysis and the ranking of these constraints with respect to each other.

[11] The L1 learner of HCA has learned to demote *ʔ, so s/he can pronounce [ʔ]. Not being exposed to [q], the L1 learner of HCA has no reason to demote *q. *q starts high in his/her grammar and maintains that high ranking.

(RTR) could be higher ranked than *ʔ as well because we would like to preserve /ʔ/ in the output as [ʔ]. In HCA grammar, the ranking between IDENT-IO (RTR) and *q is irrelevant because they are both violated by the loser and neither is violated by the winner. This leads to the following ranking of the HCA grammar:

(8) *q, IDENT-IO (RTR) >> *ʔ

The ranking in (8) guarantees the [ʔ] pronunciation of the input /ʔ/ in HCA. For a Himsi speaker, the input is constantly /ʔ/ rather than the SA and RCA /q/, because as I mentioned earlier /q/ is absent from his/her phonemic repertoire and /ʔ/ is the first form that s/he is exposed to in childhood (Prince and Smolensky 2004 [1993]). For example, if we take the input /ʔaraabi/ 'kinship' that has the underlying form /qaraabi/ in SA and RCA and apply the ranking in (8), the winning output will be [ʔaraabi], not [qaraabi], as illustrated in Tableau 3-5. The suboptimal output [qaraabi] violates the higher ranked constraints, *q and IDENT-IO (RTR), allowing for the optimal output in (b) to win although it violates the constraint *ʔ.

Tableau 3-5. Ranking of HCA: Underlying form /ʔaraabi/

/ʔaraabi/	*q	IDENT-IO (RTR)	*ʔ
a. qaraabi	*!	*	
☞ b. ʔaraabi			*

3.2.1.3 Acquisition of the HCA form by an RCA speaker

One may ask the question why [q] is replaced by [ʔ] in the HCA, not [k] (Abdel-Jawad 1981; Sawaie 1994), [g] (Al-Ani 1976; Abdel-Jawad 1981; Ferguson 1997), [dʒ][12] (Palfreyman

[12] I use the IPA transliteration instead of other forms used in the original sources, such as [j] in Palfreyman and al-Khalil (2003) and [ǧ] in Versteegh (1997).

and al-Khalil 2003; Versteegh 1997:149), or its more fronted variant [dz] (Versteegh 1997:149). /g/ used to exist in Old Arabic, but with time, it was lost for another place of articulation, palatoalveolar affricate /dʒ/ (Moscati, Spitaler, Ullendorff, and von Soden 1964). Nowadays, [g] still exists in some Bedouin or village dialects, where it replaces the /q/ sound (Abdel-Jawad 1981; Ferguson, 1997). Because [ʔ], not [k], [g], [dʒ], [dz], or [q], is the sound used in HCA, we can assume that if a set of context-free markedness constraints exist for all the unused sounds in HCA, these constraints will be ranked higher than *ʔ in HCA, as illustrated in (9).

(9) *k, *g, *dʒ, *dz, *q >> *ʔ

On the other hand, in the RCA dialect [q] and [ʔ] have equal weight because they are contrastive. Thus, the same set of context-free markedness constraints will be ranked in RCA as in (10) because the other four sounds do not occur in RCA.

(10) *k, *g, *dʒ, *dz >> *ʔ, *q

Since neither dialect allows [k], [g], [dʒ] or [dz] as a replacement for [q], I do not include the constraints *k, *g, *dʒ, and *dz in the ranking of constraints for each dialect. In both dialects, these four constraints are undominated. Thus, we should not concern ourselves with them. These constraints could be used to describe changes that occur in other Arabic dialects that make use of the sounds [k], [g], [dʒ], or [dz] in place of [q]. Our main concern here is the change of grammar that occurs as a result of the switch from RCA to HCA. Since the change is taking place from the RCA form to the HCA form, there must be some process of reranking of the three constraints in the RCA grammar (IDENT-IO (RTR) >> *q, *ʔ) for an RCA speaker to sound like an HCA speaker. Because the change is taking place from the village dialect to the city dialect, the assumed input is the surface form of the RCA dialect, in accordance with Prince and Smolensky's (2004 [1993]) idea of Lexicon Optimization, which is an elaboration on Stampe's (1972) idea. Lexicon Optimization holds that the input should be the form closest to the surface form that a child is first exposed to, unless there is evidence otherwise as from alternations, and it is this input that undergoes change.

It is worth noting here that the acquisition of the HCA form does not necessarily involve complete acquisition of the HCA grammar because of the difference in input form for an HCA speaker and an RCA speaker. It also seems that the RCA ranking (IDENT-IO (RTR) >> *ʔ, *q) promotes faithfulness over markedness to maintain the contrast between [q] and [ʔ], whereas the HCA ranking (*q, IDENT-IO (RTR) >> *ʔ) partially promotes markedness to avoid the marked sound [q]. This implies that rural speakers who attempt to learn the new form [ʔ] of the HCA dialect are inclined towards the unmarked. It may appear to the observer at first sight that the variation observed in the speech of rural migrant speakers is only a kind of change towards the unmarked.

However, the situation is more complex than it may appear. It is true that the variation observed in the speech of rural migrant speakers to the city of Hims is an indication of an attempt on the part of the learners to acquire the HCA grammar. However, the degree of variation differs from one speaker to another and from one group of speakers to another. The degree of use of the new form may range from zero to one hundred percent based on a number of social factors, such as age, gender, social class, and residential area. Before delving into the social influence on our choice of a grammar, let us portray what we mean by complete acquisition of or competence in the HCA form by an RCA speaker. In other words, let us examine what results from the interaction of the two grammars.

For an RCA speaker to produce his/her input form /qaraabi/ as [ʔaraabi], the output form uttered by a Himsi speaker, s/he has to be capable of adapting his/her grammar to accommodate the HCA form. In this case, the RCA ranking (IDENT-IO (RTR) >> *ʔ, *q) should take the form of (*q >> *ʔ, IDENT-IO (RTR)). *q should be higher ranked than the other two constraints and the faithfulness constraint IDENT-IO (RTR) is demoted at the expense of the markedness constraint *q to avoid the output form [q]. The ranking between *ʔ and IDENT-IO (RTR) is irrelevant because both of them are violable by the winner. In other words, an RCA speaker has to rerank two of the three constraints of his/her grammar (i.e., the RCA ranking) to accommodate the HCA form, sound like a Himsi person, and fit the image that s/he wants to display in front of the interlocutor. Consequently, we arrive at a ranking that does not totally mirror the HCA ranking due to the input difference between an HCA speaker and an RCA speaker. This ranking is exemplified in (11) and Tableau 3-6.

(11) *q >> *ʔ, IDENT-IO (RTR)

Tableau 3-6. Acquisition of HCA form by RCA speaker: Underlying form /qaraabi/

/qaraabi/	*q	*ʔ	IDENT-IO (RTR)
a. qaraabi	*!		
☞ b. ʔaraabi		*	*

Although the winner (b) violates two lower ranked constraints, the violation of the *q constraint is fatal because it is ranked higher than the other two constraints, yielding [qaraabi] in (a) a loser. What is portrayed in Tableau 3-6 is a case in which an RCA speaker has completely acquired the HCA form. This is not the case of each migrant speaker, though. Some speakers tend not to acquire the new form at all while others acquire it with one hundred percent accuracy. The latter ones may switch between the RCA grammar and the new grammar successfully according to the interlocutor: a family member or a stranger. There are also speakers who show intrapersonal variation. In other words, those speakers oscillate in their use of the two forms in their own speech with the same interlocutor. Thus, intrapersonal variation exists alongside interpersonal variation. The interpersonal variation is existent not only among individuals but also among groups of speakers. This brings us to the question of how we could deal with these types of variation that are based on social factors within the same framework.

It has been mentioned in Chapter 1 that the GLA proposed by Boersma and Hayes (2001) can account for optionality and free variation. If we take the case of two speakers: one who acquired the new form one hundred percent and another one who acquired the new form only fifty percent, we will have completely different representations of each speaker when applying the GLA. According to the GLA, a speaker who can completely switch between the RCA and HCA forms in accordance with her/his interlocutor is capable of setting and resetting the ranking values of the three constraints with great success. This speaker has been able to adjust the ranking of two of his/her constraints to adopt the new form and project acquisition of that form. Thus, s/he is capable of switching between the RCA ranking of constraints (Figure 3-1) and the HCA new form ranking (Figure 3-2) according to the interlocutor or at a certain time or place.

IDENT-IO (RTR)

*ʔ

*q

More strict ____ Less strict

Figure 3-1. Ranking of RCA

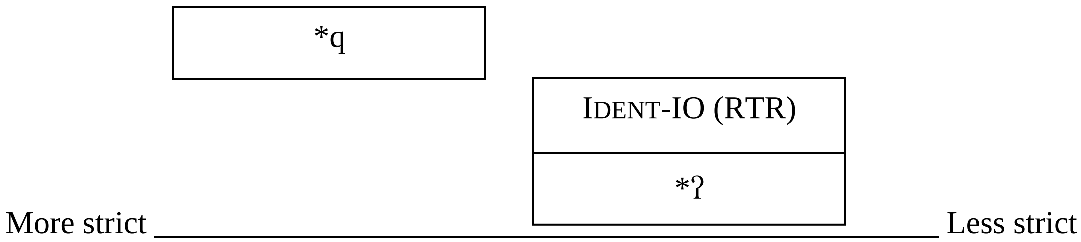

Figure 3-2. Ranking of HCA form

The case of a speaker who oscillates between the RCA ranking (IDENT-IO (RTR) >> *ʔ, *q), represented in Figure 3-1, and the HCA new form ranking (*q >> IDENT-IO (RTR), *ʔ), represented in Figure 3-2, is different. The two rankings have equal weight if each one of them occurs fifty percent of the time during speech with one interlocutor. In other words, a speaker who oscillates between the two forms does not have a strong grip on one ranking or the other. Reranking of constraints and reselection of ranking values for those constraints is a continuous process. In other words, oscillating speakers have not acquired the new ranking values of constraints completely. Sometimes they approximate the right ranking value of the two shifted constraints and produce the new form correctly. At other times, they revert to their original ranking value associated with their native dialect grammar and produce the old form. In this case, selection points remain fixed in the center of the range or strictness band of the three constraints, but the ranking values of those constraints are very close to each other. The closeness of the ranking values of the constraints leads to overlapping of constraints (Figure 3-3) and thus variation. Given that the ranges of those constraints are equal in width, when they are given close ranking values whose difference from each other is less than 8-10 points, the constraints inevitably overlap on a continuum/continuous scale. This overlapping may, however, be optional and depend on personal choice and perhaps self-correction, which may influence the ranking value assigned by the speaker to one constraint at a certain time or a place.

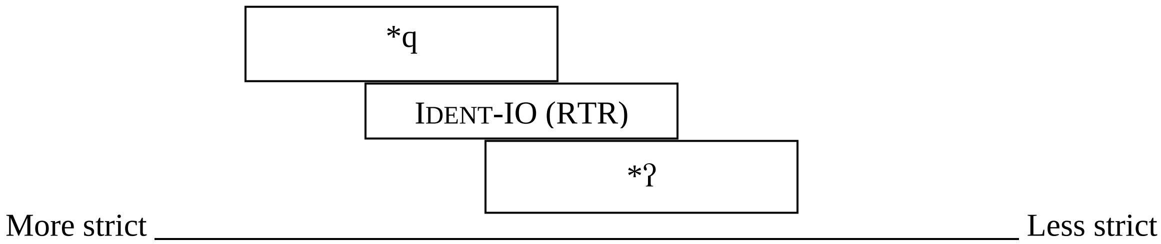

Figure 3-3. Ranking of the three constraints IDENT-IO (RTR), *ʔ and *q in an oscillating speaker

This overlapping results in different outputs for the same input, depending on the speaker's personal conscious choice. The faithfulness constraint IDENT-IO (RTR) in Figure 3-3 is struggling between the two context-free markedness constraints *ʔ and *q. This means that an oscillating speaker fails to adjust the ranking values of constraints completely to one of the rankings of the two forms. S/he is stuck in an intermediate stage where s/he oscillates between two or more different ranking values. One cannot tell if s/he will ever get over this oscillating position (i.e., leaning towards one ranking value or the other). Nonetheless, what determines the percentages of oscillation between two grammars or rankings? In other words, why may some speakers choose to use, for example, one ranking 30% of the time and another ranking 70% of the time and vice versa? In addition, what are the factors that motivate people to acquire a new form and to what degree do they influence a speaker's choice of one grammar over another?

These questions motivated me to examine the social influence in the observed variation in my data between [q] and [ʔ]. A number of social factors appeared to have great influence on the choice or preference of one variant over another. This led me to propose a number of social constraints that I will be stating in Section 3.2.2. I will show how these social constraints play a major role in answering the above questions. Their intersection with linguistic constraints alters the results; the number and kind of social constraints involved offer various grammars, which we will see as we delve into more details in Section 3.2.2.

3.2.2 Social Constraints Pertinent to the Variation between [q] and [ʔ]

In this section, I propose a number of social constraints based on social factors that have been often investigated and stressed as essential factors in language variation and change (e.g., Labov 2001). Among these factors are age, gender, residential area, and social class (e.g., Labov 1966, 1972a; Milroy 1980; Eckert 1989, 1991). I choose these factors because I believe that they play a major role in this study, and they are applicable to other studies and languages or dialects.

In the following list of constraints, each of the social factors included in the study is split into four social constraints. Of course, this division of constraints may differ in other languages or when dealing with different variables. As I am dealing here with the variation between [q] and [ʔ], I state the social constraints that can restrict the use of each of these two sounds. For example, the category of gender consists of males and females who can either use [q] or [ʔ]. This motivates the division of the gender social factor into four separate gender constraints, each stating that one of the sounds is socially marked when used by one of the genders. Thus, gender is factored first into males and females. Then, males are factored into marked usage of [q] and marked usage of [ʔ]. Females are factored in the same way, resulting in four distinct social constraints pertaining to gender and to the use of [q] and [ʔ]. Each social factor is treated in the same way, resulting in sixteen different social constraints. Each social factor consists of two categories, and each category is split into those to whom [q] is marked socially and those to whom [ʔ] is marked socially. We need a balanced number and type of constraints for each social factor, even in cases in which certain constraints are inactive or not activated by a certain individual or a group of individuals because the theory should be as general as possible. In addition, the social values of linguistic sounds may differ from one speaker to another or from one group of speakers to another. Thus, the application of these constraints depends on what variant each speaker or group of speakers values the most.

Having explained how social constraints were developed and factored for this study, it is important to familiarize ourselves with these social constraints before starting the analysis. I, therefore, would like to present them first in bulk and then manipulate them later individually or in groups, intersecting them with the previously proposed linguistic constraints to see the role they play in determining the choice between [q] and [ʔ]. The sixteen social constraints that I propose and that are deemed necessary for the variable use of [q] and [ʔ] are:

Gender:	*F[q]	[q] is marked socially in the speech of females
	*F[ʔ]	[ʔ] is marked socially in the speech of females
	*M[q]	[q] is marked socially in the speech of males
	*M[ʔ]	[ʔ] is marked socially in the speech of males
Age:	*OLD[q]	[q] is marked socially in the speech of older generation
	*OLD[ʔ]	[ʔ] is marked socially in the speech of older generation
	*YOUNG[q]	[q] is marked socially in the speech of younger generation
	*YOUNG[ʔ]	[ʔ] is marked socially in the speech of younger generation
Area:	*AKR[q]	[q] is marked socially in the speech of Akrama residents
	*AKR[ʔ]	[ʔ] is marked socially in the speech of Akrama residents
	*HAM[q]	[q] is marked socially in the speech of Al-Hameeddieh residents
	*HAM[ʔ]	[ʔ] is marked socially in the speech of Al-Hameeddieh residents
Social class:	*UMC[q]	[q] is marked socially in the speech of upper-middle class
	*UMC[ʔ]	[ʔ] is marked socially in the speech of upper-middle class

*LMC[q] [q] is marked socially in the speech of lower-middle class

*LMC[ʔ] [ʔ] is marked socially in the speech of lower-middle class

3.2.3 Praat Analysis of the Variation between [q] and [ʔ]

All coding and data analysis was carried out using the Praat software (Boersma and Weenink 2007), which was fed with scripts written by me. After developing and introducing a number of social and linguistic constraints, these constraints should be written into scripts that are readable by the Praat software. In the script, I define my grammar by providing the relevant constraints and suggest a ranking value for each constraint as well as the possible input forms and all their corresponding output forms. I also indicate which constraint each input/output violates. An example of a script is:

File type = "ooTextFile"

Object class = "OTGrammar 1"

<OptimalityTheory>

6 constraints

Constraint [1]: "*?" 100 100 ! *ʔ

Constraint [2]: "*q" 100 100 ! *q

Constraint [3]: "I\s{DENT}-IO (RTR)" 100 100 ! IDENT-IO (RTR)

Constraint [4]: "*M[ʔ]" 100 100 ! *M[ʔ]

Constraint [5]: "*O\s{LD}[ʔ]" 100 100 ! *OLD[ʔ]

Constraint [6]: "*A\s{KR}[ʔ]" 100 100! *AKR [ʔ]

0 fixed rankings

1 tableau

Input [1]: "qiffii" 2

Candidate [1]: "qiffii" 0 1 0 0 0 0

Candidate [2]: "ʔiffii" 1 0 1 1 1 1

In the above script, I develop an OT grammar that includes six constraints: three linguistic constraints and three social constraints. I give all constraints the same starting ranking value, 100. The numbers written to the right of Candidates [1] and [2] refer to the number of violations that each candidate incurs of each constraint in the order they are listed in the script, although their order before being listed is arbitrary because Praat cares only about ranking values and number of violations. Once constraints are listed, the location of violations should correlate with the order in which these constraints occur in the list. Then, Praat is asked to read this script from a file. Since my data is variable, I follow the evaluation process of stochastic OT in which I choose a 2.0 noise that is representative of the standard deviation according to a Gaussian distribution (Boersma and Weenink 2007). I choose 100,000 times as the number of repetition of evaluation or learning trails.

In order to discover the distribution of each possible output, one can follow either of the following processes. First, one can select the defined OT grammar and choose Input to Outputs, which results in two string objects that could be sent to distribution, yielding the percentage of each output. Then one can select the OT grammar and the two strings and learn with a plasticity of 0.1 to see the gradual learning process of a grammar. One can further go to check the output distribution to see if any change or gradual learning has taken place. However, one can take a shortcut to grammar learning (Boersma and Weenink 2007) by skipping the strings step and immediately choose to go to pair distribution from selecting the OT grammar, then select the OT grammar and the pair distribution and learn with a plasticity of 0.1. This not only allows us to observe learning but also to find out the output distribution (i.e., the percentage of the occurrence of each variant) by choosing to go to strings from pair distribution and then from strings to distribution. Consequently, we will get input distribution and output distribution. This process is applied to a number of grammars defined by me to see how social constraints could affect our choice of a grammar at a certain time and place and the degree to which they affect our grammars and the ranking values as well as the rankings of other constraints.

Because I am interested in modeling real life variation, after applying the previous process I chose to apply learning from partial outputs that become inputs for speakers. I select the OT grammar and the output distribution or the output string and learn from partial outputs. The motivation behind this type of learning is that speakers are constantly exposed to variation in the output they receive as input. This should definitely influence their learning process and their next set of outputs. In other words, it will influence the percentages of the occurrence of each of the variants in their speech. The complete process of learning from partial outputs is that we first read an OT grammar from a script file prepared and defined by the author, select it, and go to pair distribution. Then, we select the pair distribution that appears in the object window and go to strings. We can select only the output string and go to output distribution. This output distribution is selected with the previously defined OT grammar, and we let Praat learn from partial outputs with a plasticity of 0.1 and a number of learning trails set to 100,000. In order to explain this learning process, I will present a number of examples and show how it can model real life occurrences of the variants under investigation. It is worth noting here that the examples that are presented here are just a small fraction of the great number of experimental trials performed with the GLA, not only the intersection of social constraints with linguistic constraints but also comparing the exclusive use of linguistic constraints to the intersection of constraints. These experimental trials also include manipulation of the output distributions or pair distribution to show that learning from different output distributions result in different degrees of variation, and thus different grammars. However, even when we do not manipulate the output distribution, we still get different results when social constraints are involved. The degree of variation depends on the type and number of social constraints involved. The following examples will exhibit just some of what we can do and what we can model with the GLA regarding the social phenomenon of sociolinguistic variation and change. They will also manifest the major role played by social constraints in determining the percentage of each output.

In all examples, the input is the RCA surface form, the form that migrant speakers are first exposed to in childhood, unless specified otherwise. The ranking value of all constraints at the start of a trail is 100 unless specified otherwise. Pair distributions are attained from this impartial grammar unless manipulation in the distribution is specified otherwise. All learning trials run 100000 times, that is 100000 steps of learning. In all trials, the evaluation noise is 0.2 and the plasticity is 0.1. Let us look first on what variation looks like when social constraints are not involved.

Example 1: Starting with an OT grammar that contain the three linguistic constraints *ʔ, *q, and IDENT-IO (RTR) and setting their ranking values to 100. Learning from partial outputs after 100000 trials leads to the ranking values in Table 3-7 and the following output percentages: 33% of [ʔ] and 67% of [q].

Table 3-7. Ranking values and disharmonies of *ʔ, *q, and IDENT-IO (RTR)

Constraint	Ranking value	Disharmony
*ʔ	100.052	102.829
IDENT-IO (RTR)	100.052	99.313
*q	99.948	100.538

Disharmony in Table 3-7 and in other upcoming tables refers to the effective ranking value during stochastic evaluation (i.e., with non-zero evaluation noise) and it is usually different from ranking (Boersma and Weenink 2007). According to Boersma (1997a: 1),

> If every constraint in an Optimality-Theoretic grammar has a ranking value along a continuous scale, and the disharmony of a constraint at evaluation time is randomly distributed about this ranking value, the phenomenon of optionality in determining the winning candidate follows automatically from the finiteness of the difference between the ranking values of the relevant constraints. The degree of optionality is a descending function of this ranking difference.

In this sense, disharmony is the effective ranking of a constraint "determined at evaluation time from the ranking value and a random variable" (Boersma 1997a: 3). It is more or less the ranking value added to it the degree of spread of the ranking value of the constraint multiplied by a Gaussian random variable with mean 0 and standard deviation 1, which is referred to as **z**. the formula for calculating disharmony is:

disharmony = *ranking* + *rankingSpreading* · ***z*** (Boersma 1997a: 3)

The result in Example 1 is expected because there are two constraints that are in support of the [q] sound (i.e., *ʔ and IDENT-IO (RTR)) and only one in support of the [ʔ] (i.e., *q). This gives a fraction of two-to-one out of three, that is approximately 67% of [q] and 33% of [ʔ]. Table 3-7 could be misleading because one may infer from it that the two constraints *ʔ and IDENT-IO (RTR) are always higher ranked than *q. In fact, there is no categorical ranking of the aforementioned three constraints. They overlap and their overlapping leads to the observed variation in the output distribution. The close ranking values observed in Table 3-7 must inevitably result in this overlapping and the non-categorical ranking. The percentages indicate the number of times the ranking that allows for [q] is chosen and the number of times the ranking that allows for [ʔ] is chosen. But in real life this is not the case. In real life, a person who is exposed to the overt form [q] 100% of the time, should have 100% pronunciation of [q]; his/her underlying form, /q/, and surface form [q] should match. There should be a categorical ranking that determines the grammar of that speaker and identical to the RCA grammar ranking, IDENT-IO (RTR) >> *q, *ʔ. The disparity between real life occurrences and the results of the Praat software lies in that the software is given equal rankings to the three constraints and two output candidates for one input (e.g., the outputs [qaraabi] and [ʔaraabi] for the input /qaraabi/). Consequently, the number of constraints that favor one of the two outputs over the other determines the output distribution or percentages. This situation mirrors Anttila's SG model for free variation in which the number of constraints that favors one sound over another determines the frequency of its occurrence (Anttila 1997a,b, 2002; Anttila and Cho 1998). In Section 1.3.1.3, I mentioned that Anttila's SG model runs into problems if there is a large disparity in the output frequencies. The GLA can overcome this problem because of its stochastic process of learning and the ability to manipulate the ranking values of constraints or the output pair distribution from which a speaker can learn and mirror his/her environment. The ability to manipulate the output pair distribution to match real life occurrences can give us the ranking values of constraints in a speaker or a group of speakers (i.e., the grammar implemented by a speaker or a group of speakers). Thus, instead of having multiple grammars from which a speaker chooses one as in the case of SG, the GLA presents one stochastic grammar for each speaker or group of speakers through manipulation of the pair distribution or the ranking values of constraints.

Thus, to solve the unrealistic results of Example 1, we can either set the ranking values of the constraints according to the speaker's supposed grammar or feed the GLA with the real output percentages from a pair distribution file. Applying the first method, we can model the RCA grammar by giving the two constraints *q and *ʔ a lower ranking value than IDENT-IO (RTR) by at least 10 points to guarantee that the latter constraint will be higher ranked than the former two and that the winning candidate will remain the same (Boersma and Weenink 2007). For example, we can set IDENT-IO (RTR) to 100 and the other two constraints to 90 or lower. This manipulation of the ranking value of constraints secures the RCA categorical ranking of IDENT-IO (RTR) above *q and *ʔ and the equal ranking of the latter two as well as an output distribution of [q] that is equal to 100%. This same result can be achieved by applying the second method (i.e., manipulating the pair distribution values to 100% occurrence of [q] and [ʔ] and 0% occurrence of [ʔ] and [q] when the input containts /q/and /ʔ/ respectively). The latter manipulation will ensure the occurrence of the RCA ranking 100% of the time. That is, it will gaurantee a much higher ranking value of IDENT-IO (RTR) than *q and *ʔ as Table 3-8 shows. There is at least a difference of thirteen points between the ranking value of IDENT-IO (RTR) and the ranking values of each of *q and *ʔ. Consequently, [q] occurs 100% when the input has /q/ and [ʔ] occures 100% of the times when the input has /ʔ/.

Table 3-8. Ranking values and disharmonies of *ʔ, *q, and IDENT-IO (RTR), manipulating the output distribution to 100% use of [q] and [ʔ] and 0% use of [ʔ] and [q] when the input has /q/ and /ʔ/ respectively

Constraint	Ranking value	Disharmony
IDENT-IO (RTR)	113.702	111.934
*q	100.594	101.045
*ʔ	99.594	103.045

Moreover, the percentages of Example 1 – 33% of [ʕ] and 67% of [q] – and their discrepancy with real life occurrences were the result of equal rankings of the three constraints, two output candidates for one input, and the number of constraints that favor one output/sound over another. As I mentioned earlier, manipulating the output pair distribution of the three aforementioned linguistic constraints can give us results that match the real life occurrences of each speaker or group of speakers. For example, If we take the same three linguistic constraints and manipulate the pair distripution of [q] and [ʕ] to match the real life occurrences of older female speakers from Akrama (i.e., 82% of [q] and 18% of [ʕ]), we get the ranking values in Table 3-9 and the approximate output percentages 83% of [q] and 17% of [ʕ].

Table 3-9. Ranking values and disharmonies of *ʕ, *q, and IDENT-IO (RTR), manipulating the values of the pair distribution to 18% [ʕ] and 82% [q]

Constraint	Ranking value	Disharmony
*ʕ	100.695	101.943
IDENT-IO (RTR)	100.695	101.748
*q	99.305	101.139

Manipulating the pair distripution of [q] and [ʕ] to match the real life occurrences of older male speakers from Akrama (i.e., 96% of [q] and 4% of [ʕ]) gives the ranking values in Table 3-10 and the approximate output percentages 94% of [q] and 6% of [ʕ].

Table 3-10. Ranking values and disharmonies of *ʕ, *q, and IDENT-IO (RTR), manipulating the values of the pair distribution to 4% [ʕ] and 96% [q]

Constraint	Ranking value	Disharmony
*ʕ	101.634	104.884
IDENT-IO (RTR)	101.634	98.528
*q	98.366	99.081

Furthermore, manipulation of the pair distripution of [q] and [ʕ] to match the real life occurrences of younger female speakers from Al-Hameeddieh (i.e., 2% of [q] and 98% of [ʕ]) leads to the ranking values in Table 3-11 and the approximate output percentages 2% of [q] and 98% of [ʕ].

Table 3-11. Ranking values and disharmonies of *ʕ, *q, and IDENT-IO (RTR), manipulating the values of the pair distribution to 98% [ʕ] and 2% [q]

Constraint	Ranking value	Disharmony
*q	103.289	103.766
*ʕ	96.711	97.238
IDENT-IO (RTR)	96.711	95.237

The last three manipulations give us three different grammars for three different groups of speakers all of which are rural migrants to the city of Hims. Further manipulations will show us that even individual speakers may have different grammars from the grammar of the social group to which they belong. For example, Speaker-30 (and so is the case concerning Speakers 29 & 31) is a young male residing in Akrama. He uses [q] 96% and [ʕ] 4%. His grammar and the ranking values of his constraints will be the same as those of older male speakers residing in Akrama (Table 3-10). Although Speaker-30 belongs to the younger age group, his grammar differs from that of the younger age group who uses [q] 3% and [ʕ] 97% (Section 4.4.1). The younger age gourp grammar will be similar to that of young female speakers from Al-Hameeddieh and the ranking values in Table 3-11. This disparity between the members of the same social group raises the issue of the unrelatedness of the grammar of some members of a social group to the grammar of that social group. Manipulating the pair distribution and creating different grammars for each speaker or group of speakers from the same linguistic constraints does not explain why speakers that belong to the same social group behave differently and have different grammars. It does not also explain why the grammar of one social group differs from the grammar of another social group (e.g., the difference between older female speakers and younger female speakers). This is one of the reasons that motivated me to intersect social constraints with linguistic constraints within the same framework.

Including social constraints in the computation provides some kind of explanation of what takes place in the mind of a speaker because of social factors. In other words, including social constraints provides explanation for such disparity among members of the same social group or disparity among different speakers or social groups. Interacting social constraints with linguistic constraints in the same framework is a simple comprehensive method to depict and explain the mental process of a speaker at a certain time and/or place. One can see what happens in the mind of a varying speaker in one simple step in the GLA. Feeding the GLA with the right output disribution/percentages gives the specific ranking values or grammar of each speaker or group of speakers. In other words, the model takes advantage of the stochastic grammar embedded in the GLA to generate grammars that match real life output percentages without trying all the possible rankings of constraints and counting the times those rankings give a certain output, as it is the case in SG. Some real life percentages are hard to achieve exactly, when applying only all the possible rankings of the pertinent constraints. This is the downfall of the SG, although one should take into consideration that knowing the number and type of social constraints involved can help in giving approximate percentages to real life occurrences. Thus, knowing the social constraints involved and manipulating the output distribution in the GLA to match real life output percentages provide us with more precise grammars that match the target output percentages in a sociolinguistic variation situation.

Another reason for including social constraints in the computation is that speakers may rank social constraints that do not affect their speech. Ranking these constraints gives speakers and listeners alike expectations about what the speech of others would sound like. For example, an older speaker may rank *YOUNG[q] higher than other constraints, although this constraint may not affect the way s/he speaks. Such ranking gives him/her expectations about what the speech of younger speakers should sound like. This higher ranking of *YOUNG[q] tells him/her that younger speakers do not use or are not expected to use the [q] sound in their speech. The same is applicable to other speakers or groups of speakers who may rank constraints that are not active in their speech but are active in others, and thus know the grammar of the other/interlocutor.

Thus, in the case of sociolinguistic variation, it is wise to include social constraints in the mental process of a speaker because they influence the way s/he speaks. These social constraints play a role in the linguistic discrepancy among speakers (even members of the same social group) or groups of speakers. This means the different degrees of variation that are encountered in the speech of rural migrant speakers to the city of Hims are influenced by a number of social constraints, and it is the ranking values of those constraints that lead to change and determine the degree of variation. Therefore, there is much more involved than the manipulation of the pair distribution or the ranking values of the aforementioned three linguistic constraints. I believe that social constraints should be taken into consideration to see their simultaneous degree of effect on the variation between [q] and [ʔ] in the speech of rural migrant speakers to a city in which [ʔ] is the prestigous form. In Example 2, we will see a difference in percentages from Example 1 as a result of the intersection of one social constraint with the aforementioned three linguistic constraints.

Example 2: If we add the social constraint *F[q] ([q] is marked socially in the speech of female speakers) to the computation in Example 1 with the various criteria – noise (2.0), plasticity (0.1), number of learning trials (100000), and ranking values (100) – set to the same values as in the previous experiment and in the following experiments, learning from partial outputs results in the ranking values in Table 3-12 and the following percentages 49% [ʔ] and 51% [q]. If the same process is repeated we get fluctuating results ranging between 49% and 51% for each variant. That is an average of 50% occurrence of each variant. Thus, the result was influenced by adding the social constraint that militates against the use of [q] among female speakers. In this example, two constraints militate against the use of [q] (i.e., *q and *F[q]) and two militate against the use of [ʔ] (i.e., *ʔ and IDENT-IO (RTR)), yielding 50-50% choice between the two variants. This example shows that the inclusion of just one social constraint, *F[q], can have a determining effect on the results. It leads not only to changing the ranking values of the constraints, but also to different percentages of the occurrence of each variant. The 50-50% choice of each variant may or may not match real life occurences, but it reflects on what the inclusion of social constraints could do. In real life, it is most likely that more than one social constraint is involved. I will elaborate on this point as we move on with the discussion.

Table 3-12. Ranking values and disharmonies of *ʔ, *q, *F[q], and IDENT-IO (RTR), without manipulation of the values of the pair distribution

Constraint	Ranking value	Disharmony
*q	100.192	99.092
*F[q]	100.192	100.635
*ʔ	99.808	99.939
IDENT-IO (RTR)	99.808	96.564

Example 3: Having observed the influence that one social constraint can exert on the ranking values and the degree of optionality in the choice between two variants, it would be of

interest to observe what results would look like if we manipulated the values of the pair distripution. Conversely, we take the real life percentages of each of [q] and [ʔ] in the speech of female speakers in this study, which are 35% and 65% respectively, and put these percentages as pair distribution values of [q] and [ʔ] respectively in the computation. In this case, learning from partial outputs in which [ʔ] occurs 65% as a result of the *F[q] constraint, and the learner hears these outputs as inputs, the ranking values of the four constraints in Table 3-12 will be after 100000 learning trials as in Table 3-13. The output distribution will be as follows: 66.5% [ʔ] and 33.5% [q], which is very close to the real life percentages. The slight difference in results is expected because of the learning process and optionality that is held here as a core feature of variation. Learning from partial outputs that has a higher percentage of [ʔ] may result in higher learning percentage of the [ʔ] sound. Thus, our surroundings and the people we interact with may determine our grammar because they determine the percentage of the input of each of [ʔ] and [q]. Further, this alone does not explain why some people may have similar attributes and similar interactions, yet one switches between the two forms with great success according to the interlocutor, while one may oscillate between the two forms with the same interlocutor. This is why I believe that social constraints play a major role in determining our grammars. It depends on what social constraints are activated at a certain time and place in addition to the input intake. This will be further examined by the addition of further social constraints to see how results shift as we add social constraints of various types.

Including the right social constraints and manipulating the pair distribution of [q] and [ʔ] to arrive at the observed variation in the data is important to model the various speakers' or groups of speakers' different grammars. Following this process determines that, for example, the group of female speakers gets an input of such percent of [q] and such percent of [ʔ] from our data. However, a group of female speakers could have outliers or females from different age groups that are influenced by different social factors. Once those social constraints are determined and included in the GLA grammar, one should be able to model individual variation as well as smaller group variation (e.g., younger female group or older female group). In other words, the results become closer to real life variation, when more specification or detail is offered and this usually applies to smaller groups and individuals (i.e., intraspeaker variation). Sometimes we could expect results that are compatable with real life production without manipulating the pair distribution of [q] and [ʔ] if the number of constraints that favor one sound over another correspondes with the output percentages of real life. This can be achieved by determining the social constraints involved and adding them to the computation. For example, having the real life percentages 85% of [q] and 15% of [ʔ] and five constraints favoring [q] and only one constraint favoring [ʔ] will lead to similar percentages without manipulating the pair distribution (Example 5). In order to explain this point, we explore a further example that deals with the female group from the older generation. This age group according to the data should be influenced by the constraint *OLD[ʔ] ([ʔ] is marked socially in the speech of older generation) because most older female speakers use more [q] than [ʔ] in their speech.

Table 3-13. Ranking values and disharmonies of *ʔ, *q, *F[q], and IDENT-IO (RTR), manipulating the values of the pair distribution to 65% [ʔ] and 35% [q]

Constraint	Ranking value	Disharmony
*q	100.457	104.274
*F[q]	100.457	100.407
*ʔ	99.543	99.154
IDENT-IO (RTR)	99.543	94.586

Example 4: With the addition of the constraint *OLD[ʔ], the results are also shifted towards 60% use of [q] and 40% use of [ʔ] when learning from partial outputs. In this example, it seems that the number of constraints that support the use of [ʔ] are three out of five constraints (*ʔ, *OLD[ʔ], and IDENT-IO (RTR)), which correlates with the 60% use of [q] – 20% for each constraint in support of [q]. Only two constraints out of five constraints support the use of [ʔ] (*q, *F[q]), which correlate with the 40% use of [ʔ]. These results that we observe without manipulating the pair distribution of a grammar whose value of constraints is set to 100 are very similar to those observed in my data. Calculating the percentages of the use of [q] and [ʔ] in the group of older female speakers, I got 63% use of [q] and 37% use of [ʔ]. This kind of result shows that the GLA can, when the right number of constraints is involved, model real-life sociolinguistic variation without even manipulating the pair distribution. We are arriving at results that approximate real life occurrences from just adding the respective pertinent social constraints to the computation. If we look also at the ranking values of constraints in Table 3-14, we will find that they are very close to those if we manipulate the pair distribution by setting the [ʔ] output distribution to 37% and the [q] output distribution to 63% (Table 3-15).

Table 3-14. Ranking values and disharmonies of *ʔ, *q, *F[q], *OLD[ʔ], and IDENT-IO (RTR), without manipulation of the values of the pair distribution

Constraint	Ranking value	Disharmony
*ʔ	100.031	98.742
* OLD[ʔ]	100.031	101.672
IDENT-IO (RTR)	100.031	96.666
*q	99.969	100.337
*F[q]	99.969	103.072

Table 3-15. Ranking values and disharmonies of *ʔ, *q, *F[q], *OLD[ʔ], and IDENT-IO (RTR), manipulating the values of the pair distribution to 37% [ʔ] and 63% [q]

Constraint	Ranking value	Disharmony
*ʔ	100.036	101.789
*OLD[ʔ]	100.036	100.449
IDENT-IO (RTR)	100.036	98.743
*q	99.964	99.410
*F[q]	99.964	97.268

Example 4 is one case in which it is possible to model a speaker or a group of speakers' grammar without manipulating the pair distribution because the number of constraints that favor one sound over another corresponds with the real life occurences of that sound. Learning from partial outputs without the manipulation of the pair distribution yielded percentages that are close to those with the manipulation – 39% of [ʔ] and 61 % of [q] – because the number of constraints that favor [q] are three and those that favor [ʔ] are two. In addition, if we repeat the 100000 learning trials from partial outputs a couple of times without manipulating the values of the pair distribution, we will get results that range between 40-43% for [ʔ] and 57-60% for [q]. This is further expected because of the degree of optionality allowed and the instability of input intake in real life.

Example 4 is a good illustration of how older female speakers model their surroundings; the percentage of the occurrence of [q] and [ʔ] in their speech corresponds with the input percentages of the two variants that they are exposed to in their speech environment. The addition of the two social constraints *OLD[ʔ] and *F[q] to the computation has provided us with the overlapping variable grammar of older female speakers, their input intake/percentages (i.e., their speech environement) and output percentages (i.e., their acutal use). The compatable results to real life occurrences of Example 4 without manipulating the pair distribution are not entirely possible when there is a great disparity in the output percentages (Examples 6 & 7). In such cases, manipulation of the pair distribution gives a more exact ranking values of constraints (i.e., a more defined grammar for specific speakers or groups of speakers).

Example 5: The addition of a sixth constraint *AKR[ʔ] ([ʔ] is marked socially in the speech of Akrama residents) will allow us to observe more interaction among social and lingusitic constraints and the importance given to the weight or ranking values of social constraints in comparison to some linguistic constraints. Learning from partial outputs after manipulating the pair distribution of the grammar, assigning the output of [q] 82% and the output of [ʔ] 18%, results in the ranking values in Table 3-16 and the percentages 82% use of [q] and 18% use of [ʔ]. This swerve in real life percentages is due to the social constraints *AKR[ʔ] and *OLD[ʔ], not so much to the social constraint *F[q] because this constraint militate against the use of [q].

Table 3-16. Ranking values and disharmonies of *ʔ, *q, *F[q], *OLD[ʔ], *AKR[ʔ], and IDENT-IO (RTR), manipulating the values of the pair distribution to 18% [ʔ] and 82% [q]

Constraint	Ranking value	Disharmony
*AKR[ʔ]	100.492	102.851
IDENT-IO (RTR)	100.492	101.989
*OLD[ʔ]	100.492	100.561
*ʔ	100.492	99.992
*F[q]	99.508	100.202
*q	99.508	99.236

Learning from partial outputs without the above manipulation gives us the ranking values in Table 3-17 and the following percentages 32% of [ʔ] and 68% of [q]. Repetition of this process could give a range 30.5-35% of [ʔ] and 69.5-65% of [q]. These percentages result obviously from the number of constraints that support [q], that is four in comparison with two constraints supporting [ʔ], which gives a fraction of two-to-one out of three respectively (i.e., approximately 67% of [q] and 33% of [ʔ]). In other words [q] is chosen two thirds of the times and [ʔ] only one third of the times.

Table 3-17. Ranking values and disharmonies of *ʔ, *q, *F[q], *OLD[ʔ], *AKR[ʔ], and IDENT-IO (RTR), without manipulation of the values of the pair distribution

Constraint	Ranking value	Disharmony
*AKR[ʔ]	100.041	102.167
IDENT-IO (RTR)	100.041	102.040
*OLD[ʔ]	100.041	98.697
*ʔ	100.041	100.371
*F[q]	99.959	94.916
*q	99.959	100.851

This result does not appear to match real life occurrences. But if we look closely at the characteristics or social values of the Akrama residential area, we should reconsider the constraints that are activated by old female speakers in that area. It seems that both old age and area of residence require that the constraint *F[ʔ] be activated instead of *F[q]. Apparently, *AKR[ʔ] and *OLD[ʔ] work together along similar constraints for a certain age group that reside in a certain area and require that they be accompanied by a constraint that is a member of the same family of constraints, that is the *ʔ family or the family of constraints that militate againt the use of [ʔ] to which *F[ʔ] belongs. In this case, we formulate a grammer that include the six constraints in Table 3-18 and set the value of all of them to 100. Then, we go through the same process of going to pair distribution, to strings, to distribution, selecting the OT grammar and the output distribution, and finally learn from partial outputs. We will arrive at the ranking values in Table 3-18 and at results that approximate real life occurrences: 85% use of [q] and 15% use of

[ʔ]. These results match real life occurrences without manipulating the pair distribution because there are five constraints that favor [q] and only one constraint that favors [ʔ].

Table 3-18. Ranking values and disharmonies of *ʔ, *q, *F[ʔ], *OLD[ʔ], *AKR[ʔ], and IDENT-IO (RTR), without manipulation of the values of the pair distribution

Constraint	Ranking value	Disharmony
*AKR[ʔ]	100.049	102.470
IDENT-IO (RTR)	100.049	100.065
*OLD[ʔ]	100.049	103.691
*ʔ	100.049	100.073
*F[ʔ]	100.049	101.517
*q	99.951	100.793

The ranking values observed in Table 3-18 and the percentages that resulted from the non-manipulation of the pair distribution are comparable to those in Table 3-19 and the percentages if we manipulate the pair distribution: 84% [q] and 16% [ʔ]. This is another case in which it is possible to model real life variation without manipulating the values of the output pair distribution because the number of constraints that favor [q] and [ʔ] correspond with their real life percentages. It is enough to know the social constraints that are involved in order to achieve results compatable with the variation we observe in real life.

Table 3-19. Ranking values and disharmonies of *ʔ, *q, *F[ʔ], *OLD[ʔ], *AKR[ʔ], and IDENT-IO (RTR), manipulating the values of the pair distribution to18% [ʔ] and 82% [q]

Constraint	Ranking value	Disharmony
IDENT-IO (RTR)	100.008	101.412
*AKR[ʔ]	100.008	99.437
*OLD[ʔ]	100.008	98.799
*F[ʔ]	100.008	97.505
*ʔ	100.008	96.376
*q	99.992	95.583

Thus, like SG, the GLA can easily model sociolinguistic variation. It can give us probabilities of variation that could reflect real life variation based on incorporating the right type and number of social constraints. However, it exceeds SG in that it is capable of modeling any speaker's or group's variable grammar through manipulation of the output pair distribution. The GLA dispenses with trying all possible rankings of constraints to arrive at the frequencies of each variant. Even all possible rankings of constraints may not reflect the exact real life percentages of variants and do not provide explanation of why such inter- and intra-speaker sociolinguistic variation exists. I have also argued that the inclusion of social constraints in the GLA, in addition to the manipulation of pair distribution, is essential to explain linguistic differences among speakers from the same social group or different social groups and to model sociolinguistic variation in formal theory. In addition, certain social constraints could give us expectations about what other speakers' speech should sound like. In Example 5, the constraints*F[ʔ], *OLD[ʔ], and *AKR[ʔ] make us expect limited use of [ʔ] in the speech of older female speakers from Akrama. What is expected from these constraints is what we observe in the speech of older female speakers from Akrama in real life. In this sense, listeners may also be able to discover the grammar used by a certain speaker or group of speakers and the social constraints activated by those speakers at a certain time and place, as some interviewees' comments indicate. That is, they observe variation in the speech of their relatives based on the interlocutor. These interviewees point out their awareness of such shift in pronunciation, when it takes place, and with whom it takes place. This awareness may be an indication of their knowledge of the various social constraints and various grammars that exist in their community and that result from different activations of different social constraints. In support of this argument, I will explore one further example.

Example 6: Similarly, if we only replace *F[ʔ] with the constraint *M[ʔ] ([ʔ] is marked socially in the speech of male speakers) and learn from partial outputs, the percentages of each of [q] and [ʔ] will be after 100000 learning trials: 84% and 16% respectively. These percentages are also close to real life occurences. In our case, [q] occurs 96% in the speech of older male speakers from Akrama. This precentage may be lower and closer to 84% if the sample is taken from more than three speakers, which is the number of older male speakers from Akrama that are part of my original data. It seems that the following social constraints *AKR[ʔ], *M[ʔ] and *OLD[ʔ] play a major role in determining the results and the precentages of each of [ʔ] and [q]. They make us expect a low percentage of [ʔ] and this is the case in older male speakers from Akrama. Since the percentage of [ʔ] in older male speakers from Akrama is lower than that of older female speakers from Akrama and the only constraint that differs between the two social groups is *M[ʔ] instead of *F[ʔ], we can conclude that *M[ʔ] gives lower percentages of [ʔ] in the speech of male speakers than does *F[ʔ] in the speech of female speakers. In other words, *M[ʔ] has a higher ranking value than *F[ʔ] in all speakers. It makes speakers and listeners expect a difference between the speech of males and females (i.e., less [ʔ] and more [q] in the speech of males than in the speech of females).

If we change the percentages of the pair distibution we get from the OT grammar that include the six constraints in Table 3-20 and that resulted in 16% [ʔ] and 84% [q] to 96% [q] and 4% [ʔ], we will get from learning from partial outputs the ranking values in Table 3-20 and the approximate percentages: 94% use of [q] and 6% use of [ʔ]. Table 3-20 shows that *M[ʔ] has a slightly higher ranking value than that of *F[ʔ] in Table 3-19. This last manipulation of the pair distribution of [q] and [ʔ] presents us not only with the grammar of these three male speakers from Akrama but also with a model of their input environment. It provides us with information on their social networks and surroundings as well as the type of interaction they are exposed to. In other words, these three speakers have 96% input of [q] and thus more interaction with people that use this sound; the same is true of [ʔ]: 4% input of [ʔ]. Thus, manipulation of the pair distribution enables us to model speakers' input intake and the characteristics of the speech of their social networks, surroundings, or area of residence or workplace.

Table 3-20. Ranking values and disharmonies of *ʔ, *q, *M[ʔ], *OLD[ʔ], *AKR[ʔ], and IDENT-IO (RTR), manipulating of the values of the pair distribution to 4% [ʔ] and 96% [q]

Constraint	Ranking value	Disharmony
*AKR[ʔ]	100.878	103.730
IDENT-IO (RTR)	100. 878	97.323
*OLD[ʔ]	100. 878	100.783
*M[ʔ]	100. 878	98.379
*ʔ	100. 878	101.061
*q	99.122	99.309

Example 7: Let us take another case in which young female speakers use 98% [ʔ] and 2% [q] in real life data. We will assume six constraints stated in Table 3-21, which should enable female speakers from getting a high percentage of pronunciation of [ʔ]. Most of the young female speakers are occupants of Al-Hameeddieh area; hence, the constraint *HAM[q] ([q] is marked socially in the speech of Al-Hameeddieh residents) is used. *YOUNG [q] and *F[q] are used because we are dealing with young female speakers who rarely use the [q] sound. Using the RCA input and learning from partial outputs before adjusting the probabilities of the occurrence of [q] and [ʔ] in the pair distribution, the approximate use percentages are 67% [ʔ] and 33% [q].

This is a case in which four constraints support the use of [ʔ] (i.e., *q, *F[q], *YOUNG[q], and *HAM[q]) and two constraints support the use of [q] (i.e., *q and IDENT-IO (RTR)), forming a fraction of two-to-one out of three, which is approximately 67% to 33%. These percentages are quite disparate from the real life occurrences of young female speakers from Al-Hameeddieh. This disparity in percentages could be indicative of two things.

First, social constraints should have higher weight or ranking values in order to match reality. Once we change the probabilities of the pair distribution to match the occurrence of each of the [q] and [ʔ] in real life (i.e., 98% and 2% respectively), we get the ranking values in Table 3-21 and the precentages 98.5% use of [ʔ] and 1.5% use of [q] after 100000 trials of learning from partial outputs. This is further evidence that social constraints play a major role in determining the winner and in influencing our grammar and the ranking values that each speaker assigns to certain constraints. It is also possible to change the ranking values of constraints in the defined grammar. This change could give a similar result to the observed sociolinguistic variation among young female speakers from Al-Hameeddieh. We can, for example, set the value of the four constraints *q, *F[q], *YOUNG[q], and *HAM[q] to 100 and the value of the other two constraints to 95 or less. Giving the constraints these values results in approximately 99% use of [ʔ] and 1% use of [q].

Table 3-21. RCA input: Ranking values and disharmonies of *ʔ, *q, *F[q], *YOUNG[q], *HAM[q], and IDENT-IO (RTR), with manipulation of the values of pair distribution to 98% [ʔ] and 2% [q]

Constraint	Ranking value	Disharmony
*HAM[q]	101.846	101.573
*q	101.846	101.121
*YOUNG[q]	101.846	97.161
*F[q]	101.846	98.518
*ʔ	98.138	94.280
IDENT-IO (RTR)	98.138	97.922

Second, the input of the younger generation is the HCA form, not the RCA form. Changing the input to /ʔ/ instead of /q/ in the above computation yields without manipulation of the pair distribution of [ʔ] and [q] the approximate percentages 83% use of [ʔ] and 17% use of [q]. These percentages are the result of five constraints in support of the use of [ʔ] (i.e., *q, *F[q], *YOUNG[q], *HAM[q], and IDENT-IO (RTR)) and only one constraint in support of the use of [q], that is *ʔ. Changing the young generation's input from /q/ to /ʔ/ without manipulating the pair distribution gives percentages that are closer to those of the real life occurrences of [q] and [ʔ] in the speech of young female speakers, although the resulting percentages are not the exact percentages of those speakers. In the initial stage of Example 7, we got the percentages 67% use of [ʔ] and 33% use of [q] when the input was the RCA form, which are very different from the real life occurrences of [q] and [ʔ] in the speech of young female speakers from Al-Hameeddieh. This raises issue of the ability of the younger generation to restructure their input. I believe that not only do social constraints exert an effect on the younger generation's grammar but also that the younger generation has succeeded in restructuring their input. Their input becomes the HCA input instead of the RCA input. Conversely, the input should contain /ʔ/ instead of /q/. Being born in the city of Hims, although to a rural family that uses the overt form [q] at home, and being exposed from an early age to the overt form [ʔ] at school, the younger generation may have been able to restructure their parents' input from listening to the majority of their environment's input (i.e., friends at school). This means the younger generation, perhaps, do not have /q/ in their phonemic inventory any more; all they have is /ʔ/ like HCA speakers and they tend to neutralize in the same way.

Modeling the real life occurences of young female speakers from Al-Hameeddieh, whose input is the HCA form, requires a lower ranking value for the constraint *ʔ than the other five constraints. It is expected that this constraint starts with a very low ranking in the speech of HCA speakers and those who are able to use the HCA form with 100% accuracy. This is exactly what happens if we lower the ranking value of the constraint *ʔ to 90 or less; we get 100% use of [ʔ] and 0% use of [q]. In other words, *ʔ should have a lower ranking value than the other constraints because it is violated constantly by HCA speakers, young female speakers from Al-Hameeddieh, and all speakers who can use the [ʔ] with 100% accuracy. We can get the exact ranking values of the constraints (i.e., the grammar of young female speakers from Al-Hameedieh) by manipulating the pair distribution of [q] and [ʔ] to 2% and 98% respectively. Table 3-22 shows the grammar of young female speakers from al-Hameeddieh and that the constraint *ʔ has a lower ranking value than the rest of the constraints. There is approximately a three-point difference.

Table 3-22. HCA input: Ranking values and disharmonies of *ʔ, *q, *F[q], *YOUNG[q], *HAM[q], and IDENT-IO (RTR), with manipulation of the values of pair distribution to 98% [ʔ] and 2% [q]

Constraint	Ranking value	Disharmony
*HAM[q]	101.382	104.275
*q	101.382	104.237
*F[q]	101.382	103.628
*YOUNG [q]	101.382	100.204
IDENT-IO (RTR)	101.382	99.495
*ʔ	98.618	97.191

Example 7 can be taken as evidence for the occurrence of restructuring of the input in the younger generation as a result of the influence of social factors, such as social networks, and learnability out of exposure to the new form at an early age. It can also be taken as evidence for the dormancy of some linguistic constraints, such as *ʔ, in some speakers and the activation of other constraints instead. The example further shows the importance of social constraints in comparison to some linguistics constraints in determing a speaker's grammar. It is worth noting here that even in cases where the percentages are a little different from real life data, these examples show that social constraints do influence our selection of a ranking value for a certain linguistic constraint and do play a role in our choice of a grammar at a certain time or place. These social constraints determine the approximate number of times each output occurs (i.e., the percentage of the occurrence of each variant).

3.2.4 Concluding Remarks on the Sociolinguistic Variation between [q] and [ʔ]

The above examples have shown that the manipulation of the pair distribution can model the different grammars of different speakers or groups of speakers. To explain the differences among those speakers or groups of speakers, it was essential to include social constraints in the computation. Manipulating the pair distribution of the linguistic constraints alone does not explain why speakers' speech differs from each other in a sociolinguistic variation situation or why speakers from the same social group or different social groups have different grammars.

Furthermore, the above examples have shown that certain social constraints may give us expectations about what a speaker's or a group of speakers' speech should sound like. For example, the bundling of the constraints *F[ʔ], *Old[ʔ], and *AKR[ʔ] in Example 5 tells us to expect very low percentage of [ʔ] in the speech of older female speakers from Akrama but a little higher than the percentage of [ʔ] in the speech of older male speakers from Akrama. As a result, the [ʔ] sound is probably more marked among older male speakers from Akrama, leading to the suggestion that the constraint *M[ʔ] is probably ranked higher than *F[ʔ] and is assigned a higher ranking value by male and female speakers alike. Ranking constraints that are activated by other speakers highlight the importance of the inclusion of social constraints in the computation in the case of a sociolinguistic variation. Having the constraint *M[ʔ] ranked higher than other constraints in the grammar of all speakers means that the listener should expect what the interlocutor's speech should sound like based on whether the interlocutor is a rural male or female migrant speaker to the city[13]. In the same way that an RCA speaker expects an HCA speaker to produce [ʔ] as a result of a different grammar, an RCA speaker may expect what an older male migrant speaker should sound like and simultaneously the social constraints that allow him to speak in a certain way or to make choices of his grammar. A listener who listens to a speaker in two different setting using a different form in each of the settings is aware of that speaker's change of grammar and is most likely aware of the social contraints involved in that switch according to the interlocutor.

In addition, the above examples present how each speaker or group of speakers can model their environment. Examples 4, 5 and 7 show that female speakers model their environment and so do male speakers in Example 6. It also seems from Examples 5 and 6 that female speakers are capable of modeling their environment, the HCA setting, better than male speaker. Thus, it may be possible to predict that males use the [q] sound more than females because of their activation

[13] This does not exclude the possibility that males may be exposed more to the [q] sound than females are. In other words, they associate more with people (particularly males) from their own background and maintain their [q] sound to express solidarity. Such associations with people who use their own native sound expose males to higher output (i.e., input for the learner) percentages of the [q] sound (i.e., the pair distribution from which they learn is inclined more towards the [q] sound than it is in females). Learning from higher percentages of [q] leads to higher production percentages of [q] because the surrounding linguistic environment of speakers influences their degree of learnability of a form. In other words, males do not learn the new form, [ʔ], as much as females do because they are not as exposed to it as females are. Their production (i.e., learnability) is affected by the pair distribution of [q] and [ʔ] in their environment. Even in the case of different pair distribution of [q] and [ʔ] for males and females, *M[ʔ] will have in the computation a slightly higher ranking value than *F[ʔ] to match this difference (Compare Table 3-20 to Table 3-19).

of the *M[ʔ] constraint that is as aforementioned more fatal or has higher ranking among gender constraints than *F[ʔ]. Thus, social constraints within one social factor may have a variety of strength and ranking values based on the social significance or markedness of a sound to a particular gender, age group, residential area, social class, etc. In my data, *M[ʔ] may be more fatal than *F[ʔ], but in other social settings or linguistic environment, *F[ʔ] may be more fatal because [ʔ] is considered more marked among females than among males. This does not only apply to the constraints proposed in this study, but could apply to other social constraints that are pertinent to other varieties or languages. All what has been mentioned so far support the psychological reality of the model and the constraints involved in the computation, particularly when we speak of choice, expectations, and awareness of one's grammar as well as the other's grammar.

3.3 Modeling Variation between [t] and [s] and between [d] and [z]

After discussing the variable use of [q] and [ʔ] and their modeling in the GLA by proposing social constraints and incorporating them in the computation process, I move our attention to the variable use of [t] and [s] and [d] and [z] in the colloquial speech of HCA and RCA speakers. I refer to this type of variation as *stable* because each variant occurs in particular words of the RCA and HCA dialects; there is no interchangeability between the variants. This type of variation is different from the variation observed between [q] and [ʔ]. The latter can be considered of the gradient type because it varies based on a number of social factors. The former is more of the categorical type because it does not vary within a speaker, among speakers, or among groups of speakers. The same variant is used by all speakers to pronounce certain words

(Chapter 5). In this sense, it could be referred to as a phenomenon in its current state rather than variation. This current stable phenomenon may have resulted from variation historically.

The first two variants, [t] and [s], are pronounced [θ] in SA and the latter two variants, [d] and [z] are pronounced [ð]. In other words, the SA variants do not exist anymore in HCA or RCA speech except in very rare use of lexical borrowings from SA that contain those two variants. The SA variants [θ] and [ð] merged completely with [t] and [d] respectively around the 14th century (Daher, 1998a, 1999). This was the first historical change in the history of the SA variants [θ] and [ð] (Schmidt 1974: 94, cited in Daher 1999, 164). The second change took place some time after the 14th century (Birkeland 1952; Schmidt 1986: 57; Schulz 1981:33; all cited in Daher 1999); some [θ] and [ð] variants in borrowed words from SA were replaced in colloquial speech with [s] and [z] respectively. According to Daher (1999), the sounds [θ] and [ð] might only appear in the speech of some Damascene speakers who are highly educated and whose jobs involve extensive use of the written language, SA. Daher tries to argue that the appearance of the SA variants [θ] and [ð] in colloquial speech as [s] and [z] respectively is due to attempting to imitate the SA variants but pronouncing them as [s] amd [z] instead (p. 164). According to Daher, the use of [s] and [z] is more elevated than the use of [t] and [d] respectively, despite being also dialectal variants. Thus, some speakers may produce [s] and [z] when aiming at producing the SA variants [θ] and [ð] respectively. However, he discovered that the observed variation between [t] and [s] and between [d] and [z] is “stable” (p. 180) with no indication of any change in progress. Daher dealt with the variants of interest from a different perspective; he treated them as ternary and binary variables. The ternary variables are [t] and [d] and the binary variables are [s] and [z]. Ternary refers to the possibility of using the three forms in one word interchangeably. For example, [t], [s], or [θ] can occur in the word for 'snow': [talʒ], [salʒ], or [θalʒ]. In this case, the underlying forms for all the variants would be /t/. It would be /d/ for words that can be pronounced with either [d], [z], or [ð]. On the other hand, the underlying form for binary variables would be /s/ and /z/ because words can be pronounced with either [s] and [θ] or [z] and [ð]. Daher's findings are different from the findings in this study because his primary purpose was comparing females' and males' use of standard and colloquial variants. These findings are based on his data that were probably elicited in a less natural way, in that people used the [θ] or the [s] sounds instead of [t] and the [ð] and [z] sounds instead of [d] in words that are normally pronounced in colloquial speech with [t] and [d] respectively. According to Daher (1998: 2), the sociolinguistic interview could elicit spoken SA from educated speakers outside a formal setting, such as television and radio broadcasting, public speeches, journalism, etc. This is not the case in my data. All speakers spoke naturally using their dialectal variants all the time. They used specifically [t] in some words and specifically [s] in other words in place of the SA variant [θ]. The same applies for the use of [d] and [z]; each is used specifically in certain words instead of the SA variant [ð]. For this reason, I call this kind of variation *stable variation*, and I suggest that each variant has its own underlying form that is the surface form of each one of them, which is found in the colloquial speech of RCA and HCA speakers. In this sense, /t/ is the underlying form for [t]; /s/ for [s]; /d/ for [d]; and /z/ for [z]. I will also argue that the two SA phonemes /θ/ and /ð/ are absent from the inventory of RCA and HCA speakers (Appendix F). The difference between HCA and RCA, on the one hand, and SA, on the other hand, is illustrated in Table 3-23.

Table 3-23. The variants of the variables (θ) and (ð) in SA, HCA, and RCA

Variable	Variants in SA	Variants in RCA	Variants in HCA
(θ)	[θ]	[t]/[s]	[t]/[s]
(ð)	[ð]	[d]/[z]	[d]/[z]

To support my argument, I checked the linguistic environment for each variant and I noticed that all four variants could occur in similar environments, and there is no natural class that can be identified before or after any one of them. This tells us that the linguistic environment does not play a role in determining which variant should be used and when. It is obvious from the list of environments in Table 3-24 that each of the variants is a separate phoneme; it is the underlying form for its surface form (i.e., the underlying form for [t] is /t/ and so on). The environments that are written in blue in Table 3-24 are identical to the environment of the counterpart of each variant; the ones written in pink coincide in all four variants.

Examination of the linguistic environments justify my earlier suggestion that /θ/ and /ð/ are not part of the RCA and HCA inventory of phonemes and that each of the variants represents the basic allophone (i.e., the phoneme or the underlying form). It seems that there is a fixed and stable division among words that have historically come to be pronounced with one of the four variants: [t] and [s] and [d] and [z]. For example, the words [ktiir] ‘a lot/many/much/plenty’, [masalan] ‘for example’, [haadaa] ‘this (M)’, and [ʔizaa] ‘if’ are always produced with the sounds [t] and [s] and [d] and [z] respectively by all speakers. [t] and [s] are not interchangeable in [ktiir] and [masalan][14], and so is the case with [d] and [z] in [haadaa] and [ʔizaa].

[14] This is the HCA form that is pronounced with [an] word-finally. Some speakers use [masalen] instead because of what is called in Arabic *ʔimala*, i.e. the change of [a] to [e]. It is a feature of the RCA dialect, a feature that also undergoes change in the speech of those who acquire the HCA dialect completely. However, this is beyond the scope of this study and will be left for further research.

Table 3-24. List of environments for [t] and [s] and [d] and [z]

[t]	[s]	[d]	[z]
[k – i]	[a –a]	[i – e]	[i – a]
[k – a]	[a – i]	[a – a]	[# - a]
[i – t]	[ʔ - i]	[a – u]	[a – a]
[# – l]	[u – a]	[x – V]	[t – i]
[a – i]	[# - a]	[i – a]	[i - #]
[k – o]	[# - u]	[a - #]	[a - #]
[a – r]	[o - #]	[i – #]	[a – k]
[i – r]	[a - #]	[o - #]	[t – a]
[a – a]	[i - #]	[a – i]	[n – u]
[e – i]	[t – a]	[a – o]	[i – n]
[a – #]	[d – i]	[u – e]	[ʕ - a]
[i – #]	[i – y]	[i – u]	[i – k]
[# - i]	[ħ - #]	[e – a]	[# - i]
[# - a]	[u - #]	[a - ʔ]	[a – b]
[# - e]	[ʕ - #]	[a – q]	[a – i]
[# - m]	[ʕ - a]	[a – t]	[ʕ - e]
[# - n]	[t – i]	[a – n]	[i – i]
[# - o]	[b – b]	[a – r]	[i – r]
[o - #]	[a – n]	[# - a]	[ɣ - i]
[i – l]	[i – n]	[u – a]	[i – t]
[m – a]	[e - #]	[b – d]	[a – n]
[# - ʔ]	[i – m]	[# - r]	[i – b]
[# - q]	[r – i]	[i – o]	[a – l]
[# - y]	[ʕ - i]	[i – b]	[k – o]
[ʕ - a]	[i – i]	[i – i]	[ʕ - i]
[a – u]	[a – b]	[a – b]	[x – i]
	[r – o]	[u - #]	[x – u]
	[i – u]	[# - i]	[r – a]
	[i – b]	[y – b]	[a – h]
	[i – a]	[u – a]	[i – e]
	[ʕ - u]		[ʒ - m]
	[a – m]		[o – o]
	[a – r]		[u – a]
	[m – i]		[ʒ - i]
	[# - i]		[ʕ - u]
	[a – q]		[a – r]
	[n – a]		[k – i]
	[a – b]		[# - e]
	[d – o]		[n – i]
	[y – i]		[a – e]
			[b – a]
			[# - o]
			[n – a]
			[e - #]

3.3.1 Linguistic Constraints Pertinent to the Variation between [t] and [s] and [d] and [z]

Because of the fixed and stable variation that is observed in the data, I propose a number of linguistic constraints that are required for the maintenance of the four variants in their respective words. Since the SA variants [θ] and [ð] are not observed in the data, I assume that they are not part of the phonemic system of speakers. In other words, the SA variables /θ/ and /ð/ are absent from the speakers’ phonemic inventory. The context-free markedness constraints militating against these two sounds (i.e., *θ and *ð) will be undominated in the grammar of speakers’ speech. What is present in speakers’ phonemic repertoire are the observed variants in the data: /t/, /s/, /d/, and /z/. For example, the SA words /θalaaθa/ ‘three’ and /haaðaa/ ‘this (M)’ are always pronounced in RCA and HCA as [tlaati] and [haadaa] respectively. Since this applies to all speakers, there is no reason to believe there is an underlying form that is different from the surface form. The existence of all four variants (/t/, /s/, /d/, and /z/) in the speech of speakers impels us to suggest four context-free markedness constraints that militate against each of the four variants in attempt to eliminate it from or prevent it from occurring in certain words. These four context-free markedness constraints are:

(12)	*t	Voiceless alveolar stop is marked
(13)	*s	Voiceless alveolar fricative is marked
(14)	*d	Voiced alveolar stop is marked
(15)	*z	Voiced alveolar fricative is marked

A switch from the use of [t] to the use of [s], for example, or vice versa involves a manner of articulation change: a change from a stop to a fricative or from a fricative to a stop, and so is the case with respect to switching between [d] and [z]. Hence, we need the following faithfulness constraints to maintain the friction and stop features in the input:

(16) IDENT-IO (Fric) Let α be a segment in the input, and β a correspondent of α in the output. If α is [γFric], then β is [γFric]

(17) IDENT-IO (Stop) Let α be a segment in the input, and β a correspondent of α in the output. If α is [γStop], then β is [γStop]

Any change from /t/ into [s], /s/ into [t], /d/ into [z], and /z/ into [d] will result in violation of one of the two constraints in (16) and (17). Since both constraints in (16) and (17) militate against the change of some manner of articulation, we can combine them in one IDENT-IO constraint for manner:

(18) IDENT-IO (Manner) Let α be a segment in the input, and β a correspondent of α in the output. If α is [γManner], then β is [γManner]

The constraint in (18) is sufficient to prevent any change in the manner of articulation and guarantees that all input forms will have equivalent corresponding output forms. In other words, the faithfulness constraint must be higher ranked than the four markedness constraints to preserve the input in the output. The ranking among the four markedness constraints is irrelevant because they are all violable since all fours sounds are possible in natural speech.

3.3.2 Faithfulness and the Variants [t] and [s] and [d] and [z]

Here, I will follow the same process that I followed in modeling the variable use of [q] and [ʔ]. I define a number of grammars. The ranking value of constraints will be set at 100 unless specified otherwise. Each grammar will be forwarded to pair distribution, then to strings and to distributions. We learn from partial outputs by selecting the output string or the output distribution with the defined OT grammar. The number of learning trials is 100,000 unless specified otherwise with 0.2 noise and 0.1 plasticity. The underlying form is assumed to be the surface form of the speakers, that is /ktiir/ for [ktiir] and /masalan/ for [masalan], for example. I will start examining the variable use of [t] and [s], using the two mentioned underlying forms as inputs and two possible outputs for each input: [ktiir] and [ksiir] and [masalan] and [matalan] (the latter of each pair of words does not occur in speech) respectively.

Example 8: Without manipulation of the pair distribution or output distribution, we will get varied results of 15% of [ksiir], 36% [ktiir], 33% of [masalan], and 16% of [matalan] and the ranking values in Table 3-25.

Table 3-25. Ranking values and disharmonies of *s, *t, and IDENT-IO (Manner), without manipulation of the values of the pair distribution

Constraint	Ranking value	Disharmony
IDENT-IO (Manner)	100.107	102.446
*s	100.042	99.465
*t	99.958	98.453

Alhough we get about 50% use of each word, we do not get results that match real life occurrences. That is, in real life, [matalan] and [ksiir] are not used, but they still appear as winners in the above percentages. To avoid this contradiction with real life, we need either to change the ranking values of constraints, allowing for a definitive higher ranking of IDENT-IO (Manner) over the other two constraints. For example, we can set the ranking value of IDENT-IO (Manner) at 100 and give the other two constraints a ranking value of 90 or less. In this way, we get after learning from partial outputs 50% use of [ktiir] and 50% use of [masalan], which in actuality means 100% use of [ktiir] and 100% use of [masalan] if we had only one representative tableau of one of the inputs rather than both tableaus in the grammar. We also get the ranking values in Table 3-26 and Tableaus 3-27 and 3-28.

Table 3-26. Ranking values and disharmonies of *s, *t, and IDENT-IO (Manner) when ranked at 90, 90, 100 respectively

Constraint	Ranking value	Disharmony
IDENT-IO (Manner)	103.161	103.616
*t	91.193	89.535
*s	88.807	89.521

Tableau 3-27. Ranking of *s, *t, and IDENT-IO (Manner): Underlying form /ktiir/

/ktiir/	IDENT-IO (Manner)	*t	*s
☞ a. [ktiir]		*	
b. [ksiir]	*!		*

Tableau 3-28. Ranking of *s, *t, and IDENT-IO (Manner): Underlying form /masalan/

/masalan/	IDENT-IO (Manner)	*t	*s
☞ a. [masalan]			*
b. [matalan]	*!	*	

The second option besides changing the ranking value of constraints is that we can manipulate the pair distribution and we will still get similar results to those in Table 3-26 and similar percentages. If we change the pair distribution to 100% use of [ktiir] and 100% use of [masalan], and we learn from partial outputs, we get 50% use of each word (i.e., 100% actual use of each) and the ranking values in Table 3-29.

Table 3-29. Ranking values and disharmonies of *s, *t, and IDENT-IO (Manner), manipulating the pair distribution to 100% use of [ktiir] and 100% use of [masalan]

Constraint	Ranking value	Disharmony
IDENT-IO (Manner)	112.132	112.332
*t	100.315	101.213
*s	99.685	96.749

The large difference between the ranking value of IDENT-IO (Manner) and the other two constraints apparent in Table 3-29 guarantees its higher ranking than the other two constraints: *t and *s. This is indicative of the role that faithfulness plays in maintaining the input in the output. Thus, one can conclude that in this type of variation, faithfulness constraints are the leading factors for maintaining a *stable* variation. This point will be highlighted more as we examine the effect of social constraints on this type of variation. Nonetheless, a small clarification may be needed for why the 50% is equal to 100% in actuality. Having two tableaus in the grammar (one with the input /masalan/; the other with the input /ktiir/) and a number of input strings of 1000 will result in equal number of input for each input: 500 inputs of /ktiir/ and 500 inputs of /masalan/. This further results in a 1000 output strings divided equally between [masalan] and [ktiir]: 500 outputs of [masalan] and 500 outputs of [ktiir]. This explains the 50-50% occurrence of each word. If we had the three constraints *t, *s, and IDENT-IO (Manner) and one tableau in the grammar in which the input and the winning output has, for example, a *t* only, not an *s*, like *ktiir*. In this case, all the input strings (i.e., 1000) will be /ktiir/ and all the output strings (i.e., 1000) will be [ktiir], yielding 100% use of [ktiir]. The only difference in this case is that IDENT-IO (Manner) and *s will have equal ranking or non-categorical ranking with regards to each other. The difference between their ranking value and the ranking value of *t is around 10, which is considered a high difference that will secure higher, categorical ranking between those two constraints and *t. Having higher rankings than *t, violation of any one of the former two constraints is fatal, whereas violation of *t is endurable as it is violated by the winner. Moreover, learning from partial outputs in which [t] occurs 100% in some words and the learner hears these outputs as inputs results in 100% use of [t] and the ranking values in Table 3-30 after 100000 learning trials.

Table 3-30. Ranking values and disharmonies of *s, *t, and IDENT-IO (Manner) with manipulation of the pair distribution to 100% use of [ktiir]

Constraint	Ranking value	Disharmony
*s	106.018	106.817
IDENT-IO (Manner)	106.118	104.400
*t	93.982	92.073

The same applies to [masalan]; its occurrence 50% equals 100% in actuality if we had the three constraints *t, *s, and IDENT-IO (Manner) and one tableau in which the input and the winning output have an *s* only, not a *t*, such as *masalan*. Without manipulation of the pair distribution, we should get results that match a fraction of two-to-one because the [masalan] output will be violating only one constraint out of three constraints; the suboptimal output, [matalan] would be violating two constraints out of three. This should result in approximately 67% use of [masalan] and 33% use of [matalan], which is far apart from real life occurrences. Therefore, in the case of this type of variation, it is essential to manipulate the pair distribution or the ranking value of constraints to achieve results that match real life production. All that has been discussed so far applies also to the variable use of [d] and [z]. There is no need to present more examples for the latter pair of variants because they behave exactly like [t] and [s] concerning their occurrence in speech.

After showing the importance of faithfulness constraints in determining the winner with regards to the variants [t] and [s] and [d] and [z], it is important to test the influence of social constraints on this type of variation. Do social constraints play the same role observed in the variable use of [q] and [ʔ]? In the next section, I will intersect some social constraints with the linguistic constraints proposed in this section to see if they also play a role in determining our grammar at a certain time and a place regarding the variants [t] and [s] and [d] and [z]. However, a slight change should be done to the constraints to accommodate the variants [t] and [s] and [d] and [z].

3.3.3 Social Constraints Pertinent to the Variants [t] and [s] and [d] and [z]

The social constraints pertinent to the variants [t] and [s] and [d] and [z] are factored in the same way we factored the social constraints for [q] and [ʔ]. There are 32 social constraints; eight constraints for each social factor because there are four variants and each one is marked with respect to two categories within one social factor. Hence, each social factor should be factored into eight social constraints as follows:

Gender: *F[t] [t] is marked socially in the speech of females

	*F[s]	[s] is marked socially in the speech of females
	*M[t]	[t] is marked socially in the speech of males
	*M[s]	[s] is marked socially in the speech of males
	*F[d]	[d] is marked socially in the speech of females
	*F[z]	[z] is marked socially in the speech of females
	*M[d]	[d] is marked socially in the speech of males
	*M[z]	[z] is marked socially in the speech of males
Age:	*OLD[t]	[t] is marked socially in the speech of older generation
	*OLD[s]	[s] is marked socially in the speech of older generation
	*YOUNG[t]	[t] is marked socially in the speech of younger generation
	*YOUNG[s]	[s] is marked socially in the speech of younger generation
	*OLD[d]	[d] is marked socially in the speech of older generation
	*OLD[z]	[z] is marked socially in the speech of older generation
	*YOUNG[d]	[d] is marked socially in the speech of younger generation
	*YOUNG[z]	[z] is marked socially in the speech of younger generation
Area:	*AKR[t]	[t] is marked socially in the speech of Akrama residents
	*AKR[s]	[s] is marked socially in the speech of Akrama residents
	*HAM[t]	[t] is marked socially in the speech of Al-Hameeddieh residents
	*HAM[s]	[s] is marked socially in the speech of Al-Hameeddieh residents
	*AKR[d]	[d] is marked socially in the speech of Akrama residents
	*AKR[z]	[z] is marked socially in the speech of Akrama residents
	*HAM[d]	[d] is marked socially in the speech of Al-Hameeddieh residents
	*HAM[z]	[z] is marked socially in the speech of Al-Hameeddieh residents

Social class:	*UMC[t]	[t] is marked socially in the speech of upper-middle class
	*UMC[s]	[s] is marked socially in the speech of upper-middle class
	*LMC[t]	[t] is marked socially in the speech of lower-middle class
	*LMC[s]	[s] is marked socially in the speech of lower-middle class
	*UMC[d]	[d] is marked socially in the speech of upper-middle class
	*UMC[z]	[z] is marked socially in the speech of upper-middle class
	*LMC[d]	[d] is marked socially in the speech of lower-middle class
	*LMC[z]	[z] is marked socially in the speech of lower-middle class

3.3.4 Will Social Constraints Affect the Previous Results?

In this *stable* variation, it is not expected for social constraints to have much influence on the variable use of [t] and [s] or [d] and [z]. All speakers use the same variant in the same word regardless of age, gender, social class or area (e.g., /ktiir/ is pronounced [ktiir] by all speakers and so on). To erase doubt, it may be useful to take an example in which social constraints are involved. In this case, the social constraints involved should balance each other. That is, two social constraints of the same category (e.g., female gender) and of two different marked usages will be involved (e.g., *F[t] and *F[s]), since females use both [t] and [s] equally and the variation is based on the word the variant occurs in, not on whether they are females or not.

Example 8: Following the same process in the GLA and without manipulation of the ranking values of constraints, we get after 100000 learning trails from partial outputs the percentages: 21% of [ksiir], 30% of [ktiir], 29% of [masalan], and 20% of [matalan] and the ranking values in Table 3-31. Moreover, these results do not match real life occurrences because [ksiir] and [matalan] do not occur in real life. The percentages are almost 50% for the total outputs for each input, which seems at first sight accurate since 50% output for each input equals 100% in actuality. However, the problem lies in the three-to-two fraction of the use of [ktiir] and [ksiir] and of [masalan] and [matalan] respectively. This is further due to the number of constraints involved in the computation: three constraints in support of [ktiir] and [masalan] and two constraints in support of [ksiir] and [matalan]. This is very informative; it informs us that we should manipulate either the pair distribution or the ranking values to arrive at real life values of variation. This manipulation will be explored in Example 9.

Table 3-31. Ranking values and disharmonies of *s, *t, IDENT-IO (Manner), *F[t], and *F[s] without manipulation of the values of the pair distribution

Constraint	Ranking value	Disharmony
*F[s]	100.004	98.465
*s	100.004	95.193
*t	99.996	98.453
*F[t]	99.996	100.739
IDENT-IO (Manner)	99.656	97.660

Example 9: If we manipulate the pair distribution into 100% occurrence of each of [ktiir] and [masalan], we get an almost 50-50% occurrence of each word after learning from partial outputs, which is equal to 100% occurrence of each output in actuality. The ranking values of constraints will be as in Table 3-32 after the 100000 learning trials from partial outputs.

Table 3-32. Ranking values and disharmonies of *s, *t, IDENT-IO (Manner), *F[t], and *F[s], manipulating the values of the pair distribution to 100% use of both [ktiir] and [masalan]

Constraint	Ranking value	Disharmony
IDENT-IO (Manner)	114.282	117.236
*s	101.666	103.724
*F[s]	101.666	101.099
*F[t]	98.334	100.931
*t	98.334	99.206

These results show again that the faithfulness constraint IDENT-IO (Manner) should have much higher-ranking value than the other four constraints. Violation of this constraint is fatal. The ranking of the other four constraints with respect to each other is irrelevant because the winners violate at least two of them. From this example, we can conclude that social constraints are not very important in determining our grammar with respect to the variable use of [t] and [s] and [d] and [z]. What are important in this type of *stable* variation are faithfulness constraints; these constraints play a major role in maintaining an equal corresponding output to the input.

3.3.2.1 Concluding remarks on the stable variation among [t] and [s] and [d] and [z]

In conclusion, Examples 8 and 9 show that the inclusion and exclusion of social constraints regarding the use of the four sounds [t] and [s] and [d] and [z] do not make a difference. Whether the social constraints *F[s] and *F[t] are included or not, the results are the same (i.e., the faithfulness constraint is higher ranked than the other constraints (social or linguistic) to preserve the input in the output). Thus, IDENT-IO (Manner) plays a major role in determining the winners; it must always have a higher-ranking value than the other markedness constraints to ensure the observed *stable* variation between [t] and [s] as well as between [d] and [z]. However, this kind of lexical conditioning could still be attributed to markedness because even when someone is reading (which is the case of one speaker who was reading a document to his cousin during the recording), the person uses [s] instead of [θ]. This presents evidence that speakers prefer less marked sounds and use them even in casual reading. In other words, speakers may find it easier to access sounds in their native phonemic inventory and use them instead of those learned later on in life (i.e., access /s/ and use its surface form [s] rather than use [θ] that was learned through formal education of SA as a second language).

CHAPTER 4
QUANTITATIVE ANALYSES OF [q] VS. [ʔ]

4.1 Introduction

In this chapter, I present quantitative analyses for the observed variation in the use of [q] and [ʔ]. The purpose of these quantitative analyses is to examine associations and correlations between both the dependent variants and the independent variables. First, I present tests of association that could inform us on what determines social class in the city of Hims. Next, a Bivariate test will be performed on the two dependent variants – [q] and [ʔ] – to see if they are correlated. To examine the main effects of and the interaction effects among the four independent variables – age, gender, residential area, and social class – on the variable use of [q] and [ʔ], I apply a number of statistical methods. These statistical procedures will help understand which of these four social factors plays a major or a minor role in the variation. Such investigations may help in confirming the findings of the theoretical analysis in Chapter 3. A number of statistical procedures are required for each variant as the following sections will reveal. The chapter will conclude with a discussion of the findings of the statistical analyses, trying to relate these findings to previous studies and the findings in Chapter 3. It will also present implications of these findings.

4.2 Tests of Association of Social Class with Education, Income, Residential Area, and Occupation

These tests are important because social class is a very hazy concept in the Arab World; many factors may play a role in determining someone's class. In addition, the social mobility existent in most societies affects a person's classification within one social class or another (Haeri 1996; Labov 2001). This is particularly true of Arab societies because of the great influx of migration from rural areas to urban centers. Most urban centers are associated with more prestige, better life style, and civilization. Consequently, a change from being a farmer to being a white-collar worker influences a person’s social classification. Also, being the son of a farmer and becoming a medical doctor affects that person’s social status. Thus, implementing these association tests may give an answer to what factors contribute to a person’s social status not only in the city of Hims, but also in other Syrian cities and urban centers in other parts of the Arab World. In addition, if social class emerges as a significant factor in the statistical analysis of the influence of the independent variables on the variable use of [q] and [ʔ], the associated factors will by inheritance have significant effect and vice versa.

In Table 2-1 in Chapter 2, I assigned social class to participants based on the community’s general evaluation of them as somewhat rich or somewhat poor. Rich in the Syrian sense does not mean extremely rich as it is in the English sense of the word. Rich could refer to someone who lives a comfortable lifestyle, equivalent to what would be termed upper-middle class in the West. Poor does not refer to those who are in need or cannot afford to live. It refers to those who can support themselves, but cannot lead the same comfortable lifestyle that the rich or upper-middle class leads. Poor in its Syrian sense would be equivalent to what is termed lower-middle class in the West. Given the hazy definition of social class in the Arab world, the lack of studies that refer to class division, and the possibility of social mobility because of migration from rural to urban areas and obtaining higher academic degrees, I decided to examine my assignment of social class to participants based on the general evaluation of the community to them against four possible social indicators. These social indicators are family income (mainly breadwinner income), education, occupation and residential area. Such social indicators are assumed by many studies to play a role in social class assignment (e.g., Labov 1972a; Eckert 1991b).

In order to see the degree of association among each of these four social indicators and social class, I use contingency tables that include Chi-squared tests. These tests are appropriate to measure the strength of association between a qualitative variable and other qualitative variables (i.e., categorical variables) (Agresti and Finlay 1997). In our case the response variable is social class that has two categories: lower middle and upper middle. The predictor variables are income, education, occupation and residential area. Income is divided into three categories: low, mid, and high. Education is divided into six categories: elementary school, middle school, high school, associate degree, bachelor's degree, and professional. The latter includes medical doctors, dentists, and those seeking master's or doctoral degrees. Occupation is divided into four categories: unemployed, government employee, private job/business, and professional. The latter includes teachers, engineers, medical doctors, and dentists. Each of the categorical variables is tested independently against social class because the Chi-squared test allows for testing only one categorical variable against another categorical variable. In our case, it is testing the effect of each of the four categorical variables on social class classification.

4.2.1 Test of Association between Social Class and Education

The Chi-squared test shows lack of association between education and social class (Appendix A). The value of the Pearson Chi-squared test is 6.21 and the *p*-value is 0.29, which is higher than 0.05, the probability value adopted throughout the study to reject the null hypothesis. Rejecting the null hypothesis is an indication of association. Since the *p*-value for education is higher that 0.05, the null hypothesis holds. That is, there is no association between social class and education. If we look at the bar chart in Figure 4-1, we will see that the six educational groups have slight differences between the two social classes. Only the Associate degree group shows great disparity between lower- and upper-middle classes. Although there are more professionals and bachelor's degrees in the upper-middle class category, the difference is slight in that it does not reflect an association between education and social class.

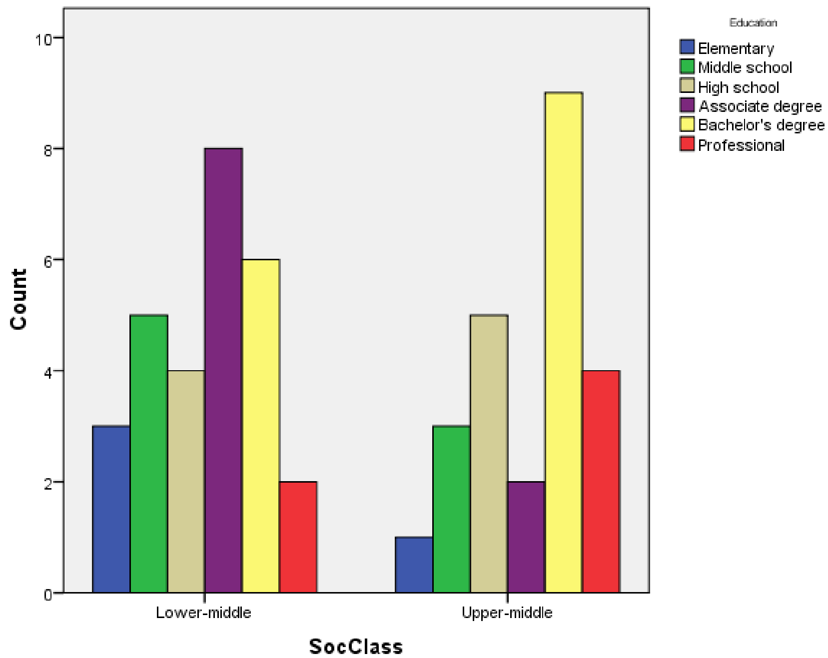

Figure 4-1. Bar chart for the distribution of the six educational groups between lower-middle and upper-middle classes

4.2.2 Test of Association between Social Class and Income

The Chi-squared test shows the existence of association between income and social class (Appendix A). The value of the Pearson Chi-squared test is 35.2 and the *p*-value is 0.000. The very low *p*-value indicates strong association between social class and income. The bar chart, in Figure 4-2, shows that low income is associated with lower-middle class, whereas high income is associated with upper-middle class. In fact, there is not a high-income person included among lower-middle class. The mid income is divided equally between the two social classes.

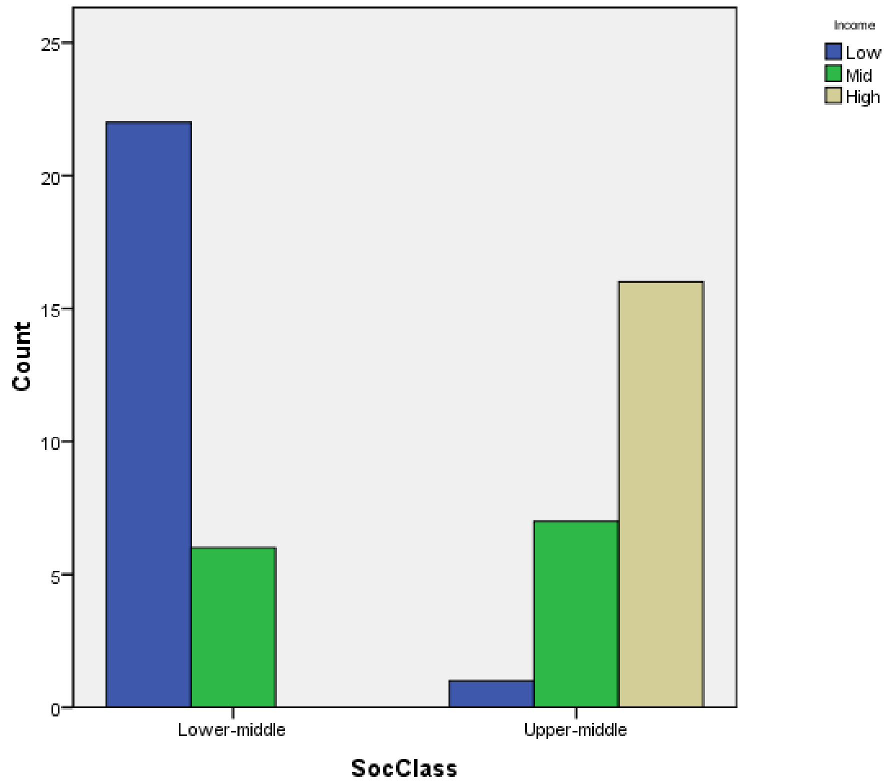

Figure 4-2. Bar chart for the distribution of the three income groups between lower-middle and upper-middle classes

4.2.3 Test of Association between Social Class and Occupation

The Chi-squared test shows the existence of association between occupation and social class (Appendix A). The value of the Pearson Chi-squared test is 9.578 and the *p*-value is 0.023. The low *p*-value indicates association between social class and occupation. The bar chart, in Figure 4-3, shows that the occupational category government employee shows significant difference in distribution between the two social classes. More government employees are in the lower-middle class category. The other three occupational categories do not show significant difference of distribution between the two social classes.

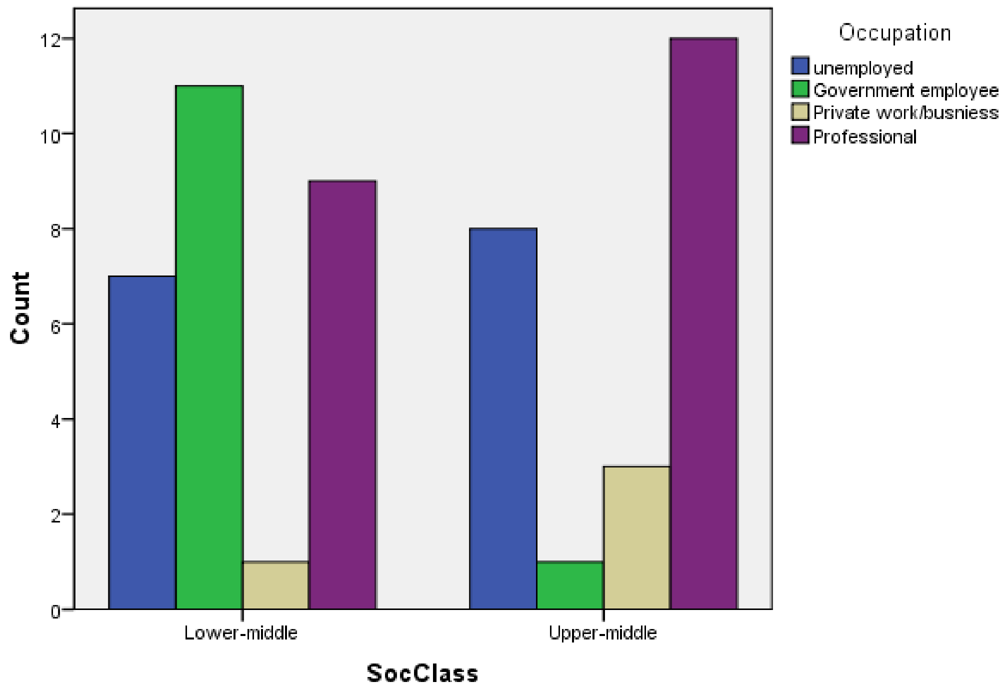

Figure 4-3. Bar chart for the distribution of the four occupational groups between lower-middle and upper-middle classes

4.2.4 Test of Association between Social Class and Residential Area

The Chi-squared test shows the existence of association between residential area and social class (Appendix A). The value of the Pearson Chi-squared test is 10.317 and the *p*-value is 0.001. The very low *p*-value indicates strong association between social class and residential area. The bar chart, in Figure 4-4, shows that much more upper-middle class people live in Al-Hameedieh than in Akrama. On the other hand, the number of lower-middle class people living in Al-Hameeddieh and Akrama is not much different.

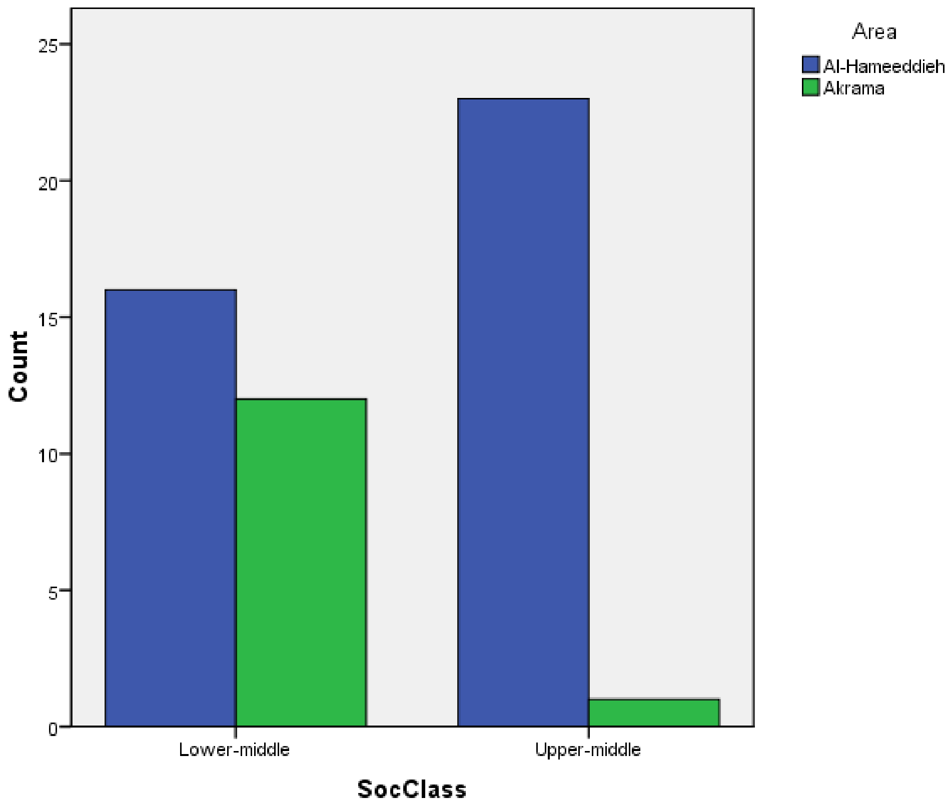

Figure 4-4. Bar chart for the distribution of the lower-middle and upper-middle classes in the two residential areas: Akrama and Al-Hameeddieh

4.2.5 Concluding Remarks on the Tests of Association between Social Class and Education, Income, Occupation, and Residential Area

The Chi-squared tests showed lack of association between social class and education. On the other hand, they showed association between social class and income, occupation, and residential area. Nonetheless, the Chi-squared values are not enough to tell us the strength of association between social class and the other variables. It is true that the larger the Chi-squared value, the stronger the association. However, this value could be affected by the sample size; the larger the sample size, the larger this value is. In order to eliminate doubt, we look at the adjusted residual values. If the adjusted residual absolute value is higher than two, there is strong association. Also, the higher the absolute value than two, the stronger is the association. Since only income, occupation, and residential area showed association, we look at their adjusted residuals (Appendix A) to see which one of them has the strongest association. Income has an adjusted residual absolute value of 5.4 for low income; 5.2 for high income; and only 0.6 for mid income. Occupation has an adjusted residual absolute value of 3 for government employee; 0.7 for unemployed; 1.2 and 1.3 for business/private job and professional respectively. Residential area has an adjusted residual absolute value of 3.2 for each of the residential areas. In this sense, income shows the strongest association followed by residential area. Occupation has the smallest association; there is only strong association with the government employee category. This fact was observed in the bar chart in Figure 4-3.

These results are confirmed by the Pearson correlation coefficient, which has the symbol *R*. The value of *R* is usually between -1 and 1; the closer the value to -1 or 1, the stronger the association. If the value is close to 0, the association is weak. The value of *R* for education is 0.2, indicating lack of association. The value of *R* for income is 0.82, indicating strong association. The value of *R* for occupation is 0.1, indicating lack of association. This last result contradicts the Chi-squared test result for occupation. Hence, one should consider other statistics in addition to the Chi-squared value and *p*-value to determine the strength of association. The value of *R* for residential area is 0.45, indicating moderate association. The *R* values for the different categorical variables investigated for strength of association with social class correlate with the adjusted residuals results. According to both the *R* values and the adjusted residual values, income has the strongest association, followed by residential area. Occupation and education have no association with social class according to the *R* values; occupation only shows significant association with respect to the government employee category according to the adjusted residual values.

In conclusion, one can assume that social class is mainly determined by income and area of residence in urban centers in the Arab World. It is slightly affected by occupation. Education does not seem to be a good determining factor of social class. These findings may be helpful for other researchers who tend to study the influence of social class on linguistic variation in the Arab World. They could be a starting point for further investigation in urban center, not only in Syria, but also in other Arab countries.

4.3. Speakers' Distribution of [q] and [ʔ]

Before applying statistical procedures to the data to see the effect of the four social factors on the variable use of [q] and [ʔ], I present the distribution of [q] and [ʔ] in the speech of each speaker in Table 4-1. Table 4-1 shows the number of occurrence of each sound from the total number of sounds for each speaker under the columns [q] and [ʔ]. Next to each of these columns, the percentage of the occurrence of each sound is calculated and presented under the percentage columns. The speakers' distribution regarding the four factors tested for effect on the observed variation is also included under separate columns for each factor. Table 4-1 shows that the total number of tokens for [q] and [ʔ] is 11,548. 5874 tokens of [q], which constitute 51% of the total number of tokens; 5674 tokens of [ʔ], which constitute 49% of the total number of tokens.

I entered the information included in Table 4-1 into SPSS to examine the effect of age, gender, residential area, and social class on the variable use of [q] and [ʔ]. I created two separate SPSS data files to perform different tests. I entered social factors in the same way in both data files. Each of the social factors contains two categories and is entered as a nominal variable. Age is assigned 1 for the younger age group and 2 for the older age group. Gender is assigned 1 for females and 2 for males. Residential area is assigned 1 for Al-Hameeddieh and 2 for Akrama.

Table 4-1. Distribution of [q] and [ʔ] in the speech of each speaker

Speaker	Gender	Age	Social class	Area	No. of [q]	% of [q]	No. of [ʔ]	% of [ʔ]
1	M	77	LM	Akrama	222/232	96	10/232	4
2	M	67	LM	Akrama	264/264	100	0/264	0
3	M	64	LM	Al-Hameeddieh	467/470	99	3/470	1
4	M	60	LM	Al-Hameeddieh	204/204	100	0/204	0
5	M	70	LM	Al-Hameeddieh	80/102	78	22/102	22
6	M	67	LM	Al-Hameeddieh	70/111	63	41/111	37
7	M	64	LM	Al-Hameeddieh	122/122	100	0/122	0
8	M	53	LM	Akrama	183/193	95	10/193	5
9	M	70	UM	Al-Hameeddieh	79/129	61	50/129	39
10	M	69	UM	Al-Hameeddieh	273/273	100	0/273	0
11	M	62	UM	Al-Hameeddieh	286/305	94	19/305	6
12	M	62	UM	Al-Hameeddieh	308/308	100	0/308	0
13	M	64	UM	Al-Hameeddieh	205/205	100	0/208	0
14	F	75	LM	Akrama	170/170	100	0/170	0
15	F	61	LM	Akrama	278/278	100	0/278	0
16	F	61	LM	Al-Hameeddieh	44/130	34	86/130	66
17	F	61	LM	Al-Hameeddieh	0/154	0	154/154	100
18	F	59	LM	Al-Hameeddieh	421/421	100	0/421	0
19	F	56	LM	Al-Hameeddieh	56/131	43	75/131	57
20	F	52	LM	Akrama	61/129	47	68/129	53
21	F	53	LM	Al-Hameeddieh	7/94	8	87/94	92
22	F	67	LM	Al-Hameeddieh	115/116	99	1/116	1
23	F	58	LM	Al-Hameeddieh	44/65	68	21/65	32
24	F	58	UM	Al-Hameeddieh	375/375	100	0/375	0
25	F	57	UM	Al-Hameeddieh	163/218	75	55/218	25
26	F	61	UM	Al-Hameeddieh	0/137	0	137/137	100
27	F	58	UM	Al-Hameeddieh	361/361	100	0/361	0
28	F	57	UM	Al-Hameeddieh	103/133	77	30/133	23
29	M	31	LM	Akrama	239/271	88	32/271	12
30	M	25	LM	Akrama	290/303	96	13/303	4
31	M	35	LM	Akrama	254/255	100	1/255	0
32	M	30	LM	Al-Hameeddieh	32/317	10	285/317	90
33	M	23	LM	Akrama	2/120	2	118/120	98
34	M	19	LM	Akrama	9/220	4	211/220	96
35	M	24	UM	Al-Hameeddieh	2/294	1	292/294	99
36	M	23	UM	Al-Hameeddieh	32/315	10	284/315	90
37	M	24	UM	Al-Hameeddieh	2/181	1	179/181	99
38	M	36	UM	Al-Hameeddieh	3/59	5	56/59	95
39	M	27	UM	Al-Hameeddieh	6/215	3	209/215	97
40	F	35	LM	Al-Hameeddieh	5/475	1	470/475	99
41	F	28	LM	Al-Hameeddieh	11/143	8	132/143	92

Speaker	Gender	Age	Social class	Area	No. of [q]	% of [q]	No. of [ʔ]	% of [ʔ]
42	F	24	LM	Al-Hameeddieh	0/308	0	308/308	100
43	F	18	LM	Akrama	0/65	0	65/65	100
44	F	29	LM	Akrama	5/421	1	416/421	99
45	F	28	UM	Al-Hameeddieh	1/124	1	123/124	99
46	F	33	UM	Al-Hameeddieh	3/479	0	476/479	100
47	F	32	UM	Al-Hameeddieh	0/114	0	114/114	100
48	F	28	UM	Al-Hameeddieh	7/385	2	378/385	98
49	F	23	UM	Al-Hameeddieh	6/118	5	112/118	95
50	F	25	UM	Al-Hameeddieh	2/178	1	176/178	99
51	F	21	UM	Al-Hameeddieh	2/127	2	125/127	98
52	F	26	UM	Al-Hameeddieh	0/230	0	230/230	100
Total					5874/ 11548	51%	5674/ 11548	49%

Social class is assigned 1 for lower-middle class and 2 for upper-middle class. In addition, in both files I entered [q] and [ʔ] as two separate scale variables. However, I treated the sounds [q] and [ʔ] differently in each of the data files. I used the percentages of [q] and [ʔ] for each speakers in one file. I used this file in Section 4.3.1 to explore the statistical distribution of the data with respect to each social group. The use of percentages provides more balanced comparison among individuals and groups. I used the raw frequency of [q] and [ʔ] for each speaker in the second file. I used this file in the regression tests performed in Sections 4.3.2 and 4.3.3. These tests only accept raw frequency data because they themselves calculate probabilities and percentages.

4.3.1 Exploring the Type of Statistical Distribution among the Various Groups

The choice of an appropriate statistical procedure for the data requires understanding the type of statistical distribution of those data with regards to each social group. In other words, it is essential to know if the distribution is normal or not before selecting a procedure. Normality or non-normality is an important factor to arrive at accurate statistical results. In order to discover the type of distribution in the data, we need to examine some descriptive statistics. We can run the Explore option from Descriptive statistics in the Analyze menu of SPSS. This procedure allows us to examine visually and numerically the distribution of each of the dependent variants against each group. That is, the distribution with respect to gender, social class, residential area, and age. This method also allows us to discover any outliers or extreme cases in the data. A separate SPSS data file was created for the Explore procedure in which the percentages rather than the raw frequencies of [q] and [ʔ] in Table 4-1 are used. Social factors are entered in the same way described in Section 4.3. I select the two dependent variants and place them in the dependent list and the four independent variables in the factor list. I choose the statistics Descriptives, Mean (M)-Estimates, and Outliers. Boxplots (factor levels together), histograms, stem and leaf plots, and normality plots with tests are also selected. The results of the explore procedure (Appendix B) show that for most groups the distribution is not normal. The stem and leaf plots and the normality plots are not included in Appendix B due to space limits and because histograms and boxplots are sufficient to show the data distribution.

The results of the Explore procedure show that the data is not normally distributed. There is skewness either to the right, a positive type of skewness, or to the left, a negative type of skewnes, in most cases (Appendix B contains tables, histograms, and boxplots for all the social groups with regards to the use of each of [q] and [ʔ]). If we look, for example, at the distribution of the female use of [q] and [ʔ], we observe the following. There is a great disparity between the mean, trimmed mean, and median in the female use of [q]. They are respectively: 83.7, 86.49, and 100. The skewness (-1.5) statistic provides evidence of disproportionate values at the lower/left tail of the distribution. The degree of skewness may differ from one group to another. However, the overall results show lack of normality in the distribution. The M-Estimators Table shows that the results of all four tests (Huber’s M-Estimator, Tukey’s Biweight, Hampel’s M-

Estimator, and Andrews' Wave) for the female use of [q] are closer to the median than they are to the mean. This further confirms that the data is not normally distributed. In addition, the Tests of Normality Table shows significance (*p* = 0.000), which means we reject the null hypothesis that the data is normally distributed. The histogram in Figure 4-5 shows this left tail skewness for the females' use of [q]. The boxplots show that this skewness could be due to some outliers that are marked with small circles or some extreme cases that are marked with asterisks. Consequently, these results influence the statistical model used for examining the effect of the social factors on the dependent variants, [q] and [ʔ].

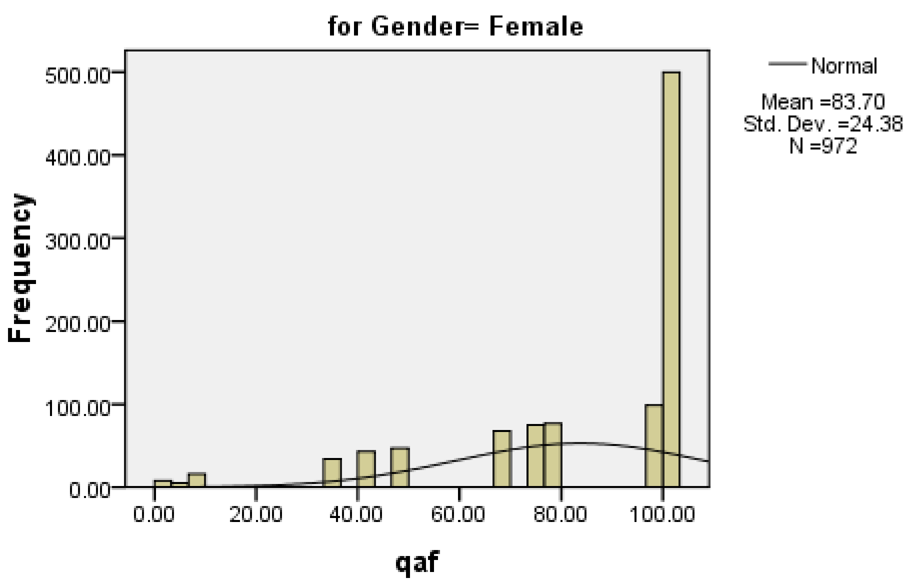

Figure 4-5. Histogram showing the skewness to the left in the females' use of [q]

I will not discuss the distribution of all the groups. They are comparable to the distribution of the female use of [q] with slight differences in the values of mean, trimmed mean, and median. There are also different degrees of skewness, the farther the statistic from 0, whether it is positive or negative, the larger the skewness and the less the normality. For example, the skewness (-3.69) statistic for Akrama's speakers' usage of [q] provide evidence of high skewness to the left. This is the result of four extreme cases as the boxplots show (Appendix B).

4.3.2 Bivariate Correlations Procedure between the Two Dependent Variants [q] and [ʔ]

This section shows that the two variants [q] and [ʔ] are highly correlated regarding their variable usage. The Bivariate Correlations procedure is used to measure degree of association between two scale variables. In our case, these two count variables are the two variants [q] and [ʔ]. I choose the Spearman's rho correlation coefficient because it does not require normal distribution like the Pearson correlation coefficient. It is also not affected by outliers if there are any in the data. Running this procedure in SPSS, we get the results in Table 4-2.

Table 4-2 shows that there is a strong negative correlation between the two variants as the *p*-value ($p < 0.01$) indicates statistical significance. This correlation is not perfect, but is close enough to -1 ($R = -0.82$). This type of negative correlation is referred to as inverse relationship (Patten 2004:117). That is, those who have high use of [q] have low use of [ʔ] and vice versa.

Table 4-2. Bivariate correlations between the dependent scale variants [q] and [ʔ]

Correlations

			qaf	hamza
Spearman's rho	qaf	Correlation Coefficient	1.000	-.820**
		Sig. (2-tailed)	.	.000
		N	52	52
	hamza	Correlation Coefficient	-.820**	1.000
		Sig. (2-tailed)	.000	.
		N	52	52

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

4.3.3 Generalized Linear Models (GZLM) Procedure for the Effect of the Four Independent Variables on the Two Dependent Variants [q] and [ʔ]

The GZLM includes statistical procedures such as linear regression for normally distributed response variables, logistic models for binary response or event count data, and loglinear models for event count responses. One can also use a mix of statistical models through the very general model formulation. The GZLM allow us to measure the main effects of one or more independent variables on a dependent variable. In our case, the independent variables are four: age, gender, residential area, and social class. The dependent variants are [q] and [ʔ]. The GZLM also allow us to measure the effect of interaction among the independent variables on the dependent variable. The general linear model (GLM) multivariate procedure allows us to measure the main effects and interaction of a number of independent variables on one or more dependent variables through a multivariate test. The GLM, however, assumes normal distribution and constant variance. The GZLM, thus, has an advantage over the GLM. They do not necessarily "assume a normal distribution or constant variance" (Agresti and Finlay 1997: 550). Having discovered in Section 4.2.1 that the distribution of the dependent variants among the different groups is not normal, it is more appropriate to use one of the GZLM. In addition to allowing non-normal distribution, the GZLM expands the GLM by specifying a link function that relates the dependent variable linearly to the independent variables.

To choose the appropriate GZLM model, we check the type of data in addition to the distribution. In this study, the data are count. Count data refer to the number of events of a number of trials. The number of events in my data is the number of occurrence of each of the two dependent variants in the speech of each speaker. The number of trials is the total number of occurrences for all speakers/subjects for each variant. The number of trials, in my data, is the fixed value 5874 for the [q] variant and 5674 for the [ʔ] variant (Table 4-1). One can use binary logistic to account for count data by specifying the fixed value of the variable (i.e., the total number of trials) for each variant, rather than treating the variant as binary. However, a Poisson distribution is more commonly used for non-normally distributed count response variable. The link function that is appropriate for count data and is usually used with a Poisson distribution is a Log link. The Log link, unlike the identity link, allows the mean to relate non-linearly to the independent variables. The Log link is often referred to as loglinear model. Hence, my initial choice of procedure for my statistical analysis is the Poisson loglinear regression, which is one type of regression tests that are used in probabilistic linguistics for count data (Manning 2003:335).

However, after performing the Poisson loglinear procedure, I realized that in the Goodness of Fit Table (Appendix C) that the Deviance and the Pearson Chi-squared (4798.992 and 5687.238 respectively) are too high. The value/df is also too high (102.106 for the Deviance and 121.005 for the Pearson Chi-squared), indicating overdispersion of the data. The value/df should be close to 1. If it is higher than 1, it could still indicate a good fit of the model. However, if it is too high, it indicates overdispersion and probably the need for a better fitting model for overdispersion. In addition, the Log Likelihood is too low (-2527.807). The Akaike's Information Criterion (AIC) (5065.613) and the Bayesian Information Criterion (BIC) (5075.369) are also too high. The smaller the AIC and BIC, the better the fit. The values of the Deviance, Pearson Chi-squared, Log Likelihood, the value/df, AIC, and BIC cast doubt on the goodness-of-fit of the model, although the Likelihood ratio Chi-squared (G^2) value (28.042) in the Omnibus Test Table shows significance (p = 0.000). The observed significance of the G^2 means that we can reject the null hypothesis that the independent variables have no effect on the variable use of the dependent variant [q]. To evade this doubt, I checked the goodness-of-fit criteria of the standard Poisson regression procedure against those of a negative binomial regression procedure with all other settings equal. Usually, negative binomial regression is recommended for overdispersed data. By changing the type of model to negative binomial with Log link, we actually get a better fitting model. The Log Likelihood (Appendix C) becomes higher (-265.034), and the value/df is higher than 1, but not extremely higher than one (1.932 for the deviance and 1.598 for the Pearson Chi-squared). In addition, the Deviance and the Pearson Chi-squared (90.806 and 75.09 respectively) are much smaller. The AIC (540.068) and BIC (549.825) are also much smaller than those in the Poisson regression. The Omnibus Test Table also shows significance (p = 0.000) of the G^2 value (41.313). In other words, the negative binomial procedure also rejects the null hypothesis and indicates that at least some of the social factors influence the variable use of [q]. Since both Poisson and negative binomial regressions show significant G^2 values, negative binomial regression provides a better fit for the overdispersed data by having other supporting goodness-of-fit criteria.

4.3.3.1 Negative binomial regression showing the main effects of the four independent variables, age, gender, residential area, and social class, on the variable use of the dependent variant [q]

In this section, mainly age and gender emerge as significant. Although residential area emerges as significant in one test, it shows otherwise in another test. On the other hand, social class emerges as insignificant. The negative binomial regression procedure is run though the SPSS software. From the analyze menu, I choose Generalized Linear Models. Then, I choose negative binomial regression as the type of model. Like the Poisson regression, negative binomial assumes non-normal distribution of the count data and the link function Log. For the response variable, I choose [q]. For the predictors, I choose the four independent variables as factors: social class, age, gender, and residential area. From options, I choose descending. For the model, I choose first the main effects of the four factors to see the effect of each independent variable on the response variable independently. For the estimation, I use the Pearson Chi-squared scale parameter method. This method is better for overdispersed data. For statistics, I check the case processing summary statistics, descriptive statistics, model information, goodness of fit, model summary statistics, and parameter estimates including exponential parameter estimates. Under the estimated mean (EM)-estimates, I select all four factors to measure simple contrast between each of the two categories included in the factor (e.g., contrast between the female and male categories in the gender factor). I also identify the category of reference, usually the highest number (2). For example, I chose the [Gender = 2], that is males who have been assigned to the category 2, as the reference category. Finally, I save the predicted value of linear predictor and the standardized deviance residual. These values are saved to the active data base and later used in a scatter plot to perform an informal model check. From graphs, I select simple scatter plot and drag it to the open window. The predicted value of linear predictor is dragged to the horizontal/X-axis and the standardized deviance residual is dragged to the vertical/Y-axis. The resultant plot should show us if there are any outliers.

The results of the negative binomial regression (Appendix C) show in the Tests of Model Effects Table that age ($p = 0.000$), gender ($p = 0.009$), and residential area ($p = 0.008$) play significant roles in the observed variation in the use of [q]. In contrast, social class ($p = 0.862$) do not seem to play a significant role in the variable use of [q]. The role played by age seems to be more important than the role played by gender and residential area. In the Parameter Estimate Table, we can read the coefficients under the column entitled *B*. These coefficients enable us to interpret the degree of use of each variant by the various groups of speakers. We can also read the exponential of the coefficient *B* under the column entitled Exp(*B*), which tells us the odds ratio of the occurrence of a certain sound in the speech of a group of speakers. The *B* coefficient for age is 2.866; it is positive. This means that older speakers [Age = 2] use more [q] than younger speaker [Age = 1]. The Exp(*B*) for age is 17.564. This number informs us that the odds that older speakers would use the [q] are 18 times the odds that the younger speakers would use the [q]. The coefficient for gender is 1.117; it is also positive. This means that males [Gender = 2] use more [q] than females [Gender = 1]. The Exp(*B*) for gender is 3.055. This number informs us that the odds that males would use the [q] are 3 times the odds that females would use the [q]. The coefficient for residential area is 1.481; it is also positive. This means that Akrama speakers [Area = 2] use more [q] than Al-Hameeddieh speakers [Area = 1]. The Exp(*B*) for residential area is 4.398. This number informs us that the odds that Akrama speakers would use the [q] are 4 times the odds that Al-Hameeddieh speakers would use the [q]. Although social class did not show significant effects, reading the coefficient may reveal some variation between the two social classes in their use of [q]. Speakers from the upper-middle class use [q] slightly less than speakers from the lower-middle class (coefficient B = - 0.072). The Exp(*B*) for social class is 0.93. This number informs us that the odds that upper-middle class would use the [q] are 93% of the odds/amount that lower-middle class would use the [q]. It is also useful to look at the estimated marginal means that result from the simple contrast performed on the two categories within each factor. The estimated marginal means indicate the difference between the two categories within a factor.

Age. With regards to age, the estimated marginal mean for older speakers is 333.42 and 18.98 for younger speakers. If we multiply 18.98 by the odds ratio, 17.564, we get 333.36. This result confirms that older speakers use [q] 18 times the amount used by younger speakers. In this sense, older speakers are expected to use [q] much more than younger speaker do. The Individual Result Table shows that the difference between older and younger speakers is highly significant

(p = 0.003). The Overall Test Table also reports significant contrast between older and younger speakers (p = 0.003).

Gender. As for Gender, the estimated marginal mean for males is 139.06, whereas it is 45.51 for females. Multiplying 45.51 by the odds ratio, 3.055, we get 139.03, indicating males are expected to use 3 times what females use. The Individual Result Table displays the significance (p = 0.023) of this difference between males' and females' use of [q]. The Overall Test Table also reports significant contrast between males and females (p = 0.023).

Residential area. Although the estimated marginal means for residential area show great difference (166.85 for Akrama speakers and 37.93 for Al-Hameeddieh speakers), this difference is not significant according to the Individual Result Table and the Overall Test Table. Both tables report a p-value that is larger than 0.05 (p = 0.092).

Social class. The same applies to social class. The estimated marginal mean for upper-middle class is 76.74 and 82.48 for lower-middle class). This difference is not significant according to the Individual Result Table and the Overall Test Table. Both tables report a p-value that is much larger than 0.05 (p = 0.86).

The significance shown in the contrast tests for age and gender indicate that the variation is not due to chance; rather, it is a variation that is affected by those two social factors. The difference is still significant even after the p-values are adjusted by the sequential Sidak method. However, the insignificance of the contrast test for residential area shows that the variation between Akrama and Al-Hameeddieh speakers is a chance variation, not necessarily a variation affected by residential area. Thus, the simple contrast results for all social factors do not completely accord with the results of the Parameter Estimates Table. Age and gender are significant predictors of the variable use of [q], but residential area is not as significant.

Looking also at the scatter plot resulting from saving the standardized deviance residuals and the estimated linear predictors, we note that there is strong variability of residuals across all values of the linear predictor. However, variability increases towards the central value of the mean and decreases as the mean increases. There may be a possible cause for concern regarding outliers. There are 3 points that are higher than 2. Usually, residuals that are higher than 2 are considered outliers. Some sources suggest that for a point to be consider an outlier, it should be higher than 3 (Agresti and Finlay 1997). In this case, the scatter plot does not show any outliers.

4.3.3.2 Negative binomial regression showing the effect of the interaction of the independent variables, age, gender, and residential area, on the variable use of the dependent variant [q]

In this section, we will see interaction between age, gender, and residential area. However, this interaction does not hold for all social categories. I apply a three-way interaction model to see if there is interaction among the social factors that have shown significant main effects in Section 4.2.3.1. I only exclude social class because it showed the least effect among the four independent variables. I do not exclude residential area, although it did not show significant difference between Akrama and Al-Hameeddieh speakers in the contrast test. The three-way interaction model of the negative binomial regression seems to be more fitting than the main effects model in Section 4.2.3.1. The Log Likelihood value is (-254.43), which is higher than the Log Likelihood value of the main effects model (-265.034). The Deviance, Pearson Chi-squared, AIC, and BIC show smaller values (69.59, 36.965, 524.86, and 540.47 respectively) than the main effects model. Also, the value/df are smaller than the main effects model (1.582 for Deviance and 0.84 for Pearson Chi-squared). The Omnibus Test Table also shows significance at $p < 0.05$ and the Likelihood ratio Chi-squared is 103.808. The Test of Model Effect Table shows that age ($p = 0.000$) and gender ($p = 0.000$) have significant effects independently from each other. The p-value for residential area ($p = 0.052$) approaches significance. Thus, residential area is included in the interaction model. The interaction of age, gender, and area is also statistically significant ($p = 0.000$). The Parameter Estimates Table shows that age ($p = 0.000$), gender (p = 0.007) and the interaction between the [Age=1], [Gender=2], and [Area=2] (younger males from Akrama) (0.005) are statistically significant. Residential area and other interactions of the categories within the three factors do not show significance. Looking at the coefficient *B* values may, however, be useful in determining the difference between the two categories within a factor or the interaction between the various categories. The coefficient *B* for age is (3.734), which indicates much more use of [q] by the older age group [Age = 2] than the younger age group. The odds ratio under column Exp(*B*) shows that the odds that older speakers would use the [q] sound is 41.845 times the odds that the younger speakers will use the [q] sound. The coefficient *B* for gender is (1.339), which indicates much more use of [q] by males [Gender = 2] than females group. The odds ratio under column Exp(*B*) shows that the odds that males would use the [q] sound is 3.815 times the odds that females would use the [q] sound. The interaction among [Age=1], [Gender=2], and [Area=2] seems to have the highest coefficient *B* (2.812) among all other interactions. This means that younger male speakers who reside in Akrama use more [q] than younger female speakers who reside in Akrama. This is supported by the fact that in Table 4-1, there are three younger male speakers (29, 30, & 31) who reside in Akrama and use almost 100% [q], in contrast to younger female speakers from the same area. In addition, the coefficient (B = 484) of the interaction among [Age=2], [Gender=1], and [Area=2] shows that older female speakers from Akrama use slightly more [q] than older female speakers from Al-Hameeddieh and younger female speakers from both Akrama and Al-Hameeddieh.

4.3.3.3 Negative binomial regression showing the effect of the interaction of the two independent variables, age and gender, on the variable use of the dependent variant [q]

This section will show strong interaction between age and gender. A two-way interaction model is employed to investigate this interaction. This model shows a worse fit than the three-way interaction model discussed in Section 4.2.3.2, but a better fit than the main effects model. The Log Likelihood value for the two-way interaction is (-261.794). The Omnibus Test Table shows significance (p = 0.000) and a Likelihood ratio Chi-squared of (71.153). The Test of Model Effect Table shows that both age (p =0.000) and gender (p = 0.000) have significant effects independently from each other. The interaction between age and gender is also significant (p = 0.000). The Parameter Estimates Table shows similar results to the Test of Model Effect Table. Age (p =0.000) and gender (p = 0.000) are statistically significant as well as the interaction between gender and age (p = 0.000). The coefficient *B* (3.815) shows that older age group uses [q] more than younger age group. The odds ratio shows that the odds that older speakers would use [q] are 45.356 times the use of [q] by younger speakers. The coefficient *B* (3.119) shows that males use [q] more than females. The odds ratio shows that the odds that males would use [q] are 24.509 times the use of [q] by females. The coefficient *B* (-2.827) for the interaction between age and gender shows negative association. That is, older male speakers use [q] less than older female speakers and younger female and male speakers. The odds ratio shows that the odds that older male speakers would use [q] are 5.9% of the use of other speakers. This result does not sound right because my observations of speakers and all the previous statistical tests show that older speakers and male speakers use more [q] than younger speakers and female speakers.

4.3.3.4 Negative binomial regression showing the main effects of the four independent variables, age, gender, residential area, and social class, on the variable use of the dependent variant [ʔ]

As it is the case regarding the use of [q], in this section age, gender, and residential area emerge as significant concerning the use of [ʔ]. I follow the same procedure of the negative binomial regression that I followed for [q]. The only difference is that the response variable is [ʔ] instead of [q]. In the Goodness-of-Fit Table (Appendix D), Deviance and Pearson Chi-squared are 104.98 and 50.341 respectively. The value/df are higher than 1 (2.234 for Deviance and 1.071 for Pearson Chi-squared), indicating the fitness of the model for the observed variation. The Log Likelihood is -268.473. The Omnibus Test Table shows significance at $p < 0.05$ and a Likelihood ratio Chi-squared of (51.853), indicating the existence of main effects of at least some of the independent variables.

The results of the negative binomial regression procedure (Appendix D, Tests of Model Effects Table) show that age ($p = 0.000$), gender ($p = 0.005$), and area ($p = 0.035$) play significant roles in the observed variation in the use of [ʔ]. In contrast, social class ($p = 0.321$) do not seem to play a significant role in the variable use of [ʔ].The role played by age seems to be more imprtant than the role played by gender and area. These results are similar to those when examining the main effects of age, gender, residential area, and social class on the variable use of [q]. In the Parameter Estimate Table, we can read the coefficients under the column entitled *B*. Those coefficients enable us to interpret the degree of use of the variant [ʔ] by the various groups of speakers. The coefficient for age is (-2.186); it is negative. This means that older speakers [Age = 2] use much less [ʔ] than younger speakers [Age =1]. The odds ratio for age (0.112) shows that the odds that older speakers would use [ʔ] is very small (i.e., 1.12% of the amount of use of [ʔ] by the younger speakers). The coefficient for gender is (-0.858), which means that male speakers [Gender = 2] use slightly less [ʔ] than female speakers [Gender = 1]. The odds ratio for gender (0.424) shows that the odds that male speakers would use [ʔ] is very small (i.e., 4.24% of the amount of use of [ʔ] by female speakers). The coefficient for area is (-0.887); it is also negative. This means that speakers from Akrama [Area = 2] use less [ʔ] than speakers from Al-Hameeddieh [Area =1]. The odds ratio for area (0.412) shows that the odds that speakers from Akrama would use [ʔ] is very small (i.e., 4.12% of the amount of use of [ʔ] by the speakers from Al-Hameeddieh). Although social class does not play a significant role in the variation, reading the coefficient column shows that there is a slight difference between the two social classes. Speakers from the upper-middle class use [ʔ] slightly less than speakers from the lower-middle class (coefficient B = -0.353). The odds ratio for social class (0.703) shows that the odds that the upper-middle class would use [ʔ] is very small (i.e., 7.03% of the amount of use of [ʔ] by the lower-middle class). It is also useful to look at the estimated marginal means that result from the simple contrast performed on the two categories within each factor. The estimated marginal means indicate the difference between the two categories.

Age. With regards to age, the estimated marginal mean for younger speakers is 157.38, whereas it is 17.68 for older speakers. Thus, younger speakers are expected to use [ʔ] much more than older speakers. Both the Individual Result Table and the Overall Test Table show that the difference between the two age group in their use of [ʔ] is significant (p = 0.000).

Gender. The estimated marginal means for gender also show great difference (81.01 for female speakers and 34.35 for male speakers). This difference is significant according to the

Individual Result Table and the Overall Test Table. Both tables report a *p*-value smaller than 0.05 ($p = 0.017$).

Residential area. As for residential area, the estimated marginal mean for Al-Hameeddieh speakers is 82.2 and 33.85 for Akrama speakers. In this sense, Al-Hameeddieh speakers' use of [ʔ] is more than double Akrama speakers' use of it. Both the Individual Result Table and the Overall Test Table show that the difference Al-Hameeddieh and Akrama speakers is highly significant ($p = 0.016$).

Social class. In contrast, the estimated marginal mean do not show a great difference between the two classes (44.22 for the upper-middle class and 62.93 for the lower-middle class). This difference is not significant according to the Individual Result Table and the Overall Test Table. Both tables report a *p*-value that is larger than 0.05 ($p = 0.304$).

The significance of age, gender, and area shown in the contrast tests indicate that the variation is not due to chance; rather, it is a variation that is affected by the three social factors: age, gender and residential area. The difference is still significant even after the *p*-values are adjusted by the sequential Sidak method. Thus, the simple contrast results for all social factors accord with the results of the Parameter Estimates Table. That is, age, gender, and residential area are significant predictors of the variable use of [ʔ].

Looking also at the scatter plot resulting from saving the standardized deviance residuals and the estimated linear predictors, we note that there is strong variability of residuals across all values of the linear predictor. There may be a possible cause for concern regarding outliers. There are 9 points that are higher than 2. Usually, residuals that are higher than 2 are considered outliers. Some sources suggest that for a point to be consider an outlier, it should be higher than 3 (Agresti and Finlay 1997). In this case, the scatter plot does not show any outliers.

4.3.3.5 Negative binomial regression showing the effect of the interaction of the independent variables, age, gender, and residential area, on the variable use of the dependent variant [ʔ]

In this section, we note that unlike the case of [q], there is no interaction between age, gender, and residential area regarding the use of [ʔ]. Like in the case of [q], I apply a three-way interaction model to see if there is interaction among the social factors that have shown significant main effects in Section 4.2.3.4. I only exclude social class because it showed the least effect among the four independent variables. The three-way interaction model of the negative binomial regression seem to be more fitting than the main effects model in Section 4.2.3.4. In the Goodness-of-Fit Table (Appendix D), Deviance and Pearson Chi-squared are 101.808 and 45.578 respectively, which are smaller than the ones in the main effects model and closer to the degree of freedom (df) value. The value/df are higher than 1 (2.314 for Deviance and 1.036 for Pearson Chi-squared), which shows smaller dispersion than the main effects model and a better fit. The Log Likelihood value is (-266.887), which is higher than the Log Likelihood value of the main effects model. The Omnibus Test Table shows significance at $p < 0.05$ and a Likelihood ratio Chi-squared 56.678. The Test of Model Effect Table shows that only age ($p = 0.000$) and gender ($p = 0.006$) are statistically significant. Residential area (p = 0.077) does not have significant effects. The interaction among the three social factors is also insignificant ($p = 0.395$). In the Parameter Estimates Table shows only age ($p = 0.000$) is statistically significant. Gender ($p = 0.847$) and residential area ($p = 0.999$), in contrast, do not show significance as well as the interaction among the various categories. The coefficient *B* for age (-1.496) from the Parameter Estimates Table shows that older speakers use [ʔ] less than younger speakers. The odds ratio for age shows that the odds that older speakers would use [ʔ] is smaller than the odds that the younger speakers would use [ʔ] (i.e., 2.24% of the amount used by younger speakers). Although the other two factors and the interaction among the three factors are not significant, I will discuss them in terms of what the coefficients show us. It is worth noting that the coefficients and the odds ratio show that males use less [ʔ] than females (*B* = - 0.1; Exp(*B*) = 0.905 = 9.05% of the females use of [ʔ]). The coefficients and the odds ratio show that younger males from Akrama use less [ʔ] than younger males from Al-Hameedieh (*B* = - 1.065; Exp(*B*) = 0.345 = 3.45% of the use of [ʔ] by younger males from Al-Hameeddieh). In addition, older female speakers form Akrama use less [ʔ] than older females from Al-Hameedieh and younger female speakers from both Akrama and Al-Hameeddieh (*B* = - 0.866; Exp(*B*) = 0.421 = 4.21% of the other females' use of [ʔ]).

4.3.3.6 Negative binomial regression showing the effect of the interaction of the two independent variables, age and gender, on the variable use of the dependent variant [ʔ]

This section will also show that unlike the case of [q], there is no interaction between age and gender regarding the use of [ʔ]. A two-way interaction model has a worse fit than both the main effects model and the three-way interaction. In the Goodness-of-Fit Table (Appendix D), Deviance and Pearson Chi-squared are 107.027 and 48.573 respectively, which are higher than the other two models. The value/df are higher than 1 (2.23 for Deviance and 1.012 for Pearson Chi-squared), an indication of a good fit. The Log Likelihood value is (-269.497), which is lower than the Log Likelihood value of the other two models. The Omnibus Test Table shows significance at $p < 0.05$ and a Likelihood ratio Chi-squared 52.86. The significance of Likelihood ratio indicates rejection of the null hypothesis that the independent variables are insignificant. The Test of Model Effect Table shows that only age ($p = 0.000$) and gender ($p = 0.002$) are statistically significant independently from each other. The interaction among the two social factors is insignificant ($p = 0.103$). In the Parameter Estimates Table only age ($p = 0.000$) is statistically significant. Gender ($p = 0.272$) as well as the interaction between the two independent variables ($p = 0.102$) are not significant. The coefficients and the odds ratio show that older speakers use less [ʔ] than younger speakers ($B = - 1.619$; Exp(B) = 0.198 = 1.98% of the younger speakers' use of [ʔ]). The coefficients and the odds ratio show that males use less [ʔ] than females ($B = - 0.454$; Exp(B) = 0.635 = 6.35% of the female speakers' use of [ʔ]). In addition, older males use less [ʔ] than younger males and older and younger females ($B = -0.931$; Exp(B) = 0.394 = 3.94% of other speakers' use of [ʔ]). It seems that a three-way interaction (Section 4.2.3.5) and a two-way interaction (this section) do not show statistically significant interaction among the social factors regarding the observed variation in the use of [ʔ]. The three social factors, age, gender, and area, seem to work mostly independently from each other.

4.4 Discussion of the Statistical Results

After investigating the degree of influence of each of the four social factors – age, gender, residential are, and social class – on the variable use of [q] and [ʔ], I will present a summary of those findings, their implications, and their relation to other variationist studies and to the theoretical proposal of this study. First, I will explore each variable separately. Then, I will conclude with a general summary.

4.4.1 Age

Age has been investigated by many sociolinguistic studies and found to play a major role in linguistic variation (e.g., Walters 1991, 1992; Miller 2005; Sankoff and Blondeau 2007). In most studies, younger speakers are more likely to adopt the prestigious form. From the statistical analysis above, age emerges as a major factor influencing the variable use of [q] and [ʔ]. Table 4-3 presents manually calculated differences in percentage usage of [q] between younger and older speakers. The table shows that there is a great difference between the two age groups. Older speakers use [q] 85% of the time; younger speakers use it 15% of the time. This usage is almost reversed with respect to [ʔ]. Younger speakers use [ʔ] 84%; older speakers use it 16%. The difference between the usage of [q] and [ʔ] between the two age groups is 69%. That is, the older speakers use [q] 69% more than younger speakers; younger speakers use [ʔ] 69% more than older speakers.

Table 4-3. Distribution of [q] and [ʔ] according to age group

Variant	No. of Tokens for Younger Age Group	% Younger Age Group	No. of Tokens for Older Age Group	% Older Age Group	Difference in Percentage
[q]	913/5718	16%	4961/ 5830	85%	69%
[ʔ]	4805/5718	84%	869/5830	15%	69%
Diff. in percent between use of [q] and [ʔ]		68%		70%	

It is worth noting that if we exclude the three young male speakers (29, 30, & 31) that appear to be exceptions to the other young speakers, regarding their use of [q], we will have a greater difference. Those three speakers live in Akrama and use [q] almost 100%. It seems that they show more solidarity with their surroundings than younger male speakers from Al-Hameeddieh who seem to be more influenced by the prestige of that area. Those three speakers' use of [q] constitutes 783 tokens out of the 913 tokens used by all 24 young speakers. The remaining 130 tokens are used by the other 21 speakers. If we divide 130 on the total number of tokens (4889) for the 21 young speakers, we get less than 3% use of [q] by the younger generation. Calculating also the three speakers' use of [ʔ] leads to a total of 46 tokens out of the 4805 tokens of the 24 speakers. Subtracting these 46 tokens from 4805 and dividing the resulting number (4759) on the total number of tokens for the 21 young speakers (4889) gives a 97% use of [ʔ] by the younger speakers.

These findings have a number of implications. First, the great difference between the two age groups indicates that the shift towards the urban, prestigious form is quick. The younger generation is more inclined towards the new form than older speakers. It took only one generation to adopt the new form. Although the younger generation, in this study, are the sons and daughters of the older generation and have been exposed to their parents' linguistic forms from birth, they show complete shift of linguistic interest. This situation is comparable to Miller's (2005:924) study of migrant speakers to Cairo. She suggests that the contact situation in Cairo leads "to a long-term accommodation for the first migrant generation and to total accommodation or dialect shift for the second generation, for example, those born in Cairo who speak almost dominantly CA." It seems that the younger speakers' exposure to schools, which involves mixing with native Himsi children, at an early age, has greatly influenced their choice of a variant. In this sense, they started understanding the social stigma associated with [q] at an earlier stage and were able to evade it by completely adopting the Himsi form, [ʔ]. The city social values along with their influence on the selection of a linguistic variant became their values, leading to their selection of [ʔ] over [q]. This is the core of Mufwene's (2005) theory of language evolution and selection. Selection is very much influenced by the species' surroundings and their relationship to their environment. Adopting the social values of their surroundings leads to restructuring of their parents' initial input to adapt to their environment, an environment that could be demanding linguistically and socially.

Second, some parents may be showing a struggle with this stigma, particularly older females who show greater variation than older males. They are trying to adopt the new form. Intra- and inter-speaker variation results from such attempts. Not all older speakers adopt the prestigious form to the same degree. Such variation may be very indicative of a number of issues. Older speakers are aware of the social stigma associated with [q], but they are unable to employ their social knowledge to its fullest. Some of them show almost complete acquisition of the new form (e.g., Speakers 17 & 21). Others do not show any kind of adaptation to the new form. There are also those who oscillate between the two forms within the same conversation with the same interlocutor. In the latter case, speakers probably have an internal struggle between their original social values and the present social values that impose pressure on their linguistic behavior. This internal struggle among social values leads to linguistic struggle because the social and linguistic are highly associated. Those who do not show any adaptation to the new environment could be the result of a fully developed social system that is very difficult to interfere with after full development. This is similar to species that may easily change genetically at their early stage of development for the sake of environmental adaptation, but once developed, they hardly change.

This brings us to the third point. These findings are consonant with my theoretical proposal in Chapter 3, in that, social factors should be treated on a continuous scale. They may be employed completely in the adoption process, resulting in 100% usage of the new form. In other words, their ranking values have been acquired and applied accurately in speech. In varying speakers, their new ranking values are not totally acquired; hence, the observed oscillation between the two forms. Speakers who do not show any kind of adoption of the new form seem to cling to their original social values, and thus, the ranking values of their native form. Such clinging could be an indication of their wish to maintain their original identity and show solidarity with their native community. Those points are only applicable to socially conditioned variations, not to other types of variation that may be conditioned by other factors, such as linguistic factors including markedness and faithfulness factors.

4.4.2 Gender

Gender has played a major role in linguistic variation as well (e.g., Fischer 1958; Trudgill 1974; Macaulay 1977, 1978; Romaine 1978; Gal 1979; Milroy 1980; Abdel-Jawad 1981, 1986; Milroy and Milroy 1985, 1992; Newbrook 1982; Eisikovits 1987, 1988; Walters 1991, 1992; Eckert 1991; Sawaie 1994; Coates 1996; Haeri 1996; Daher 1998a, 1998b; Al-Wer 1999, 2002). Most of these studies have shown that women are more inclined towards the prestigious forms. Abdel-Jawad (1981) and Al-Wer (1999, 2002), for example, showed that women in Jordan use the urban prestigious forms more than men do. Abdel-Jawad (1981) generalizes this to include the Arab World. His generalization seems to be borne out. The statistical analysis above has shown that gender is statistically significant in the variable use of [q] and [ʔ]. Men tend to use [q], the rural form, more than women do. On the other hand, women are more inclined towards the urban form, [ʔ]. Table 4-4 shows that males use [q] 66% of the time, whereas females use [q] 37%. There is a difference of 29%. Furthermore, women use [ʔ] 63%, whereas men use it 34% of the time with the same difference in usage.

Table 4-4. Distribution of [q] and [ʔ] according to gender

Variant	No. of Tokens for Males	% Males	No. of Tokens for Females	% Females	Difference in Percentage
[q]	3634/5469	66%	2240/6079	37%	29%
[ʔ]	1835/5469	34%	3839/6079	63%	29%
Diff. in percent between use of [q] and [ʔ]		32%		26%	

This difference between males and females is an indication that “women are more aware of the social significance” (Habib 2005:26) of [ʔ] than males are. In other words, women are more sensitive to the new form (Labov 1972a:303). The higher use of [ʔ] by rural females seems to indicate that rural females like to climb up the social scale and sound city-like. It seems more important for women to appear prestigious in a society that implements more limitations and restrictions on women. Women in restricted communities usually learn to adapt more to their environment than men do. Consequently, this leads to higher levels of linguistic adaptation. Language becomes an escape gate to the world around them. It becomes a tool to declare their difference (Ayres-Bennett 2004) from and superiority over men in one aspect of life, as Habib (2005:27) asserts

> Women probably compensate for their general social inferiority in Syrian society by presenting themselves as more linguistically capable and prestigious ….. They may be more inclined towards the prestigious forms because of the social pressure that is imposed on them: sounding pleasant and aspiring to appear more educated and urban, so that they can attract a good husband from a good social status and prosperous economic position.

Older women have shown linguistic insecurity (Labov 2001) in their interviews. Most of the varying women speakers from the older age group employed correction towards the prestigious forms. With regards to some words, they may show a reverse type of correction or rather slips of the tongue, which probably they could not control. Further, this could be due to their incomplete acquisition of the ranking values of the social constraints and consequently the ranking values of the relevant linguistic constraints. For example, Speaker-20 shows great variation in the same conversation. Table 4-5 presents her use of a number of words in the same conversation, sometimes with the sound [q] and at other times with the sound [ʔ]. The table shows the number of occurrence of each word and the corresponding meaning. One can notice that the only difference between the two words in one row is the use of [q] or [ʔ].This is just one example of an older female speaker who shows great variation in her speech, and thus, some linguistic insecurity.

Table 4-5. Variability in the speech of Speaker-20

Words with [q]	No. of word with [q]	Words with [ʔ]	No. of word with [ʔ]	Glossary
qabl	1	ʔabl	1	Before
qilt	3	ʔilt	17	I said
hallaq	3	hallaʔ	12	Now
qiḍḍainaa	1	ʔiḍḍainaa	1	We spent time
qallee	4	ʔallee	10	He told me
waqt	2	waʔt	2	Time
qal	2	ʔal	2	Discourse marker

Statistics have also shown that the interaction of age and gender is statistically significant. Table 4-6 shows that the difference between older female and male speakers is very small with respect to the use of [q]. Although the number of older males (i.e., 13) is smaller than the number of older females (i.e., 15), they use [q] 12% more than older females. This difference is greater regarding the use of [ʔ]. Older females use [ʔ] 64% more than older males. As for younger male and female speakers, the difference with respect to the use of [q] is greater between them than between older speakers. Although the number of younger males (i.e., 11) is smaller than the number of younger females (i.e., 13), they use [q] 90% more than younger females. Younger females use [ʔ] 30% more than younger males.

However, if we exclude the three young male speakers (Speakers 29, 30, and 31) that seem to behave differently from all other younger speakers, we get completely different percentages. These three male speakers are brothers and have lived all their lives in Akrama, a linguistically less influential area because of its abundance in rural migrants whose speech is characterized with [q]. Living in Akrama seems to have hindered them from adopting the prestigious form, [ʔ].

Table 4-7 shows that excluding those three speakers brings the difference between younger male and female speakers down to 36% more use of [q] by younger males. In addition, the difference regarding the use of [ʔ] goes up to 32% more use of [ʔ] by younger female speakers. Regardless of which table we adopt, there is difference when gender is grouped according to age. In other words, gender and age work together in influencing this apparent variation.

Table 4-6. Distribution of [q] and [ʔ] according to age and gender

	No. of speakers	No. of [q] Tokens	% [q]	No. of [ʔ] Tokens	% [ʔ]
Older males	13	2763/4961	56%	155/869	18%
Older females	15	2198/4961	44%	714/869	82%
Difference in percentage			12%		64%
Younger males	11	871/913	95%	1680/4805	35%
Younger females	13	42/913	5%	3125/4805	65%
Difference in percentage			90%		30%

Table 4-7. Distribution of [q] and [ʔ] according to age and gender without speakers 29, 30, & 31

	No. of speakers	No. of [q] Tokens	% [q]	No. of [ʔ] Tokens	% [ʔ]
Older males	13	2763/4961	56%	155/869	18%
Older females	15	2198/4961	44%	714/869	82%
Difference in percentage			12%		64%
Younger males	8	88/130	68%	1634/4759	34%
Younger females	13	42/130	32%	3125/4759	66%
Difference in percentage			36%		32%

4.4.3 Residential area

Residential area showed significance in the above statistics. Table 4-8 also shows difference in the use of [q] between Akrama and Al-Hameeddieh speakers. Akrama speakers use [q] 23% more than Al-Hameeddieh speakers, while Al-Hameeddieh speakers use [ʔ] 23% more. The results of this study support Miller’s (2005) findings in Cairo. Miller found that the speech of migrant speakers was affected by the area of residence. Those who lived in the suburban area, Giza, showed less accommodation to the Cairene forms. The reason is that the Giza area is occupied with more rural people than the Cairo area. Consequently, people have less contact with the new forms than those who live in the Cairo area and show more accommodation towards the Cairene forms.

Table 4-8. Distribution of [q] and [ʔ] according to residential area

Variant	No. of Tokens for Akrama	% Akrama	No. of Tokens for Al-Hameeddieh	% Al-Hameeddieh	Difference in Percentage
[q]	1977/2921	68%	3897/8627	45%	23%
[ʔ]	944/2921	32%	4730/8627	55%	23%
Diff. in percent between use of [q] and [ʔ]		36%		10%	

Furthermore, examining the interaction between age and area is useful because age has shown throughout the study to be the most important factor in influencing the observed variation. Table 4-9 shows that older people from Akrama use [q] 20% more than younger speakers from Akrama. Younger speakers from Akrama use [ʔ] 82% more than older speakers form Akrama. Older speakers from Al-Hameeddieh use [q] 94% more than younger speakers from Al-Hameeddieh. Although the number of younger speakers from Al-Hameeddieh (i.e., 17) is smaller than the number of older speakers form Al-Hameeddieh (i.e., 22), they use [ʔ] 66% more than older speakers form Al-Hameeddieh. These results indicate that younger speakers from Akrama are less susceptible to [ʔ] in their environment. Thus, their degree of use of [q] is not much different from that of older speakers. On the other hand, younger speakers who reside in Al-Hameeddieh seem to have less exposure to [q]. Consequently, they use [q] much less than older speakers. Furthermore, the smaller difference between older and younger speakers from Al-

Hameeddieh with regards to their use of [ʔ] indicates greater exposure of the older speaker in Al-Hameeddieh to [ʔ]; hence, their greater use of [ʔ] than those who live in Akrama.

Table 4-9. Distribution of [q] and [ʔ] according to age and residential area

	No of speakers	No. of [q] Tokens	% [q]	No. of [ʔ] Tokens	% [ʔ]
Older speakers from Akrama	6	1178/1977	60%	88/944	9%
Younger speakers from Akrama	7	799/1977	40%	856/944	91%
Difference in percentage			20%		82%
Older speakers from Al-Hameeddieh	22	3783/3897	97%	781/4730	17%
Younger speakers from Al-Hameeddieh	17	114/3897	3%	3949/4730	83%
Difference in percentage			94%		66%

4.4.4 Social class

Social class did not show any significance in the statistical analyses with respect to the variable use of both [q] and [ʔ]. Table 4-10 shows that there is only a 16% difference between the two social classes. The upper-middle class uses [q] 16% less than the lower-middle class and [ʔ] 16% more than the lower-middle class. These differences emerged as insignificant in Sections 4.3.3.1 and 4.3.3.4.

The fact that the upper-middle class is more inclined towards the prestigious form is not surprising. Many studies have shown that the lower-middle class aspires to appear prestigious. Members of the lower-middle class try to imitate those from the upper classes. For example, Labov (1972a) found that the use of (r) increases by social class and formality of style. However, he found that women from the lower-middle class use the upper class form, r-1, more than other speakers in word-lists and minimal pairs. He describes this phenomenon as hypercorrection towards the more prestigious form among lower-middle class females. Speakers from the lower-middle class realize the importance of the *r*-pronunciation. Consequently, they outperform the upper-middle class in the *r*-pronunciation when they are able to monitor themselves in formal styles, such as reading word-lists or minimal pairs. This phenomenon is also termed as the "crossover pattern" (Labov 1972a) or "apparent deviation" (Labov 1966:227). Such crossover patterns are taken as a sign for change in progress. Like Labov (1966, 1972a), Trudgill (1974) found a crossover pattern in the use of the variable (ing) in Norwich. Female speakers from the lower-middle class showed a great shift from the use of *-in* in casual style to the use of *-ing* in formal style. This shift is much greater in the lower-middle class than it is in any other social group. However, in other studies like Milroy's (1980), males from working classes showed less use of the prestigious form in Belfast because of their strong connection to their working class community. It is a way of expressing solidarity with their fellow workers.

Table 4-10. Distribution of [q] and [ʔ] according to social class

Variant	No. of Tokens for LM	% LM	No. of Tokens for UM	% UM	Difference in Percentage
[q]	3655/6284	58%	2219/5264	42%	16
[ʔ]	2629/6284	42%	3045/5264	58%	16
Diff. in percent between use of [q] and [ʔ]		16%		16%	

Since social class emerged as statistically insignificant, the associated factors such as income and occupation are assumed, in Section 4.2, not to play a role on their own, by inheritance, in determining variation in the use of [q] and [ʔ]. A GZLM procedure was performed to examine the influence of income, occupation, and education on each of the variants [q] and [ʔ]. The results are included in Appendix E. The results show that income (p = 0.318), occupation (p = 0.804), and education (p = 0.353) do not play a significant role in the variable use of [q]. However, the results are slightly different with respect to the variable use of [ʔ]. Income (p = 0.114) and occupation (p = 0.148), which are associated with social class, do not play a significant role. In contrast, Education, which is not associated with social class, plays a significant role ($p = 0.000$). Speakers with elementary education [Education = 1] ($p = 0.531$) and middle-school education [Education = 2] do not show significance according to the Parameter Estimates Table. The other four educational categories show significance. The least significant category is speakers with high-school education [Education = 3] ($p = 0.043$). The other three categories – associate degree [Education = 4], bachelor's degree [Education = 5], and professional [Education = 6] – are highly significant, all of which have the *p*–value ($p = 0.000$). Examining the coefficients in the Parameter Estimates Table, we notice that the higher the education, the higher the use of [ʔ]. The coefficient for professional [Education = 6] is 4.029, indicating that professionals use [ʔ] much more than other categories. The Exp(*B*) is 56.201, which informs us that the odds that professionals will use the [ʔ] sound is 56 times the odds that other educational categories will use the [ʔ].The coefficient for bachelor's degree [Education = 5] is 3.588, indicating that speakers with a bachelor's degree use [ʔ] much more than those with less education. The Exp(*B*) is 36.169, which informs us that the odds that speakers with a bachelor's degree will use the [ʔ] sound is 36 times the odds that lower educational categories will use the [ʔ]. The coefficient for associate degree [Education = 4] is 3.473, indicating that speakers with an associate degree use [ʔ] much more than those with less education. The Exp(*B*) is 32.249, which informs us that the odds that speakers with an associate degree will use the [ʔ] sound is 32 times the odds that lower educational categories will use the [ʔ]. The coefficient for high school [Education = 3] is 1.836, indicating that speakers with high school education use [ʔ] more than those with less education. The Exp(*B*) is 6.274, which informs that the odds that speakers with high school education will use the [ʔ] sound is 6 times the odds that speakers with middle school or elementary school education will use the [ʔ].

These findings implicate that schooling greatly affects a speaker’s adoption of the prestigious form, [ʔ]. Although in formal education the [q] sound is the basis for learning reading and writing (Daher 1998a; Haeri 2003), it seems that the social influence of the people we interact with in the school setting is greater, resulting in increased use of [ʔ] and decreased use of [q]. This finding is very interesting because it emphasizes the need to separate, in the Arab World, between what is considered prestigious in speech, [ʔ] in our case, and what is prestigious or standard in formal education, [q]. This separation was first suggested by Ibrahim (1986:125) “Standard Arabic has a certain degree of prestige and its religious, ideological, and educational values are undeniable, but its social evaluative connotations are much weaker than those of locally prestigious varieties.” Walters (1996:177), likewise, differentiates between two norms, a norm that is chosen for “free speech” and is “local”, the other is chosen for reading aloud and is “external”. Hachimi (2001:30) further refers to the possibility of having “competing prestige varieties”. Thus, even local varieties may carry different types of prestige and may be evaluated differently by different speakers based on the social class they belong to or their educational and occupational background.

4.4.5 Relationship of the Statistical Findings to the Theoretical Analysis

In Chapter 3, I showed that the three social constraints *F[ʔ], *OLD[ʔ], and *AKR[ʔ] are involved in giving us results that match real life occurrences of [q] (82%) and [ʔ] (18%) in the speech of older female speakers from Akrama. The quantitative analysis of this chapter has shown that there is significant interaction between gender, age, and residential area with respect to the use of [q], not with respect to the use of [ʔ]. This finding slightly contradicts with the findings of the theoretical analysis. Although, it reveals that there is interaction among the three factors, it eliminates this interaction in the case of the variable use of [ʔ]. Consequently, the theoretical analysis has an advantage over the quantitative analysis, in that it shows that there is partial interaction among the three factors with regards to the variable use of each of the independent variants. The theoretical analysis splits each social factor into four different constrains and specifies exactly which of the four constraints is involved. In this sense, only one of the constraints may be involved at one time or used by a certain speaker or group of speakers, whose effect may not show clearly in the quantitative analysis. Furthermore, not all speakers may use the same social factor in the same way. Speakers may activate different constraints within the same social factor. For example, I showed that younger female speakers from Al-Hameeddieh activate *F[q], *YOUNG[q], and *HAM[q], as opposed to older female speakers from Akrama, to arrive at their real life occurrences of [q] (2%) and [ʔ] (98%). These results tell us that residential area interacts with age and gender with regards to the use of [ʔ], in contrast to the results of the quantitative analysis. This finding highlights one further advantage of the theoretical analysis. Although a whole factor may not be involved in the interaction with regards to the use of one variant, part of it may be implemented by some speakers. Thus, the theoretical proposal of this study allows for more options and accounts more closely for the differences among different groups of speakers as well as individual speakers, which is very hard to do in one step in the statistical analyses. The theoretical analysis shows that it is not sufficient to say that this factor does not interact with other factors. It informs us specifically what constraint(s) is(are) involved. It also gives us the mental representation of how these factors interact with the linguistic constraints and how they influence the ranking values of those constraints.

Furthermore, the theoretical proposal allows us to see that certain social constraints may have higher ranking values in some speakers than others. For examples, we have seen that *M[ʔ] may have a higher ranking value than *F[ʔ] in the speech of older male speakers from Akrama because of their higher use of [q] (96%) and lower use of [ʔ] (4%) than older female speakers from Akrama. This is a further advantage of the theoretical analysis. It can indicate that one social factor, such as gender, may be more important to one group of speakers than another group of speakers. In the case of the variable use of [q] and [ʔ], it may explain the masculine connotation of [q] and the feminine connotation of [ʔ] in the literature (Sawaie 1994; Daher 1998a). Moreover, it may explain the masculine meaning that is associated with non-prestigious forms versus the feminine meaning associated with the prestigious forms (Abdel-Jawad 1986).

Nonetheless, the quantitative analysis cannot be disregarded completely because it has also its advantages, such as giving us a head start on what social factors may be involved or not, particularly for someone who may not be very familiar with the community. For someone who is from a community under investigation, like me, s/he will be able in the theoretical analysis to know the social constraints that are involved in the learning process for each group of speakers. Knowing the gender, area, and age of the speaker and the linguistic behavior of that speaker or group of speakers would enable a researcher to easily discover the social constraints involved in the speech of that speaker. Furthermore, I have mentioned in Chapter 3 that the GLA gives predications on what the speech of speakers would sound like if certain social constraints are involved. A listener is also capable of discovering the social constraints employed by a certain speaker at a certain time and place because they are familiar with their environment and the social constraints that are usually activated by different speakers. The GLA also gives representations of the amount of input of each variant that a speaker or a group of speakers is exposed to. Thus, it reflects on the social networks of the speakers. It can tell us that those older female speakers from Akrama receive approximately 82% input of [q] and 18% input of [ʔ], implicating that the Akrama environment is more dense with rural people and it is not a good environment for acquiring the new form quickly. This is apparent in the speech of the three young male speakers from Akrama (29, 30, & 31). They differ from their counterparts who reside in Al-Hameeddieh and who only took one generation to acquire the new form completely. The complete acquisition of [ʔ] by young female speakers from Al-Hameeddieh is a further indication of the density of Himsi people in that area and that Al-Hameeddieh is a facilitative learning environment of the new form.

This discussion leaves us with one further question. How does the learning process proceeds? In other words, do speakers learn some words quicker than others? If that is the case, does the frequency of certain words influence such acquisition? We have seen that the variable use of [q] and [ʔ] is influenced by social factors. However, it is worth examining if this variation proceeds first in the direction of the most common words than it does in the direction of the less frequent words.

4.5 Frequency Effects on the Acquisition of [ʔ]

It is expected that highly frequent words will be acquired faster by speakers than less frequent words (Pierrehumbert 2001; Medoza-Denton, Hay, & Jannedy 2003). First, I entered the words for each speaker in a separate table, grouping similar words together. Then, I created one huge table in which I grouped similar words from all speakers. I added the number of similar words to examine the frequency of their occurrence. I extracted from that huge table the most frequent words produced with [ʔ], words that occur 20 times or more (Table 4-11). I also extracted the most frequent words produced with [q], words that occur 20 times or more (Table 4-11). I performed this extraction because it may help in making comparison between the two lists – the [ʔ] list and the [q] list. Having similar words in the two frequent lists may be a further indication that the frequency of these words leads to faster acquisition of them. The frequency of words produced with [q] does not necessary mean that it will negatively affect the acquisition. Rather, it informs us that those words are very frequent in speech in society in general and that people are exposed to them more often than to other words.

The process of learnability of the new form [ʔ] will be noticed significantly if we examine the words produced with [ʔ] by older speakers whose speech is characterized with variation. For this reason, I decided to investigate the words used with the [ʔ] sound by those speakers. The speakers who show greater variability are speakers 5, 6, 9, 16, 19, 20, 23, 25, and 28. There are older speakers who show minor variability, such as speakers 1, 3, 8, 11, and 22. I will examine first those with lower variability and then those with higher variability to see which words with the [ʔ] sound are used by them. Then, I will present in Table 4-12, the number of occurrence of some of the frequent words extracted in Table 4-11 in their speech in comparison to less frequent words. I will also calculate the percentage of the occurrence of these frequent words in relation to other words uttered with [ʔ] in their speech to arrive at conclusions regarding whether frequency has influenced their acquisition of certain words before other words.

Table 4-12 strongly suggests that the more frequent the word, the more likely to occur in the speech of varying speakers. This implies that frequently occurring words are acquired faster than non-frequent words. In most of the varying speakers the word *hallaʔ* ‘now’ shows the highest percentages because it is the most frequent word in Table 4-11 (735 tokens with [ʔ] and

457 tokens with [q]). Even in speakers whose variation is minor, this word seems to penetrate into their system because of its high frequency, as is the case with regards to speakers 1, 3, 8, and 11 (Table 4-12). The second most frequent word in Table 4-11 is *waʔt* ‘time’ (295 occurrences with [ʔ]). Table 4-12 shows that this word occurs in high percentages in the speech of most speakers. For example, it is the only occurring word besides *hallaʔ* ‘now’ in the speech of Speaker-8 and has a higher percentage than *hallaʔ* ‘now’ (Table 4-12). It has the highest percentage after *hallaʔ* ‘now’ in the speech of Speaker-16 (Table 4-12). The next four words in frequency are *ʔaal* ‘said’, *ʔilt* ‘I/you said’, *baʔaa* ‘so/such/yet’, and *ʔallee* ‘he told me’ (264, 234, 124, , and 115 occurrences with [ʔ] respectively) (Table 4-11). *ʔaal* ‘said’, for instance, has the second highest percentage in Speaker-25, the third highest percentage in Speakers 16 & 19 , and the fourth highest percentage in Speaker-20 (Table 4-12). It occurs in the speech of most other speakers. *ʔilt* ‘I/you said’ has the second highest percentage in Speakers 19 & 28. It also occurs in the speech of most other speakers. *baʔaa* ‘so/such/yet’ has the second highest percentage in Speaker-23, the third highest percentage in Speaker-28, the fourth highest percentage in Speakers 6 & 16, and the fifth highest percentage in Speakers 9 & 25. This word appears in the speech of most other speakers. *ʔallee* ‘he told me’ has the third highest percentage in Speaker-20 and it occurs in the speech of most other speakers. It is worth noting here that a word like *ʔallee* ‘he told me’ is related semantically to other frequently occurring words like *ʔallaa* ‘he told her’, *ʔalluu* ‘he told him’, *ʔuul* ‘say/I say’, etc. All of these words carry the semantic meaning of ‘saying’. They are calculated independently from each other. However, it is possible to group them together because they are derived from the same root in Arabic. Arabic

morphology depends mainly on root and patterns; patterns are added to roots to derive other words which are semantically related. Grouping them together will give higher frequencies of them. Although the various forms of this verb and other words have been calculated separately, I do not eliminate the possibility that speakers may operate on the basis of the frequency of the root, not the word. Feldman, Frost, and Pnini (1995) have argued that morphemes and rules are stored in the brain, comparing English, a concatenative language, with Hebrew, a non-concatenative language like Arabic. Their study showed morphological relatedness effects in a repetition priming study among words that share the same root, even at long lags. This indicates that roots are stored separately in the lexicon and are accessed quickly by speakers who have encountered them earlier on in speech. Once accessed, speakers apply stored rules to build or decipher semantically related words. Nonetheless, Beret, Vaknin, and Marcus (2006) argued that in Hebrew, stems, not roots, are stored in the brain, although their findings do not completely eliminate the possibility of roots being stored. On the other hand, Davis and Zawaydeh (2001) and Arad (2003) propose that both stems and roots are stored in the brain. This point is beyond the scope of this study and requires further research.

In conclusion, from comparisons between Table 4-11 and Table 4-12, one can confirm that frequency plays a major role in the acquisition process. Mostly, high frequency words are the ones that occur in the speech of varying speakers. This is apparent in the high percentages of these words in their speech. We have seen that the more frequent the word, the higher its percentage in the speech of varying speakers. This leads to the conclusion that the more frequent the word, the faster the acquisition of that word and the more likely for it to be acquired by learners. Highly frequent words are even acquired by those whose speech can be characterized with almost 100% use of [q]. Knowing the frequency of a word allows us to make predications on whether this word is used by varying speakers or not. In other words, the frequency of words gives expectations on what a varying speaker's speech is likely to contain. Moreover, frequency should not be understood as the main reason for acquisition of the new form. Social factors impose pressure on speakers to adopt the new form. The role of frequency is leading this adoption process towards the most common words first.

4.6 Conclusion

This chapter has shown the influence of social factors on the variable use of [q] and [ʔ]. The results have shown that age, gender, and residential area play major roles in affecting this variation. Social class emerged as an insignificant factor in this variation. The results have also shown some interaction between the three significant factors with respect to the use of [q], but not with regards to the use of [ʔ]. The interaction between gender and age proved significant for both variants. The chapter has also tested the association between social class and education, income, occupation, and residential area. Education did not show significant association with social class. Income and residential area showed the most significance. Occupation proved to be significant with respect to the government employees' category. The factors that showed association with social class, occupation and income, did not have an effect on the variable use of [q] and [ʔ]. However, education showed some significance with respect to the use of [ʔ] independently from social class, to which it is not associated. The chapter has also shown some advantages of the theoretical analysis over the quantitative analysis. The theoretical analysis allows more specificity with regards to social factors; it gives clearer picture of what revolves in the mind of a speaker at a certain time and place. While some social constraints within one social factor may be activated by a speaker or a group of speaker, they may not be activated by others. While the quantitative analysis did not show interaction among age, gender, and residential area with regards to the use of [ʔ], the theoretical analysis was able to show this interaction because of its specificity. Furthermore, the theoretical analysis has shown that one social constraint within one social factor may have a higher ranking value within the same speech community than its counterpart. This specificity is not as achievable in the quantitative analysis as it is in the theoretical analysis. Finally, this chapter has shown that word frequency influence the acquisition process. Highly frequent words are acquired before less frequent words. The following chapter will present a quantitative analysis of the four variants [t] and [s] and [d] and [z]. Those four variants will be dealt with differently from the two variants [q] and [ʔ] because as we have seen they are not socially conditioned.

Table 4-11. Most frequent words produced with [q] and [ʔ]

	Word produced with [ʔ]	No. of tokens	Matching word produced with [q]	Glossary	No. of tokens
1	hallaʔ/halleʔ	735	hallaq/halleq	Now	457
2	waʔt	295	waqt	Time	82
3	ʔaal	264	qaal	Said	424
4	ʔilt	234	qilt	I/you said	397
5	baʔaa	124	baqaa	So/such/yet	98
6	ʔallee	115	qallee	He told me	172
7	ʔabl	96	qabl	Before	87
8	ʔaam	77	qaam	Discourse marker (Lit. ‘got up/did’)	41
9	rifʔaat/rifʔeet	76	rifqaat	Friends	53
10	ʔuulee	68	quulee	You can say/say	61
11	ħaʔʔ	58	ħaqq	Right/price	49
12	tlaaʔee	52	tlaaqee	You can find	22
13	rfiiʔ	50	rfiiq	Friend	24
14	ʔillik	50	qillik	I tell you	110
15	biiʔuuloo	49	quuloo	You (pl)/they say	47
16	ʔaddeeʃ	42	qaddeeʃ	How much	19
17	ṭariiʔ	42	ṭariiq	Road/way	48
18	taʔriiban/taʔriiban	43	taqriiban/taqriiben	Almost/approximately	59
19	ʔalluu	41	qalluu	He told him	148
20	farʔ	38	farq	Difference	13
21	ʔal	36	qal	Discourse marker (Lit. ‘it has been said’)	139
22	ʔaʕad	36	qaʕad	He sat/lived	7
23	ʔiṣṣa	35	qiṣṣa	Story	21
24	ʔimt/ʔumit	34	qimt	Discourse marker (Lit. ‘I got up/did’)	3
25	ʔadd	33	qadd	As much	34
26	ʔallaa	32	qallaa	He told her	42
27	ʔalb	32	qalb	Heart	39
28	ʔuul	31	quul	Say/I say	20
29	ʔaaʕdi	31	qaaʕdi/deeʕdi	Sitting/living (F)	10
30	fooʔ	31	fooq	Up/above/upstairs	55
31	ʔilnaa	30	qilnaa	We said	88
32	ʔiddaam/ʔiddeem	31	qiddaam/qiddeem	Before/in front of	60

Table 4-11. Continued.

	Word produced with [ʔ]	No. of tokens	Matching word produced with [q]	Glossary	No. of tokens
33	ʔaliil	27	qaliil	Little	43
34	ʔadiim	12	qadiim	Old/archaic	36
35	warʔa/waraʔa	26	warqa/waraqa	Paper/leaf/Syrian pound	32
36	ʔaṭṭiini	29	qaṭṭiini	Town name	7
37	suuʔ	28	suuq	Market/drive	19
38	manṭiʔa/ manṭaʔa/manṭʔa	28	manṭaqa/manṭqa	Area	7
39	ʔariib	24	qariib	Close/relative	28
40	tʔillee	24	tqillee	She/you tell(s) me	25
41	ntaʔalnaa	24	ntaqalnaa	We moved	8
42	ṭariiʔa	23	ṭariiqa	Method/way	10
43	wraaʔ	23	wraaq	Papers	10
44	laaʔee	22	laaqee	I find	6
45	yʔʕod	21	yqʕod	He sits/lives	12
46	maʕʔuul	20	maʕquul	Possible	20
47	niʔʕod	20	niqʕod	We sit/live	10
48	ʔaaʕdiin	20	qaaʕdiin/qeeʕdiin	Living/sitting	9
49	ʔallon	5	qallon	He told them	25
50	ʔaʔall	7	ʔaqall	Less	22
51	ṭabaʔa	12	ṭabaqa	Social class	20
52	ʕaʔl	15	ʕaql	Mind	20
53	ʔahwi	8	qahwi	Coffee	20
54	yʔillee	18	yqillee	He tells me	27
55	biiʔillee	13	biiqillee	He tells me	28
56	ʕalaaʔa	13	ʕalaaqa	Relation	29
57	ʔeeʕid/ʔaaʕid	15	qeeʕid/qaaʕid	He is sitting down	33
58	ṭaabiʔ	13	ṭaabiq	Floor/story	24

Table 4-12. Percentage of the occurrence of frequently occurring words in the speech of varying speakers

Speaker	Word with [ʔ]	No. of tokens	Total No. of tokens with [ʔ]	% of the word's occurrence to the total of words with [ʔ]
1	hallaʔ	8	10	80%
3	hallaʔ	2	3	67%
8	hallaʔ	3	10	30%
	waʔt	7		70%
11	hallaʔ	9	19	57%
22	ʔimt	1	1	100%
5	ʔaʕad	8	22	36%
	ʔabl	2		9%
	rifʔaat	1		4.5%
	waʔt	1		4.5%
	hallaʔ	1		4.5%
	ʔaam	1		4.5%
	ʔaal	1		4.5%
	ʔillik	1		4.5%
	ʔumit	1		4.5%
6	hallaʔ	9	41	22%
	ṭabaʔa	5		12%
	fooʔ	3		7%
	baʔaa	2		5%
	manṭiʔa	2		5%
	ʔal	1		2%
	ṭariiʔa	1		2%
	ṭariiʔ	1		2%
	farʔ	1		2%

Table 4-12. Continued.

Speaker	Word with [ʔ]	No. of tokens	Total No. of tokens with [ʔ]	% of the word's occurrence to the total of words with [ʔ]
9	ʔaam	11	50	22%
	hallaʔ	9		18%
	waʔt	5		10%
	ʔuul	4		8%
	baʔaa	4		8%
	ʔuulee	3		6%
	ʔalluu	3		6%
	ʔaddeeʃ	2		4%
	ʔaal	2		4%
	ʔimt	1		2%
	suuʔ	1		2%
	ʔabl	1		2%
	ʔallon	1		2%
16	hallaʔ	12	86	14%
	waʔt	6		7%
	ʔaal	5		6%
	baʔaa	4		5%
	ʔilt	3		3%
	ʔadd	3		3%
	ʔal	2		2%
	ṭariiʔ	2		2%
	ʔaliil	2		2%
	ʔallaa	2		2%
	ṭabaʔa	2		2%
	ʔillik	2		2%
	ʔillaa	2		2%
	ʔalluu	2		2%
	rifʔaat	1		1%
	ʔahwi	1		1%
	tlaaʔee	1		1%
	ʔuulee	1		1%
	ʔillon	1		1%
	ʔadiim	1		1%
	ʕaʔl	1		1%

Table 4-12. Continued.

Speaker	Word with [ʔ]	No. of tokens	Total No. of tokens with [ʔ]	% of the word's occurrence to the total of words with [ʔ]
19	hallaʔ	12	75	16%
	ʔilt	9		12%
	ʔaal	9		12%
	ʔalluu	7		9%
	rfiiʔ	3		4%
	rifʔaat	2		3%
	ʔadd	2		3%
	ʔaaʕdiin	1		1%
	ʔaam	1		1%
	ʔilnaa	1		1%
	ʔahwi	1		1%
	ʔaʕad	1		1%
	ʔallee	1		1%
	fooʔ	1		1%
20	ʔilt	17	61	28%
	hallaʔ	12		20%
	ʔallee	10		16%
	ʔaal	4		7%
	waʔt	2		3%
	ʔal	2		3%
	ʔilnaa	2		3%
	ʔimt	1		2%
	ʕaʔl	1		2%
	waraʔa	1		2%
	ʔabl	1		2%
	ʔadd	1		2%
23	hallaʔ	14	21	67%
	baʔaa	1		5%
	tʔillee	1		5%
	ʔilt	1		5%
	ʔilnaa	1		5%
	ʔaal	1		5%

Table 4-12. Continued.

Speaker	Word with [ʔ]	No. of tokens	Total No. of tokens with [ʔ]	% of the word's occurrence to the total of words with [ʔ]
25	hallaʔ	16	55	29%
	ʔaal	13		24%
	ʔal	7		13%
	niʔʕod	2		4%
	baʔaa	2		4%
	waʔt	2		4%
	ʔaam	1		2%
	ʔallee	1		2%
	ʔallaa	1		2%
	ʔabl	1		2%
	maʕʔuul	1		2%
28	halleʔ	10	29	35%
	ʔilt	3		10%
	baʔaa	1		3%
	ʕaʔl	1		3%
	ʕalaaʔa	1		3%
	ʔilt	1		3%
	ʔaal	1		3%

CHAPTER 5
QUANTITATIVE ANALYSIS OF THE VARIANTS [t] AND [s] AND [d] AND [z]

5.1 Introduction

Because all speakers behave in the same way regarding the use of the variants [t] and [s] and [d] and [z], social factors do not seem to play a role in this type of variation. If social factors were to play a role, we would notice variation among speakers and groups of speakers. On the contrary, what we notice is that certain words are always used by all speakers with only one of the variants, [t] or [s] or [d] or [z]. In Chapter 3, I have shown that the linguistic environment does not influence the use of one variant over another. This led me to examine the frequency of these words to see if the number of occurrences of words has diachronically led to the present stable phenomenon.

To investigate the effect of frequency on the use of the four variants, I entered the words pronounced with each of the four variants in a separate table for each speaker, grouping similar words together. Then, I grouped similar words from all speakers in one large table to arrive at the frequency of each word in the speech of all 52 speakers. Then, I summarized the most frequent words in Tables 5-1 and 5-6. The results of this process will be explored in the following sections. I will first start with the frequency analysis of the two sounds [t] and [s] followed by a discussion of the results. Then, I will present the frequency analysis of the two sounds [d] and [z] followed by a discussion of the results. The general discussion and conclusion Sections 5.6 and 5.7 will touch on usage-based theory proposed by Bybee (2001) and on how this theory is able to explain the present situation as a result of two different diachronic changes.

5.2 Analysis of the Use of [t] and [s]

I extracted from the large table, in which I grouped all similar words produced with [t] and [s] and [d] and [z] together, the most frequent words produced with [t] and [s], words whose frequency is 10 or higher (Table 5-1). The total number of words produced with [t] is 2767. Table 5-1 shows that the most frequent word produced with [t] is *ktiir* ‘much/a lot’; it occurs 1159 times, which constitutes 42% of the total number of words produced with [t]. The second most frequent word is *mitl* ‘like/as’ (288 tokens = 10%). The third word in frequency is *ʔaktar/ʔaktor*[15] ‘more’ (245 tokens = 9%). *tlat* ‘three’ (153 tokens), *taanee/teenee* ‘second (M)’ (149 tokens), and *tlaati* ‘three’ (123 tokens) are respectively next highest in frequency. They constitute 6%, 5%, and 4% of the total number of words produced with [t] respectively. Though *tlat* and *tlaati* have exactly the same meaning, their syntactic position is usually different, and thus their usage. *tlat* is used as the first term of a construct state (two consecutive nouns) (e.g., *tlat kutub* ‘three books’). It cannot stand as a number on its own or be connected to an enclitic pronoun. *tlaati*, on the other hand, is used as a number on its own and can be suffixed to an enclitic pronoun (e.g., *tlaatiton* ‘the three of them’). Other words such as *tlaatiin/tleetiin* ‘thirty’ (93 tokens = 3%), *tneen* ‘two’ (71 tokens = 3%) and *taaniiyii/teeniiyii* ‘second (F)’ (64 tokens = 2%) also show high frequency.

As for the variant [s], the total number of words produced with [s] is 870. The most frequent word produced with [s] is *masalin/masalan* ‘for example/instance’ (530 tokens = 61%). This seems to be the most frequent word among all words produced with [s]. Other words such as *saaʔir* ‘a proper noun’ (19 tokens), *ħadiis* ‘modern/talk’ (18 tokens), and *ħaadis* ‘accident’ (16 tokens) constitute about 2% each.

[15] *ʔaktar* occurs in free variation with *ʔaktor*. *ʔaktar* is the HCA; *ʔaktor* is the RCA from. This example shows one of the vowel differences between the two dialects. As *ʔaktor* and *ʔaktar* occur in free variation, other subsequent words in the text such as *taanee/teenee*, *tlaatiin/tleetiin*, *taaniiyii/teeniiyii*, *masalan/masalin* occur in free variation. In each of these pairs of words, the first term is the HCA form; the second term is the RCA form. These are examples that show vowel differences between the two dialects. RCA speakers who reside in Hims may vary their speech regarding the use of these vowels, which is beyond the scope of this study.

Table 5-1. Most frequent words produced with [t] and [s]

	Word produced with [t]	Glossary	No. of tokens	Word produced with [s]	Glossary	No. of tokens
1	ktiir	Much/a lot	1159	masalin/masalan	For example	530
2	mitl	Like/as	288	saaʔir	A proper noun	19
3	ʔaktar/ʔaktor	More	245	ħadiis	Modern/ talk	18
4	tlat	Three	153	ħaadis	Accident	16
5	taanee/teenee	Second	149	saanawiiyii	High school	13
6	tlaati	Three	123	musaqqaf	Educated	12
7	tlaatiin/tleetiin	Thirty	93	baħs	Research	11
8	tneen	Two (M)	71	ʔassar	Affected	11
9	taaniiyii/teeniiyii	Second	64	tʔassir	Effect (V)	10
10	tmaaniin/tmeeniin	Eighty	41	saqaafii	Education	10
11	tminn	Eight	37	siqaa	Trust	10
12	tmaanaauu	The monomial ‘eight’ digit of a two digit number, not decimal	31	Total		660/870
13	tlaataauu	The monomial ‘three’ digit of a two digit number, not decimal	30			
14	tmaanii/tmeenii	Eight	27			
15	taalit/teelit	Third (M)	26			
16	kattir	Make more/ increase	23			
17	taaltii/teeltii	Third (F)	22			
18	tnteen	Two (F)	22			
19	tlaatmiiyii	Three hundreds	16			
20	tnaʕʃ	Twelve	15			
21	tʔiil/tqiil	Heavy	13			
22	tyaab/tyeeb	Clothes	12			
23	tmintaʕʃ	Eighteen	11			
	Total		2671/2767			

If we compare the number of words whose frequency is less than 10 times for each of the variants [t] and [s], we realize a larger number of words produced with [s] than with [t]. However, most of those words occur once or twice. 23 words out of 50 words produced with [t] have very high frequency. That is, about half of the words have very high frequency. They add up to 2671 words out of 2767 words (Table 5-1), which constitute 97% of the total number of words produced with [t] (Table 5-2). On the other hand, only 11 words out of the 109 words produced with [s] have high frequency. They total 660 out of 870 (Table 5-1), which constitutes 76% of all the words produced with [s] (Table 5-2). In addition, their frequency is not as high as those produced with [t]. They have very low frequency compared to the words produced with [t], which is obvious from each word count and from the number of words that have much higher frequency. Furthermore, a proper noun such as *saaʔr* mainly occurs in the speech of two speakers, his parents. His name is repeated many times during relating personal facts or stories about their son. Even the most frequent word produced with [s], *masalin/masalan*, adds to less than half the frequency of the word *ktiir*.

This comparison will be made clearer by constructing a contingency table that show the frequency of words pronounced with [t] and [s] in comparison to each other. Table 5-2 shows a two-category division of frequency: words with frequency less than 10 and words with frequency higher than 10. The table also shows the percentage of those frequencies to the total number of words. The two sets of percentages for the [t]-words and [s]-words are called the “conditional distribution” (Agresti and Finlay 1997:251) on the frequency. If the conditional distribution on the frequency is identical, the two categorical variables are statistically independent (i.e., frequency and type of word are independent form each other). In other words, frequency does not have an effect on the type of sound used in a word. In contrast, if the conditional distribution is not identical, the two categorical variables are statistically dependent (i.e., frequency and type of word are dependent on each other). In other words, frequency influences the type of sound used in a word. Table 5-2 shows that there is discrepancy in the conditional distribution; hence, frequency and the type of sound used in a word are dependent on each other. Frequency plays a role in this type of variation. Frequent words are mostly pronounced with the [t] sound in contrast to infrequent words that are mostly pronounced with the [s] sound.

Table 5-2. Contingency table showing the frequency use of [t] and [s] words and their conditional distribution in all speakers

Word Type	Freq < 10 & %	Freq > 10 & %	Total & %
[t]-words	96 (3%)	2671 (97%)	2767 (100%)
[s]-words	210 (24%)	660 (76%)	870 (100%)
Total & %	306 (8%)	3331 (92%)	3637

To have a visual presentation of this comparison, I entered all the words produced with [t] and [s] into SPSS as two separate variables. Their frequency category was entered as a separate categorical nominal variable with 1 assigned for low frequency (<10) and 2 for high frequency (> 10). The result of the examination of frequencies from Analyze-Descriptive Statistics-Frequencies is summarized in Figures 5-1 and 5-2. Figure 5-1 shows clearly that the difference between the number of high and low frequency words produced with [t] is not very big. Figure 5-2 shows a great disparity between the numbers of high and low frequency words produced with [s]. In addition, comparing the two figures reveals a great difference in frequency between the high frequency words produced with both [t] and [s]. From the two figures, one can conclude that the higher the frequency of the word, the higher the possibility that it is pronounced with [t].

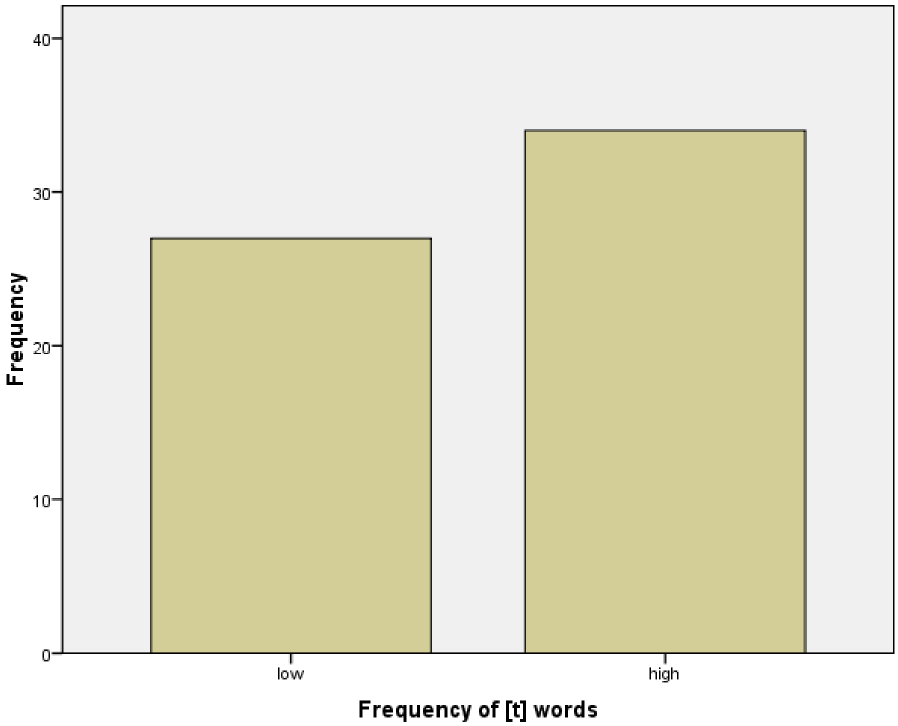

Figure 5-1. Distribution of [t]-words between high and low frequency

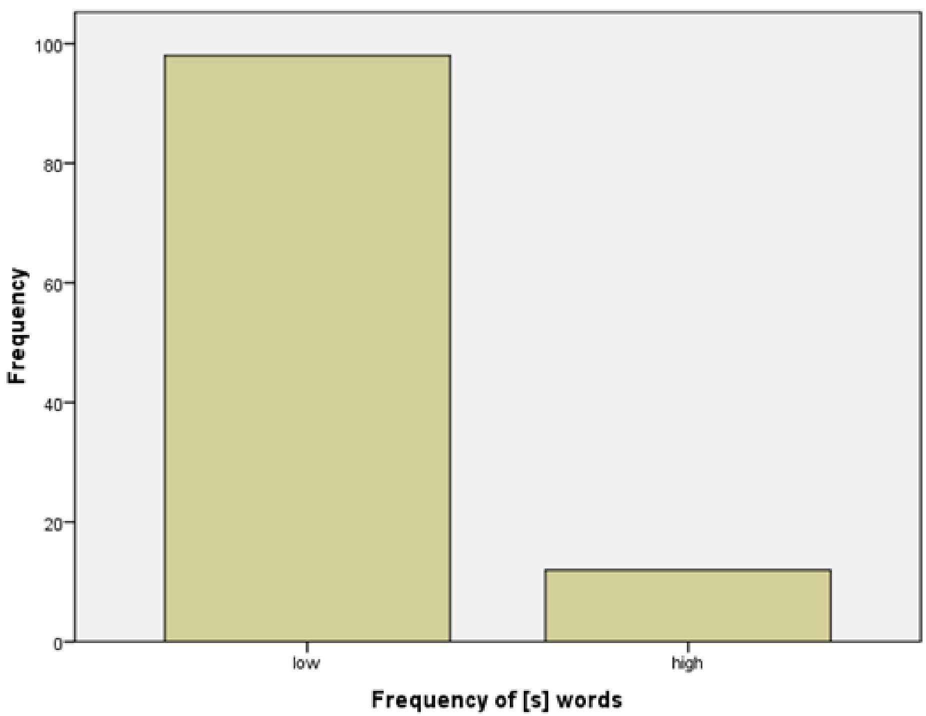

Figure 5-2. Distribution of [s]-words between high and low frequency

Furthermore, to test whether the difference in frequency between [t]-words and [s]-words is significant, I conducted two two-tailed one-sample *t*-tests to compare the raw frequency of the [t]-words to the raw frequency of [s]-words. . In this case, I entered into SPSS all words produced with [t] and [s] as two separate variables and their raw frequencies as two separate variables. The comparison yielded a highly significant result ([t]-words frequency: $t = 2.294$, $df = 60$, $p = .025$; [s]-words frequency: $t = 2.334$, $df = 109$, $p = .021$). In general, the mean for [t]-words is 45.36 which is much higher than the mean of [s]-words, 7.93 (Tables 5-3). The high difference in mean is a good indicator of the influence of frequency on the current use of [t]-words vs. [s]-words.

Table 5-3. Two tailed One-Sample T-Test comparing the significance of the difference in the frequency of [t]-words and [s] words

One-Sample T-Test

	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Frequency [t]-words	2.294	60	.025	45.361	5.81	84.91
Frequency [s]-words	2.334	109	.021	7.927	1.19	14.66

5.3 Discussion of the Frequency Analysis of the Stable Variants [t] and [s]

The above observations are an indication that frequency may have played a role diachronically in determining this synchronic type of stable phenomenon (i.e., which words are produced with [t] and which ones are produced with [s]). Nonetheless, if we take, at face value, the complete merger theory of the SA variants [θ] and [ð] with [t] and [d] respectively around the 14th century (Daher, 1998a, 1999; Schmidt 1974), how do we explain the presence of words with [s] pronunciation instead of [t]? Daher (1999:164) suggests that the use of [s] and [z] is more elevated than the use of [t] and [d] respectively in colloquial speech. If his suggestion is correct, we would expect variation among speakers and groups of speakers. This is not the case in my data. All speakers behave similarly. According to some studies, a second change occured some time after the 14^{th} century (Birkeland 1952; Schmidt 1986:57; Schulz 1981:33; all cited in Daher 1999). Borrowed words form SA with the [θ] and [ð] variants were replaced in colloquial speech with [s] and [z] respectively. This seems plausible given the following observations.

The non-frequent words with the [t] sound are related semantically to the frequent words. They are derived from the same root and most of them are related to the numbers *three* and *eight* as well as the word for *much.* On the other hand, the low frequency words with the sound [s] are not necessarily semantically related to those of high frequency, but they may be semantically related to each other. A close examination of these words reveals that many of them have the vowel system of the SA corresponding words, indicating that they are mainly borrowings from SA. However, due to the high markedness of the sound [θ], the sound [s] is used instead. Table 5-4 presents just a few examples that show the similarity in vowel system between the observed forms and their SA corresponding forms. Other words may have shown some assimilation to the vowel system of the dialects, but this change is less likely to happen word-internally. It mostly occurs word-finally as a result of suffixing a colloquial suffix in place of the SA suffix, for example, the colloquial feminine marker [-i] in place of the SA feminine marker [-a] (Examples 1-3 in Table 5-5); the relational adjective marker [-ee] in place of [-iiy] (Examples 4 & 5 in Table 5-5); or a colloquial pronominal in place of a SA pronominal (Examples 6 & 7 in Table 5-5). There is a number of word-internal vowel assimilation to the vowel system of the dialects, as in Examples 8 & 9 in Table 5-5. The integration of the SA root with the colloquial dialects patterns could be an indication that roots and patterns are stored separately in the brain because speakers could interlock the root of the SA with a pattern from the colloquial dialects. Thus, the root is borrowed from SA, not the pattern, in some cases. Furthermore, the previously observed semantic relatedness among words that are produced with one of the two variants provides evidence for the possibility that roots and patterns are stored separately in the brain, because roots are “semantic abstractions” from which semantically related words are derived (Holes 2004:99). Speakers seem to use the same root with its dialectal phonemic representation (i.e., the same sound [t] or [s]) in different words that are semantically related.

Table 5-4. Similarity between the vowel system of observed words with [s] with their counterparts in SA

	Observed word with [s]	SA corresponding word with [θ]	Glossary
1	ʔasar	ʔaθar	Trace
2	ʔasnaaʔ	ʔaθnaaʔ	During
3	ʔisbaat	ʔiθbaat	Proof
4	ʔaħdaas	ʔaħdaaθ	Incidents
5	saabit	θaabit	Firm/fixed
6	tamsiil	tamθiil	Acting

Table 5-5. Assimilated words with [s] to the vowel system of the dialects

	Observed word with [s]	SA corresponding word with [θ]	Glossary
1	wiraas-i	wiraaθ-a	Heredity/ inheritance
2	baʕsi	baʕθ-a	Delegation
3	lissi	liθθ-a	Gum
4	sawaanee	θawaan-iiy	Seconds
5	saanawee	θaanaw-iiy	High school
6	saqaaft-uu	θaqaafatu-huu	His education
7	ytħadds-oo	yataħaddaθ-uuna	They talk
8	tuusaq-ee	taθiq-iina	You (F) trust
9	tuuras	tariθ	Inherit

In Chapter 3, I have established that /t/ and /s/ are the underlying form for [t] and [s] respectively in colloquial speech. The phonological representations of these two sounds are accessed when using similar words. Because phonemes constitute morphemes and roots are separate morphemes in Arabic, one can conclude that speakers access these root morphemes with their phonemic representations. The status of the root and the pattern in the brain is beyond the scope of this study and requires further research. They are mentioned here to show that there is the possibility that some words (more specifically roots/morphemes) are borrowed from SA and are intersected with colloquial morphology and phonology. The borrowings show assimilation to the vowel system of the dialects and adoption of the phonemic system of those dialects, which consists of the phonemes /t/ and /s/, not /θ/.

5.4 Analysis of the Use of [d] and [z]

I also extracted from the large table that contains all words produced with [t] and [s] and [d] and [z] the most frequent words produced with [d] and [z], words whose frequency is 10 or higher (Table 5-6). The total number of tokens produced with [d] is 1740. Table 5-6 shows that the most frequent word produced with [d] is *haadaa* 'this (M)'; it occurs 607 times, which constitutes 35% of the total number of words produced with [d]. The second most frequent word is *hadool* 'these' (135 tokens = 8%). The third word in frequency is *haadii* 'this (F)' (116 tokens = 7%). *ʔaχad* 'took' (114 tokens = 7%), *hadiik* 'that (F)' (67 tokens = 4%), and *ʔaχd* 'take' (59 tokens = 3%) are respectively next highest in frequency. Other words such as *ʔaaχod* 'I take' (48 tokens = 3%), *yaaχod* 'he takes' (48 tokens = 3%) and *ʔaaχd* 'take' (47 tokens = 3%) also show high frequency. It is also worth noting here that there are a number of variants of *haadaa* 'this (M)', *hadool* 'these', and *haadii* 'this (F)', all pronounced with [d], but they show various vowel patterns. These words are *haad* 'this (M)' (2 tokens), *hadaa* 'this (M)' (1 token), *hedaa* 'this (M)' (1 token), *hidaak* 'that (M)' (1 token), *hauud* 'these' (1 token), *hauudaalee* 'these' (2 tokens), *haduuk* 'those' (4 tokens), and *haidii* 'this (F)' (8 tokens). If we add these words to their respective variants (i.e., those with which they show free variation), we will find even higher frequency of those words. It may not make much difference in this small corpus of words, but it may make a difference when looking at a larger corpus of words.

Table 5-6. Most frequent words produced with [d] and [z]

	Word produced with [d]	Glossary	No. of tokens	Word produced with [z]	Glossary	No. of tokens
1	haadaa	This (M)	607	ʔizaa	If	567
2	hadool	These	135	kazaa	So/like this	231
3	haadii	This (F)	116	tzakkar	Remember (V)	35
4	ʔaχad	Took	114	lizaalik	For this reason	29
5	hadiik	That (F)	67	ʔstaaz	Teacher/ professor	27
6	ʔaχd	Take	59	kizb	Lying	26
7	ʔaaχod	I take	48	ʃazaa	Proper noun	22
8	yaaχod	He takes	48	tʕzzab	Suffered	15
9	yaaχd	Take	47	zakaa	Intelligence	14
10	ʔaaχd	I take/ I have taken	33	kizza	So/like this	14
11	χadt	I took	30	ʔizn	Permission	12
12	hadaak	That (M)	30	zaat	Same	10
13	taaχd	You take/she takes	29	Total		1002/1257
14	ʔaaχid	Has taken/ taking/ I take	29			
15	taaχod	She takes/ you take	27			
16	baaχod	I take	24			
17	ʔeexid	Has taken/ taking/ I take	24			
18	naaχod	We take	23			
19	llaadʔiiyii/ llaadqiiyii	Name of a city	22			
20	χadnaa	We took	20			
21	yaaχid	He takes	17			
22	hauudee	These	15			
23	ʔeeχd	Has taken	15			
24	taaχid	She takes	14			
25	χood	Take (imp)	13			
26	haidaa	This	13			
27	daraa	Corn	11			
28	ʕadraa	Virgin Mary	10			
	Total		1640/1740			

As for the variant [z], the total number of tokens produced with [z] is 1257 (Table 5-6). The most frequent word produced with [z] is *ʔizaa* ‘if’ (567 tokens = 45%). The second most frequent word is *kazaa* ‘so/like this’ (231 tokens = 18%). *tzakkar* ‘remember’ (35 tokens) constitutes 3%. Other words such as *lizaalik* ‘for this reason’ (29 tokens), and *ʔistaaz* ‘teacher/Mr./professor’ (27 tokens), and *kizb* ‘lying’ (26 tokens) constitute about 2% each.

If we compare the number of words whose frequency is less than 10 times for each of the variants [d] and [z], we realize a larger number of words produced with [z] than with [d]. However, most of those words occur once or twice. 28 words out of 64 words produced with [d] have very high frequency. That is, about half of the words have very high frequency. They add up to 1640 words out of 1740 words (Table 5-6), which constitute 94% of the total number of words produced with [d] (Table 5-7). On the other hand, only 12 words out of the 138 words produced with [z] have high frequency. They total 1002 out of 1257 (Table 5-6), which constitutes 80% of all the words produced with [z] (Table 5-7). In addition, the frequency of most of the words produced with [z] is not as high as those produced with [d]. Most of them have very low frequency compared to the words produced with [d], which is obvious from each word count and from the number of words that have higher frequency. However, two words produced with [z] could be considered exceptions regarding their high frequency: *ʔizaa* ‘if’ that occurs 567 times and *kazaa* ‘so/like this’ that occurs 231 times. I attribute the high frequency of these two words to their being a conditional expression and a discourse marker respectively. Consequently, these two words occur frequently in speech.

As in the case of words with [t] and [s], this comparison will be made clearer by constructing a contingency table that show the frequency of words pronounced with [d] and [z] in comparison to each other. Table 5-7 shows the two-category division of frequency and the conditional distribution on the frequency for each type of word. Table 5-7 shows that there is some discrepancy in the conditional distribution, although it is smaller than that in the case of [t] and [s] words. The difference in the conditional distribution indicates that frequency and the type of sound used in a word are somewhat dependent on each other. Frequency seems to play a role in this type of phenomenon. Frequent words are mostly pronounced with the [d] sound in contrast to infrequent words that are mostly pronounced with the [s] sound.

Table 5-7. Contingency table showing the frequency use of [d] and [z] words in all speakers

Word Type	Freq < 10 & %	Freq > 10 & %	Total & %
[d]-words	100 (6%)	1640 (94%)	1740 (100%)
[z]-words	255 (20%)	1002 (80%)	1257 (100%)
Total & %	355 (12%)	2642 (88%)	2997

To have a visual presentation of this comparison, I also entered all the words produced with [d] and [z] into SPSS as two separate variables. Their frequency category was entered as a separate categorical nominal variable with 1 assigned for low frequency (<10) and 2 for high frequency (> 10). The result of the examination of frequencies from Analyze-Descriptive Statistics-Frequencies is summarized in Figures 5-3 and 5-4. Figure 5-3 shows that the difference in number between high and low frequency words produced with [d] is insignificant. Figure 5-4 shows a great disparity between the numbers of high and low frequency words produced with [z]. In addition, comparing the two figures reveals a great difference in frequency between the high frequency words produced with both [d] and [z]. From the two figures, one can conclude that the higher the frequency of the word, the higher the possibility that it is pronounced with [d]. The case of [d] and [z] words is not much different from that of [t] and [s] words, although the low frequency words with [d] may be a little more than those with [t].

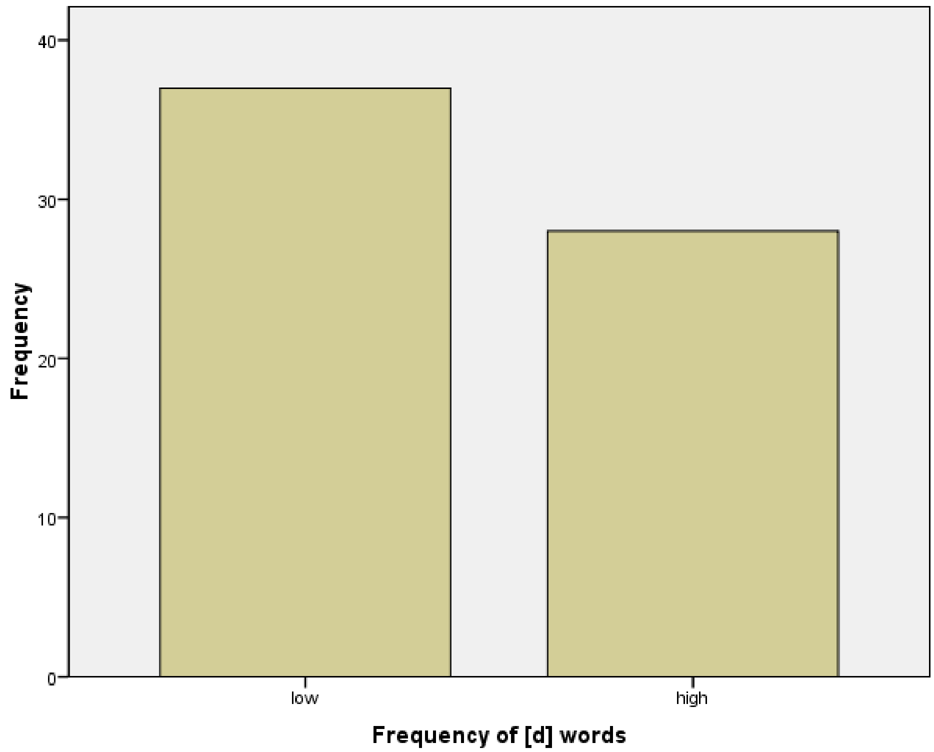

Figure 5-3. The distribution of [d]-words between high and low frequency

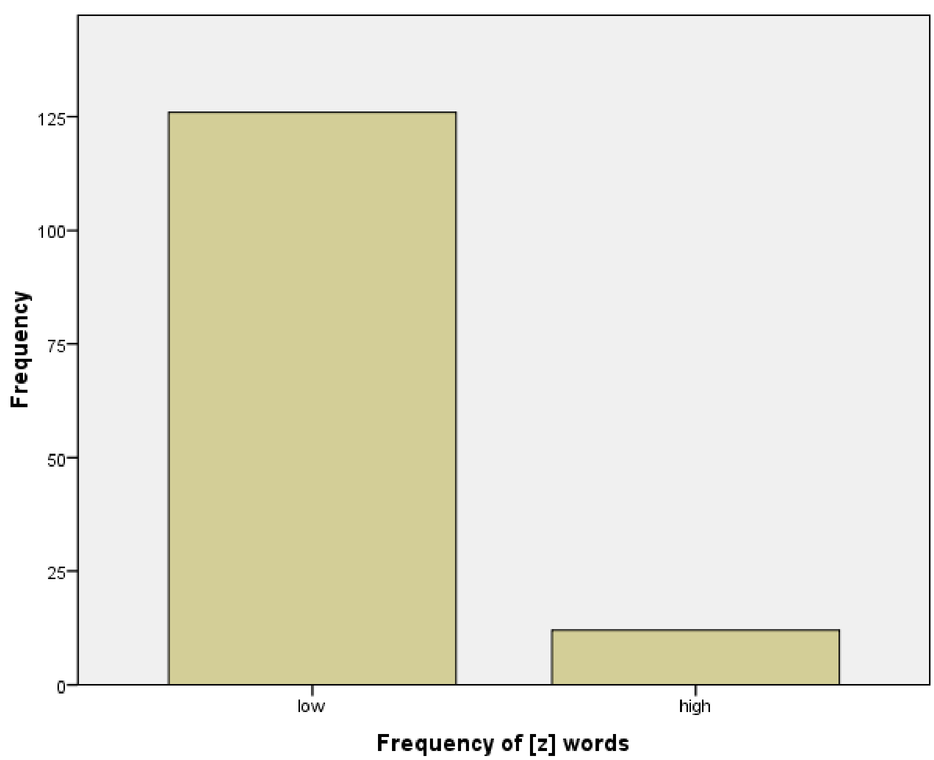

Figure 5-4. The distribution of [z]-words between high and low frequency

To test whether the difference in frequency between [d]-words and [z]-words is significant, I conducted two two-tailed one-sample *t*-tests to compare the raw frequency of the [d]-words to the raw frequency of [z]-words. In this case, I entered into SPSS all words produced with [d] and [z] as two separate variables and their raw frequencies as two separate variables. The comparison yielded a highly significant result ([d]-words frequency: $t = 2.762$, $df = 64$, $p = .007$; [z]-words frequency: $t = 2.063$, $df = 137$, $p = .041$). In general, the mean for [d] words is 26.77, which is much higher than the mean of [z]-words, 9.12 (Table 5-8). The high difference in mean is a good indicator of the influence of frequency on the current use of [d]-words vs. [z]-words as a consequence of two separate diachronic changes.

Table 5-8. Two tailed One-Sample T-Test comparing the significance of the difference in the frequency of [d]-words and [z]-words

One-Sample Test

	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Frequency [d]-words	2.762	64	.007	26.769	7.40	46.13
Frequency [z]-words	2.063	137	.041	9.116	.38	17.85

5.5 Discussion of the Frequency Analysis of the Stable Variants [d] and [z]

Like in the case of [t]- and [s]-words, frequency seems to have played a role diachronically in determining the present synchronic stable phenomenon (i.e., which words are produced with [d] and which ones are produced with [z]). Like in the case of [t]- and [s]-words, Birkeland's (1952), Schmidt's (1986), and Schulz's (1981) suggestions that a second change has occurred some time after the 14^{th} century seems to apply in the case of the use of [d] and [z]. Borrowing words form SA with the [θ] and [ð] variants was followed by a replacement of those two marked sounds with the less marked sounds, [s] and [z] respectively.

The non-frequent words with the [d] sound are related semantically to the frequent words. They are derived from the same root and most of them are related to the word *take* and variants of the word for *this.* On the other hand, the low frequency words with the sound [z] are not necessarily semantically related to those of high frequency, but they may be semantically related to each other. Similar to the case of [t] and [s], a close examination of these words reveals that they mostly have the vowel system of the SA corresponding words, indicating that they are mainly borrowings from SA. However, it seems that the high markedness of the sound [ð] has been disliked and replaced by the less marked sound [z]. In other words, speakers find it easier to access a sound that is present in their phonemic system, /z/, and resembles the SA variant but lacks the [+distributed] feature. Phonological reduction is not foreign to frequent words (e.g., Hooper 1976; Patrick 1992; Bybee 2000, 2001, 2002; Pierrehumbert 2001; Coetzee 2008). Table 5-9 presents just a few examples that show the similarity in vowel system between the observed forms and their SA corresponding forms. Other words may have shown some assimilation to the vowel system of the dialects. The assimilation is more obvious in the case of [z] than it is in the case of [s]. It occurs word-internally as well as word-finally as a result of suffixing a colloquial suffix in place of the SA suffix, for example, the colloquial feminine marker [-i] in place of the SA feminine marker [-a] (Examples 1-3 in Table 5-10); the relational adjective marker [-ee] in place of [-iiy] (Examples 4 & 5 in Table 5-10); or a colloquial pronominal in place of a SA pronominal (Examples 6 & 7 in Table 5-10). The word-internal vowel assimilation to the vowel system of the dialects are numerous. Some examples are stated in 8 & 9 in Table 5-10. Interweaving the SA root with the colloquial dialects patterns and the existent semantic relationship among words that are produced with one of the two variants, [d] or [z], provide evidence that roots and patterns are stored separately in the brain because speakers could interlock the root of the SA with a pattern from the colloquial dialects. In many cases, the root is borrowed from SA, not the pattern.

Table 5-9. Similarity between the vowel system of observed words with [z] with their counterparts in SA

	Observed word with [s]	SA corresponding word with [θ]	Glossary
1	mazhab	maðhab	School of thought
2	ʔitiχaaz	ʔitiχaað	making (decision)
3	maʕzuuriin	maʕðuuriin	They are forgiven
4	ʔinzaar	ʔinðaar	Warning
5	tanfiiz	tanfiið	Doing a project/performance
6	haakazaa	haakaðaa	Such/this way

Table 5-10. Assimilated words with [s] to the vowel system of the dialects

	Observed word with [s]	SA corresponding word with [θ]	Glossary
1	ʁizaaʔiiy-i	ʁizaaðiiy-i	nutritious
2	lizz-i	liðð-a	Pleasure
3	zakiiy-i	ðakiiy-a	Clever (F)
4	zakar-ee	ðakar-iiy	Masculine
5	zak-ee	ðak-iiy	Clever
6	btiχzil-uu	taχðulu-huu	It let him down
7	zakkr-oo	ðakkar-uu	They reminded
8	zooq	ðawq	Taste
9	mitzakkr-a	mutaðakkir-a	I remember (N)

5.6 General Discussion

The above frequency analysis not only informs us about the effect of frequency on the use of certain words, but also enables us to make kind of predications about what may have happened diachronically. It allows us to answer some, not all, of the questions about the current stable phenomenon. It is puzzling to see that the words that are produced with the fricative sounds, [s] and [z], are higher in number than those produced with the stops, [t] and [d]. If the former words are borrowed from SA, we would expect a smaller number of words to be borrowed. The data contradict that. The data give the impression that there has been some kind of influx of SA borrowings into the dialects, but this influx stopped at a certain point in time for some reason. The data give a sense of creeping foreign elements that were stopped by an opposing force. This leads to the question: what is this opposing force?

We have observed one list of words for each of the sounds, [t] and [s] and [d] and [z]. The most frequent words maintain the stops; the least frequent ones maintain the fricatives, although few words produced with the fricatives show very high frequency. If we only take markedness or "the emergence of the unmarked" (McCarthy and Prince 1994) into consideration, we would expect to have more words pronounced with [t] and [d] than with [s] and [z] because fricatives are more marked than stops (*[+cont] >> *[-cont]) cross-linguistically (Clement 1990; Roca and Johnson 1999; Lombardi 2003). In addition, [t] is the least marked consonant because it is "unmarked for all features" (Frisch, Broe, and Pierrehumbert 1998:23). In other words, it is underspecified for dorsal, labial, [-anterior], [+distributed], lateral, round, [+continuant], and [+continuant, -strident]. All of these features add some kind of markedness to a sound. [t] is simply characterized as a [coronal] and [-voice], which are the least marked among all the mentioned features. For example, in English, words such as [θin] 'thin' and [ðis] 'this' are replaced by some speakers with [tin] and [dis] respectively (Labov 1972a), not [*sin] and [*sis]. One would expect more words produced with [t] and [d] not only based on markedness but also due to the complete merger that happened in the 14th century between the SA interdentals [θ] and [ð] and the stops [t] and [d] respectively (Daher, 1998a, 1999; Schmidt 1974). The situation is the contrary; we find more words produced with the fricatives [s] and [z] as a result of the second historical change that occurred sometime after the 14th century (Birkeland 1952; Schmidt 1986:57; Schulz 1981:33; all cited in Daher 1999). However, this change did not seem to affect certain words that are produced with [t] and [d] (i.e., the most frequent words of all). It stopped at a certain point, affecting mainly the least frequent words, which are supposedly borrowed from SA and replaced by the colloquial Arabic phonology, in our case /s/ and /z/.

To explain the current split between lexical items that are totally produced with the stops and others that are completely produced with the fricative, we may have to follow one of two possibilities. The first possibility will be to refute the theory of a complete merger in the 14th century between stops and interdentals (Daher, 1998a, 1999; Schmidt 1974), that is traces of interdentals continue to surface, although not as interdentals, rather as fricatives. Refuting the first theory leads to refuting the second theory of a second change after the 14th century, which introduced the fricatives in place of the interdentals (Birkeland 1952; Schmidt 1986:57; Schulz 1981:33; all cited in Daher 1999). Refuting this theory will be accompanied with then suggesting that the historical change only affected highly frequent words on the basis of usage-based models (Bybee 2001) or exemplar-based models (Pierrehumbert 2001). These models propose that words of higher frequency are more prone to reduction. Non-frequent words are less affected by change and usually retain their original form or features. Thus, one can assume on these grounds that highly frequent words, such as *haadaa* and *ktiir*, historically underwent reduction of the SA features [+continuant] and [+distributed], but the least frequent words did not. However, there are no traces of interdentals in natural speech. In addition, refuting this theory does not explain the two lists of words with fricatives, such as *masalan* and *ʔizaa*, instead of the SA interdentals. These two lists also show reduction of the feature [+distributed]. The few high frequency words with the fricatives do not behave like other highly frequent words that have also reduced the [+continuant] feature. They seem to have resisted this type of reduction. Why would some frequent words resist one reduction and not the other? In other words, why would some frequent words show reduction of two features and others show reduction of only one feature?

Furthermore, if there was not a complete merger, we would expect some kind of variation and probably a balanced number of words with the stops and the fricatives. We actually have no variation and continue to have a large number of words produced with fricatives and less words produced with stops. It seems this possibility cannot completely explain the present split among stops and fricatives. Consequently, we have to take the second theory into consideration. That is, a second change happened some time after the 14th century and led to this stable phenomenon. Taking the second theory into account implies accepting the first theory too. Furthermore, a support of the merger theory comes from Churchyard's (1993:335) historical study. He mentions, in a footnote, "[t]hat *θ, *θ̣, and *ð actually remained distinct in Old Aramaic is seen from the fact that in later Aramaic these sounds merged with the dental/alveolar stops *t, *ṭ, and *d, respectively"[16]. These historical sound variation and changes, according to Churchyard, may have developed in some dialects before others and then they gained prestige to the point that they started to gain importance and prestige in other dialects later on, leading to the spread of the change to other dialects and eventually a merger. Since Arabic is Proto-Semitic language and most of its sound system (twenty-one out of the twenty-eight letters in Arabic were borrowed from the twenty-two Aramaic Alphabet) was adopted from Aramaic, a similar change and a merger may have happened in Arabic. This seems to be a feature of Proto-Semitic languages in which similar shifts and mergers have occurred historically and have influenced each other, as is

[16] The asterisk before each of the sounds in the quotation is used to indicate a variable, not a variant. The symbol *θ̣ is used to refer to a dental/alveolar emphatic fricative; *ṭ is the symbol used to refer to dental/alveolar emphatic stop. These two symbols are represented in IPA as ð̡ and t̡ respectively.

the case of the influence of Aramaic dental/alveolar **s´* sound shift ([ɬ] → [s]) on the Hebrew **s´* sound shift ([ɬ̌] → [ɬ] and [ɬ]→ [s])[17].

This brings us to the second possibility and back to the role of frequency in this stable phenomenon. According to Bybee (2001:11), "token frequency"[18] has two main effects. In one effect of frequency "phonetic change often progresses more quickly in items with high token frequency". Pierrehumbert (2001:3) argues on the basis of Bybee's (2000, 2001) theory of usage-based phonology that "leniting historical changes are more advanced in frequent words than in rarer ones." Thus, high frequency words are more likely to undergo change, mainly reduction. For example, the deletion of [t] and [d] word-finally post-consonantally is more common in English in highly frequent words, such as *went*, *just*, and *and*, than in infrequent words (Guy 1991; Santa Ana 1992; Bybee 2000; Phillips 2006; Coetzee 2008; Coetzee and Pater 2008). This is an example of a whole segment reduction, but reduction could include feature reduction for the purpose of minimizing articulatory effort (Saussure 1959, Martinet 1964) (i.e., easier and simpler articulation). This first frequency effect proposed by Bybee (2001) can explain the first historical change towards the use of [t] and [d] in place of [θ] and [ð] respectively. The SA interdentals were reduced to full stops; the features [+distributed] and [+cont] were eradicated. This merger apparently happened gradually, affecting the most frequent words first and then the least frequent ones.

The second effect of token frequency contradicts the first effect, because "it makes items more resistant to change" (Bybee 2001:12). In other words, high frequency words become

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[17] **s´* refers to voiceless lateral fricative. [ɬ̌] stands for (alveo)palatal fricative-lateral that existed in early first millennium B.C.E. Hebrew. [ɬ] stands for dental/alveolar fricative-lateral that existed in early first millennium B.C.E. Aramaic.

[18] "Token Frequency" to the frequency of the occurrence of a word.

resistant to a new swiping change because they have already developed an automatized production (p. 12). Because “tokens of use map onto existing representations, high-frequency items grow strong and therefore are easier to access” (p. 28). Bybee (2001:12) refers to this type of resistance as “conserving” effect, rendering some words more “conservative” in the face of change. For her, the frequency of words

> gives them a high level of lexical strength. That is, they are so engrained as individual patterns that they are less likely to change even if general changes are occurring in the language. To account for this entrenchment effect, I have proposed (Bybee 1985) that representations are strengthened whenever they are accessed. This strengthening makes them subsequently easier to access and also more resistant to some forms of change.

This second effect of frequency, as proposed by Bybee (2001), can account for the existence of [s]- and [z]-words alongside the [t]- and [d]-words that resulted from the 14th century merger. It seems that the second historical change that occurred sometime after the 14th century (Birkeland 1952; Schmidt 1986:57; Schulz 1981:33; all cited in Daher 1999) did not affect the most frequent words in the dialects (i.e., words that are produced with the stops, [t] and [d]). We have observed in the data that the most frequent words are those produced with the stops with few exceptions that are produced with the fricatives, [s] and [z]. The findings of this study support Bybee’s (2001) usage-based theory, which provides explanation to the current stable situation of the use of [t] and [s] and [d] and [z]. For Bybee (2003), “repetition” and “high frequency” develop ‘automatization” and “autonomy” that lead to “entrenchment”. In this sense, the highly frequent words produced with the stops were not affected by the second historical change because they became entrenched in their own phonemic representation. I avoid here using Bybee’s (2001) suggestion that words are stored as whole units in the lexicon because of their autonomy. In a language like Arabic that has a more complex morphological system, this may not be case. Bybee’s suggestion was actually critiqued by Pierrehumbert (2002) in her review of Bybee’s (2001) book. Pierrehumbert suggests that

> the case for excluding morphemes in addition to words is less firm. Even in English, and even for infants, words are normally extracted from running speech rather than learned in isolation; positing a mental lexicon of any and all effectively extractable chunks might provide a better basis for the analysis of more complex morphological systems. (2002:462)

The case of how words and morphemes are stored in Arabic requires further investigation. Suggesting that words become entrenched in their phonemic representation does not violate the view that words could be "storage units" (Bybee 2001; Beret, Vaknin, and Marcus 2006) or morphemes could be stored separately (Feldman, Frost, and Pnini 1995; Pierrehumbert 2002).

5.7 Conclusion

In conclusion, Bybee's (2001) usage-based theory with its two frequency effects provides an explanation to the current stable phenomenon regarding the use of the four variants [t] and [s] and [d] and [z] in the naturally occurring speech of rural migrant speakers to the city of Hims. The two frequency effects of the usage-based theory support the theories of two different historical changes. It is because of those two historical changes and frequency effects that we have two different categories of words for each of the SA interdentals. The first change led to the loss of the two features [+distributed] and [+continuant] from the SA interdentals. The second change began with borrowing a large number of words from SA. Instead of using the marked sounds [θ] and [ð], speakers apparently sought in their native phonology similar sounds that are less marked, [s] and [z]. This is not surprising for a people that grew accustomed to producing much less marked sound, [t] and [d]. Borrowing the SA forms was, thus, accompanied in this case with one feature reduction instead of two, [+distributed]. This case of seeking native phonology is observed in an example given by Morris (2000:14) in an endnote. The example presents the case of the Peninsular dialect of Chinato, native to the province of Cáceres (Extremadura), in which there is no underlying /s/. Instead, the dialect has only /θ/ (spelled with ‘s’, ‘c’, or ‘z’), which is realized as [h] in syllable coda (2000:14). Because [θ] is highly marked in that dialect, it is replaced with the native dialect phonology (i.e., /h/). Although I have been able, to a great extent, to explain the reason behind this stable phenomenon, I still think that further research is required in this area to confirm these findings.

Although the speech sample is taken from only RCA speakers, it is my belief that the same pattern applies to HCA speakers. It is also believed to be a characteristic of big urban centers in Arab countries, such as Amman (Abdel-Jawad 1986). This pattern may differ in Bedouin dialects or in other Arab dialects. In Bahrain, for example, Holes (1986) actually notes a kind of convergence towards the SA variant [θ] away from the non-standard form [f]. For him, this variation is led by social factors such as religious denominations and social identity as well as the influence of SA through education. The [θ] is used by the *‘Arab*, the “Sunni descendents of the Bedouin tribes” (p. 33) whose dialect is perceived as prestigious. This example among others calls for investigating similar phonological changes, in which the marked interdentals are used. It seems their use and variation may depend on different factors in different settings and require explanation from different angles.

CHAPTER 6
CONCLUSION

6.1 Introduction

In the first chapter, a number of research questions were set forth for investigation. This chapter aims not only to give a brief summary of the answers to each of those five research questions but also to summarize other findings that emerged throughout the study. I will first provide an answer to each question individually, based on the findings in the various analysis chapters. I will then provide some advantages of and caveats concerning the new model proposed in this study. Then, I will touch on the role of frequency effects in this study. I will also present some implications, directions and recommendations for future research. I will conclude this chapter by emphasizing the importance of combining both the social and linguistic in one linguistic theory.

6.2 Use of OT and the GLA to Account for Switching between Two Different Dialects and Inter- and Intra-speaker Variation

Research question 1: How can Optimality Theory account for speakers' switch between two different dialects and their intrapersonal and interpersonal variation in the use of particular sounds (e.g., the use of [ʔ] in place of [q]) based on their interlocutor's background?

To answer this question, I developed a new model for analyzing sociolinguistic variation, employing OT and the GLA. In this model, I proposed a number of social constraints in addition to more conventional linguistic constraints of OT and the GLA, although the particular linguistic constraints themselves may not have been proposed previously. I treated social constraints in the same way that linguistic constraints are treated in the GLA. They are given a continuous scale of ranking values and are subject to the continuous ranking of stochastic grammar. In other words, their ranking values may differ from one speaker to another and from one group of speakers to another. I have shown that the interaction of those social constraints with linguistic constraints yields results that match real life occurrences. I have also shown that the choice of the right type and number of social constraints determines the grammar of an individual or a group of individuals at a certain time and place. In order for a speaker to acquire the new form, [ʔ], completely, s/he has to change the ranking values of two constraints of his/her mother dialect, RCA. Speakers who can switch between the two forms [q] and [ʔ] with one hundred percent accuracy have acquired the new ranking values with one hundred percent accuracy, in that they do not have overlapping among certain constraints. Thus, they sound city-like because of acquiring the new grammar, and thus, the new form completely. In those speakers, certain social constraints rank very high, affecting their choice of a ranking value at a certain time and place.

Speakers who show intra- and inter-speaker variation in the use of [q] and [ʔ] with the same interlocutor have not acquired the new ranking values of the constraints completely. The ranking values of constraints become very close to each other, and to the constraints of their mother dialect, leading to overlapping of constraints. This overlapping leads to variable outputs. The degree of variation relies on the type and number of social constraints involved. For example, a speaker or a group of speakers that uses [q] 85% and [ʔ] 15% may have more social constraints or different social constraints involved than a speaker or a group of speakers that uses [q] 65% and [ʔ] 35%. I would like to add that some social constraints might rank higher than other social constraints in some speakers, leading also to inter-speaker variation.

OT and the GLA not only account for sociolinguistics variations, such as the variable use of [q] and [ʔ], but also for other types of phenomena that may occur within the same speech. They have the advantage of accounting for two different variations independently from each other. For example, the use of the sounds [t] and [s] and [d] and [z] is a stable situation in the naturally occurring speech of rural migrant speakers to Hims. OT and the GLA have been able to deal with this phenomenon separately from the sociolinguistic variation between [q] and [ʔ]. One variation does not necessarily affect the other. In the case of the variants [t] and [s] and [d] and [z], OT and the GLA have shown that faithfulness to the input is the major factor that determines the output, in contrast to the variable use of [q] and [ʔ], in which faithfulness constraints are easily violated.

6.3 Incorporating Social Factors into the GLA

Research question 2: How can social factors be incorporated into the GLA?

I implemented social constraints as part of OT and the GLA like linguistic constraints. They interact with linguistic constraints to represent what goes on in the brain of speakers during speech production because of their social surroundings. I showed that their interaction with linguistic constraints is essential to give percentages that match real life occurrences. I treated these social constraints like stochastic constraints on a continuous scale. The ranking value of these social constraints may differ from one speaker or group of speakers to another. The difference in their ranking values among speakers reflects the difference in real life percentages. For example, the social constraint *M[ʔ] may be higher ranked than *F[ʔ] because women are more socially conscious of the prestige associated with the form [ʔ] than males are, particularly older females. The higher ranking value of *M[ʔ] leads to higher percentages of use of [q] by males than by females. In addition, some social constraints form groups together and work as one family. For example, older female speakers from Akrama should have all of the following social constraints higher ranked than other constraints to maintain their mother dialect form [q]:

*F[ʔ], *OLD[ʔ], *AKR[ʔ]. Conflict may arise when speakers employ constraints that militate against two opposing sounds (i.e., more variation results from such implementation). Furthermore, incorporating social constraints in the computation explains the variable use of [q] and [ʔ] among members of the same social groups or different groups. In addition, certain social constraints give expectations on what the speech of a certain speaker or group of speakers should sound like.

6.4 Role Played by Social Factors

Research question 3: To what degree do social factors play a role in building our grammars, or rather developing new grammars?

We have noticed that the intersection of social constraints with linguistic constraints provides a clear picture of what goes on in the mind of a learner of a new dialect (usually prestigious urban dialects). The social constraints that are involved determine the percentages of the occurrence of each variant in the naturally occurring speech of rural migrant speakers. The degree of the social awareness, which is related in this study to the ranking value of the social constraints, affects the choice of a certain variant over another. Thus, if the social constraints that impose the use of the urban prestigious variant have high-ranking values (i.e., are highly valued by speakers), such as *F[q] and *OLD[q], the prestigious form is more likely to be produced. If they are ranked low, the mother dialect form is more likely to be produced. The latter situation reflects the importance of the mother dialect social values in the speech of those speakers. In speakers who do not show acquisition of the new form, the ranking values of their mother dialect social constraints are fixed and do not change, particularly in the speech of older speakers. In such situation, social constraints such as *F[ʔ] and *OLD[ʔ] would be highly ranked, whereas social constraints such as *F[q] and *OLD[q] would be low ranked. I have compared this to species that, when fully developed in their environment, are less likely to change and develop later on in life. They maintain their features and move on with life. One should, in any case, consider that whether speakers adopt the new ranking values of social constraints or not, these social constraints affect the way they speak and the type of grammar chosen at a particular time and place. If they are affected by their new environment and the new social constraints, they tend to vary their speech and some of them my reach complete levels of acquisition of the new form. If they are not influenced by the urban society's values, they retain their rural community social values and continue to produce their native form almost invariably.

6.5 Consistency of Variation

Research question 4: How consistent is the pattern of variation and sound change within and among rural migrant speakers to the city of Hims?

Concerning the two variants [q] and [ʔ], intra- and inter-speaker variation has been observed. Thus, some speakers showed not only variation in their speech within the same conversation but also correction towards the new form. In addition, varying speakers differed from each other in the degree of usage of each variant. Other speakers used either the [q] sound or the [ʔ] sound invariably. Thus, the variable use of [q] and [ʔ] is not consistent. There is a clear inter- and intra-speaker variation. We have seen that social factors play a major role in this variation, particularly age. Younger speakers are more inclined towards the urban form, [ʔ], whereas the majority of older speakers are more inclined towards the [q] sound. Females are more inclined towards the prestigious form [ʔ] than men are. Actually, men, mainly elderly men, are more inclined towards the [q] sound. Furthermore, residents of Al-Hameeddieh show higher usage of [ʔ] than residents in Akrama because of their environment, which is more linguistically demanding in Al-Hameeddieh than it is in Akrama. This inconsistency is reflected in both the statistical analyses and the ranking values of social and linguistic constraints.

As for the variants [t] and [s] and [d] and [z], speakers have shown consistency in their use. All speakers – young and old, males and females, upper- and middle-class, and residents of both residential areas, Akrama and Al-Hameeddieh – use a certain variant with certain words and the other variant in other specific words. I have called this a *stable* variation because of the observed consistency among speakers. This phenomenon developed historically because of two different changes: one that led to a merger between the SA forms [θ] and [ð] and the stops [t] and [d] respectively; the second led to the introduction of [s] and [z] in place of the SA forms [θ] and [ð] as a result of lexical borrowings from SA.

6.6 Markedness Constraints versus Social Constraints

Research question 5: Which factors are stronger in leading a sound change: markedness constraints or social constraints?

We have seen that in the variable use of [q] and [ʔ], social constraints play a major role in determining the grammar chosen at a particular time and place. In this type of variation, social constraints are the ones leading the present change towards the prestigious form more than linguistic markedness constraints do, although one cannot completely eliminate the effect of markedness on this type of variation. First, the glottal stop is less marked cross-linguistically than the uvular voiceless stop. It lacks the [RTR] feature that is characteristic of the [q] sound. According to radical underspecification, the positive value of a feature is the marked one and the negative value is the default, unmarked one (Archangeli 1984, 1988). In an endoscopic study of tokens of /ʔ h/ spoken by a Jordanian Arabic speaker, Zawaydeh (1999) found that no retraction of the tongue root accompanied these two segments. Thus, they are considered underspecified for place, which makes them less marked than other consonants. This finding is supported by a number of phonological analyses of laryngeals (e.g., Clements 1985; Steriade 1987; Kenstowicz 1994; Rose 1996), which have indicated that /ʔ h/ are produced with only a glottal gesture, rendering them placeless. This makes Glottal the least marked place of articulation in many languages, allowing for the following hierarchy *[LAB] >> *[DOR] >> *[COR] >> *[Glottal].

The unmarkedness of the glottal stop /ʔ/, for example, can be observed in its use as an epenthetic consonant in Arabic (Holes 2004) and many other languages to avoid onsetless syllables, such as Malay (from the Austronesian language Bahasa Melayu/Indonesia as spoken in Malaysia) (e.g., El-Imam and Don 2005). Shahin (2002:60) argues that all word-initial glottal stops in Arabic are epenthetic and the evidence “is that they are not observed when another consonant can serve as onset of the word-initial syllable.” For example, in Palestinian Arabic, [ʔik.tib] ‘write’ is possible, but not *[ik.tib] or *[bi.-ʔik.tib][19].

The unmarkedness of [ʔ] may have led historically to the merger of [q] with [ʔ] (Abdel-Jawad 1981; Haeri 1996: 122) in major urban areas, such as Hims (Habib 2005), Damascus (Daher 1998a), Cairo (Haeri 1991), Amman (Abdel-Jawad 1981), etc. This merger, according to Garbell 1978 [1958]) occurred sometime between the 11th and the 15th centuries. However, the role of markedness in the variable use of [q] and [ʔ] is not limited to the historical linguistic markedness of [q] in comparison to the unmarkedness of [ʔ]. If we look closely at the social constraints that have been employed in this study, we find that they are mainly markedness constraints that militate against the use of a certain variant by a speaker or a group of speakers.

[19] Dots indicate syllable boundary; hyphens indicate morpheme boundary; and asterisks indicate ill-formedness/ungrammaticality.

Thus, those social constraints that are pertinent to what is prohibited, allowed or expected in certain communities are one type of markedness constraints. In the current synchronic variation, they play a more pronounced role than linguistic markedness constraints in determining the grammars of the various speakers. Those affected by the urban markedness constraints tend to vary their speech. On the other hand, those who maintain their mother dialect forms show their maintenance or clinging to the social values of their native communities, and thus are affected by the markedness social constraints that are pertinent to their communities. This could also be viewed as the effect of faithfulness to their social values.

As for the four variants [t] and [s] and [d] and [z], social constraints did not seem to play any role in this phenomenon. The study has indicated that markedness may have played a role historically in pronouncing the SA variants [θ] and [ð] as [t] and [d] respectively. The merger with these two sounds was completed around the 14th century (Daher, 1998a, 1999; Schmidt 1974). In addition, the use of [s] and [z] in place of [θ] and [ð] of the borrowed words from SA is another indication of the role of markedness in the second diachronic change which took place some time after the 14th century (Birkeland 1952; Schmidt 1986:57; Schulz 1981:33; all cited in Daher 1999). There is ample evidence from Arabic and other languages that show that the sounds [θ] and [ð] are marked. Morris (2000:3), for example, indicates that the realization of Spanish aspirated /s/ and /θ/ as [h] word-finally and sometimes word-internally are cases of the emergence of the unmarked, e.g., *diez* /dieθ/ may surface as *die[h]*. Today, markedness is no longer playing a role in the use of the four variants [t] and [s] and [d] and [z]. What maintains the pronuncation of each of the four variants as it is are faithfulness constraints. Each of the four variants has its identical underlying form, which represents the input in OT. This input is protected by faithfulness constraints to appear as it is in the output.

6.7 Advantages of and Caveats about the New Model

6.7.1 Advantages of the New Model

The five questions that started this work led to the development of a new model that has the following advantages:

1. It gives mental representation of the interaction between social and linguistic constraints and the effect of each type of constraints simultaneously. The results have shown how the GLA can model sociolinguistic variation by incorporating the right type and number of social constraints. The continuous approach to constraints allows for great degrees of optionality and variation. The results show that social constraints should constitute an important part of linguistic theory, as they play a major role in determining our grammar at a certain time and place. It is social constraints that influence our degree of acquisition of the ranking value of constraints and the degree of usage of each of the sociolinguistic variants, [q] and [ʔ]. Giving mental representations of the various individual and group grammars in a sociolinguistic variation situation endows the model and the proposed constraints with a psychological reality (Section 1.1). The second, third, and fourth advantages of the model also draw our attention to the psychological reality of the proposed constraints and the accompanying sociolinguistic process.
2. This new model not only presents what goes on in the human's brain when a sociolinguistic variation is in process but also gives predications on what variation would look like if certain constraints are involved. A listener can predict from listening to the speech of an interlocutor what type of grammar or constraints are involved. If that listener is a rural migrant and the interlocutor is another rural migrant who displays

some kind of variation between the rural and the urban forms, s/he will most likely notice the interlocutor's variable use and the social constraints involved in this variation. For instance, a male listener to an older female speaker from Al-Hameeddieh knows that she activates the two constraints *F[q] and *OLD[ʔ]. These two constraints have also opposing effects: one of them militates against the use of [q] and the other one militates against the use of [ʔ]. This could be a further reason for the occurrence of variation in a certain speaker or group of speakers. Opposing social constraints may create conflict between the social meaning associated with each variant in a speaker's brain, leading to overlapping of constraints and consequently variation.

3. The model further reflects on each individual's or group of individuals' linguistic environment because the degree of input of a form affects the degree of acquisition of that form. A speaker who has ample contact with urban interlocutors is more likely to have higher degree of acquisition of the new form than a speaker who is surrounded with rural speakers most of the time, as was the case when comparing Al-Hameeddieh speakers to Akrama speakers.
4. It has also been observed during applying this new model that because of the young speakers' early contact with the urban form, they tend to acquire it and use it all the time. The model, in this case, predicts that the younger speakers have reconstructed their input despite their initial exposure to their parents' rural form, [q]. In other words, their input becomes the urban form, /ʔ/. They restructured their input not only because they are in contact with a new form but also because they notice the prestigious social value of the urban form. As many may know, children are very sensitive to comments and criticism. They do not like to be stigmatized or ridiculed by their peers or friends

because they do not sound like them. As soon as these children notice the new form and the stigma associated with their parents' form, they decide to adopt the new form. In their early stage of acquisition, it is easy to restructure their input and sound more urbane than their parents are. We have seen exceptions among three young male speakers who have lived all their lives in Akrama. Because of their less demanding environment to learn the new form, they retain their parents' form. However, all the other young speakers, who are likewise the sons and daughters of rural migrants, show complete acquisition of the new form in just the span of one generation, as is the case of the sons and daughters of rural migrant speakers to Cairo (Miller 2005).

5. The model not only accounts for sociolinguistic variation but also other accompanying phenomena that may be led by different factors. This is an important aspect of the GLA, its ability to account for categorical and optional ranking values. The GLA has enabled me to account for the use of the variants [t] and [s] and [d] and [z] separately from the sociolinguistic variation between [q] and [ʔ]. It has shown that social constraints do not play a role in the case of the former four variants, although they play a role in the variable use of [q] and [ʔ]. It has further shown that the consistent occurrence of each variant in certain words is the result of the categorical higher ranking of faithfulness constraints with respect to other constraints.
6. Where statistical analyses fail to indicate a specific influence of a social factor on the variation observed, the new model provides evidence of the effect of that factor because of the model's more refined specificity. Each social factor is divided into a balanced number of constraints in relation to its categories and the sociolinguistic variants. A social factor such as residential area could be divided into four social

constraints if there are two residential areas and two variants. Thus, the constraints are calculated in a factorial manner, multiplying the number of the social factor categories with the number of the sociolinguistic variants. This specificity allows, for example, for only one of the four constraints to be involved in the computation. In Section 4.4.4, I have shown that the statistical analysis fails to show significant interaction between residential area and gender and age, regarding the variable use of [ʔ]. However, the results of Example 7 in Chapter 3 have shown that young female speakers from Al-Hameeddieh must rank all three constraints – *F[q], *YOUNG[q], and *HAM[q] – higher than *ʔ to achieve 98% pronunciation of [ʔ] and 2% of [q]. Thus, the social constraint, *HAM[q], which constitutes one of the four social constraints of residential area, is implemented in the speech of young female speakers from Al-Hameeddieh to produce high percentages of [ʔ].

6.7.2 Caveats about the New Model and Other Limitations of the Study

A researcher should know the speech community well to be able to discover the social constraints that are involved in the variation and the learning process. It was feasible for me to investigate the speech of rural migrant speakers to the city of Hims because I am a close member of that community. I know the participants well. I know their life styles and the community's social evaluation for each one of them. I also know the culture and the social values and behavior associated with each linguistic form. This is not only knowledge on my part but also on the part of many speakers who have expressed throughout their conversations the stigma associated with [q] and the rural dialects. They also mentioned who they think tend to change their speech the most (i.e., older females). In addition, some of them pointed out some of the reasons that rural speakers tend to change their speech (Habib 2005, Sections 5.2 and 5.3).

The model cannot converge on a simple categorical grammar for multiple varying speakers, which is normal because the ranking values of constraints are very close to each other, leading to overlapping of constraints, and hence variation. Because the model cannot converge on a strictly dominated grammar, one can only predict continuous variation and the present percentage usage of each variant in speakers. One cannot predict if a varying speaker can acquire the new form completely. The only way to make such prediction is to manipulate the pair distribution in the GLA and make speakers learn from partial outputs that are considered potential input. Changing the amount of input that a speaker receives of each variant can change the result in the direction of convergence towards one grammar or the other. However, in the real world the exact percentages of input are hard to determine; there are many factors that can play a role in determining the input intake, which is very hard to determine without observing a speaker over a very long period of time or for the rest of his/her life. Although it is beyond the scope of this study, it is worth mentioning that I have noticed during the examination of the speech of one older female speaker whom I recorded in 2004 and 2006 that she has progressed more, in two years, towards the prestigious form. More observations of this type throughout upcoming years are essential to understand and arrive at conclusions on how language change progresses in a society.

Although this study did not cover all the possible social factors that could be involved in the variation under investigation, it introduced a new model of sociolinguistic analysis that could be improved and expanded on. It may be a good idea to include social factors, such as religion, social status, and social distance in future studies. It may also be a good idea to have more than one interviewer conduct the interviews with the same interviewees (Walters 1991). The background of the interviewer may have influenced the way speakers speak. I would expect speakers to use the [ʔ] sound more frequently with a speaker who is originally from the city of Hims, for example. Because interviewees in this study are very close relatives and friends to me, they may have felt more comfortable using their native form, [q], with me, particularly in the case of Speakers 29, 30, and 31. According to their sister (i.e., Speaker-44), those three young male speakers who reside in Akrama change their speech towards the prestigious form, [ʔ], when conversing with urban interlocutors or strangers, particularly from the opposite sex. This was not the case when I interviewed them. My explanation of this situation is that they felt very comfortable talking to me in their native form, [q], because of their strong familiarity with me. They know that I am familiar with their rural form and the way people from Oyoun speak. They also know that I will not be critical of that rural form because my parents use it with us all the time.

6.8 Frequency effects

Although frequency was not a part of the research questions that led this work, I felt that it was essential to examine the influence of frequency of words on the acquisition process of the urban form [ʔ]. The examination of word frequency was even more important in the case of the four variants [t] and [s] and [d] and [z], because this stable phenomenon cannot be explained by social factors, as all speakers are consistent in using them. The results show that frequency has varying roles with respect to the two types of variations that are dealt with in this work. Frequency has a facilitative learning effect concerning the sociolinguistic variation between [q] and [ʔ]. In other words, it is not the factor that leads the change from [q] to [ʔ]; rather, it is the leading factor for acquiring highly frequent words faster than less frequent words which contain the prestigious form [ʔ]. Thus, frequency, in this case, plays a major role in determining which words a varying speaker acquires initially.

As for the use of the variants [t] and [s] and [d] and [z], frequency has two opposing effects. The first effect led to the historical merger between the SA [θ] and [ð] and the stops [t] and [d] respectively. The second effect safeguarded the most frequent words that contain the [t] and [d] from another historical sweeping change (i.e., from the use of [s] and [z] in place of the SA [θ] and [ð] in borrowed words). Very frequent words develop with time some kind of autonomy or automatization because of continuous repetition (Bybee 2001); they develop a strong mental representation that makes them easier to access and more resistant to change.

6.9 Implications, Directions and Recommendations for Future Research

For a long time phonological theory and sociolinguistic theory acted independently from each other. In this work, I was able to bring these two subfields together. Linguistic theory should be general enough to account for not only the phonological aspect of grammar but also the social aspect of that grammar. Researchers who are interested in factors other than social factors may find the new model helpful in accounting for psychological, pragmatic, or other factors within the same framework. I would not want to make the claim that the model is perfect in its present shape. I believe more work and modifications may need to be done to improve the model. It needs to be tested on other languages and other social constraints. The development of the model does not stop at the application of the social constraints proposed in this study. Rather, it should extend to the proposition of other social constraints that may be pertinent to different sound changes in different speech communities.

One important implication of this study is the possibility of generalizing the proposed social constraints to other languages. Many sociolinguistic studies have shown similar results regarding the increased use of prestigious forms by women, younger generations, or residents of prestigious areas (e.g., Labov 1972a; Gal 1979; Milroy 1980; Eckert 1991b; Miller 2005). These similar results prompt me to propose some general social constraints that can be applied to any language and any linguistic form. At the same time, there are studies that have shown contradictory results. Thus, the ranking values of those social constraints are the determining factor of what form is chosen at a certain time and place by a certain speaker or group of speakers. Those ranking values, in this sense, may differ from one speech community to another or from one language to another. Because not all speech communities evaluate sounds in the same way, one should always take into consideration different grammars and different social constraints. Consequently, generalizing the social constraints does not have negative effects because those general constraints could be higher or lower ranked in one speech community or another. The general social constraints that I propose are as follows:

Gender:

*F[SF]	Stigmatized forms are marked in the speech of females
*M[SF]	Stigmatized forms are marked in the speech of males
*F[PF]	Prestigious forms are marked in the speech of females
*M[PF]	Prestigious forms are marked in the speech of males

Age:

*OLD[SF]	Stigmatized forms are marked in the speech of older speakers
*YOUNG[SF]	Stigmatized forms are marked in the speech of younger speakers
*OLD[PF]	Prestigious forms are marked in the speech of older speakers
*YOUNG[PF]	Prestigious forms are marked in the speech of younger speakers

Social class:

*UM[SF]	Stigmatized forms are marked in the speech of upper-middle class
*LM[SF]	Stigmatized forms are marked in the speech of lower-middle class
*UM[PF]	Prestigious forms are marked in the speech of upper-middle class
*LM[PF]	Prestigious forms are marked in the speech of lower-middle class

Residential area:

*PR[SF]	Stigmatized forms are marked in the speech of prestigious areas
*NR[SF]	Stigmatized forms are marked in the speech of non-prestigious areas
*PR[PF]	Prestigious forms are marked in the speech of prestigious areas
*NR[PF]	Prestigious forms are marked in the speech of non-prestigious areas

Of course, these constraints do not form an exhaustive list of general social constraints; rather, they are just a subset of the possible general social constraints that can be proposed. One can even modify these general ones to include more constraints if one is dealing with more than two variants of the same variable. If there are three variants, then the social factor could be divided into six constraints. Furthermore, stigmatized forms and prestigious forms in the constraints' description could be replaced with the respective sounds under investigation. One can also take into consideration the length of stay in the city and other factors such as religion, education, etc.

Proposing general social constraints raises the issue of the universality of the sociolinguistic behavior of speakers across languages. This is a wide topic to explore in future research. Questions such as the following may occur. Are human beings endowed with a universal set of social constraints? Do they eliminate or reactivate some of these constraints because of their observations of the societal behavior around them? In other words, do they acquire the ranking of these constraints in the same way they acquire the ranking of their L1 linguistic constraints? And do they acquire these social constraints in the same way an L2 learner acquires the ranking of the linguistic constraints of an L2?

I propose that humans may have universal social constraints in the same way that they have a universal set of linguistic constraints. Similar to how they acquire their mother tongue by eliminating or reranking markedness and faithfulness linguistic constraints that are pertinent to their L1, speakers acquire their social skills from their surroundings and tend to eliminate some social constraints and rerank social constraints that are pertinent to their environment. Thus, like linguistic constraints that are universal in nature but their ranking with respect to each other is language specific, social constraints could be universal in nature and their ranking is language, dialect, or community specific. In other words, the relativity of the social constraints is maintained in the specificity of individual grammars and constraint rankings of particular speakers or communities of speakers. When speakers learn a second language or dialect, they attempt to change the ranking of those social constraints or reactivate some dormant social constraints to fit into their new environment. This is true pragmatically. For example, an L2 speaker has to learn the pragmatics of the L2 in order to sound native-like and to integrate into the new culture. Thus, the idea of universal social constraints is worth exploring in future research.

One further suggestion for future research is applying the new model to examine the percentage of usage of [q] and [ʔ] in other Arab urban communities (within or outside Syria) against those found in this study. If percentages match, then there is a similar trend in most Arab urban communities towards not only the activation of the same social constraints but also the same ranking values. If percentages do not match, then there might be difference in the ranking values of the same social constraints from one community to another or from one country to another. In addition, the difference among Arab countries with respect to the use of various variants as a replacement for [q] calls for further studies to examine those usages against the usage of other variants in other Arab countries to look for similar or different trends.

The variants [t] and [s] and [d] and [z] are not socially conditioned in the speech of most Syrian speakers. However, this may not be the case in other Arab countries. Thus, further studies are needed to investigate if the naturally occurring speech of other Arab dialects has socially conditioned variations in the use of these four variants. I presented the example of Bahrain (Holes 1986), in which the SA variant [θ] is considered socially and colloquially prestigious and there is a kind of convergence towards this form away from the non-standard form [f]. In this case, social constraints could be included in the GLA to account for the sociolinguistic variable use of [θ] and [f].

In addition to all the above suggestions, longitudinal observational studies are a good source of data to make future predictions in the GLA about changes in progress. Such longitudinal observations could complement this study, in that they could provide the usage percentages of each variant in varying speakers throughout a number of years. The results may be informative about the directionality of variation and the change in the input intake of each variant if there is any. If changes in usage percentages differ throughout a period of time, then we can conclude that some learnability is taking place despite the speakers' surrounding varying linguistic environment. Such results may also be informative about the speakers' increased or decreased social contact with speakers of the prestigious form.

Based on my personal observations and the comments of some speakers, I believe it is important to trace the sound change of [q] into [ʔ] in some villages of Wadi Al-Nasara because of contact with urban speakers through marriage or increased commuting between these villages and urban areas. I believe some villages may show greater use of [ʔ] than [q] within the village itself. Furthermore, some villages may show greater use of [ʔ] or [q] than other villages. The spread of the use of [ʔ] to the villages and the difference in spread among these villages is worth investigating. Such research should focus on children from all ages that live in the villages and receive their education in the schools of those villages to observe the outside influence on them. I mean by outside influence any of the following: going to visit relatives in urban areas or [ʔ]-speaking areas; mothers from outside the villages that have been married to men in the villages and brought with them the prestigious form [ʔ]; and the children's contact with relatives visiting from [ʔ]-speaking area. In such studies, not only children who undergo such outside influences should be investigated but also other village children who are not directly affected by an outside influence. They may have minor contact with [ʔ] through exposure to television stations that use the [ʔ] sound instead of [q] or through contact with other village children who are exposed to those outside influences. Starting with observing village children may lead to predicting the future pronunciation of the villages. In other words, we may be able to foresee a change in progress in the villages themselves. I believe there is a change in progress in the villages towards the urban prestigious form but this change has different degrees. In one or two villages of Wadi Al-Nasara, such as Marmarita, there is obvious difference between the older and younger generation regarding the use of [q] and [ʔ]. This issue will be reserved for future research that I believe can give us fascinating results.

6.10 Conclusion

This work has presented a new model for analyzing sociolinguistic variation. It is my hope that this model will be put to use by other researchers to investigate what goes on in the brain of a speaker who varies his/her speech for social reasons. In the same way that this work has brought two linguistic subfields closer together, phonologists should start accepting social factors as part of linguistic theory, and sociolinguists should not distance themselves from theoretical models to explore variation throughout the world. Interacting social constraints with linguistic constraints within one theoretical framework allows us to observe the simultaneous workings of those constraints. In some variations, social constraints are involved and required. In other variations, no social constraints are involved or required. Both situations can be accounted for in OT and the GLA. The GLA allows us to deal with different phenomena independently from each other. For example, vowel variation within the same speaker may act independently from consonant variation. Habib (in progress) has shown that the variable use of [q] and [ʔ] may or may not be accompanied by certain vowel changes. Some speakers may choose to vary between [q] and [ʔ] but use the rural dialect vowel system. Other speakers may vary in both their use of [q] and [ʔ] and their use of the rural and urban vowel systems. Furthermore, some speakers may show complete acquisition of both systems. Finally, the social constraints proposed in this study do not necessarily play a role in all types of variations. One should examine all possible causes of a certain phenomenon, such as frequency effects and linguistic, internal and psychological forces.

APPENDIX A
TESTS OF ASSOCIATION FOR SOCIAL CLASS WITH EDUCATION, INCOME, OCCUPATION, AND RESIDENTIAL AREA

Cross Tabulations (Contingency Tables)

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Social Class * Education	52	100.0%	0	.0%	52	100.0%
Social Class * Income	52	100.0%	0	.0%	52	100.0%
Social Class * Occupation	52	100.0%	0	.0%	52	100.0%
Social Class * Area	52	100.0%	0	.0%	52	100.0%

Social Class * Education

Crosstab

		Social Class				
		Lower-middle		Upper-middle		Total
		Count	Adjusted Residual	Count	Adjusted Residual	Count
Education	Elementary	3	.9	1	-.9	4
	Middle school	5	.5	3	-.5	8
	High school	4	-.6	5	.6	9
	Associate degree	8	1.8	2	-1.8	10
	Bachelor's degree	6	-1.3	9	1.3	15
	Professional	2	-1.1	4	1.1	6
	Total	28		24		52

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.207[a]	5	.287
Likelihood Ratio	6.494	5	.261
Linear-by-Linear Association	2.006	1	.157
N of Valid Cases	52		

a. 9 cells (75.0%) have expected count less than 5. The minimum expected count is 1.85.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.198	.133	1.431	.159[c]
Ordinal by Ordinal	Spearman Correlation	.207	.135	1.499	.140[c]
N of Valid Cases		52			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Social Class * Income

Crosstab

			Income			
			Low	Mid	High	Total
Social Class	Lower-middle	Count	22	6	0	28
		Adjusted Residual	5.4	-.6	-5.2	
	Upper-middle	Count	1	7	16	24
		Adjusted Residual	-5.4	.6	5.2	
	Total	Count	23	13	16	52

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	35.151[a]	2	.000
Likelihood Ratio	45.608	2	.000
Linear-by-Linear Association	34.464	1	.000
N of Valid Cases	52		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.822	.053	10.209	.000[c]
Ordinal by Ordinal	Spearman Correlation	.822	.055	10.193	.000[c]
N of Valid Cases		52			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Social Class * Occupation

Crosstab

		Social Class				
		Lower-middle		Upper-middle		Total
		Count	Adjusted Residual	Count	Adjusted Residual	Count
Occupation	unemployed	7	-.7	8	.7	15
	Government employee	11	3.0	1	-3.0	12
	Private work/business	1	-1.2	3	1.2	4
	Professional	9	-1.3	12	1.3	21
	Total	28		24		52

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.578[a]	3	.023
Likelihood Ratio	10.987	3	.012
Linear-by-Linear Association	1.028	1	.311
N of Valid Cases	52		

a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 1.85.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.142	.140	1.014	.315[c]
Ordinal by Ordinal	Spearman Correlation	.114	.144	.811	.421[c]
N of Valid Cases		52			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Social Class * Residential Area

Crosstab

			Area		
			Al-Hameeddieh	Akrama	Total
Social Class	Lower-middle	Count	16	12	28
		Adjusted Residual	-3.2	3.2	
	Upper-middle	Count	23	1	24
		Adjusted Residual	3.2	-3.2	
	Total	Count	39	13	52

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	10.317[a]	1	.001		
Continuity Correction[b]	8.357	1	.004		
Likelihood Ratio	11.926	1	.001		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	10.119	1	.001		
N of Valid Cases	52				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.

b. Computed only for a 2x2 table

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	-.445	.099	-3.518	.001[c]
Ordinal by Ordinal	Spearman Correlation	-.445	.099	-3.518	.001[c]
N of Valid Cases		52			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

APPENDIX B
DESCRIPTIVE STATISTICS EXAMINING TYPE OF DISTRIBUTION IN THE DATA

Gender

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	Gender	N	Percent	N	Percent	N	Percent
qaf	Female	972	100.0%	0	.0%	972	100.0%
	Male	1506	100.0%	0	.0%	1506	100.0%
hamza	Female	972	100.0%	0	.0%	972	100.0%
	Male	1506	100.0%	0	.0%	1506	100.0%

Descriptives

	Gender			Statistic	Std. Error
qaf	Female	Mean		83.7016	.78199
		95% Confidence Interval for Mean	Lower Bound	82.1671	
			Upper Bound	85.2362	
		5% Trimmed Mean		86.4959	
		Median		100.0000	
		Variance		594.381	
		Std. Deviation		24.37992	
		Minimum		1.00	
		Maximum		100.00	
		Range		99.00	
		Interquartile Range		25.00	
		Skewness		-1.498	.078
		Kurtosis		1.504	.157
	Male	Mean		91.5458	.44149
		95% Confidence Interval for Mean	Lower Bound	90.6798	
			Upper Bound	92.4118	
		5% Trimmed Mean		94.2044	
		Median		99.0000	

		Variance		293.534	
		Std. Deviation		17.13285	
		Minimum		1.00	
		Maximum		100.00	
		Range		99.00	
		Interquartile Range		6.00	
		Skewness		-3.266	.063
		Kurtosis		12.083	.126
hamza	Female	Mean		16.30	.782
		95% Confidence Interval for Mean	Lower Bound	14.76	
			Upper Bound	17.83	
		5% Trimmed Mean		13.50	
		Median		.00	
		Variance		594.381	
		Std. Deviation		24.380	
		Minimum		0	
		Maximum		99	
		Range		99	
		Interquartile Range		25	
		Skewness		1.498	.078
		Kurtosis		1.504	.157
	Male	Mean		8.45	.441
		95% Confidence Interval for Mean	Lower Bound	7.59	
			Upper Bound	9.32	
		5% Trimmed Mean		5.80	
		Median		1.00	
		Variance		293.534	
		Std. Deviation		17.133	
		Minimum		0	
		Maximum		99	
		Range		99	
		Interquartile Range		6	
		Skewness		3.266	.063
		Kurtosis		12.083	.126

M-Estimators[e]

	Gender	Huber's M-Estimator[a]	Tukey's Biweight[b]	Hampel's M-Estimator[c]	Andrews' Wave[d]
qaf	Female	.	.	.	.
	Male	98.7437	99.6968	99.1258	99.7040
hamza	Female	.	.	.	.
	Male	1.31	.23	.84	.22

a. The weighting constant is 1.339.

b. The weighting constant is 4.685.

c. The weighting constants are 1.700, 3.400, and 8.500

d. The weighting constant is 1.340*pi.

e. Some M-Estimators cannot be computed because of the highly centralized distribution around the median.

Extreme Values

	Gender			Case Number	Value
qaf	Female	Highest	1	14	100.00
			2	15	100.00
			3	18	100.00
			4	24	100.00
			5	27	100.00
		Lowest	1	50	1.00
			2	45	1.00
			3	44	1.00
			4	40	1.00
			5	51	2.00[a]
	Male	Highest	1	2	100.00
			2	4	100.00
			3	7	100.00
			4	10	100.00
			5	12	100.00[b]
		Lowest	1	37	1.00
			2	35	1.00
			3	33	2.00
			4	39	3.00

			5	34	4.00
hamza	Female	Highest	1	40	99
			2	44	99
			3	45	99
			4	50	99
			5	48	98[c]
		Lowest	1	27	0
			2	24	0
			3	18	0
			4	15	0
			5	14	0
	Male	Highest	1	35	99
			2	37	99
			3	33	98
			4	39	97
			5	34	96
		Lowest	1	31	0
			2	13	0
			3	12	0
			4	10	0
			5	7	0[d]

a. Only a partial list of cases with the value 2.00 are shown in the table of lower extremes.

b. Only a partial list of cases with the value 100.00 are shown in the table of upper extremes.

c. Only a partial list of cases with the value 98 are shown in the table of upper extremes.

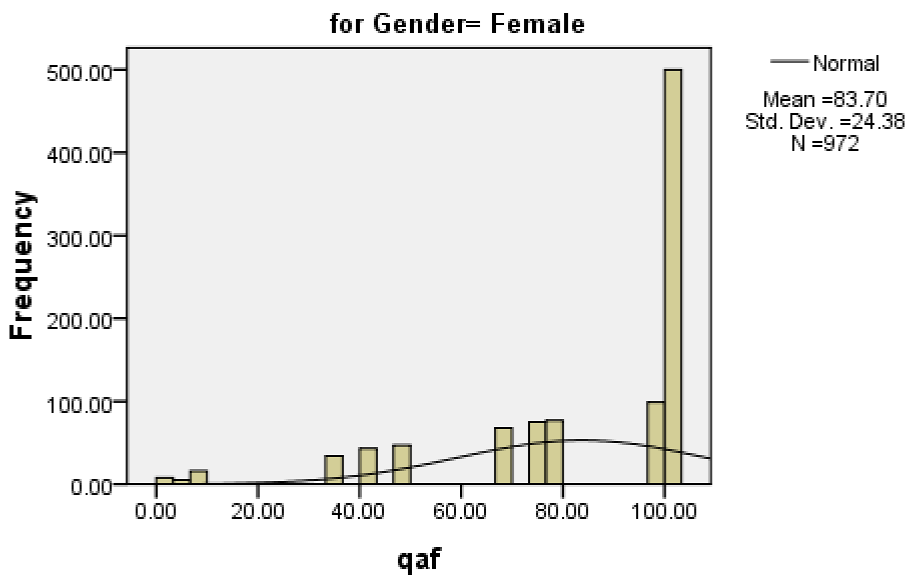
d. Only a partial list of cases with the value 0 are shown in the table of lower extremes.

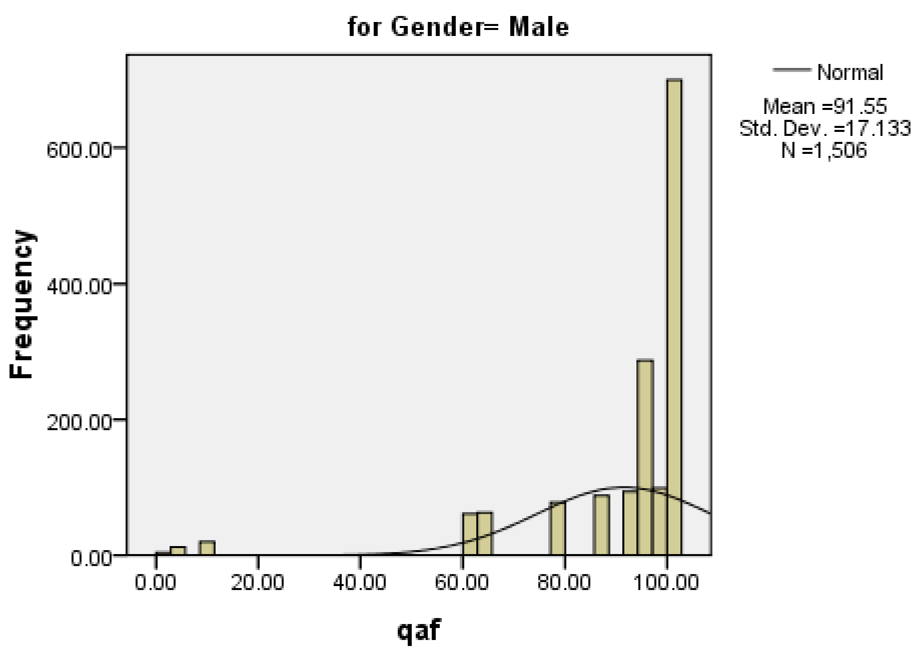
Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Gender	Statistic	df	Sig.	Statistic	df	Sig.
qaf	Female	.351	972	.000	.707	972	.000
	Male	.340	1506	.000	.535	1506	.000
hamza	Female	.351	972	.000	.707	972	.000
	Male	.340	1506	.000	.535	1506	.000

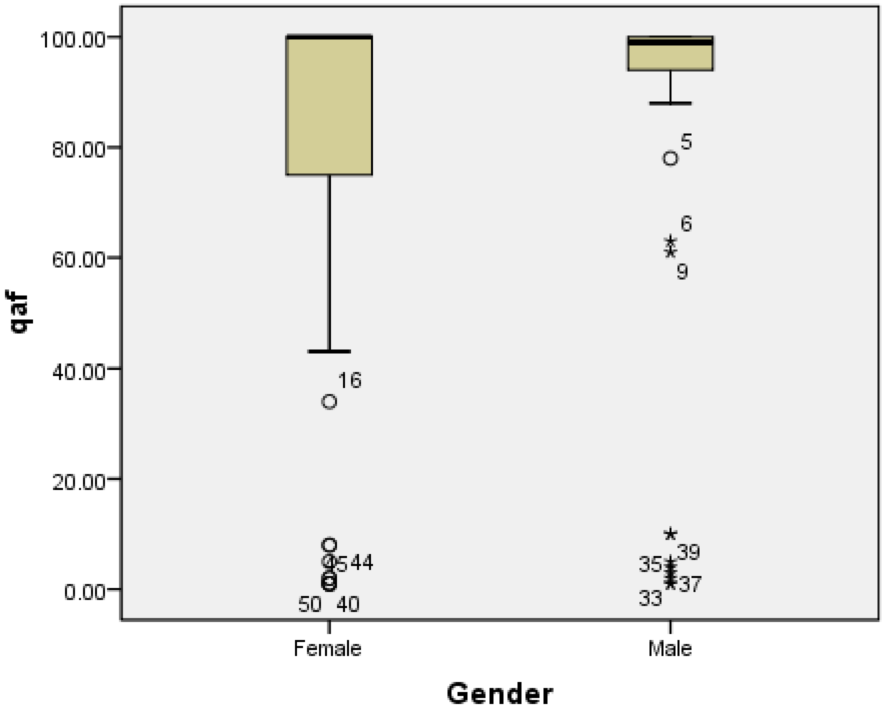
a. Lilliefors Significance Correction

qaf: Gender Histograms

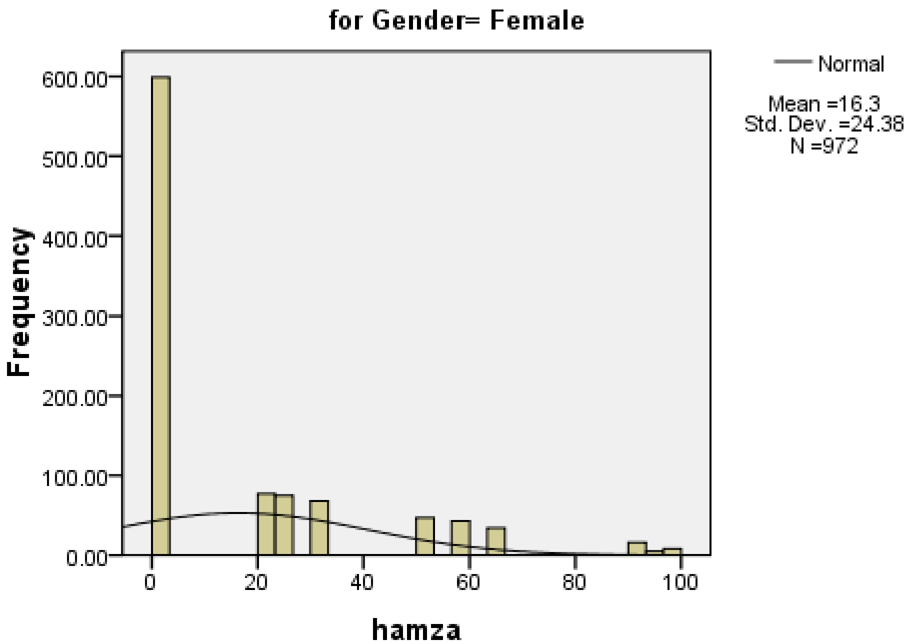


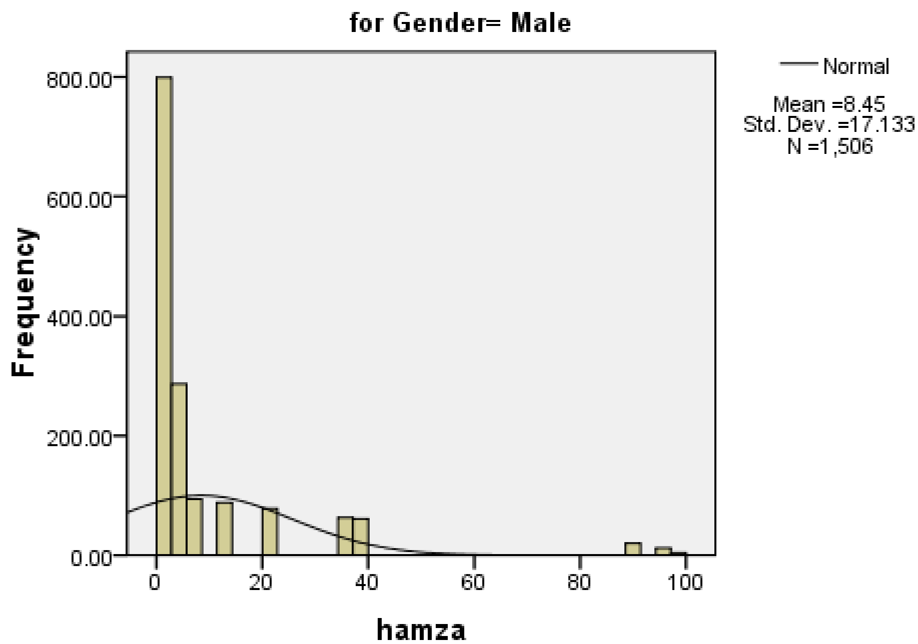


qaf: Gender Boxplots

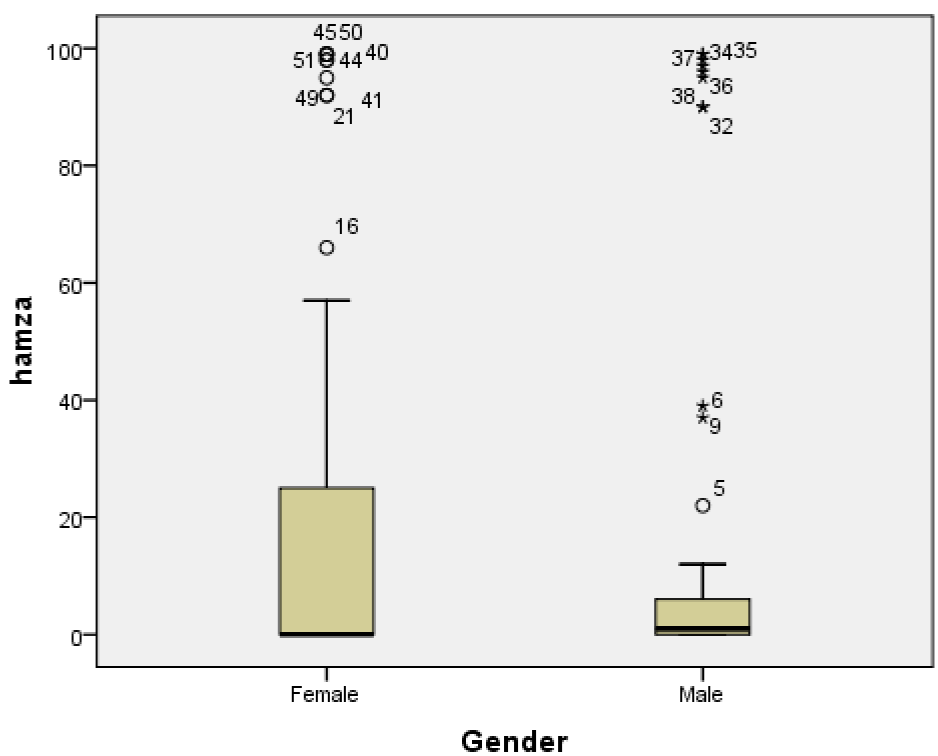


hamza: Gender Histograms





hamza: Gender Boxplots



Age

Case Processing Summary

	Age	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
qaf	Young	341	100.0%	0	.0%	341	100.0%
	Old	2137	100.0%	0	.0%	2137	100.0%
hamza	Young	341	100.0%	0	.0%	341	100.0%
	Old	2137	100.0%	0	.0%	2137	100.0%

Descriptives

	Age			Statistic	Std. Error
qaf	Young	Mean		80.1085	1.81223
		95% Confidence Interval for Mean	Lower Bound	76.5439	
			Upper Bound	83.6731	
		5% Trimmed Mean		83.3392	
		Median		96.0000	
		Variance		1119.903	
		Std. Deviation		33.46495	
		Minimum		1.00	
		Maximum		100.00	
		Range		99.00	
		Interquartile Range		12.00	
		Skewness		-1.727	.132
		Kurtosis		1.123	.263
	Old	Mean		89.8030	.37644
		95% Confidence Interval for Mean	Lower Bound	89.0648	
			Upper Bound	90.5412	
		5% Trimmed Mean		92.0959	
		Median		100.0000	
		Variance		302.835	
		Std. Deviation		17.40216	

		Minimum		8.00	
		Maximum		100.00	
		Range		92.00	
		Interquartile Range		22.00	
		Skewness		-1.861	.053
		Kurtosis		2.947	.106
hamza	Young	Mean		19.89	1.812
		95% Confidence Interval for Mean	Lower Bound	16.33	
			Upper Bound	23.46	
		5% Trimmed Mean		16.66	
		Median		4.00	
		Variance		1119.903	
		Std. Deviation		33.465	
		Minimum		0	
		Maximum		99	
		Range		99	
		Interquartile Range		12	
		Skewness		1.727	.132
		Kurtosis		1.123	.263
	Old	Mean		10.20	.376
		95% Confidence Interval for Mean	Lower Bound	9.46	
			Upper Bound	10.94	
		5% Trimmed Mean		7.90	
		Median		.00	
		Variance		302.835	
		Std. Deviation		17.402	
		Minimum		0	
		Maximum		92	
		Range		92	
		Interquartile Range		22	
		Skewness		1.861	.053
		Kurtosis		2.947	.106

M-Estimators[e]

	Age	Huber's M-Estimator[a]	Tukey's Biweight[b]	Hampel's M-Estimator[c]	Andrews' Wave[d]
qaf	Young	94.1673	95.5674	95.0705	95.5673
	Old	.	.	.	.
hamza	Young	6.46	4.60	5.00	4.60
	Old	.	.	.	.

a. The weighting constant is 1.339.

b. The weighting constant is 4.685.

c. The weighting constants are 1.700, 3.400, and 8.500

d. The weighting constant is 1.340*pi.

e. Some M-Estimators cannot be computed because of the highly centralized distribution around the median.

Extreme Values

	Age			Case Number	Value
qaf	Young	Highest	1	31	100.00
			2	30	96.00
			3	29	88.00
			4	32	10.00
			5	36	10.00
		Lowest	1	50	1.00
			2	45	1.00
			3	44	1.00
			4	40	1.00
			5	37	1.00[a]
	Old	Highest	1	2	100.00
			2	4	100.00
			3	7	100.00
			4	10	100.00
			5	12	100.00[b]
		Lowest	1	21	8.00
			2	16	34.00
			3	19	43.00

			4	20	47.00
			5	9	61.00
hamza	Young	Highest	1	35	99
			2	37	99
			3	40	99
			4	44	99
			5	45	99[c]
		Lowest	1	31	0
			2	30	4
			3	29	12
			4	36	90
			5	32	90
	Old	Highest	1	21	92
			2	16	66
			3	19	57
			4	20	53
			5	9	39
		Lowest	1	27	0
			2	24	0
			3	18	0
			4	15	0
			5	14	0[d]

a. Only a partial list of cases with the value 1.00 are shown in the table of lower extremes.

b. Only a partial list of cases with the value 100.00 are shown in the table of upper extremes.

c. Only a partial list of cases with the value 99 are shown in the table of upper extremes.

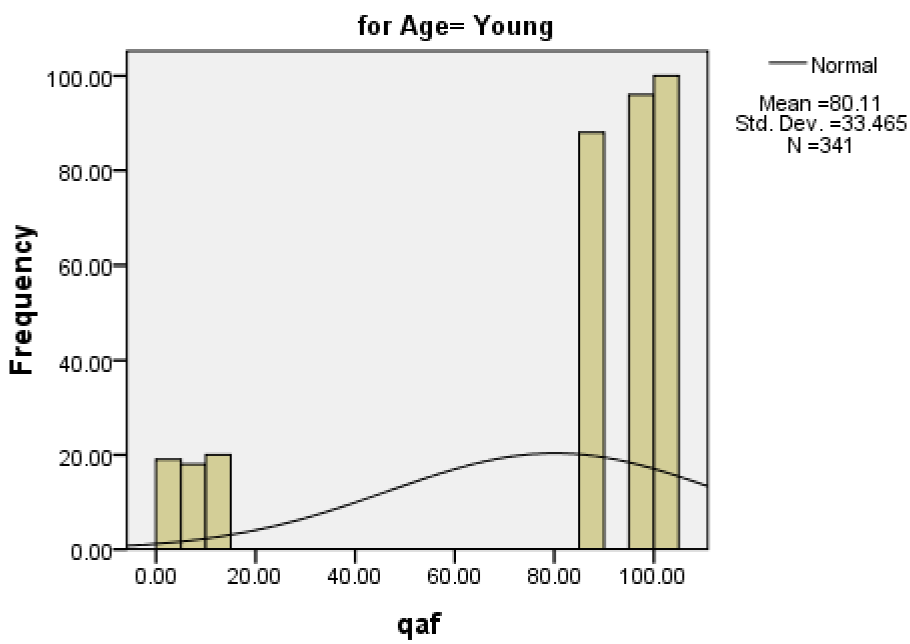
d. Only a partial list of cases with the value 0 are shown in the table of lower extremes.

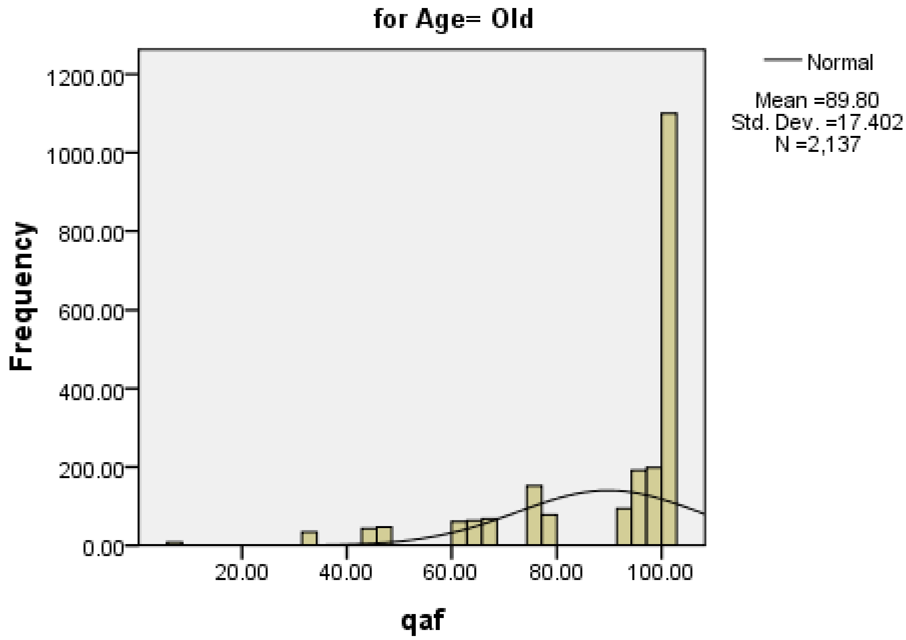
Tests of Normality

	Age	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
qaf	Young	.426	341	.000	.569	341	.000
	Old	.336	2137	.000	.650	2137	.000
hamza	Young	.426	341	.000	.569	341	.000
	Old	.336	2137	.000	.650	2137	.000

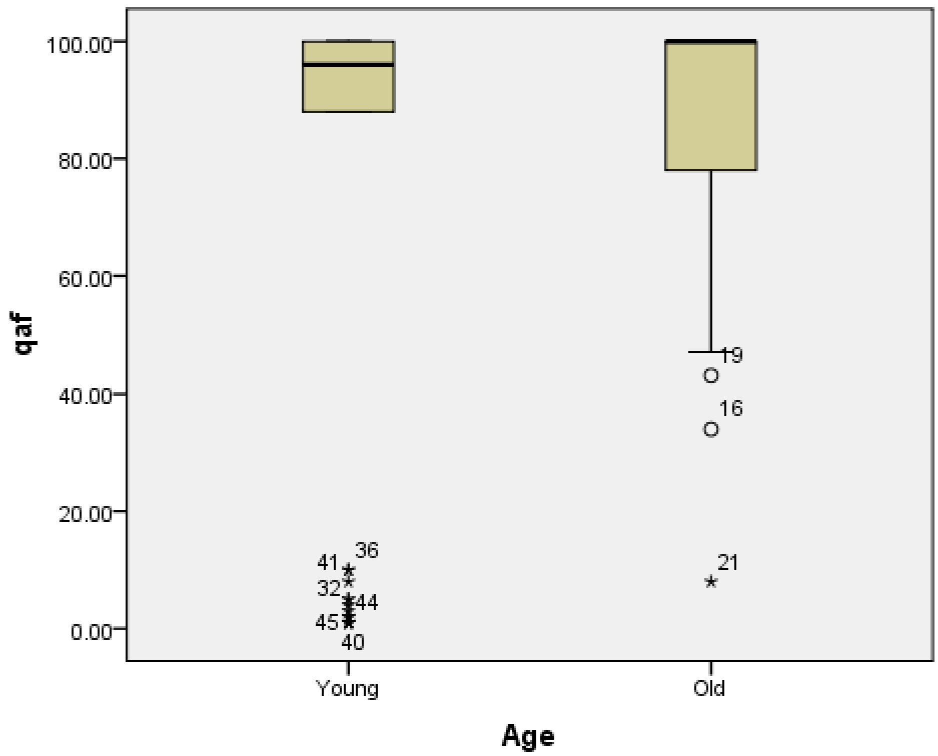
a. Lilliefors Significance Correction

qaf: Age Histograms

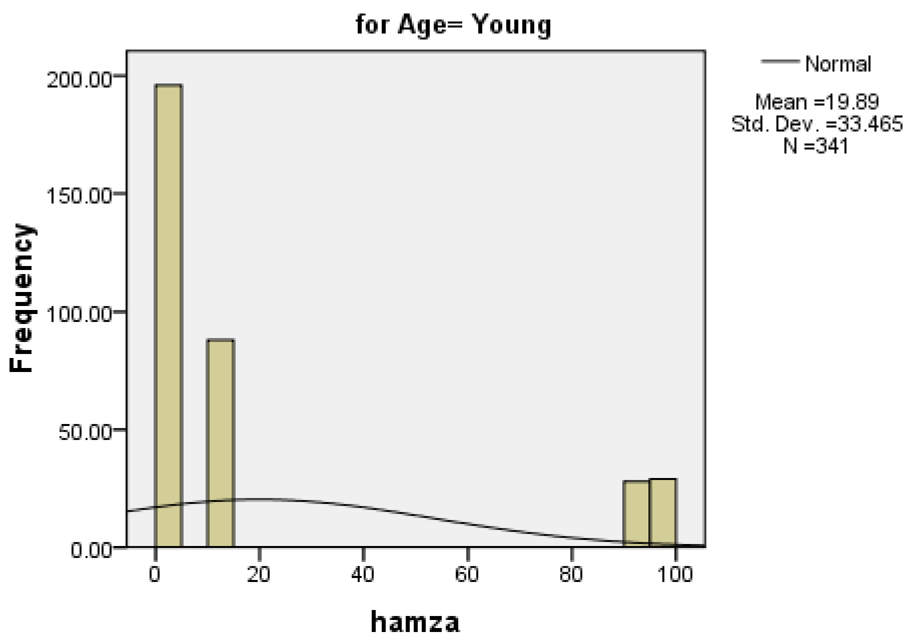


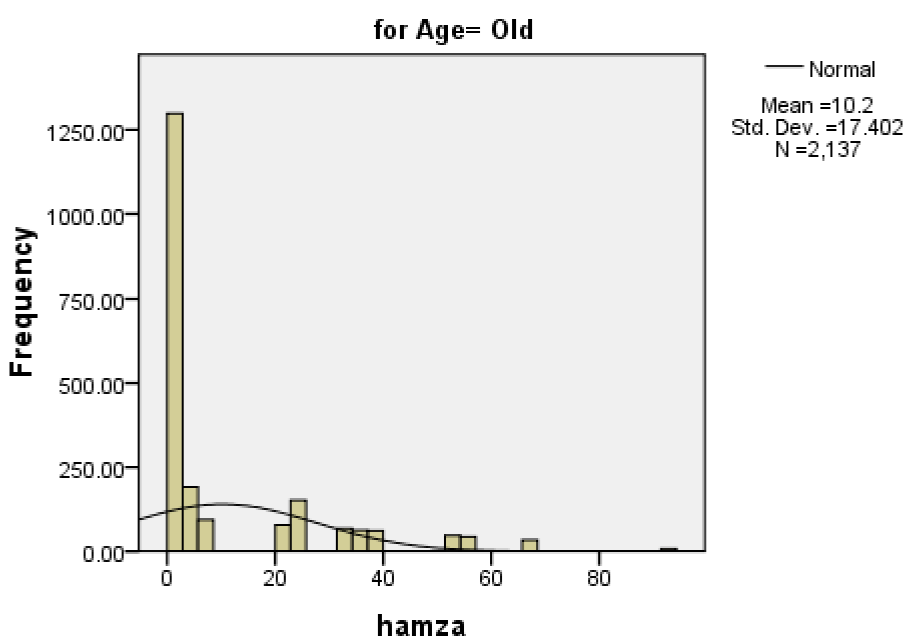


qaf: Age Boxplots

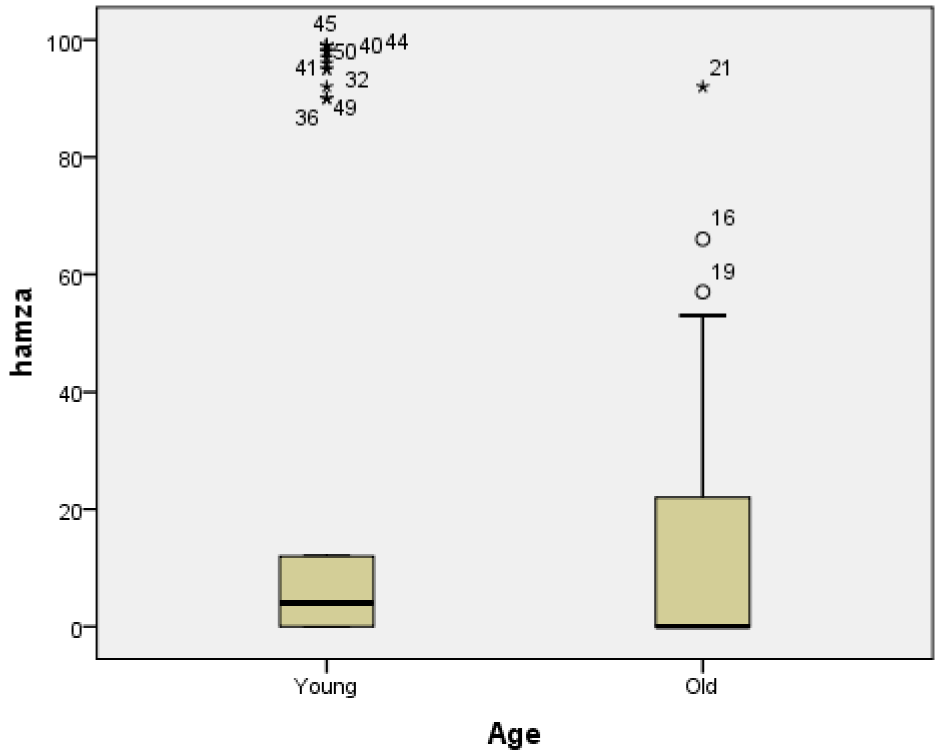


hamza: Age Histograms





hamza: Age Boxplots



Area

Case Processing Summary

	Area	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
qaf	Al-Hameeddieh	1649	100.0%	0	.0%	1649	100.0%
	Akrama	829	100.0%	0	.0%	829	100.0%
hamza	Al-Hameeddieh	1649	100.0%	0	.0%	1649	100.0%
	Akrama	829	100.0%	0	.0%	829	100.0%

Descriptives

	Area			Statistic	Std. Error
qaf	Al-Hameeddieh	Mean		85.9885	.55762
		95% Confidence Interval for Mean	Lower Bound	84.8948	
			Upper Bound	87.0822	
		5% Trimmed Mean		89.1575	
		Median		99.0000	
		Variance		512.742	
		Std. Deviation		22.64381	
		Minimum		1.00	
		Maximum		100.00	
		Range		99.00	
		Interquartile Range		23.00	
		Skewness		-1.918	.060
		Kurtosis		3.420	.120
	Akrama	Mean		93.4029	.51200
		95% Confidence Interval for Mean	Lower Bound	92.3979	
			Upper Bound	94.4079	
		5% Trimmed Mean		96.0271	
		Median		96.0000	
		Variance		217.313	
		Std. Deviation		14.74155	
		Minimum		1.00	
		Maximum		100.00	
		Range		99.00	
		Interquartile Range		5.00	
		Skewness		-3.691	.085
		Kurtosis		14.681	.170
hamza	Al-Hameeddieh	Mean		14.01	.558
		95% Confidence Interval for Mean	Lower Bound	12.92	
			Upper Bound	15.11	
		5% Trimmed Mean		10.84	
		Median		1.00	
		Variance		512.742	

		Std. Deviation		22.644	
		Minimum		0	
		Maximum		99	
		Range		99	
		Interquartile Range		23	
		Skewness		1.918	.060
		Kurtosis		3.420	.120
	Akrama	Mean		6.60	.512
		95% Confidence Interval for Mean	Lower Bound	5.59	
			Upper Bound	7.60	
		5% Trimmed Mean		3.97	
		Median		4.00	
		Variance		217.313	
		Std. Deviation		14.742	
		Minimum		0	
		Maximum		99	
		Range		99	
		Interquartile Range		5	
		Skewness		3.691	.085
		Kurtosis		14.681	.170

M-Estimators

	Area	Huber's M-Estimator[a]	Tukey's Biweight[b]	Hampel's M-Estimator[c]	Andrews' Wave[d]
qaf	Al-Hameeddieh	98.9315	99.8099	99.7124	99.8100
	Akrama	97.0764	97.4494	97.3084	97.4480
hamza	Al-Hameeddieh	1.07	.19	.29	.19
	Akrama	2.92	2.52	2.68	2.52

a. The weighting constant is 1.339.

b. The weighting constant is 4.685.

c. The weighting constants are 1.700, 3.400, and 8.500

d. The weighting constant is 1.340*pi.

Extreme Values

	Area			Case Number	Value
qaf	Al-Hameeddieh	Highest	1	4	100.00
			2	7	100.00
			3	10	100.00
			4	12	100.00
			5	13	100.00[a]
		Lowest	1	50	1.00
			2	45	1.00
			3	40	1.00
			4	37	1.00
			5	35	1.00
	Akrama	Highest	1	2	100.00
			2	14	100.00
			3	15	100.00
			4	31	100.00
			5	1	96.00[b]
		Lowest	1	44	1.00
			2	33	2.00
			3	34	4.00
			4	20	47.00
			5	29	88.00
hamza	Al-Hameeddieh	Highest	1	35	99
			2	37	99
			3	40	99
			4	45	99
			5	50	99
		Lowest	1	27	0
			2	24	0
			3	18	0
			4	13	0
			5	12	0[c]
	Akrama	Highest	1	44	99

		2	33	98
		3	34	96
		4	20	53
		5	29	12
	Lowest	1	31	0
		2	15	0
		3	14	0
		4	2	0
		5	30	4[d]

a. Only a partial list of cases with the value 100.00 are shown in the table of upper extremes.

b. Only a partial list of cases with the value 96.00 are shown in the table of upper extremes.

c. Only a partial list of cases with the value 0 are shown in the table of lower extremes.

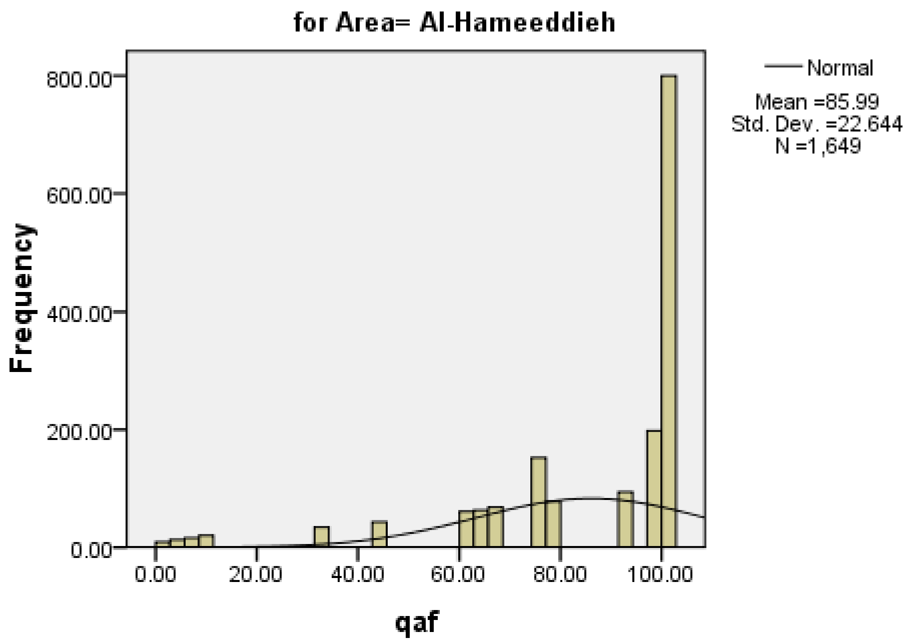
d. Only a partial list of cases with the value 4 are shown in the table of lower extremes.

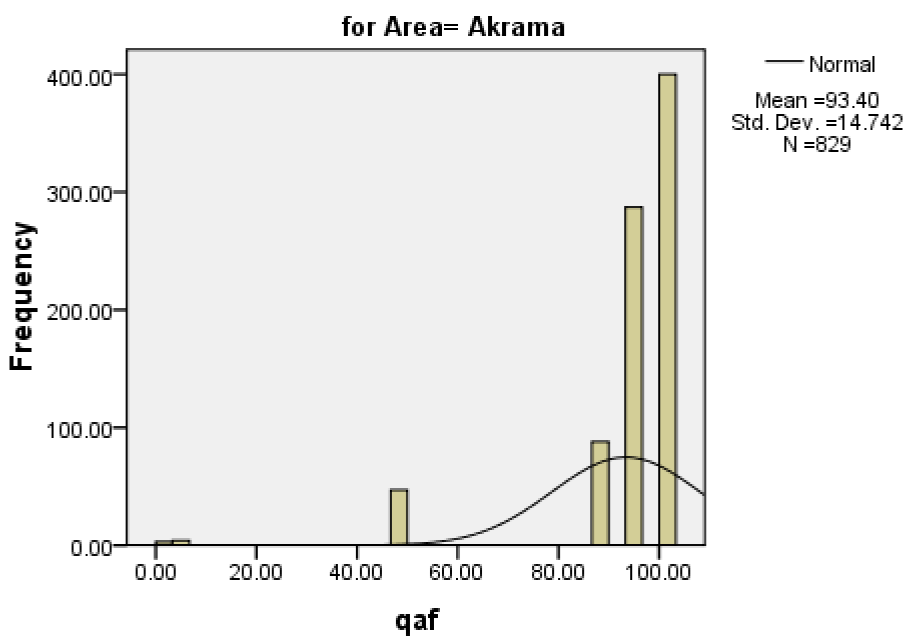
Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Area	Statistic	df	Sig.	Statistic	df	Sig.
qaf	Al-Hameeddieh	.322	1649	.000	.672	1649	.000
	Akrama	.372	829	.000	.455	829	.000
hamza	Al-Hameeddieh	.322	1649	.000	.672	1649	.000
	Akrama	.372	829	.000	.455	829	.000

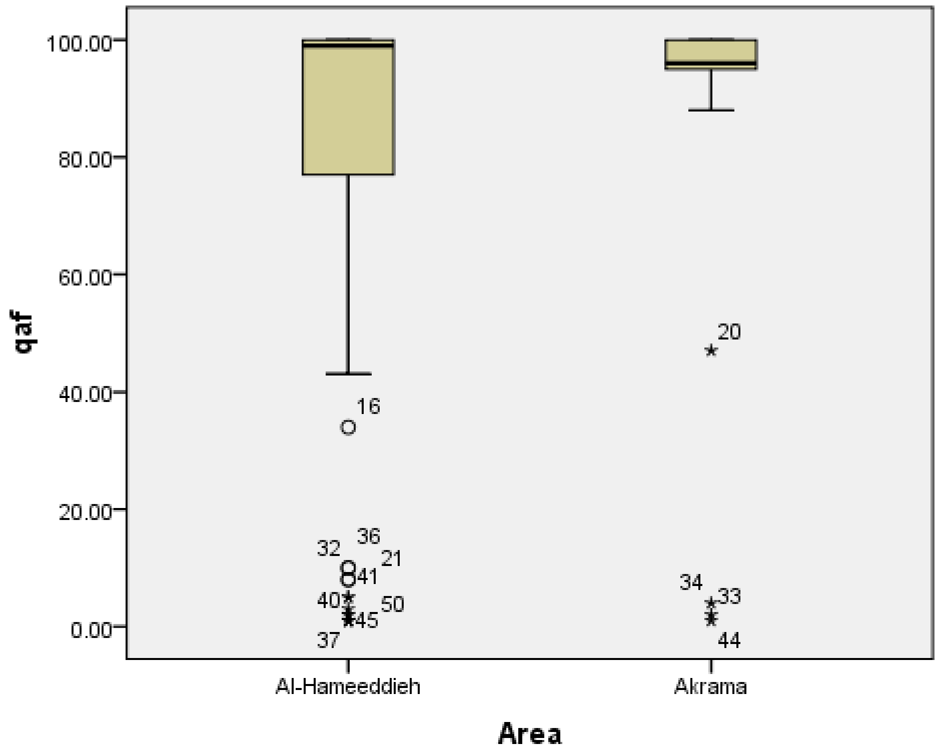
a. Lilliefors Significance Correction

qaf: Area Histograms

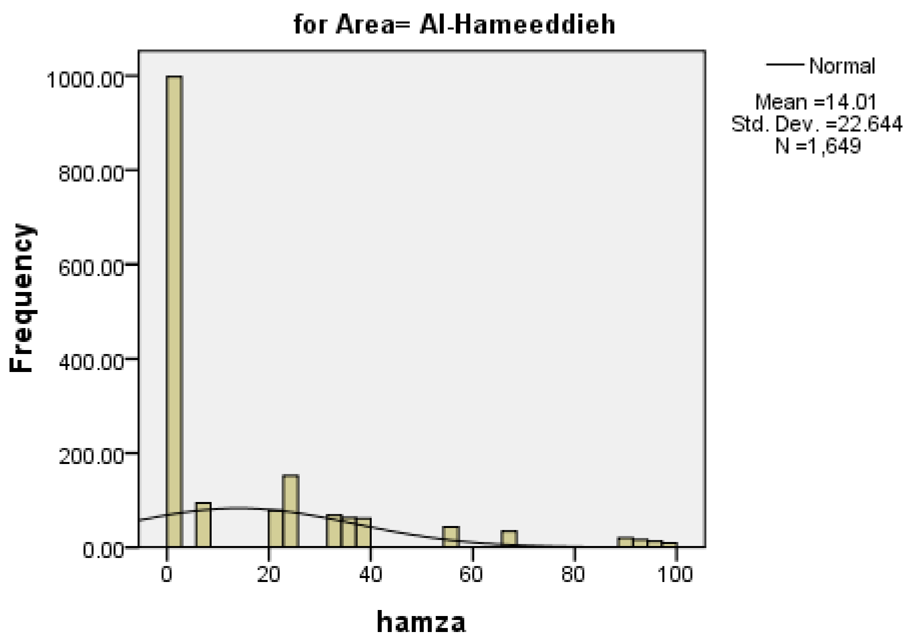


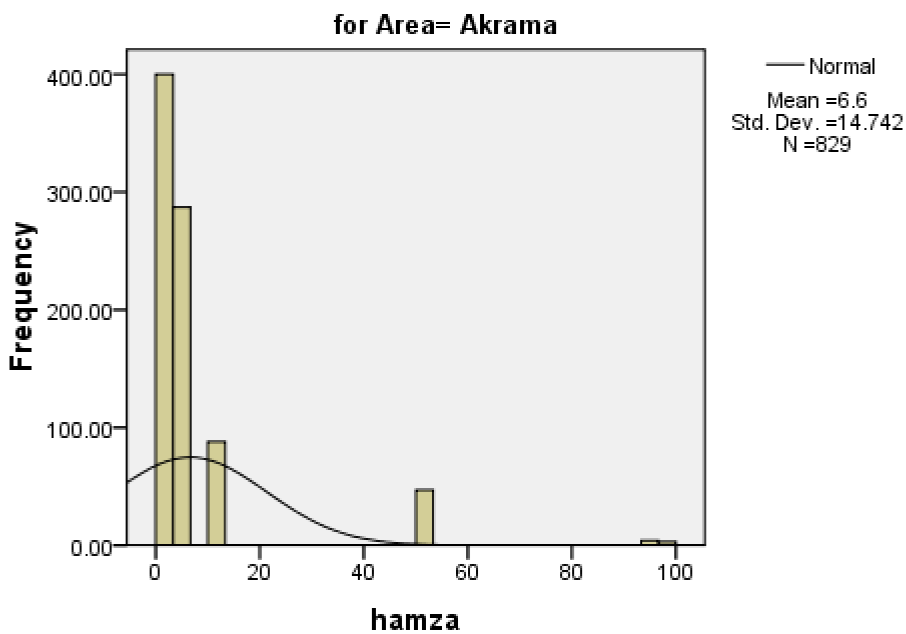


qaf: Area Boxplots

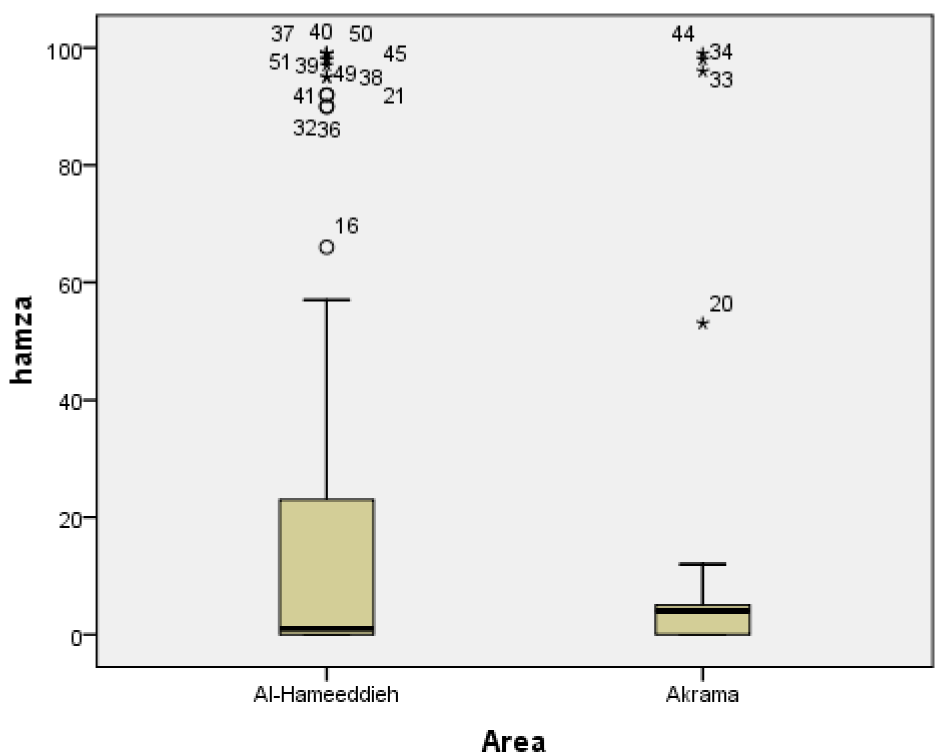


hamza: Area Histograms





hamza: Area Boxplots



Social Class

Case Processing Summary

	Social Class	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
qaf	Lower-middle	1540	100.0%	0	.0%	1540	100.0%
	Upper-middle	938	100.0%	0	.0%	938	100.0%
hamza	Lower-middle	1540	100.0%	0	.0%	1540	100.0%
	Upper-middle	938	100.0%	0	.0%	938	100.0%

Descriptives

	Social Class			Statistic	Std. Error
qaf	Lower-middle	Mean		87.6260	.53882
		95% Confidence Interval for Mean	Lower Bound	86.5691	
			Upper Bound	88.6829	
		5% Trimmed Mean		90.5130	
		Median		99.0000	
		Variance		447.096	
		Std. Deviation		21.14464	
		Minimum		1.00	
		Maximum		100.00	
		Range		99.00	
		Interquartile Range		12.00	
		Skewness		-2.052	.062
		Kurtosis		3.698	.125
	Upper-middle	Mean		89.8529	.64380
		95% Confidence Interval for Mean	Lower Bound	88.5894	
			Upper Bound	91.1163	
		5% Trimmed Mean		92.9295	
		Median		100.0000	
		Variance		388.783	
		Std. Deviation		19.71758	

		Minimum		1.00	
		Maximum		100.00	
		Range		99.00	
		Interquartile Range		23.00	
		Skewness		-2.780	.080
		Kurtosis		8.628	.160
hamza	Lower-middle	Mean		12.37	.539
		95% Confidence Interval for Mean	Lower Bound	11.32	
			Upper Bound	13.43	
		5% Trimmed Mean		9.49	
		Median		1.00	
		Variance		447.096	
		Std. Deviation		21.145	
		Minimum		0	
		Maximum		99	
		Range		99	
		Interquartile Range		12	
		Skewness		2.052	.062
		Kurtosis		3.698	.125
	Upper-middle	Mean		10.15	.644
		95% Confidence Interval for Mean	Lower Bound	8.88	
			Upper Bound	11.41	
		5% Trimmed Mean		7.07	
		Median		.00	
		Variance		388.783	
		Std. Deviation		19.718	
		Minimum		0	
		Maximum		99	
		Range		99	
		Interquartile Range		23	
		Skewness		2.780	.080
		Kurtosis		8.628	.160

M-Estimators[e]

	Social Class	Huber's M-Estimator[a]	Tukey's Biweight[b]	Hampel's M-Estimator[c]	Andrews' Wave[d]
qaf	Lower-middle	98.5813	99.3888	99.1391	99.3970
	Upper-middle	.	.	.	.
hamza	Lower-middle	1.93	.39	.83	.39
	Upper-middle	.	.	.	.

a. The weighting constant is 1.339.

b. The weighting constant is 4.685.

c. The weighting constants are 1.700, 3.400, and 8.500

d. The weighting constant is 1.340*pi.

e. Some M-Estimators cannot be computed because of the highly centralized distribution around the median.

Extreme Values

Social Class				Case Number	Value
qaf	Lower-middle	Highest	1	2	100.00
			2	4	100.00
			3	7	100.00
			4	15	100.00
			5	18	100.00[a]
		Lowest	1	44	1.00
			2	40	1.00
			3	33	2.00
			4	34	4.00
			5	41	8.00[b]
	Upper-middle	Highest	1	10	100.00
			2	12	100.00
			3	13	100.00
			4	14	100.00
			5	24	100.00[a]
		Lowest	1	50	1.00
			2	45	1.00
			3	37	1.00

			4	35	1.00
			5	51	2.00[c]
hamza	Lower-middle	Highest	1	40	99
			2	44	99
			3	33	98
			4	34	96
			5	21	92[d]
		Lowest	1	31	0
			2	18	0
			3	15	0
			4	7	0
			5	4	0[e]
	Upper-middle	Highest	1	35	99
			2	37	99
			3	45	99
			4	50	99
			5	48	98[f]
		Lowest	1	27	0
			2	24	0
			3	14	0
			4	13	0
			5	12	0[e]

a. Only a partial list of cases with the value 100.00 are shown in the table of upper extremes.

b. Only a partial list of cases with the value 8.00 are shown in the table of lower extremes.

c. Only a partial list of cases with the value 2.00 are shown in the table of lower extremes.

d. Only a partial list of cases with the value 92 are shown in the table of upper extremes.

e. Only a partial list of cases with the value 0 are shown in the table of lower extremes.

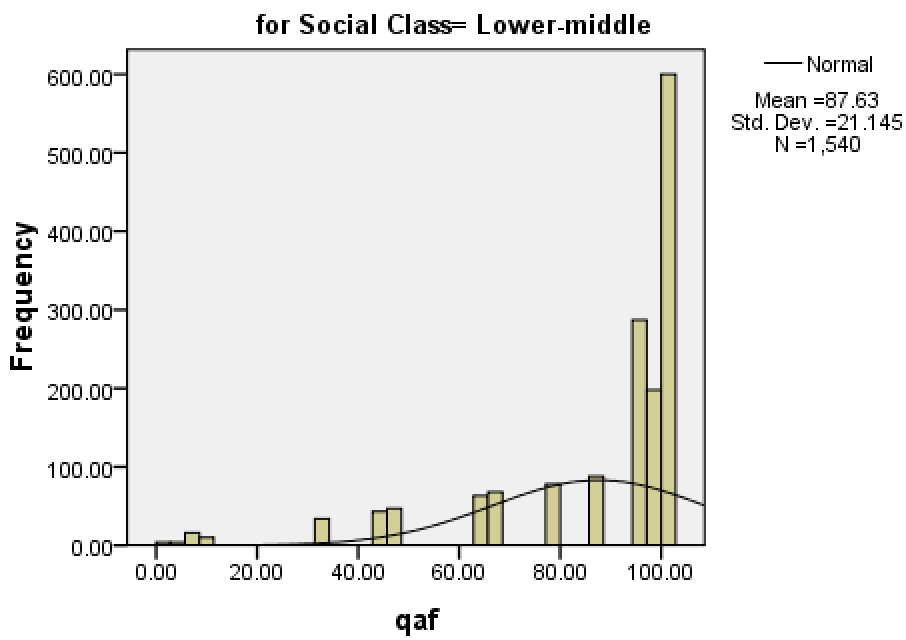
f. Only a partial list of cases with the value 98 are shown in the table of upper extremes.

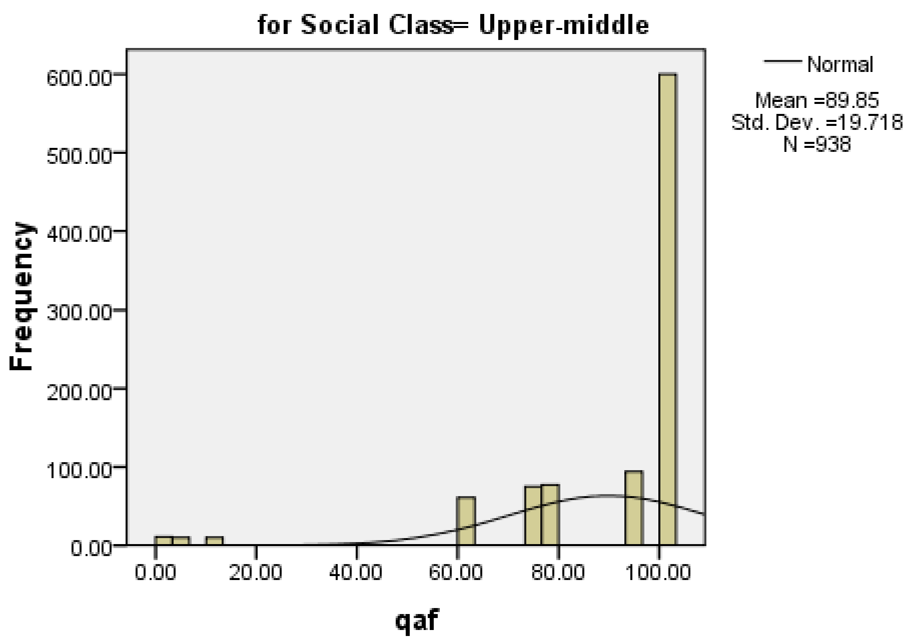
Tests of Normality

	Social Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
qaf	Lower-middle	.341	1540	.000	.644	1540	.000
	Upper-middle	.336	938	.000	.566	938	.000
hamza	Lower-middle	.341	1540	.000	.644	1540	.000
	Upper-middle	.336	938	.000	.566	938	.000

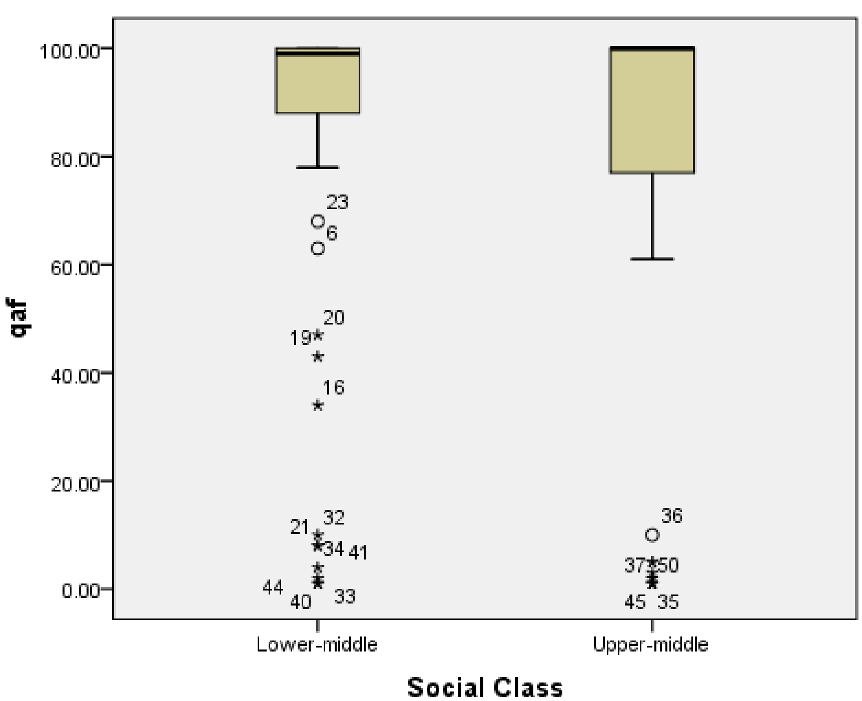
a. Lilliefors Significance Correction

qaf: Social Class Histograms

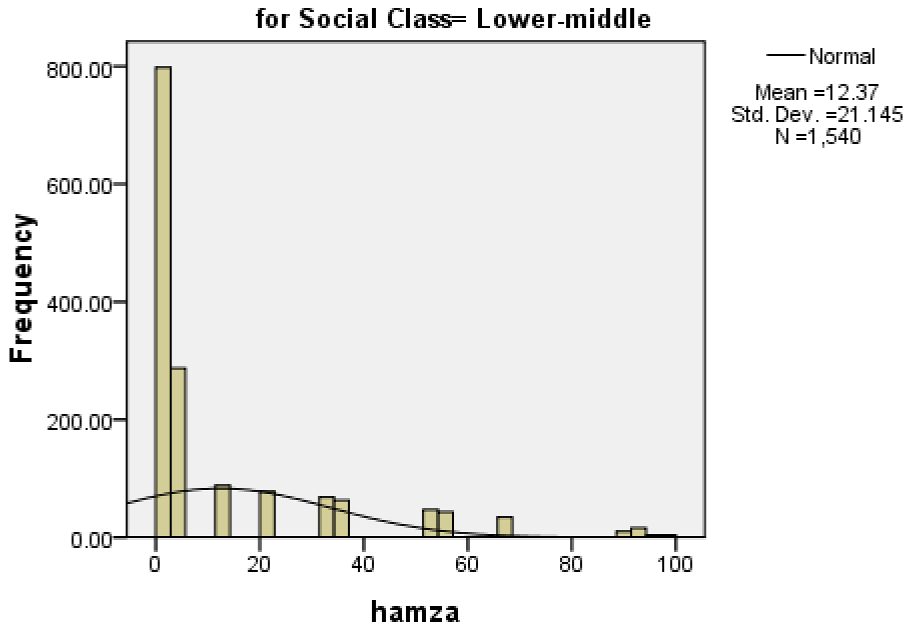


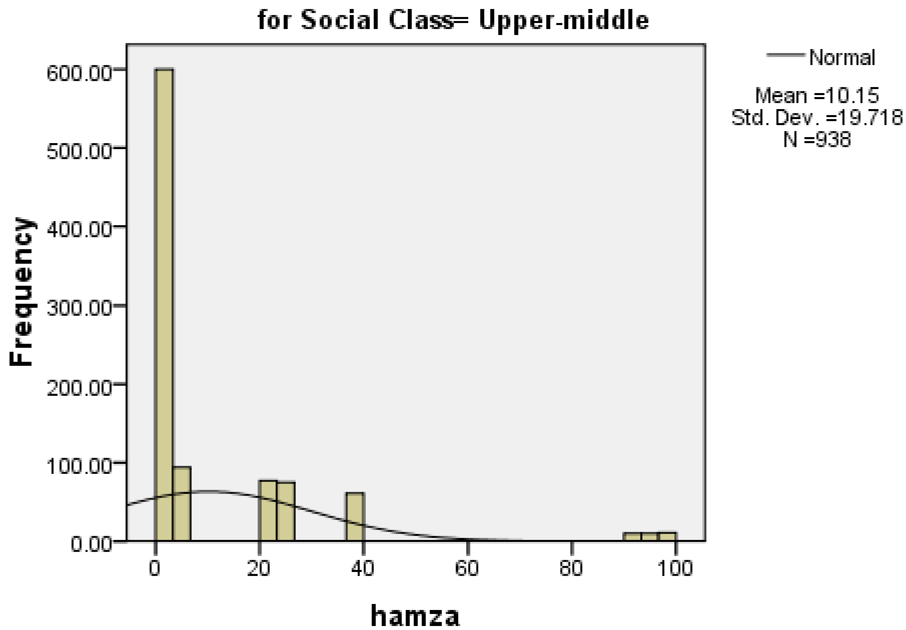


qaf: Social Class Boxplots

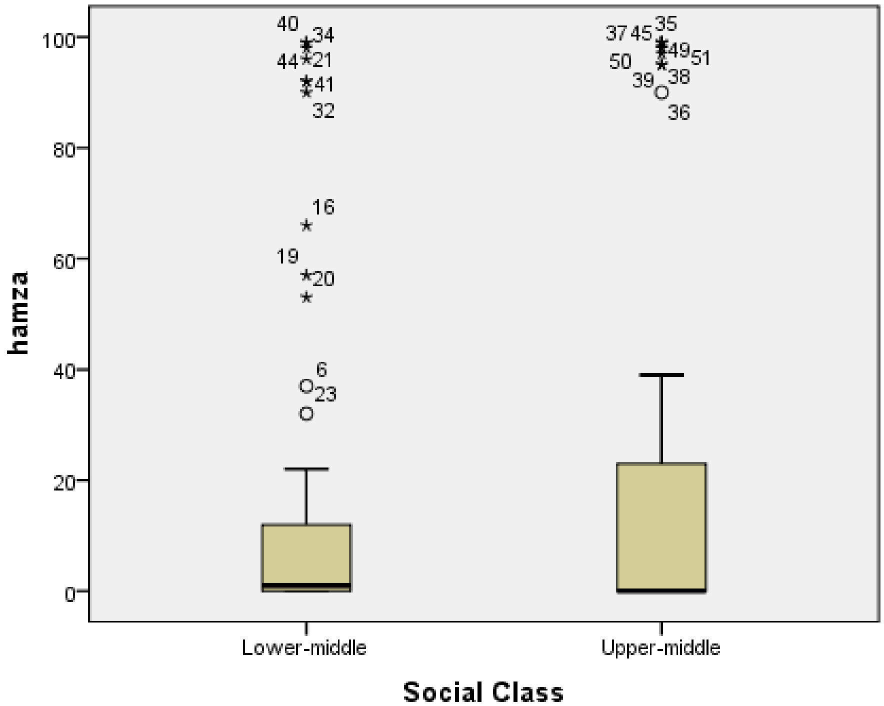


hamza: Social Class Histograms





hamza: Social Class Boxplots



APPENDIX C

GENERALIZED LINEAR MODELS RESULTS FOR THE DEPENDENT VARIABLE [q]

Poisson Loglinear Regression Showing the Main Effects of the Independent Variables, Age, Gender, Residential Area, and Social Class, on the Use of the Dependent Variant [q]

Model Information

Dependent Variable	qaf
Probability Distribution	Poisson
Link Function	Log

Case Processing Summary

	N	Percent
Included	52	100.0%
Excluded	0	.0%
Total	52	100.0%

Categorical Variable Information

			N	Percent
Factor	Age	Old	28	53.8%
		Young	24	46.2%
		Total	52	100.0%
	Gender	Male	24	46.2%
		Female	28	53.8%
		Total	52	100.0%
	Area	Akrama	13	25.0%
		Al-Hameeddieh	39	75.0%
		Total	52	100.0%
	Social Class	Upper-middle	24	46.2%
		Lower-middle	28	53.8%
		Total	52	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	qaf	52	0	467	112.96	132.696

Goodness of Fit[d]

	Value	df	Value/df
Deviance	4798.992	47	102.106
Scaled Deviance	39.659	47	
Pearson Chi-Square	5687.238	47	121.005
Scaled Pearson Chi-Square	47.000	47	
Log Likelihood[a]	-2527.807		
Adjusted Log Likelihood[c]	-20.890		
Akaike's Information Criterion (AIC)	5065.613		
Finite Sample Corrected AIC (AICC)	5066.918		
Bayesian Information Criterion (BIC)	5075.369		
Consistent AIC (CAIC)	5080.369		

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Social Class

a. The full log likelihood function is displayed and used in computing information criteria.

c. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

d. Information criteria are in small-is-better form.

Omnibus Test[a]

Likelihood Ratio Chi-Square	Df	Sig.
28.042	4	.000

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Social Class

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

Source	Type III						
	Likelihood Ratio Chi-Square	df	Sig.	F	df1	df2	Sig.
(Intercept)	117.806	1	.000	117.806	1	47	.000
Age	22.268	1	.000	22.268	1	47	.000
Gender	4.238	1	.040	4.238	1	47	.045
Area	2.843	1	.092	2.843	1	47	.098
Social Class	.379	1	.538	.379	1	47	.541

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Social Class

Parameter Estimates

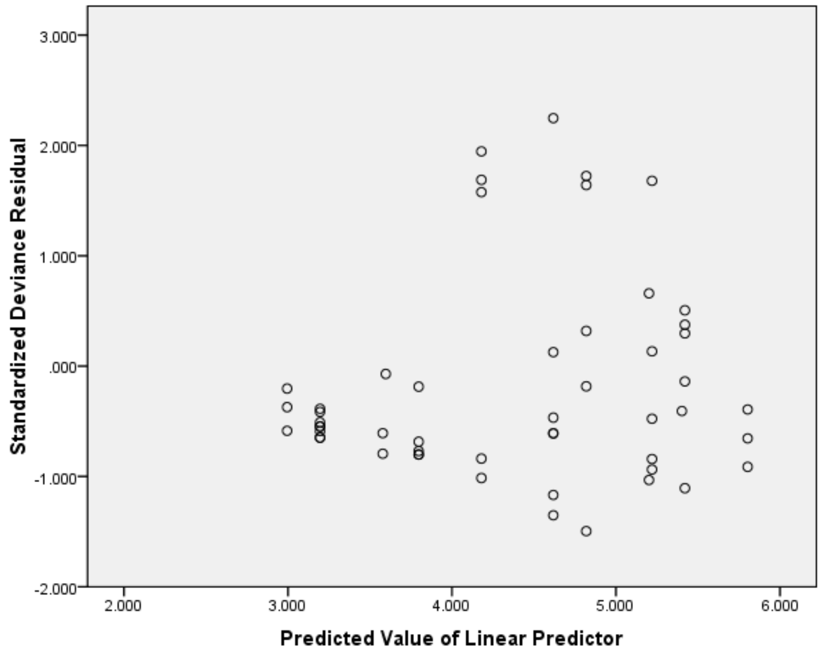
Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	2.995	.4833	2.048	3.942	38.393	1	.000	19.982	7.749	51.530
[Age=2]	1.623	.3996	.840	2.406	16.503	1	.000	5.069	2.317	11.094
[Age=1]	0[a]	.	.	.	.	.	.	1	.	.
[Gender=2]	.602	.2970	.020	1.184	4.104	1	.043	1.825	1.020	3.266
[Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
[Area=2]	.583	.3386	-.080	1.247	2.967	1	.085	1.792	.923	3.480
[Area=1]	0[a]	.	.	.	.	.	.	1	.	.
[SocClass=2]	.201	.3252	-.437	.838	.381	1	.537	1.222	.646	2.312
[SocClass=1]	0[a]	.	.	.	.	.	.	1	.	.
(Scale)	1.210E2									

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Social Class

a. Set to zero because this parameter is redundant.

b. Computed based on the Pearson chi-square.



Negative Binomial Regression to Show the Main Effects of Gender, Age, Residential Area, And Social Class on the Use of [q]

Model Information

Dependent Variable	Qaf
Probability Distribution	Negative binomial (1)
Link Function	Log

Case Processing Summary

	N	Percent
Included	52	100.0%
Excluded	0	.0%
Total	52	100.0%

Categorical Variable Information

			N	Percent
Factor	Age	Old	28	53.8%
		Young	24	46.2%
		Total	52	100.0%
	Gender	Male	24	46.2%
		Female	28	53.8%
		Total	52	100.0%
	Area	Akrama	13	25.0%
		Al-Hameeddieh	39	75.0%
		Total	52	100.0%
	Social Class	Upper-middle	24	46.2%
		Lower-middle	28	53.8%
		Total	52	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	qaf	52	0	467	112.96	132.696

Goodness of Fit[d]

	Value	df	Value/df
Deviance	90.806	47	1.932
Scaled Deviance	56.837	47	
Pearson Chi-Square	75.090	47	1.598
Scaled Pearson Chi-Square	47.000	47	
Log Likelihood[a]	-265.034		
Adjusted Log Likelihood[c]	-165.890		
Akaike's Information Criterion (AIC)	540.068		
Finite Sample Corrected AIC (AICC)	541.373		
Bayesian Information Criterion (BIC)	549.825		
Consistent AIC (CAIC)	554.825		

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Social Class

a. The full log likelihood function is displayed and used in computing information criteria.

c. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

d. Information criteria are in small-is-better form.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
41.313	4	.000

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Social Class

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

	Type III						
Source	Likelihood Ratio Chi-Square	df	Sig.	F	df1	df2	Sig.
(Intercept)	2016.892	1	.000	2016.892	1	47	.000
Age	37.478	1	.000	37.478	1	47	.000
Gender	7.515	1	.006	7.515	1	47	.009
Area	7.794	1	.005	7.794	1	47	.008
Social Class	.030	1	.862	.030	1	47	.862

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Social Class

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	1.681	.4810	.738	2.623	12.207	1	.000	5.368	2.091	13.780
[Age=2]	2.866	.4227	2.037	3.694	45.963	1	.000	17.564	7.670	40.221
[Age=1]	0[a]	.	.	.	.	.	.	1	.	.
[Gender=2]	1.117	.4194	.295	1.939	7.093	1	.008	3.055	1.343	6.951
[Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
[Area=2]	1.481	.5490	.405	2.557	7.279	1	.007	4.398	1.500	12.901
[Area=1]	0[a]	.	.	.	.	.	.	1	.	.
[SocClass=2]	-.072	.4146	-.885	.740	.030	1	.862	.930	.413	2.097
[SocClass=1]	0[a]	.	.	.	.	.	.	1	.	.
(Scale)	1.598[b]									
(Negative binomial)	1									

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Social Class

a. Set to zero because this parameter is redundant.

b. Computed based on the Pearson chi-square.

Estimated Marginal Means 1: Age

Estimates

Age	Mean	Std. Error	95% Wald Confidence Interval	
			Lower	Upper
Old	333.42	107.727	122.28	544.56
Young	18.98	5.502	8.20	29.77

Individual Test Results

Age Simple Contrast	Contrast Estimate	Std. Error	Wald Chi-Square	df	Sig.
Level Young vs. Level Old	-314.44	107.581	8.543	1	.003

Overall Test Results

Wald Chi-Square	df	Sig.
8.543	1	.003

Estimated Marginal Means 2: Gender

Estimates

Gender	Mean	Std. Error	95% Wald Confidence Interval	
			Lower	Upper
Male	139.06	39.340	61.96	216.17
Female	45.51	14.887	16.34	74.69

Individual Test Results

Gender Simple Contrast	Contrast Estimate	Std. Error	Wald Chi-Square	df	Sig.
Level Female vs. Level Male	-93.55	41.217	5.152	1	.023

Overall Test Results

Wald Chi-Square	df	Sig.
5.152	1	.023

Estimated Marginal Means 3: Area

Estimates

Area	Mean	Std. Error	95% Wald Confidence Interval	
			Lower	Upper
Akrama	166.85	73.833	22.14	311.56
Al-Hameeddieh	37.93	8.811	20.66	55.20

Individual Test Results

Area Simple Contrast	Contrast Estimate	Std. Error	Wald Chi-Square	df	Sig.
Level Al-Hameeddieh vs. Level Akrama	-128.92	76.523	2.838	1	.092

Overall Test Results

Wald Chi-Square	df	Sig.
2.838	1	.092

Estimated Marginal Means 4: Social Class

Estimates

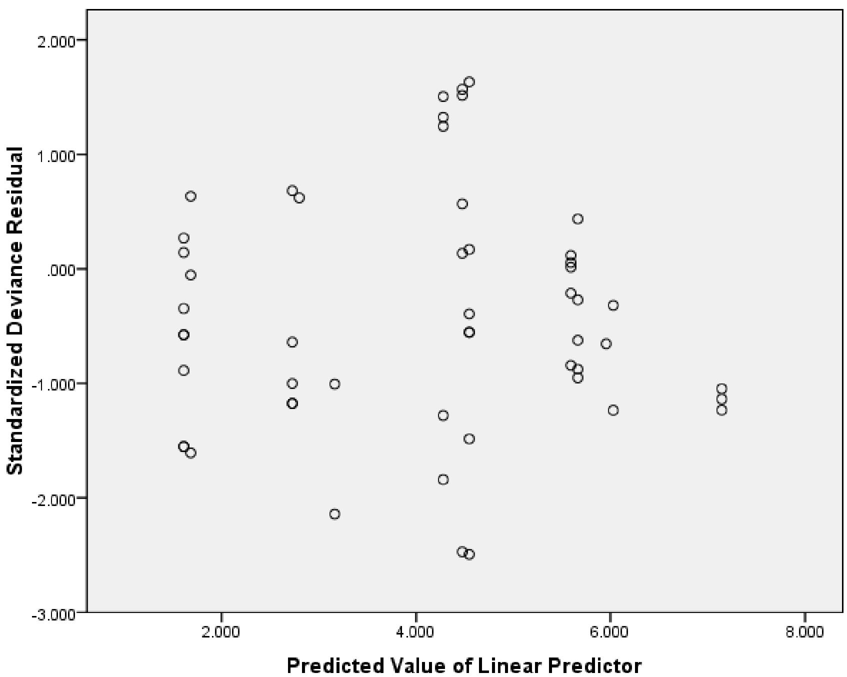
			95% Wald Confidence Interval	
Social Class	Mean	Std. Error	Lower	Upper
Upper-middle	76.74	26.856	24.10	129.38
Lower-middle	82.48	20.625	42.05	122.90

Individual Test Results

Social Class Simple Contrast	Contrast Estimate	Std. Error	Wald Chi-Square	df	Sig.
Level Lower-middle vs. Level Upper-middle	5.74	32.613	.031	1	.860

Overall Test Results

Wald Chi-Square	df	Sig.
.031	1	.860



Negative Binomial Regression Showing the Effect of the Interaction of Three Independent Variables, Age, Gender, and Residential Area, on the Use of the Dependent Variant [q]

Model Information

Dependent Variable	qaf
Probability Distribution	Negative binomial (1)
Link Function	Log

Case Processing Summary

	N	Percent
Included	52	100.0%
Excluded	0	.0%
Total	52	100.0%

Categorical Variable Information

			N	Percent
Factor	Age	Old	28	53.8%
		Young	24	46.2%
		Total	52	100.0%
	Gender	Male	24	46.2%
		Female	28	53.8%
		Total	52	100.0%
	Area	Akrama	13	25.0%
		Al-Hameeddieh	39	75.0%
		Total	52	100.0%
	Social Class	Upper-middle	24	46.2%
		Lower-middle	28	53.8%
		Total	52	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	qaf	52	0	467	112.96	132.696

Goodness of Fit[d]

	Value	df	Value/df
Deviance	69.598	44	1.582
Scaled Deviance	82.842	44	
Pearson Chi-Square	36.965	44	.840
Scaled Pearson Chi-Square	44.000	44	
Log Likelihood[a]	-254.430		
Adjusted Log Likelihood[c]	-302.849		
Akaike's Information Criterion (AIC)	524.860		
Finite Sample Corrected AIC (AICC)	528.209		
Bayesian Information Criterion (BIC)	540.470		
Consistent AIC (CAIC)	548.470		

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Age * Gender * Area

a. The full log likelihood function is displayed and used in computing information criteria.

c. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

d. Information criteria are in small-is-better form.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
103.808	7	.000

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Age * Gender * Area

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

Source	Type III						
	Likelihood Ratio Chi-Square	Df	Sig.	F	df1	df2	Sig.
(Intercept)	487.243[a]	1	.000	487.243	1	44	.000
Age	41.012	1	.000	41.012	1	44	.000
Gender	17.383	1	.000	17.383	1	44	.000
Area	3.778	1	.052	3.778	1	44	.058
Age * Gender * Area	25.302	4	.000	6.326	4	44	.000

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Age * Gender * Area

a. The validity of the likelihood ratio chi-square is uncertain because log-likelihood convergence was not achieved for the constrained model. Results shown are based on the last iteration.

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	1.213	.3148	.596	1.830	14.851	1	.000	3.364	1.815	6.234
[Age=2]	3.734	.4118	2.927	4.541	82.214	1	.000	41.845	18.668	93.794
[Age=1]	0[a]	.	.	.	.	.	.	1	.	.
[Gender=2]	1.339	.5000	.359	2.319	7.172	1	.007	3.815	1.432	10.166
[Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
[Area=2]	-.297	.8290	-1.921	1.328	.128	1	.720	.743	.146	3.773
[Area=1]	0[a]	.	.	.	.	.	.	1	.	.
[Age=2] * [Gender=2] * [Area=2]	-.582	1.2195	-2.972	1.808	.228	1	.633	.559	.051	6.099
[Age=2] * [Gender=2] * [Area=1]	-.942	.6363	-2.189	.305	2.190	1	.139	.390	.112	1.357
[Age=2] * [Gender=1] * [Area=2]	.484	1.0195	-1.515	2.482	.225	1	.635	1.622	.220	11.962
[Age=2] * [Gender=1] * [Area=1]	0[a]	.	.	.	.	.	.	1	.	.
[Age=1] * [Gender=2] * [Area=2]	2.812	1.0036	.845	4.779	7.853	1	.005	16.649	2.329	119.023
[Age=1] * [Gender=2] * [Area=1]	0[a]	.	.	.	.	.	.	1	.	.
[Age=1] * [Gender=1] * [Area=2]	0[a]	.	.	.	.	.	.	1	.	.
[Age=1] * [Gender=1] * [Area=1]	0[a]	.	.	.	.	.	.	1	.	.

(Scale)	.840[b]										
(Negative binomial)	1										

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Area, Age * Gender * Area

a. Set to zero because this parameter is redundant.

b. Computed based on the Pearson chi-square.

Negative Binomial Regression to Show the Effect of the Interaction of Gender and Age on the Use of [q]

Model Information

Dependent Variable	qaf
Probability Distribution	Negative binomial (1)
Link Function	Log

Case Processing Summary

	N	Percent
Included	52	100.0%
Excluded	0	.0%
Total	52	100.0%

Categorical Variable Information

			N	Percent
Factor	Age	Old	28	53.8%
		Young	24	46.2%
		Total	52	100.0%
	Gender	Male	24	46.2%
		Female	28	53.8%
		Total	52	100.0%
	Area	Akrama	13	25.0%
		Al-Hameeddieh	39	75.0%
		Total	52	100.0%
	Social Class	Upper-middle	24	46.2%
		Lower-middle	28	53.8%
		Total	52	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	qaf	52	0	467	112.96	132.696

Goodness of Fit[d]

	Value	df	Value/df
Deviance	84.326	48	1.757
Scaled Deviance	82.778	48	
Pearson Chi-Square	48.898	48	1.019
Scaled Pearson Chi-Square	48.000	48	
Log Likelihood[a]	-261.794		
Adjusted Log Likelihood[c]	-256.988		
Akaike's Information Criterion (AIC)	531.588		
Finite Sample Corrected AIC (AICC)	532.440		
Bayesian Information Criterion (BIC)	539.393		
Consistent AIC (CAIC)	543.393		

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Age * Gender

a. The full log likelihood function is displayed and used in computing information criteria.

c. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

d. Information criteria are in small-is-better form.

Omnibus Test[a]

Likelihood Ratio Chi-Square	Df	Sig.
71.153	3	.000

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Age * Gender

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

	Type III						
Source	Likelihood Ratio Chi-Square	Df	Sig.	F	df1	df2	Sig.
(Intercept)	1702.422[a]	1	.000	1702.422	1	48	.000
Age	54.524	1	.000	54.524	1	48	.000
Gender	35.057	1	.000	35.057	1	48	.000
Age * Gender	22.061	1	.000	22.061	1	48	.000

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Age * Gender

a. The validity of the likelihood ratio chi-square is uncertain because log-likelihood convergence was not achieved for the constrained model. Results shown are based on the last iteration.

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	1.173	.3203	.545	1.801	13.402	1	.000	3.231	1.724	6.053
[Age=2]	3.815	.4135	3.004	4.625	85.095	1	.000	45.356	20.167	102.003
[Age=1]	0[a]	.	.	.	.	.	.	1	.	.
[Gender=2]	3.199	.4432	2.330	4.068	52.108	1	.000	24.509	10.282	58.417
[Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
[Age=2] * [Gender=2]	-2.827	.5861	-3.976	-1.678	23.269	1	.000	.059	.019	.187
[Age=2] * [Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
[Age=1] * [Gender=2]	0[a]	.	.	.	.	.	.	1	.	.
[Age=1] * [Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
(Scale)	1.019[b]									
(Negative binomial)	1									

Dependent Variable: qaf

Model: (Intercept), Age, Gender, Age * Gender

a. Set to zero because this parameter is redundant.

b. Computed based on the Pearson chi-square.

APPENDIX D

GENERALIZED LINEAR MODELS RESULTS FOR THE DEPENDENT VARIABLE [ʔ]

Negative Binomial Regression to Show the Effect of Gender, Age, Residential Area, and Social Class on the Use of [ʔ]

Model Information

Dependent Variable	hamza
Probability Distribution	Negative binomial (1)
Link Function	Log

Case Processing Summary

	N	Percent
Included	52	100.0%
Excluded	0	.0%
Total	52	100.0%

Categorical Variable Information

			N	Percent
Factor	Age	Old	28	53.8%
		Young	24	46.2%
		Total	52	100.0%
	Gender	Male	24	46.2%
		Female	28	53.8%
		Total	52	100.0%
	Area	Akrama	13	25.0%
		Al-Hameeddieh	39	75.0%
		Total	52	100.0%
	Social Class	Upper-middle	24	46.2%
		Lower-middle	28	53.8%
		Total	52	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	hamza	52	0	476	109.12	130.152

Goodness of Fit[d]

	Value	df	Value/df
Deviance	104.980	47	2.234
Scaled Deviance	98.014	47	
Pearson Chi-Square	50.341	47	1.071
Scaled Pearson Chi-Square	47.000	47	
Log Likelihood[a]	-268.473		
Adjusted Log Likelihood[c]	-250.658		
Akaike's Information Criterion (AIC)	546.947		
Finite Sample Corrected AIC (AICC)	548.251		
Bayesian Information Criterion (BIC)	556.703		
Consistent AIC (CAIC)	561.703		

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Area, Social Class

a. The full log likelihood function is displayed and used in computing information criteria.

c. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

d. Information criteria are in small-is-better form.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
51.853	4	.000

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Area, Social Class

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

Source	Type III						
	Likelihood Ratio Chi-Square	df	Sig.	F	df1	df2	Sig.
(Intercept)	1576.332	1	.000	1576.332	1	47	.000
Age	45.865	1	.000	45.865	1	47	.000
Gender	7.763	1	.005	7.763	1	47	.008
Area	4.422	1	.035	4.422	1	47	.041
Social Class	.984	1	.321	.984	1	47	.326

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Area, Social Class

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	6.107	.3797	5.363	6.852	258.781	1	.000	449.211	213.443	945.408
[Age=2]	-2.186	.3098	-2.793	-1.579	49.781	1	.000	.112	.061	.206
[Age=1]	0[a]	.	.	.	.	.	.	1	.	.
[Gender=2]	-.858	.3023	-1.450	-.265	8.051	1	.005	.424	.234	.767
[Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
[Area=2]	-.887	.4130	-1.697	-.078	4.615	1	.032	.412	.183	.925
[Area=1]	0[a]	.	.	.	.	.	.	1	.	.
[SocClass=2]	-.353	.3584	-1.055	.350	.968	1	.325	.703	.348	1.419
[SocClass=1]	0[a]	.	.	.	.	.	.	1	.	.
(Scale)	1.071[b]									
(Negative binomial)	1									

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Area, Social Class

a. Set to zero because this parameter is redundant.

b. Computed based on the Pearson chi-square.

Estimated Marginal Means 1: Age

Estimates

Age	Mean	Std. Error	95% Wald Confidence Interval	
			Lower	Upper
Old	17.68	4.445	8.97	26.40
Young	157.38	35.545	87.71	227.05

Individual Test Results

Age Simple Contrast	Contrast Estimate	Std. Error	Wald Chi-Square	df	Sequential Sidak Sig.
Level Young vs. Level Old	139.70	35.107	15.834	1	.000

Overall Test Results

Wald Chi-Square	df	Sig.
15.834	1	.000

Estimated Marginal Means 2: Gender

Estimates

Gender	Mean	Std. Error	95% Wald Confidence Interval	
			Lower	Upper
Male	34.35	8.046	18.58	50.12
Female	81.01	19.349	43.08	118.93

Individual Test Results

Gender Simple Contrast	Contrast Estimate	Std. Error	Wald Chi-Square	df	Sequential Sidak Sig.
Level Female vs. Level Male	46.65	19.546	5.697	1	.017

Overall Test Results

Wald Chi-Square	df	Sig.
5.697	1	.017

Estimated Marginal Means 3: Area

Estimates

Area	Mean	Std. Error	95% Wald Confidence Interval	
			Lower	Upper
Akrama	33.85	11.748	10.83	56.88
Al-Hameeddieh	82.20	14.487	53.81	110.60

Individual Test Results

Area Simple Contrast	Contrast Estimate	Std. Error	Wald Chi-Square	df	Sequential Sidak Sig.
Level Al-Hameeddieh vs. Level Akrama	48.35	20.023	5.831	1	.016

Overall Test Results

Wald Chi-Square	df	Sig.
5.831	1	.016

Estimated Marginal Means 4: Social Class

Estimates

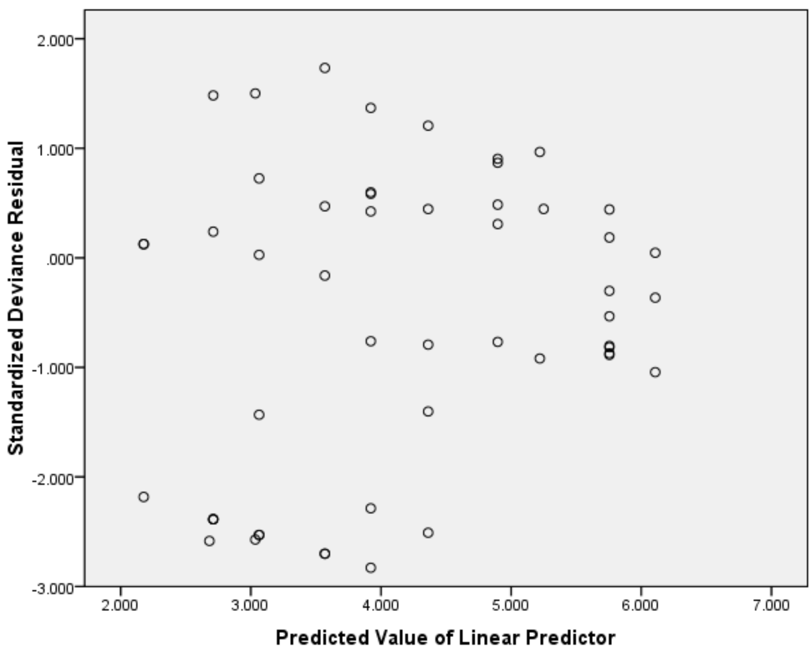
Social Class	Mean	Std. Error	95% Wald Confidence Interval	
			Lower	Upper
Upper-middle	44.22	13.252	18.25	70.20
Lower-middle	62.93	12.687	38.06	87.79

Individual Test Results

Social Class Simple Contrast	Contrast Estimate	Std. Error	Wald Chi-Square	df	Sequential Sidak Sig.
Level Lower-middle vs. Level Upper-middle	18.70	18.195	1.056	1	.304

Overall Test Results

Wald Chi-Square	df	Sig.
1.056	1	.304



Negative Binomial Regression Showing the Effect of the Interaction of the Three Independent Variables, Age, Gender, and Residential Area on the Use of the Dependent Variant [ʔ]

Model Information

Dependent Variable	hamza
Probability Distribution	Negative binomial (1)
Link Function	Log

Case Processing Summary

	N	Percent
Included	52	100.0%
Excluded	0	.0%
Total	52	100.0%

Categorical Variable Information

			N	Percent
Factor	Age	Old	28	53.8%
		Young	24	46.2%
		Total	52	100.0%
	Gender	Male	24	46.2%
		Female	28	53.8%
		Total	52	100.0%
	Area	Akrama	13	25.0%
		Al-Hameeddieh	39	75.0%
		Total	52	100.0%
	Social Class	Upper-middle	24	46.2%
		Lower-middle	28	53.8%
		Total	52	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	hamza	52	0	476	109.12	130.152

Goodness of Fit[d]

	Value	df	Value/df
Deviance	101.808	44	2.314
Scaled Deviance	98.283	44	
Pearson Chi-Square	45.578	44	1.036
Scaled Pearson Chi-Square	44.000	44	
Log Likelihood[a]	-266.887		
Adjusted Log Likelihood[c]	-257.647		
Akaike's Information Criterion (AIC)	549.775		
Finite Sample Corrected AIC (AICC)	553.124		
Bayesian Information Criterion (BIC)	565.385		
Consistent AIC (CAIC)	573.385		

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Area, Age * Gender * Area

a. The full log likelihood function is displayed and used in computing information criteria.

c. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

d. Information criteria are in small-is-better form.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
56.678	7	.000

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Area, Age * Gender * Area

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

Source	Type III						
	Likelihood Ratio Chi-Square	df	Sig.	F	df1	df2	Sig.
(Intercept)	1332.157[a]	1	.000	1332.157	1	44	.000
Age	32.467	1	.000	32.467	1	44	.000
Gender	7.665	1	.006	7.665	1	44	.008
Area	3.130	1	.077	3.130	1	44	.084
Age * Gender * Area	4.080	4	.395	1.020	4	44	.408

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Area, Age * Gender * Area

a. The validity of the likelihood ratio chi-square is uncertain because log-likelihood convergence was not achieved for the constrained model. Results shown are based on the last iteration.

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	5.482	.3075	4.879	6.085	317.826	1	.000	240.364	131.558	439.157
[Age=2]	-1.496	.4272	-2.334	-.659	12.268	1	.000	.224	.097	.517
[Age=1]	0[a]	.	.	.	.	.	.	1	.	.
[Gender=2]	-.100	.5177	-1.115	.915	.037	1	.847	.905	.328	2.496
[Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
[Area=2]	.001	.7840	-1.536	1.537	.000	1	.999	1.001	.215	4.651
[Area=1]	0[a]	.	.	.	.	.	.	1	.	.
[Age=2] * [Gender=2] * [Area=2]	-1.989	1.2477	-4.435	.456	2.542	1	.111	.137	.012	1.578
[Age=2] * [Gender=2] * [Area=1]	-1.283	.6835	-2.623	.056	3.525	1	.060	.277	.073	1.058
[Age=2] * [Gender=1] * [Area=2]	-.866	1.0311	-2.886	1.155	.705	1	.401	.421	.056	3.175
[Age=2] * [Gender=1] * [Area=1]	0[a]	.	.	.	.	.	.	1	.	.
[Age=1] * [Gender=2] * [Area=2]	-1.065	.9990	-3.023	.893	1.137	1	.286	.345	.049	2.442
[Age=1] * [Gender=2] * [Area=1]	0[a]	.	.	.	.	.	.	1	.	.
[Age=1] * [Gender=1] * [Area=2]	0[a]	.	.	.	.	.	.	1	.	.
[Age=1] * [Gender=1] * [Area=1]	0[a]	.	.	.	.	.	.	1	.	.

(Scale)	1.036[b]									
(Negative binomial)	1									

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Area, Age * Gender * Area

a. Set to zero because this parameter is redundant.

b. Computed based on the Pearson chi-square.

Negative Binomial Regression Showing the Effect of the Interaction of the Two Independent Variables, Age and Gender, on the Use of the Dependent Variant [ʔ]

Model Information

Dependent Variable	hamza
Probability Distribution	Negative binomial (1)
Link Function	Log

Case Processing Summary

	N	Percent
Included	52	100.0%
Excluded	0	.0%
Total	52	100.0%

Categorical Variable Information

			N	Percent
Factor	Age	Old	28	53.8%
		Young	24	46.2%
		Total	52	100.0%
	Gender	Male	24	46.2%
		Female	28	53.8%
		Total	52	100.0%
	Area	Akrama	13	25.0%
		Al-Hameeddieh	39	75.0%
		Total	52	100.0%
	Social Class	Upper-middle	24	46.2%
		Lower-middle	28	53.8%
		Total	52	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	hamza	52	0	476	109.12	130.152

Goodness of Fit[d]

	Value	df	Value/df
Deviance	107.027	48	2.230
Scaled Deviance	105.764	48	
Pearson Chi-Square	48.573	48	1.012
Scaled Pearson Chi-Square	48.000	48	
Log Likelihood[a]	-269.497		
Adjusted Log Likelihood[c]	-266.317		
Akaike's Information Criterion (AIC)	546.994		
Finite Sample Corrected AIC (AICC)	547.845		
Bayesian Information Criterion (BIC)	554.799		
Consistent AIC (CAIC)	558.799		

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Age * Gender

a. The full log likelihood function is displayed and used in computing information criteria.

c. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

d. Information criteria are in small-is-better form.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
52.860	3	.000

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Age * Gender

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

	Type III						
Source	Likelihood Ratio Chi-Square	df	Sig.	F	df1	df2	Sig.
(Intercept)	2618.410	1	.000	2618.410	1	48	.000
Age	48.470	1	.000	48.470	1	48	.000
Gender	9.883	1	.002	9.883	1	48	.003
Age * Gender	2.658	1	.103	2.658	1	48	.110

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Age * Gender

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	5.482	.2796	4.934	6.030	384.505	1	.000	240.385	138.972	415.801
[Age=2]	-1.619	.3835	-2.371	-.868	17.835	1	.000	.198	.093	.420
[Age=1]	0[a]	.	.	.	.	.	.	1	.	.
[Gender=2]	-.454	.4132	-1.264	.356	1.205	1	.272	.635	.283	1.428
[Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
[Age=2] * [Gender=2]	-.931	.5692	-2.046	.185	2.674	1	.102	.394	.129	1.203
[Age=2] * [Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
[Age=1] * [Gender=2]	0[a]	.	.	.	.	.	.	1	.	.
[Age=1] * [Gender=1]	0[a]	.	.	.	.	.	.	1	.	.
(Scale)	1.012[b]									
(Negative binomial)	1									

Dependent Variable: hamza

Model: (Intercept), Age, Gender, Age * Gender

a. Set to zero because this parameter is redundant.

b. Computed based on the Pearson chi-square.

APPENDIX E

GENERALIZED LINEAR MODELS THE DEPENDENT VARIABLES [q] AND [ʔ]

Negative Binomial Regression Showing the Main Effects of Education, Income, and Occupation on the Variable Use of [q]

Model Information

Dependent Variable	qaf
Probability Distribution	Negative binomial (1)
Link Function	Log

Case Processing Summary

	N	Percent
Included	52	100.0%
Excluded	0	.0%
Total	52	100.0%

Categorical Variable Information

			N	Percent
Factor	Education	Professional	6	11.5%
		Bachelor's degree	15	28.8%
		Associate degree	10	19.2%
		High school	9	17.3%
		Middle school	8	15.4%
		Elementary	4	7.7%
		Total	52	100.0%
	Income	High	16	30.8%
		Mid	13	25.0%
		Low	23	44.2%
		Total	52	100.0%
	Occupation	Professional	21	40.4%
		Private work/business	4	7.7%

	Government employee	12	23.1%
	unemployed	15	28.8%
	Total	52	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	qaf	52	0	467	112.96	132.696

Goodness of Fit[d]

	Value	df	Value/df
Deviance	132.380	41	3.229
Scaled Deviance	57.536	41	
Pearson Chi-Square	94.334	41	2.301
Scaled Pearson Chi-Square	41.000	41	
Log Likelihood[a]	-285.821		
Adjusted Log Likelihood[c]	-124.226		
Akaike's Information Criterion (AIC)	593.642		
Finite Sample Corrected AIC (AICC)	600.242		
Bayesian Information Criterion (BIC)	615.106		
Consistent AIC (CAIC)	626.106		

Dependent Variable: qaf

Model: (Intercept), Education, Income, Occupation

a. The full log likelihood function is displayed and used in computing information criteria.

c. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

d. Information criteria are in small-is-better form.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
10.618	10	.388

Dependent Variable: qaf

Model: (Intercept), Education, Income, Occupation

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

Source	Type III						
	Likelihood Ratio Chi-Square	df	Sig.	F	df1	df2	Sig.
(Intercept)	568.410	1	.000	568.410	1	41	.000
Education	5.542	5	.353	1.108	5	41	.371
Income	2.291	2	.318	1.145	2	41	.328
Occupation	.987	3	.804	.329	3	41	.804

Dependent Variable: qaf

Model: (Intercept), Education, Income, Occupation

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	5.062	.7647	3.563	6.560	43.816	1	.000	157.844	35.265	706.500
[Education=6]	-1.950	1.2197	-4.341	.440	2.556	1	.110	.142	.013	1.553
[Education=5]	-.728	1.0079	-2.703	1.248	.521	1	.470	.483	.067	3.482
[Education=4]	-.912	1.0938	-3.056	1.231	.696	1	.404	.402	.047	3.426
[Education=3]	.139	1.1134	-2.043	2.321	.016	1	.901	1.149	.130	10.189
[Education=2]	.730	1.0760	-1.379	2.839	.460	1	.497	2.075	.252	17.098
[Education=1]	0[a]	.	.	.	.	.	.	1	.	.
[Income=3]	-1.073	.6926	-2.431	.284	2.401	1	.121	.342	.088	1.329
[Income=2]	-.563	.8062	-2.143	1.017	.487	1	.485	.570	.117	2.766
[Income=1]	0[a]	.	.	.	.	.	.	1	.	.
[Occupation=4]	.754	.7650	-.746	2.253	.970	1	.325	2.125	.474	9.515
[Occupation=3]	.425	1.0512	-1.635	2.486	.164	1	.686	1.530	.195	12.011
[Occupation=2]	.156	.7040	-1.224	1.536	.049	1	.825	1.169	.294	4.644
[Occupation=1]	0[a]	.	.	.	.	.	.	1	.	.
(Scale)	2.301[b]									
(Negative binomial)	1									

Dependent Variable: qaf
Model: (Intercept), Education, Income, Occupation

a. Set to zero because this parameter is redundant.

b. Computed based on the Pearson chi-square.

Negative Binomial Regression Showing the Main Effects of Education, Income, and Occupation on the Variable Use of [ʔ]

Model Information

Dependent Variable	hamza
Probability Distribution	Negative binomial (1)
Link Function	Log

Case Processing Summary

	N	Percent
Included	52	100.0%
Excluded	0	.0%
Total	52	100.0%

Categorical Variable Information

			N	Percent
Factor	Education	Professional	6	11.5%
		Bachelor's degree	15	28.8%
		Associate degree	10	19.2%
		High school	9	17.3%
		Middle school	8	15.4%
		Elementary	4	7.7%
		Total	52	100.0%
	Income	High	16	30.8%
		Mid	13	25.0%
		Low	23	44.2%

	Total	52	100.0%
Occupation	Professional	21	40.4%
	Private work/business	4	7.7%
	Government employee	12	23.1%
	unemployed	15	28.8%
	Total	52	100.0%

Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable	hamza	52	0	476	109.12	130.152

Goodness of Fit[d]

	Value	df	Value/df
Deviance	106.316	41	2.593
Scaled Deviance	76.209	41	
Pearson Chi-Square	57.197	41	1.395
Scaled Pearson Chi-Square	41.000	41	
Log Likelihood[a]	-269.141		
Adjusted Log Likelihood[c]	-192.925		
Akaike's Information Criterion (AIC)	560.283		
Finite Sample Corrected AIC (AICC)	566.883		
Bayesian Information Criterion (BIC)	581.747		
Consistent AIC (CAIC)	592.747		

Dependent Variable: hamza

Model: (Intercept), Education, Income, Occupation

a. The full log likelihood function is displayed and used in computing information criteria.

c. The adjusted log likelihood is based on an estimated scale parameter and is used in the model fitting omnibus test.

d. Information criteria are in small-is-better form.

Omnibus Test[a]

Likelihood Ratio Chi-Square	df	Sig.
38.853	10	.000

Dependent Variable: hamza

Model: (Intercept), Education, Income, Occupation

a. Compares the fitted model against the intercept-only model.

Tests of Model Effects

Source	Type III						
	Likelihood Ratio Chi-Square	df	Sig.	F	df1	df2	Sig.
(Intercept)	510.843	1	.000	510.843	1	41	.000
Education	31.474	5	.000	6.295	5	41	.000
Income	4.352	2	.114	2.176	2	41	.126
Occupation	5.355	3	.148	1.785	3	41	.165

Dependent Variable: hamza

Model: (Intercept), Education, Income, Occupation

Parameter Estimates

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
			Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
(Intercept)	2.336	.8685	.634	4.038	7.234	1	.007	10.340	1.885	56.732
[Education=6]	4.029	1.0324	2.005	6.052	15.229	1	.000	56.201	7.429	425.144
[Education=5]	3.588	.9056	1.813	5.363	15.699	1	.000	36.169	6.130	213.394
[Education=4]	3.473	.7826	1.940	5.007	19.699	1	.000	32.249	6.956	149.509
[Education=3]	1.836	.9058	.061	3.612	4.111	1	.043	6.274	1.063	37.032
[Education=2]	.553	.8837	-1.179	2.285	.392	1	.531	1.739	.308	9.830
[Education=1]	0[a]	.	.	.	.	.	.	1	.	.
[Income=3]	.111	.5497	-.966	1.189	.041	1	.840	1.118	.381	3.283
[Income=2]	-.865	.5662	-1.975	.244	2.336	1	.126	.421	.139	1.277
[Income=1]	0[a]	.	.	.	.	.	.	1	.	.

[Occupation=4]	-1.093	.5929	-2.255	.070	3.396	1	.065	.335	.105	1.072
[Occupation=3]	.389	.7414	-1.064	1.842	.276	1	.600	1.476	.345	6.311
[Occupation=2]	-.667	.6469	-1.935	.601	1.064	1	.302	.513	.144	1.824
[Occupation=1]	0[a]	.	.	.	.	.	.	1	.	.
(Scale)	1.395[b]									
(Negative binomial)	1									

Dependent Variable: hamza

Model: (Intercept), Education, Income, Occupation

a. Set to zero because this parameter is redundant.

b. Computed based on the Pearson chi-square.

APPENDIX F
INTERNTIONAL PHONETIC ALPHABET (IPA) SYMBOLS FOR STANDARD ARABIC, HIMSI COLLOQUIAL ARABIC, AND RURAL COLLOQUIAL ARABIC

Standard Arabic Phonemic System in IPA[20]

	Bilabial	Labio-dental	(Inter) dental	Alveolar	Alveo-palatal	Palatal	Velar	Uvular	Pharyngeal	glottal
Stop	b			t d t̞ d̞			k	q		ʔ
Nasal	m			n						
Affricate					dʒ					
Fricative		f	θ ð ð̞	s z s̞	ʃ			χ ʁ	ħ ʕ	h
Liquid				l r						
Glide	w					j				

Himsi Colloquial Arabic Phonemic System in IPA

	Bilabial	Labio-dental	Alveolar	Alveo-palatal	Palatal	Velar	Uvular	Pharyngeal	glottal
Stop	b		t d t̞ d̞			k			ʔ
Nasal	m		n						
Fricative		f	s z s̞ z̞	ʃ ʒ			χ ʁ	ħ ʕ	h
Liquid			l r						
Glide	w				j				

[20] The sounds on the left within the same column are voiceless; the ones on the right are voiced. This applies to the other two tables.

Rural Colloquial Arabic Phonemic System in IPA

	Bilabial	Labio-dental	Alveolar	Alveo-palatal	Palatal	Velar	Uvular	Pharyngeal	glottal
Stop	b		t d t̝ d̝			k	q		ʔ
Nasal	m		n						
Fricative		f	s z s̝ z̝	ʃ ʒ			χ ʁ	ħ ʕ	h
Liquid			l r						
Glide	w				j				

LIST OF REFERENCES

Abdel-Jawad, Hassan R. 1981. *Phonological and social variation in Arabic in Amman.* Philadelphia, PA: University of Pennsylvania dissertation.

Abd-el-Jawad, Hassan Rashid, 1986. The emergence of an urban dialect in the Jordanian urban centers. *International Journal of the Sociology of Language* 61.53-63.

Abu-Haidar, Farida. 1992. Shifting boundaries: The effect of MSA on dialect convergence in Baghdad. *Perspectives on Arabic linguistics IV*, ed. by Ellen Broselow, Mushira Eid, and John McCarthy, 91-106. (Current Issues in Linguistic Theory 85). Amsterdam: John Benjamins.

Adam, Galit. 2002. *From Variable to Optimal Grammar: Evidence from language acquisition and language change*. Tel-Aviv, Israel: Tel-Aviv University dissertation. Rutgers Optimality Archive[21] ROA-567.

Agresti, Alan, and Barbara Finlay. 1997. *Statistical Methods for the Social Sciences*, Third Edition. Upper Saddle River, NJ: Prentice Hall International, Inc.

Al-Ani, Salman H. 1976. The development and distribution of the Arabic 'qaf' in Iraq. *Essays on Islamic civilization*, ed. by Donald P. Little, 48-55. Leiden: E. J. Brill. [Reprinted in *Readings in Arabic Linguistics* (1978), ed. by Salman H. Al-Ani. Bloomington, Indiana: Indiana University Linguistics Club, 1978].

Al-Khatib, Samer. 2008. On the directionality of emphasis spread. Paper presented at the annual meeting of the Linguistics Society of America, Chicago.

Al-Wer, Enam. 1999. Why do different variables behave differently? Data from Arabic. *Language and Society in the Middle East and North Africa*, ed. by Yasir Suleiman, 38-57. London: Curzon.

Al-Wer, Enam. 2002. Education as a speaker variable. *Language Contact and Language Conflict in Arabic*, ed. by Aleya Rouchdy, 41-53. London: Curzon.

Anttila, Arto. 1997a. Deriving variation from grammar. *Variation, change and phonological theory*, ed. by Frans Hinskens, Roeland van Hout, and W. Leo Wetzels, 35-68. Amsterdam: John Benjamins.

Anttila, Arto. 1997b. *Variation in Finnish phonology and morphology*. Stanford, CA: Stanford University dissertation.

[21] Rutgers Optimality Archive can be accessed at this website http://roa.rutgers.edu/index.php3.

Anttila, Arto. 2002. Variation and phonological theory. *The Handbook of Language Variation and Change*, ed. by Jack K. Chambers, Peter Trudgill, and Natalie Schilling-Estes, 206-243. Oxford: Blackwell.

Anttila, Arto, and Young-mee Yu Cho. 1998. Variation and change in optimality theory. *Lingua* 104.31-56.

Arad, Maya. 2003. Locality constraints on the interpretation of roots: the case of Hebrew denominal verbs. *Natural Language and Linguistic Theory* 21.737–778.

Archangeli, Diana. 1984. *Underspecification in Yawelmani Phonology and Morphology*, Cambridge, MA: MIT doctoral dissertation.

Archangeli, Diana. 1988. Aspects of underspecification theory. *Phonology* 5.183-208.

Aske, Jon. 1990. Disembodied rules vs. patterns in the lexicon: Testing the psychological reality of Spanish stress rules. *BLS* 7.30–45.

Ayres-Bennett, Wendy. 2004. *Sociolinguistic Variation in Seventeenth-Century France: Methodology and Case Studies.* Cambridge and New York: Cambridge University Press.

Bayley, Robert. 1994. Consonant cluster reduction in Tejano English. *Language Variation and Change* 6.303-326.

Bell, Alan. 1984. Language style as audience design. *Language in Society* 13 (2).145-204.

Bell, Alan. 1991. *The Language of News Media*. Oxford: Blackwell.

Beret, Iris; Vered Vaknin; and Gary F. Marcus. 2007. Roots, stems, and the universality of lexical representations: Evidence form Hebrew. *Cognition* 104 (2).254-286.

Bermúdez-Otero, Ricardo, and Richard M. Hogg. 2003. The actuation problem in Optimality Theory: phonologization, rule inversion, and rule loss. In Holt, 91-119.

Birkeland, Harris. 1952. *Growth and structure of Egyptian Arabic dialect*. Oslo: Avhandlinger utg. Av det Norske Videnskape-Acad.

Bod, Rens; Jennifer Hay; and Stefanie Jannedy (eds.). 2003. *Probabilistic Linguistics*, 289-341. Cambridge, MA: The MIT Press.

Boersma, Paul, and David Weenink. 2007. Praat: a system for doing phonetics by computer (Version 4.6.03) [Computer program]. Retrieved May 24, 2007, from http://www.praat.org/

Boersma, Paul. 1997a. How we learn variation, optionality, and probability. *The Institute of Phonetic Sciences of the University of Amsterdam* 21.43–58.

Boersma, Paul. 1997b. Sound change in functional phonology. Rutgers Optimality Archive ROA-237, ms.

Boersma, Paul. 1998. Functional Phonology: Formalizing the Interaction between Articulatory and Perceptual Drives. Amsterdam: University of Amsterdam dissertation.

Boersma, Paul. 2000. Learning a grammar in Functional Phonology. In Dekkers, van der Leeuw, and van de Weijer, 465-523.

Boersma, Paul. 2001. Praat: a system for doing phonetics by computer. *Glot international* 5:9/10.341-345.

Boersma, Paul, and Bruce Hayes. 2001. Empirical Tests of the Gradual Learning Algorithm. *Linguistic Inquiry* 32 (1).45–86.

Bybee, Joan L. 1985. Morphology as lexical organization: evidence from lexical diffusion. *Theoretical Morphology*, ed. by Michael Hammond, and Michael Noonan, 119-41. San Diego, CA: Academic Press.

Bybee, Joan L. 2000. The phonology of the lexicon: evidence from lexical diffusion. *Usage-based models of language*, ed. by Michael Barlow and Suzanne Kemmer, 65-85. Stanford, CA: CSLI.

Bybee, Joan L. 2001. *Phonology and Language Use*. (Cambridge Studies in Linguistics 94). Cambridge: Cambridge University Press.

Bybee, Joan L. 2002. Word frequency and context of use in the lexical diffusion of phonetically conditioned sound change. *Language Variation and Change* 14.261-290.

Bybee, Joan L. 2003. Mechanisms of change in grammaticization: the role of frequency. *The Handbook of Historical Linguistics*, ed. by Brian D. Joseph and Richard D. Janda, 602-623. Oxford: Blackwell.

Bybee, Joan L., and James L. McClelland. 2005. Alternatives to the combinatorial paradigm of linguistic theory based on domain general principles of human cognition. *The Linguistic Review* 22.381-410.

Cameron, Deborah, 1998. Performing gender identity: Young men's talk and the construction of heterosexual masculinity. *Language and Gender. A Reader*, ed. by Jennifer Coates, 270-284. Oxford: Blackwell.

Chambers, Jack K.; Peter Trudgill; and Natalie Schilling-Estes (eds.). 2002. *The Handbook of Language Variation and Change*. Malden, MA: Blackwell.

Chomsky, Noam. 1980. Rules and Representations. *Behavioral and Brain Sciences* 3. 1-61.

Churchyard, Henry. 1993. Early Arabic siin and siin in light of the proto-Semitic fricative-lateral hypothesis. *Perspectives on Arabic linguistics V: Papers from the Fifth Annual Symposium on Arabic Linguistics*, ed. by Mushira Eid and Clive Holes, 313-342. Amsterdam: John Benjamins.

Clements, George N. 1985. The geometry of phonological features. In *Phonology Yearbook* 2, 225-252. Cambridge: Cambridge University Press.

Clements, George N. 1990. The role of sonority cycle in core syllabification. *Papers in Laboratory Phonology I: Between the Grammar and Physics of Speech*, ed. by John Kingston and Mary F. Beckman, 283-333. Cambridge: Cambridge University Press.

Coates, Jennifer. 1996. *Women, Men and Language*. London: Longman Group Limited.

Coetzee, Andries W. 2008. Phonological Variation and Lexical Frequency. 'Short' version to appear in the *Proceedings of the 38th Annual Meeting of the North East Linguistics Society* (*NELS 38*). Rutgers Optimality Archive ROA-952, ms.

Coupland, Nikolas. 1980. Style-shifting in a Cardiff work-setting. *Language in Society* 9.1-12.

Coupland, Nikolas. 1985. Hark, hark the lark: Social motivations for phonological style-shifting. *Language and Communication* 5 (3).195-72.

Coupland, Nikolas. 2001. Dialect stylization in radio talk. *Language in society* 30 (3).345-75.

Cutillas-Espinosa, Juan A. 2004. Meaningful variability: A sociolinguistically-grounded approach to variation in Optimality theory. *International Journal of English Studies* 4 (2).165-184.

Cutillas-Espinosa, Juan Antonio, and Juan Manuel Hernández-Campoy. 2004. Audience and speaker design in radio broadcasting: Attitudes to language as a starting script. Universidad de Murcia, ms.

Daher, Jamil. 1998a. *Linguistic variation in Damascus Arabic: A quantitative analysis of men's and women's speech*. New York, NY: New York University dissertation.

Daher, Jamil. 1998b. Gender in linguistic variation: The variable (q) in Damascus Arabic. *Perspectives on Arabic linguistics XI: Papers from the Eleventh Annual Symposium on Arabic Linguistics*, ed. by Elabbas Benmamoun, Mushira Eid, and John McCarthy, 183-206. Amsterdam: John Benjamins.

Daher, Jamil. 1999. ((theta)) and ((eth)) as Ternary and Binary Variables in Damascene Arabic. *Perspectives on Arabic linguistics XII: Papers from the Twelfth Annual Symposium on Arabic Linguistics*, ed. by Elabbas Benmamoun, 163-182. Amsterdam: John Benjamins.

Davis, Stuart. 1993. Arabic pharyngealization and phonological features. *Perspectives on Arabic linguistics V*, ed. by Mushira Eid and Clive Holes, 49-162. Amsterdam: John Benjamins.

Davis, Stuart. 1995. Emphasis spread in Arabic and grounded phonology. *Linguistic Inquiry* 26 (3).465-498.

Davis, Stuart, and Zawaydeh, Bushra A. 2001. Arabic hypocoristics and the status of the consonantal root. *Linguistic Inquiry* 32.512–520.

Dekkers, Joost; Frank van der Leeuw; and Jeroen van de Weijer (eds.) 2000. *Optimality Theory: Phonology, syntax, and acquisition*. Oxford: Oxford University Press.

Devitt, Michael. 2006a. *Ignorance of Language*. Oxford: Oxford University Press.

Devitt, Michael. 2006b. Intuitions in Linguistics. *British Journal for the Philosophy of Science* 57. 481-513.

Demuth, Katherine. 1995. Markedness and the development of prosodic structure. *Proceedings of the Twenty-Fifth Annual Meeting of the North East Linguistics Society* (*NELS 25*), ed. by Jill N. Beckman, 13-25. GLSA: University of Massachusetts, Amherst.

Eckert, Penelope. 1989. *Jocks and Burnouts: Social Categories and Identity n the High School*. New York: Teachers College Press.

Eckert, Penelope (ed.) 1991a. *New Ways of Analyzing Sound Change*. San Diego: Academic Press.

Eckert, Penelope. 1991b. Social polarization and the choice of linguistic variants. *New Ways of Analyzing Sound Change*, ed. by Penelope Eckert, 213-232. San Diego: Academic Press.

Eisikovits, Edna. 1987. Sex differences in inter-group and intra-group interaction among adolescents. *Women and Language in Australian and New Zealand Society*, ed. by Anne Paulwels 45-58. Sydney: Australian Professional Publications.

Eisikovits, Edna. 1988. Girl-talk/boy-talk: Sex differences in adolescent speech. *Australian English*, ed. by Peter Collins and David Blair, 35-54. New York: University of Queensland Press.

El-Imam, Yousif A., and Zuraidah Mohd Don. 2005. Rules and Algorithms for Phonetic Transcription of Standard Malay. *IEICE TRANS. INF. and SYST*. E88–D (10). 2354-2372.

Encyclopedia Britannica. 2008. Hims. Retrieved January 27, 2008, from Encyclopedia Britannica Online: http://www.britannica.com/eb/article-9040501

Feldman, Laurie Beth; Ram Frost; and Tamar Pnini. 1995. Decomposing words into their constituent morphemes: Evidence from English and Hebrew. *Journal of Experimental psychology: Learning, Memory, and Cognition* 21 (4).947-960.

Ferguson, Charles. A. 1997. Grammatical agreement in Classical Arabic and the modern dialects: A response to Versteegh's pidginization hypothesis. *Structuralist studies in Arabic linguistics: Charles A. Ferguson's papers, 1954-1994*, compiled by R. Kirk Belnap and Niloofar Haeri, 81-91. Leiden and New York: E. J. Brill.

Finegan, Edward, and Douglas Biber. 1994. Register and Social Dialect Variation: An Integrated Approach. *Sociolinguistic Perspectives on Register*, ed. by Douglas Biber and Edward Finegan, 315-347. New York: Oxford University Press.

Fischer, John L. 1958. Social influences on the choice of a linguistic variant. *Word* 14.47-56.

Frisch, Stefan; Michael Broe; and Janet Pierrehumbert. 1998. Similarity and phonotactics in Arabic. ROA-223.

Gal, Susan, 1978. Peasant men can't get wives: Language change and sex roles in bilingual community. *Language in Society* 77 (1).1-16.

Gal, Susan. 1979. *Language Shift: Social Determinants of Linguistic Change in Bilingual Austria*. New York: Academic Press.

Garbell, Irene. 1958. Remarks on the historical phonology of an Eastern Mediterranean Arabic dialect. *Word* 14. 303-337. [Reprinted in *Readings in Arabic Linguistics*, ed. by Salman Al-Ani, 204-241. Bloomington, Indiana: Indiana University Linguistics Club, 1978].

Giles, Howard; Nikolas Coupland; and Justine Coupland. 1991. Accommodation Theory: Communication, context and consequence. *Contexts of Accommodation: Developments in Applied Sociolinguistics*, ed. by Howard Giles, Justine Coupland, and Nikolas Coupland, 1-68. Cambridge: Cambridge University Press.

Giles, Howard, and Peter F. Powesland. 1975. *Speech Style and Social Education*. London: Academic Press in association with the European association of Experimental Social Psychology.

Gilford, Henry. 1978. *Syria*, A First Book. New York; London: Franklin Watts.

Gnanadesikan, Amalia E. 1995. Markedness and Faithfulness Constraints in Child Phonology. Ms., Rutgers Optimality Archive ROA-67.

Gundel, Jeanette, and Gillian Sankoff. 2008. Pragmatics and sociolinguistics: Still in the courtship phase. Paper presented at annual meeting of the Linguistics Society of America.

Guy, Gregory R. 1991. Explanation in variable phonology: an exponential model of morphological constraints. *Language Variation and Change* 3.1-22.

Habib, Rania. 2005. *The role of social factors, lexical borrowing and speech accommodation in the variation of [q] and [ʔ] in the colloquial Arabic of rural migrant families in Hims, Syria*. Gainesville, FL: The University of Florida MA thesis.

Hachimi, Atiqa. 2001. Shifting sands: Language and gender in Moroccan Arabic. *Gender across Languages,* Volume I, *IMPACT: Studies in Language and Society* 9, ed. by Marlis Hellinger and Hadumod Bussmann, 27-51. Amsterdam: John Benjamins.

Hachimi, Atiqa. 2005. Dialect Leveling, Maintenance and Urban Identity in Morocco. Manawa, Hawaii: University of Hawaii dissertation.

Hachimi, Atiqa. 2007. Becoming Casablancan: Fessis in Casablanca as a Case Study. *Arabic in the City: Issues in Dialect Contact and Variation*, ed. by Catherine Miller, Enam Al-Wer, Dominique Caubet, and Janet C.E. Watson, 97-122. London: Routledge-Taylor and Francis.

Haeri, Niloofar. 1991. *Sociolinguistic Variation in Cairene Arabic: Palatalization and the Qaf in the Speech of Men and Women*. Philadelphia, PA: University of Pennsylvania Ph.D. dissertation.

Haeri, Niloofar. 1996. *The sociolinguistic market of Cairo: gender, class, and education.* London/New York: Kegan Paul International; Distributed by Columbia University Press.

Haeri, Niloofar. 2003. *Second language, ordinary people: Dilemmas of culture and politics in Egypt.* New York: Palgrave Macmillan.

Hayes, Bruce. 2000. Gradient well-formedness in Optimality Theory. In Dekkers, van der Leeuw, and van de Weijer, 88-92.

Hayes, Bruce, and May Abad. 1989. Reduplication and syllabification in Ilokano. *Lingua* 77.331–374.

Hayes, Bruce, and Margaret MacEachern. 1998. Quatrain form in English folk verse. *Language* 74.473–507.

Hernández-Campoy, Juan M., and Peter Trudgill. 2002. Functional compensation and southern peninsular Spanish /s/ loss. *Folia Linguistica Historica* XXIII.141-167.

Holes, Clive. 1986.The social motivation for phonological convergence in three Arabic dialects. *International Journal of the Sociology of Language* 61.33-51.

Holes, Clive. 2004. Modern Arabic: Structures, Functions, and Varieties. Washington, D.C.: Georgetown University Press.

Holt, David Eric, 2003. Remarks on Optimality Theory and language change. In Holt, 1-30.

Holt, David Eric (ed.). 2003. *Optimality Theory and Language Change*. Dordrecht: Kluwer Academic Publishers.

Homs City Council. 2008. lamħa ʕan madinat ħimṣ (A glance at the city of Hims). Retrieved February 4, 2008, from http://www.homscitycouncil.org.sy/modules/0/3.php

Hooper, Joan B. 1976. Word frequency in lexical diffusion and the source of morphological change. *Current Progress in Historical Linguistics*, ed. by William M. Christie, 95-105. Amsterdam: North-Holland Publishing Co.

Hume, Elizabeth and Naomi Nagy. 2008. Phonology. Paper presented at the annual meeting of the Linguistics Society of America.

Hymes, Dell. 1972. The Ethnography of Speaking. *Anthropology and Human Behavior*, ed. by Thomas Galdwin and William C. Sturdevant, 15-53. Washington, D.C.: Anthropological Society of Washington.

Ibrahim, H. Muhammad. 1986. Standard and prestige language: A problem in Arabic linguistics. *Anthropological Linguistics* 28.115-126.

Johnson, Keith, and Nancy Niedzielski. 2008. Phonetics, sociophonetics, and the phonetics-phonology interface. Paper presented at the annual meeting of the Linguistics Society of America.

Kager, René. 1999. *Optimality Theory*. New York, NY: Cambridge University Press.

Kenstowicz, Michael.1994. Phonology in Generative Grammar. Oxford: Blackwell Publications

Kisseberth, Charles. 1970. On the functional unity of phonological rules. *Linguistic Inquiry* 1.291-306.

Kochetov, Alexei. 1998. Labial Palatalization: A Gestural Account of Phonetic Implementation. *The Canadian Linguistic Association Annual Proceeding*.38-50.

Kroch, Anthony. 1989. Reflexes of grammar in patterns of language change. *Language Variation and Change* 1 (3).199-244.

Kroch, Anthony. 1994. Morphosyntactic variation. *The Parasession on Variation in Linguistic Theory*, ed. by Katherine Beals, Jeanette Denton, Robert Knippen, Lynette Melnar, Hisami Suzuki, and Erica Zeinfeld 180-201. CLS 30 (2), Chicago.

Labov, William. 1963. The social motivation of a sound change. *Word* 19.273-309.

Labov, William. 1966. *The Social Stratification of English in New York City*. Washington: Center for Applied Linguistics.

Labov, William. 1972a. *Sociolinguistic patterns*. Philadelphia: University of Pennsylvania Press.

Labov, William, 1972b. *Language in the Inner City: Studies in the Black English Vernacular*. Philadelphia: University of Pennsylvania Press.

Labov, William. 1994. *Principles of Linguistic Change*. Volume I: Internal Factors. Oxford: Blackwell.

Labov, William. 2001. *Principles of Linguistic Change*. Volume II: Social Factors. Oxford: Blackwell.

Lambert, Wallace E.; R. C. Hodgson; Robert D. Gardner; and Samuel Fillenbaum. 1960. Evaluational Reactions to Spoken Languages. *Journal of Abnormal and Social Psychology* 60.44-51.

Liberman, Mark. 1994. Optionality and optimality. Fragment of a draft, Department of Linguistics, University of Pennsylvania.

Lombardi, Linda. 2003. Second language data and constraints on Manner: Explaining substitution for English interdentals. *Second Language Research* 19(3).225-250.

Macaulay, Ronald K. S. 1977. *Language, Social Class and Education*. Edinburgh University Press.

Macaulay, Ronald K. S. 1978. Variation and consistency in Glaswegian English. In Trudgill, 132-143.

Mahayni, Riad G. 1990. A Decentralized Approach to Urbanization: The Case of Syria. *Journal of Planning Education and Research* 9 (2).117-125.

Manning, Christopher D. 2003. Probabilistic syntax. *Probabilistic Linguistics*, ed. by Rens Bod, Jennifer Hay, and Stefanie Jannedy, 289-341. Cambridge: The MIT Press.

Martinet, André. 1964. *Elements of General Linguistics*. Chicago: University of Chicago Press.

McCarthy, John J., and Alan Prince. 1994. The emergence of the unmarked: Optimality in prosodic morphology. *Proceedings of the North East Linguistic Society* 24, ed. by Gonzàlez Mercè, 333-79. Amherst, MA: GLSA Publications. [Reprinted in *Optimality Theory in Phonology: A Reader*, ed. by McCarthy, John J. Malden, MA: Blackwell, 2004].

McMahon, April M. S. 2000. *Lexical Phonology and the History of English*. Cambridge: Cambridge University Press.

Medoza-Denton, Norma, Jennifer Hay, and Stefanie Jannedy. 2003. Probabilistic Sociolinguistics: Beyond Variable Rules. In Bod, Hay, and Jannedy, 97-138.

Miller, Catherine. 2005. Between accommodation and resistance: Upper Egyptian migrants in Cairo. *Linguistics* 43 (5).903-956.

Milroy, Lesley. 1980. *Language and social networks*. Oxford: Basil Blackwell.

Milroy, James. 2006. Language change and the speaker: On the discourse of historical linguistics. *Variation and reconstruction*, ed. by Thomas D. Cravens. Amsterdam: John Benjamins.

Milroy, James, and Lesley Milroy. 1985. Linguistic change and social network and speaker innovation. *Journal of Linguistics* 21.339-384.

Milroy, James, and Lesley Milroy. 1992. Social network and social class: toward an integrated sociolinguistic model. *LiS* 21.1-26.

Moumine, M. E. 1990. Sociolinguistic variation in Casablanca Moroccan Arabic. Casablanca, Morocco: University Mohammed V dissertation.

Morris, Richard E. 1998. *Stylistic variation in Spanish phonology*. Columbus, OH: The Ohio State University dissertation. Rutgers Optimality Archive ROA-292.

Morris, Richard E. 2000. Constraint interaction in Spanish /s/-aspiration: three peninsular varieties. *Hispanic Linguistics at the Turn of the Millennium: Papers from the 3rd Hispanic Linguistics Symposium*, ed. by Héctor Campos, Elena Herburger, Alfonso Morales-Front, and Thomas J. Walsh. Somerville, MA: Cascadilla. Also Rutgers Optimality Archive ROA-391.

Moscati, Sabatino; Anton Spitaler; Edward Ullendorff; and Wolfram von Soden. 1964. *An introduction to the comparative grammar of the Semitic languages*. Wiesbaden: Otto Harrassowitz.

Mufwene, Salikoko S. 2005. Language evolution: The population genetics way. *Gene, Sprachen, und ihre Evolution*, ed. by Guenther Hauska, 30-52. Universitaetsverlag Regensburg.

Nagy, Naomi, and William T. Reynolds. 1996. Accounting for variable word-final deletion within Optimality Theory. *Sociolinguistic variation: Theory, Data and Analysis* (Selected Papers from NWAV 23), ed. by Jennifer Arnold, Renee Blake, Brad Davidson, Scott Schwenter, Julie Solomon. Stanford, CA: CSLI Publications.

Nagy, Naomi, and William T. Reynolds. 1997. Optimality Theory and variable word-final deletion in Faeter. *Language Variation and Change* 9.37-55.

Newbrook, Mark. 1982. *Sociolinguistic Reflexes of Dialect Interference in West Wirral*. Reading, Berkshire, United Kingdom: Reading University Dissertation.

Ohala, John J. 1993. The phonetics of sound change. *Historical linguistics: problems and perspectives*, ed. by Charles Jones, 237-278. London: Longman.

Palfreyman, David, and Muhamad al-Khalil. 2003. "A Funky Language for Teenzz to Use": Representing Gulf Arabic in Instant Messaging. *Journal of Computer-Mediated Communication* 9 (1). Retrieved November 18, 2007, from http://jcmc.indiana.edu/vol9/issue1/palfreyman.html

Patrick, Peter L. 1992. Creoles at the intersection of variable processes: -*t*, *d* deletion and past-marking in the Jamaican mesolect. *Language Variation and Change* 3.171-189.

Patten, Mildred L. 2004. *Understanding research methods: An overview of the essentials*, Fourth Edition. Glendale, CA: Pyrczak Publishing.

Phillips, Betty S. 2006. *Word Frequency and Lexical Diffusion*. New York: Palgrave Macmillan.

Pierrehumbert, Janet. 2001. Exemplar dynamics: Word frequency, lenition and contrast. *Frequency and the emergence of linguistic structure*, ed. by Joan Bybee and Paul Hopper, 137-157. Amsterdam: John Benjamins.

Pierrehumbert, Janet. 2002. Review of *Phonology and language use*, by Joan Bybee. 2001. (Cambridge Studies in Linguistics 94.) Cambridge: Cambridge University Press. Phonology 19.459–463.

Prince, Alan, and Paul Smolensky. 2004. *Optimality Theory: Constraint interaction in Generative Grammar*. Malden, MA: Blackwell. Previously available as a Ms., 1993, Piscataway, NJ: Center for Cognitive Science, Rutgers University.

Rickford, John R., and Penelope Eckert (eds.). 2001. *Style and sociolinguistic variation*. Cambridge, UK and New York: Cambridge University Press.

Reynolds, William T. 1994. *Variation and phonological theory*. Philadelphia, PA: University of Pennsylvania dissertation.

Roca, Iggy, and Wyn Johnson. 1999. *A Course in Phonology*. Malden, MA: Blackwell Publishing.

Romaine, Suzanne. 1978. Postvocalic /r/ in Scottish English: Sound change in progress? In Trudgill, 144-157.

Rose, Sharon. 1996. Variable laryngeals and vowel lowering. *Phonology* 13.73-117.

Rumelhart, David E., and James L. McClelland. 1987. Learning the past tenses of English verb: Implicit rules or parallel distributed processing? *Mechanisms of language acquisition*, ed. by Brain MacWhinney. Hillsdale, NJ: Lawrence Erlbaum Associates.

Sankoff, Gillian, and Hélène Blondeau. 2007. Language change across the lifespan: /r/ in Montreal French. *Language* 83 (3).560-588.

Santa Ana A., Otto. 1992. Chicano English evidence for the exponential hypothesis: a variable rule pervades lexical phonology. *Language Variation and Change* 4.275-288.

Saussure, Ferdinand de. 1959. Course in General Linguistics. New York: McGraw-Hill. First published 1919.

Sawaie, Mohammed. 1994. *Linguistic Variation and Speakers' Attitudes: A Sociolinguistic Study of Some Arabic Dialects*. Damascus: Al-Jaffan and Al-Jabi Publishers in co-operation with the Institut Français d'Études Arabes de Damas.

Schilling-Estes, Natalie, 1999. Situated ethnicities: Constructing and reconstructing identity in the sociolinguistic interview. *University of Pennsylvania Working Papers in Linguistics* 6 (2).137-51.

Schilling-Estes, Natalie, 2002. Investigating Stylistic Variation. In Chambers, Trudgill, and Schilling-Estes, 375-401.

Schmidt, Richard W. 1974. *Sociostylistic variation in spoken Egyptian Arabic: A reexamination of the concept of diglossia*. Washington, D.C.: Georgetown University dissertation.

Schmidt, Richard W. 1986. Applied Sociolinguistics: The case of Arabic as a second language. *Anthropological Linguistics* 28 (1).55-71.

Schultz, David E. 1981. Diglossia and variation in formal spoken Arabic in Egypt. Madison, WI: University of Wisconsin, Madison dissertation.

Shahin, Kimary N. 1998. Optimized postvelar harmony in Palestinian Arabic. In Benmamoun, Eid, and Haeri, 143-166.

Slezak, Peter. 2007. Linguistic explanation and 'psychological reality'. Retrieved June 7, 2008 from: http://web.gc.cuny.edu/Philosophy/people/devitt/Slezak_Devitt_2007.pdf

Smolensky, Paul. 1996. On the comprehension/production dilemma in child language. *Linguistic Inquiry* 27.720-731.

Stampe, David. 1972. *How I spent my summer vacation (A dissertation on natural phonology)*. Chicago, IL: University of Chicago dissertation.

Steriade, Donca. 1987. Locality conditions and feature geometry. *Proceedings of the 17th annual Meeting of the North East Linguistics Society* (*NELS 17*), ed. by Joyce McDonough and Bernadette Plunkett, 595-618. Graduate Student Linguistic Association, University of Massachusetts, Amherst.

Syrian Arab Republic Central Bureau of Statistics. 1960. Statistical Abstract. Damascus, Syria: Office of the Prime Minister.

Syrian Arab Republic Central Bureau of Statistics. 1986. Statistical Abstract. Damascus, Syria: Office of the Prime Minister.

Syrian Arab Republic Central Bureau of Statistics. 2002. Information Syria Description. Homs. Statistic Abstract. Damascus, Syria: Office of the Prime Minister. Retrieved February 5, 2008, from http://www.cbssyr.org/services.htm

Syrian Arab Republic Central Bureau of Statistics. 2004. Population and demographic indicators. Statistic Abstract. Damascus, Syria: Office of the Prime Minister. Retrieved February 5, 2008, from http://www.cbssyr.org/services.htm

Tesar, Bruce. 1995. *Computational Optimality Theory*. Boulder: University of Colorado dissertation.

Tesar, Bruce, and Paul Smolensky. 1993.The learnability of Optimality Theory: an algorithm and some basic complexity results. Rutgers Optimality Archive ROA-2, ms.

Tesar, Bruce, and Paul Smolensky. 1995. The learnability of optimality theory. *The Thirteenth West Coast Conference on Formal Linguistics* (*WCCFL XIII*), ed. by Raul Aranovich, William Byrne, Susanne Preuss, and Martha Senturia, 122-137. Stanford, CA: CSLI.

Tesar, Bruce, and Paul Smolensky. 1996. Learnability in Optimality Theory (long version). Rutgers Optimality Archive ROA-156, ms.

Tesar, Bruce, and Paul Smolensky. 1998. Learnability in Optimality Theory. *Linguistic Inquiry* 29.229-68.

Tesar, Bruce, and Paul Smolensky. 2000. *Learnability in Optimality Theory*. Cambridge, MA: The MIT Press.

The Columbia Encyclopedia, Sixth Edition. 2007. Homs. New York: Columbia University Press. Retrieved January 27, 2008, from Encyclopedia.com: http://www.encyclopedia.com/doc/1E1-Homs.html

Trudgill, Peter. 1974. *The Social Differentiation of English in Norwich*. Cambridge: Cambridge University Press.

Trudgill, Peter (ed.). 1978. *Sociolinguistic Patterns in British English*. London: Edward Arnold.

United Nations Economic Commission for Western Asia. 1980. The Population Situation in the ECWA Region: Syrian Arab Republic. Beirut.

Versteegh, Kees. 1997. *The Arabic language*. Edinburgh: Edinburgh University Press.

Walters, Keith. 1989. *Social Change and Linguistic Variation in Korba, a Small Tunisian Town.* Austin, TX: University of Texas at Austin dissertation.

Walters, Keith. 1991. Women, men, and linguistic variation in the Arab World. *Perspectives on Arabic Linguistics III*, ed. by Bernard Comrie and Mushira Eid, 199-229. (Current Issues in Linguistic Theory 80). Amsterdam: John Benjamins.

Walters, Keith. 1992. A sociolinguistic description of (u:) in Korba Arabic: Defining linguistic variables in contact situations and relic areas. *Perspectives on Arabic linguistics IV*, ed. by Ellen Broselow, Mushira Eid, and John McCarthy, 181-217. (Current Issues in Linguistic Theory 85). Amsterdam: John Benjamins.

Walters, Keith. 1996. Diglossia, linguistic variation and language change in Arabic. *Perspectives on Arabic Linguistics VIII*, ed. by Mushira Eid, 157-197. (Current Issues in Linguistic Theory 134). Philadelphia: John Benjamin.

Weinreich, Uriel; William Labov; and Marvin I. Herzog. 1968. Empirical foundation for a theory of language change. *Directions for Historical Linguistics: A Symposium,* ed. by W. Lehmann and Y. Malkiel, 95-195. Austin, TX: University of Texas Press.

Zakaria, K., and B. Sibai. 1989. Mohdadat al-Higra al-Dakheliah fi Souria (Bases of Internal Migration in Syria). Damascus: Institute of State Planning.

Zawaydeh, Bushra Adnan. 1998. Gradient uvularization spread in Ammani-Jordanian Arabic. In Benmamoun, Eid, and Haeri, 117-142.

Zawaydeh, Bushra Adnan. 1999. *The phonetics and Phonology of Gutturals in Arabic*. Bloomington, Indiana: University of Indiana, Bloomington dissertation.

BIOGRAPHICAL SKETCH

Rania Habib was born in the small village Oyoun Al-Wadi in Syria. She moved to Hims, Syria, at the age of two, where she attended primary, middle, high school, and college. Rania attained her bachelor's degree in English literature in 1999 and a Higher Studies Diploma in English Literary Studies in 2000 from the Department of English, Al-Baath University, Hims, Syria. In each of her undergraduate academic years, she received the Al-Basil Certificate of Achievement and a prize for outstanding scholarship. During her diploma year, Rania started teaching English as a Foreign Language at The Institute of Languages, Al-Baath University, Hims, Syria. While she was teaching at the Institute, she started teaching English for Specific Purposes to third- and fourth-year chemical engineering students and to fourth- and fifth-year Food Engineering students at The Faculty of Petroleum and Chemical Engineering, Al-Baath University, Hims, Syria. She continued to teach English as a Foreign Language at The Institute of Languages until 2003 when she came to the United States on the Fulbright scholarship to pursue a master's degree in Linguistics.

Shortly after her appointment in the Language Institute, she became the Vice Director of the Institute. Her teaching experience at the Institute includes teaching English courses of different levels and TOEFL to M.A. students, assistant lecturers, teaching assistants, and university professors from all different academic departments. The courses involve the development of all kinds of skills like reading, listening, vocabulary, writing and speaking. Her duties also involved the construction of placement tests and the evaluation of tests for M.A. and Ph.D. candidates. Those tests included instantaneous translation and oral and written comprehension. Due to her commitment and dedication to her work at the Institute, she received Employee of the Year (2002) award and prize from Al-Baath University. During this time, Rania also taught at private institutes various English courses of different levels including TOEFL, Translation, Reading Comprehension and Writing to undergraduate students who are pursuing a major in translation or English literature. She also privately tutored many English literature students in various subjects, such as phonetics and phonology, drama, translation, prose, poetry, and other fields. Her private tutoring included students who were interested in English as a foreign language and who were from various levels: beginners, intermediate, advanced and TOFEL, including helping a SAT student in the verbal section. Furthermore, Rania did many translation jobs including research papers from English into Arabic and from Arabic into English. This is not to mention her great contribution to the translation of the major part of the website of Al-Baath University and the revision of the translation of others.

In 2003, Rania received the Fulbright Scholarship to complete a master's degree in Linguistics at the University of Florida for the academic years 2003 to 2005. During her major in Linguistics, Rania attained a Certificate in Teaching English as a Second Language. After completing her master's degree in 2005, she was admitted to the Ph.D. program in Linguistics at UF. In each of her academic years at UF, Rania received a Certificate of Academic Achievement from the University of Florida for outstanding academic accomplishment. In addition, she was nominated in 2007 by the Linguistics Program at UF to the Alec Courtelis Award, which is given annually to three outstanding international graduate students, and to the Outstanding International Student Award. Rania attained the latter award. In 2007, she was also one of the six finalists to the Madelyn Lockhart Dissertation Fellowship Award. Consequently, Rania was awarded a supporting grant from the President of the University of Florida.

During Rania's studies in the University of Florida, she received a one year Research Assistantship to work with Professor Fiona McLaughlin in 'The Project on the Languages of Urban Africa'. In addition, Rania taught several courses: Scholarly Writing (Academic Written

English) and Introduction to Linguistics in the Linguistic Program and First-year Arabic, Third-year Arabic, Fourth-year Arabic, Arabic through the Texts, Arabic Culture, and Structure of Standard Arabic in the Arabic Program in the Department of African and Asian Languages and Literatures.

Rania received training in teaching English as a second language through a teacher's training course in 2001 at The Institute of Languages, Al-Baath University, Hims, Syria. She also received training in teaching Arabic as a second language through an Arabic Instructor Training Seminar in 2004 at Middlebury College, Arabic School, Middlebury, Vermont. Rania presented papers and posters in a number of professional conferences. She also has published a number of papers in professional journals, proceedings, or books. Rania has also done a number of professional services, such as participating in many cultural enrichment seminars and presentations through the Fulbright Program and the International Center at the University of Florida. She also was a blind reviewer on a number of articles. Rania was a member of the Higher Education Committee at Al-Baath University, Hims, Syria. She served as the President of the UF Linguistics Society of which she is still a member. She is also a member of the American Association of Applied Linguistics (AAAL) and the Linguistic Society of America (LSA).