AN ACOUSTIC STUDY OF THE LOW BACK MERGER AND NORTHERN CITIES SHIFT IN DES MOINES, IOWA

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The present study ows a great intellectual debt to the works of William Labov and Matthew J. Gordon, withouth whose work the present study would be inconceivable.

CONTENTS

Conventions used

IPA symbols are used throughout to indicate pronunciation. Not all the studies cited employ IPA symbols, and in those cases IPA symbols have been provided.

The *lexial sets* introduced by Wells (1982) are employed throughout to refer to the variables. The lexical sets refer to all words containing a certain vowel, and are rendered throughout in small caps.

1. INTRODUCTION

1.1 Aim and scope

Broadly speaking, American English can be considered to encompass three major dialect areas, General American, Southern and Northern, each of which in turn encompasses any number of sub-dialects. Among this multitude of American dialect areas, one in particular is distinguished by its potential for change. This dialect area is the Midlands, the region in which Western, Southern, and Northern features meet, rendering a unique variety of speech that draws inspiration from all three. This region includes, among others, the states of Iowa, Missouri, and Kansas. Regardless of this potential, it is largely an unexplored frontier. The present study aims to shed light on one such unexplored area; Des Moines, Iowa.

Among the current changes in progress, two are particularly salient; the Northern Cities Shift and the Low Back Merger. The Northern Cities Shift (henceforth NCS) is a chain shift effected in the Northern dialect area (predominantly in the cities, hence its name). While some features of the chain shift was discovered earlier, a systematic shift was first discovered by Labov, Yaeger, and Steiner (1972), who noticed common features in their studies of Chicago and Detroit, and partially in New York. The Low Back Merger (henceforth LBM) is the unconditional merger of THOUGHT and LOT. It's a feature predominantly associated with Western areas, and limited areas of the North East and Pennsylvania (the exact distribution is explored in chapter 2). It has, however, been subject to rapid diffusion over the last six or so decades.

The present study is a sociolinguistic study in the variationist approach aiming to explore the nature of the NCS and LBM in Des Moines, their current levels of diffusion and the mechanisms with which they are effected. Of particular interest is the interplay observed in an area subjected both to the NCS and LBM, specifically how it affects the realization of the low back vowels. Moreover, surprisingly little research has been done as to the effects of phonological conditioning on the vowel realizations involved in these two phenomena. The present study aims to add to that very limited pool of data.

1.2 The variables

The NCS involves the shifting of six potential vowel realizations, two of which are also involved in the LBM. A full account is given in chapter 2, but a very brief account is given here for clarity.

The NCS involves the potential shifting of the vowels of the lexical sets KIT, DRESS, TRAP, STRUT, LOT, and THOUGHT, and these are the six variables examined in the present study. The NCS, as outlined by Labov (2010), involves the following steps: TRAP is fronted and raised, leading LOT to be fronted, causing THOUGHT to be lowered. Then DRESS is backed, leading to the backing of STRUT. In addition, an unrelated backing of KIT is associated with the shift. This is an extremely simplified account, and the actual direction of shifting involves multiple trajectories for several of the variables.

1.3 Previous studies

The present study draws its main inspiration from Labov et al.'s (2006) *Atlas of North American English*. Utilizing phone interviews, respondents were polled on a number of variables all across North America, thus establishing the geographical diffusion of the examined features. Among these examined features were the NCS and the LBM. While this study did afford a general overview that had, until that point, been unavailable, it suffered one major drawback, the low number of respondents polled. In low population areas as few as two people were polled. This was the case for Des Moines. The low number of respondents somewhat puts in doubt the accuracy of the distribution in terms of where the spread of any given feature ends.

The *Atlas of North American English* found that the diffusion of the LBM stopped in South Dakota, Nebraska, Kansas, and Oklahoma. However, Gordon (2006) found the LBM to be quite wide-spread in Missouri, a state the *Atlas of North American English* considers not affected by the merger. If this was the case for Missouri, it would stand to reason that it might also be the case in other states bordering the limits of diffusion established by the *Atlas of North American English*.

The present study was undertaken to explore this assumption. A number of locations were considered, but ultimately Des Moines, Iowa, was chosen for study to best facilitate the examination of an area subject to both NCS and LBM influence. Des Moines, in addition to being located in a state adjacent to the suggested end of diffusion for the LBM, is also located right at the cusp of the proposed diffusion of the NCS.

Very few studies have been conducted providing comprehensive data on the NCS, (no studies whatsoever have been conducted in Iowa) and the data with which the findings of the present study are compared are based almost exclusively on two previous studies, Gordon's (2001) study of two small towns in Michigan, and Labov, Yaeger, and Steiner's (1972) regional survey with relevant data from Detroit and Chicago. In addition, single variable data are drawn from a few additional studies, among them Callery's (1975) Chicago study.

For the LBM, studies are more plentiful. This is not entirely unexpected given the far wider diffusion of this feature over the NCS, and its explosive development over the last half century. DeCamp (1971) wrote about its spread in San Francisco, Herold (1990) writes about the merger in Pennsylvania, Irons (2007) Kentucky, Fogle (2008) Indianapolis, Doernberger and Cerny (2008) Miami, Boberg and Strassel (1995) Ohio, and Gordon (2006) Missouri. Of particular interest to the present study is the work of Gordon for its proximity in the area surveyed to the area surveyed for the present study, and Irons, Herold, and Boberg and Strassel for their data on phonological conditioning.

1.4 Method

The present study is an acoustic study. Audio recordings were solicited from random passers-by in downtown Des Moines, Iowa, upon which acoustic analyses were conducted. The resulting data material form the basis of the present study.

1.5 Arrangement

The arrangement of the chapters in the present study is fairly straightforward. In chapter 2 an overview of the theory on which the present study is founded is given alongside summary findings of previous research. In chapter 3 the methodology is explored. In chapter 4 the data are presented. In chapter 5 the data are discussed and summarized. Chapter 6 is the conclusion, discussing the findings in relation to the research questions, as well as suggesting potential avenues of further research that might prove fruitful.

2. THEORY

2.1 The study of language change

All living languages are constantly changing. Changes occur in all domains of language, be it grammar, syntax, semantics or lexicon etc. However, most research on language change has perhaps been in the domain of sound change, and the present study is part of that tradition.

Language change is gradual. It does not simply one day pop up complete in speakers. Prior to the *variationist* approach, however, there was no framework to examine change in progress. As Milroy and Gordon point out, however, many linguists were aware of the extent of variation in language, but treated variation as a "methodological complication [...] a kind of noise which obscures the important underlying invariance (2003, 4)". They sought to create a unified presentation of language, and, consequently, chose to ignore the inherent variation present in living languages.

A new approach first came about in the 60s, spearheaded by Labov's seminal studies at Martha's Vineyard and in New York City. As Milroy and Gordon put it, Labov "demonstrated that the trajectories of specific linguistic changes could be inferred from the observation of patterns of variation in contemporary speech communities (2003, 2)". Labov posited that variation was not chaotic and random, but rather highly structured, and that these structures could be revealed through study.

These studies constitute the beginning of the variationist approach to sociolinguistics, and is the foundation this study is built on. Prior to this approach, linguists who wished to examine language change had two possible avenues of recourse. They could search for previous research, or they could go back and collect further data at a later point in time (Labov 1994, 73). While this approach certainly allowed for studies of language change, it was, perhaps, a bit impractical in terms of studying change in progress. In order to apply this approach to a study of change in progress one would have to rely on subsequent studies of such frequency that the change in question would not already be complete. Its perhaps biggest weakness would be its inability to suggest change from a single study.

With the variationist approach to sociolinguistics came the notion of *apparent time* studies. In these studies "[...] the speech of different generations is taken as representative of different stages in the history of the language. (Gordon 2001, 4)" If substantial differences exist among older and younger speakers, especially if the variable in question increases or decreases from one variant to another from the older to the younger speakers, one might assume that these differences represent a change in progress. As Labov (1972, 275) points out, however, one should seek out at least one previous study to confirm the results.

Since apparent time studies did not get started until the 1960s, one has only recently been able to see whether the approach accurately reflects actual change, but as Chambers (2003, 219) points out, it is basically sound, with the caveat that it only holds true where the relevant social variables governing the change remain the same over the projected period in which change is examined. That is, even if a change is found to be in progress, where younger speakers produce more or less tokens of a variant of a variable, that development could still be reversed if the factors involved in effecting the change were to be reversed or somehow invalidated.

2.1.1 The spread of sound change

In addition to the study of linguistic change with apparent time studies to suggest changes in progress and project the course of potential future change, two further aspects were of great importance to the variationists. The first of these concerns were with how linguistic innovation spreads, both geographically, from community to community, and socially, from social group to social group. Additionally, *lexical diffusion*, the process wherein innovation spreads from word to word or from linguistic context to linguistic context, and does not affect all contexts at once, has been of importance in these studies (Holmes 2008, 214). As Gordon (2001, 5) points out, most of the studies that have been undertaken have been on the social dimension, and very few studies have examined the mechanisms of the geographical diffusion of sound change. The present study only covers a single city, and consequently, geographical diffusion is beyond the scope of the study. It shall suffice to mention the two competing theories. The *gravity model* of geographical diffusion, wherein changes spread from major cities to minor cities to rural areas (Meyerhoff 2006, 259), is one. The second theory is the *wave model* (Meyerhoff 2006, 258), wherein changes radiate like waves from the source.

As for the social aspects of sound change, an investigation is beyond this study, but they will be touched upon below where relevant.

2.1.2 How Sound Change Occurs

The second aspect of investigation that was of importance to the variationists was the *hows* of linguistic innovation. That is, why does language change occur, and what are the mechanisms behind it. The aspect of why innovation occurs is beyond the scope of the present study, but two mechanisms of sound change are at its very core; these mechanisms are the *merger* and the *chain shift*. Each of these two mechanisms is intimately tied to one of the two changes in progress examined in the present study. The merger with The LBM and the chain shift with the NCS, and consequently these mechanisms will be introduced alongside these changes below.

2.2 The Low Back Merger

A merger is a process wherein two phonemes gradually lose distinction, eventually leading to the complete loss of distinction, both in production and perception, between the two, although not necessarily in that order. Such mergers can be either conditional or unconditional. An example of a conditional merger would be the *pin–pen* merger where /ɪ/ (KIT) and /ɛ/ (DRESS) merge only before nasals, a merger typically found in Southern accents, but also to some extent in speakers further north, including speakers affected by the Northern Cities Shift. The Low–Back Merger is an unconditional merger, which means that it occurs in all linguistic contexts. It is the merger of /ɑ/ (LOT) and /ɔ/ (THOUGHT), rendering homophones words such as *cot* and *caught*, and is, in fact, often referred to as the *cot–caught* merger. Wells (1982, 473) refers to it as the *thought–lot* merger. The resulting vowel quality has been the topic of much discussion. This is addressed below, but for now it will suffice to say that there is reason to assume that the resulting vowel quality differs between the affected areas.

The exact distribution of the merger has not been examined in any great detail, the most extensive effort to date being the *Atlas of North American English*. Figure 2.1 below is taken from this publication, and is an isogloss that presents the areas that are most resistant to the merger.

As can be observed from this isogloss, this merger is a widespread feature of North American speech, encompassing almost half of the United States, and all of Canada. The merger extends from the west coast, cutting a line through Texas, Oklahoma, Kansas, Nebraska, and South Dakota. Additional pockets are found on the east coast, encompassing parts of Pennsylvania, West Virginia, and Kentucky.

The isogloss also illustrates the authors' presumed retardants to the geographical diffusion of the merger. Three such retardants are given, and they boil down to influence from the Northern Cities Shift, the Southern accent, and from the New England accent. Specifically, it postulates that areas affected by the Northern Cities Shift would be less likely to adopt such a merger due to /ɑ/ (LOT) being fronted and thus no longer in danger of loss of distinction with /ɔ/ (THOUGHT). It further postulates that speakers of certain Southern accents

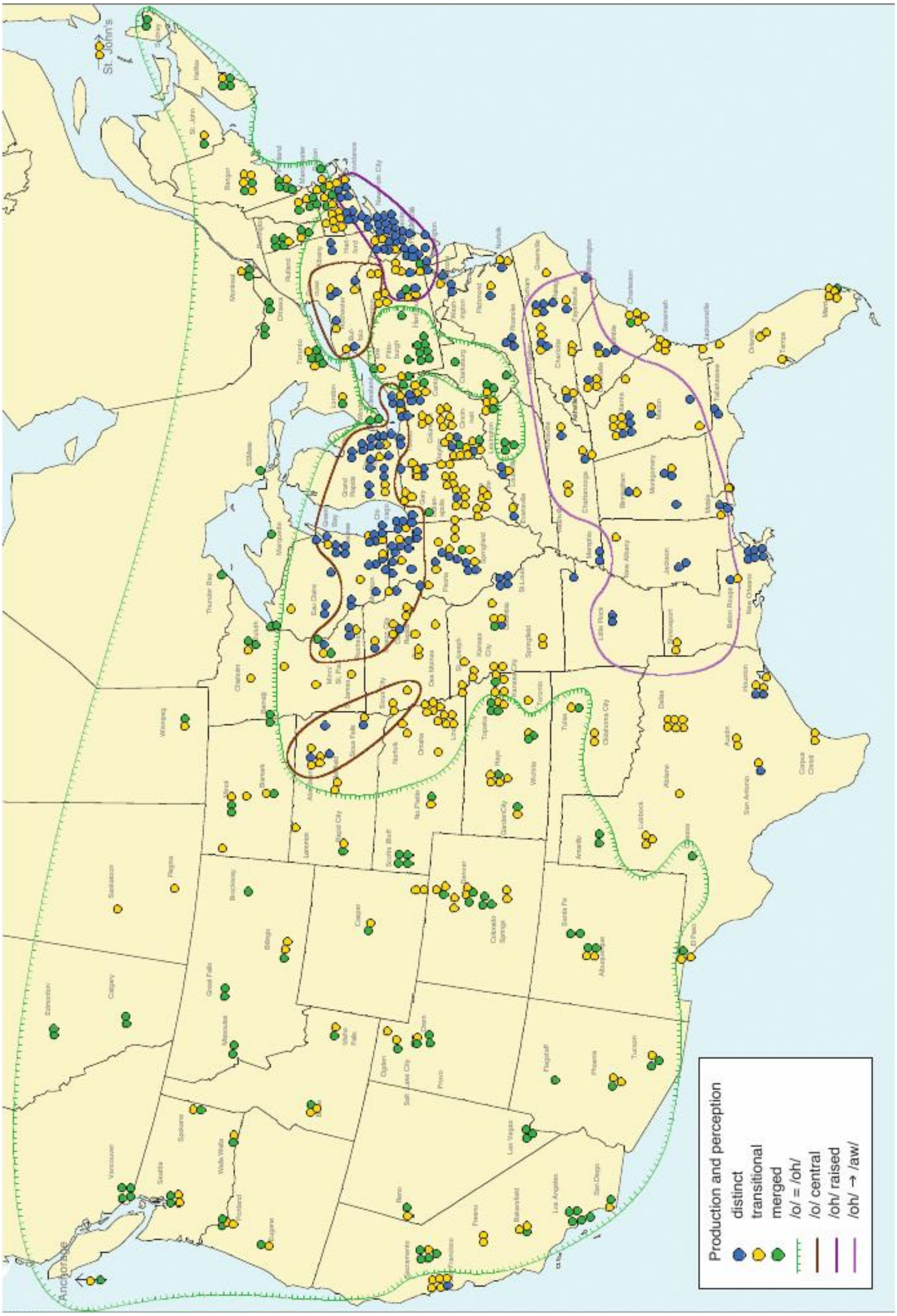

Figure 2.1: Isogloss showing resistance to the LBM, taken from the Atlas of North American English (2006, 61).

are affected by the merger to a lesser degree due to a tendency to having /ɔ/ realized as /ɔʊ/, commonly referred to as the back upglide. Lastly, it postulates that speakers of the New England accents are more resistant to the merger due to their /ɔ/ (THOUGHT) realizations being raised.

While these proposed retardants seem reasonable, it should be noted, that with the exception of the New England accent area, a good number of their informants are classified as transitional in their use even within these areas, and, moreover, several informants are classified as transitional in their use within the outlined merger areas. Given the low number of informants, any exact distribution would be impossible to ascertain from this study. However, it affords a general overview of its distribution more accurate than any previous study.

2.2.1 The chronological spread of the Low Back Merger

Since the initial occurrence and subsequent spread of the merger far outdates variationist theory and consequently interest in language variation, the chronology of the geographical diffusion is not directly available to us.

According to Irons (2007, 139) evidence of the Low–Back Merger may be found as early as the 1930s and 1940s in the *Linguistic Atlas of the United States and Canada*, and it was first analyzed and described in the late 1950s, then covering the merger in Western Pennsylvania.

In 1958 DeCamp, addressing the spread of the LBM in the Pacific Northwest region, wrote in his article *Pronunciation of English in San Francisco*:

> *In parts of the western United States (Utah, for example), /a/ and /ɔ/ have fallen together into one phoneme, usually with a wide phonetic range. In certain other western areas, including parts of Washington, this coalescence is not complete, for /a/ and /ɔ/ still contrast in some words; however, many words occur with [a], [*[1]], [ɔ], and various intermediate variants all in free variation. Some speakers there are unable to hear this contrast in knotty-naughty yet they clearly perceive it in cot-caught (DeCamp 1971, 555-556).*

There are two things of note in DeCamp's finding, both of which will be addressed below. They are, respectively, the phonetic nature of the merger, and the issue of lexical diffusion and diffusion on the basis of linguistic environment.

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[1] * represents a character that could not be reproduced from the original. The original character represents a pronunciation somewhere between /ɑ/ and / ɔ/.

2.2.3 The phonetic and mechanical nature of the merger

A central issue in the study of the LBM is the nature of the phonetic mechanisms involved. There is an ongoing debate as to whether it is a merger by approximation or a merger by expansion.

Prior to Herold's (1990) study in Tamaqua, Pennsylvania, there were two competing theories as to the mechanical nature of mergers, respectively that mergers spread by transfer, and that mergers spread by approximation.

Merger by transfer is a process "[...] described as phonetically discrete and lexically irregular, like other examples of lexical diffusion" (Herold 1990, 49). In essence, this theory postulates that mergers spread gradually through the lexicon, one word at a time. The result of a merger implemented by this mechanism would be that eventually all words belonging to one group would have moved to a second group, leaving no words in the first group. As a consequence, the phonetic result of the merger is that one vowel is replaced by another, and in opposition to the approximation theory outlined below, an intermediary vowel is not produced.

Merger by approximation is "[...] described as phonetically gradual and lexically regular [...]" (Herold 1990, 49). Unlike the merger by transfer theory outlined above, the merger by approximation theory postulates that mergers spread gradually through the phonetic system, that is, they spread from one linguistic context to another until complete. Moreover, unlike the transfer theory, it postulates that the lexical change is not gradual, but affects all relevant words from the outset. The phonetic result of a merger effected in this manner would be a new intermediary vowel located somewhere between the two original vowels.

Phonetically, both of these theories have in common that the end result is one vowel in place of the original two. In the case of merger by transfer it is one of the original vowels, and in the case of merger by approximation it is a new intermediary vowel.

Most of the early research on the merger advocated one of these mechanisms. Wells (1982, 473-476) relates several studies where /ɔ/ (LOT) is said to be changing into /ɑ/ (LOT). DeCamp's findings could advocate either of them; on one hand he speaks of distribution limited to certain words, but on the other hand the example he gives would seem to be indicative of a merger spreading through linguistic contexts rather than through specific words. However, his finding that the result is a realization anywhere on the spectrum between /ɔ/ (THOUGHT) and /ɑ/ (LOT) would indicate a merger by approximation, or potentially a merger by expansion.

The findings of Herold's (1990) study, however, did not support either of these mechanisms. Herold found that the result of the merger in Tamaqua, Pennsylvania was not that one vowel had appeared in place of the original two, but rather that "the lexical constraints on the distribution of the two former phonemes [had been] lifted. As a result, the entire phonetic range formerly divided between the two phonemes [became] available for the realization of either" (Herold 1990, 91-92). She coined this mechanism as merger by expansion.

According to Fogle (2008) merger by expansion has been largely accepted as the general mechanism of the merger. There are, however, good reasons to be skeptical about accepting merger by expansion as the general mechanism. Evidence would suggest that different mechanisms are at work in different instances of the merger, which would again suggest that the merger probably is not spreading continuously eastward, but rather there may be instances of the merger that are separate instances from another, with separate catalysts. Fogle's (2008) data from Indianapolis, Indiana, showed that the merger there was a result of merger by approximation. Irons (2007, 166) found that in Kentucky the merger is developing independently of the development of the merger elsewhere, and is a product of the loss of the back upglide system, as mentioned above as being a retardant to the spread of the LBM.

2.2.4 Evidence for diffusion by linguistic context

The theories of merger by approximation and merger by expansion both postulate that mergers spread from one linguistic context to the next. There is evidence suggesting that this is the case for the LBM.

Wells cites Bailey claiming that "the shift [...] first affects the environment '_tV [...] then other environments involving a following alveolar [...] and lastly those involving a following velar" (Wells 1982: 475). Boberg and Strassel (1995, 8) found in their study of Cincinnati, Ohio, that the merger there was most advanced before /n/ and /t/, and least advanced before /d/ and /k/. Fogle (2008) found that in Indianapolis, Indiana, the merger was most advanced before /l/. Nasals are known to be a preferred environment for the merger, to the extent that the *Atlas of North American English* differentiates between speakers only affected before nasals, and those affected in all environments.

2.2.5 Social factors

Three primary social factors are of interest in a variationist study: age, sex, and class. The findings related to age of speaker naturally differ depending on the status of the merger. In some areas, for instance Miami (Doernberger and Cerny 2008), the merger is complete, and as such age no longer plays a factor. In other areas, where the spread is not yet complete, differences are discovered. As for speaker sex, the findings are mixed. Fogle (2008, 147), for instance, finds nothing to support differentiation. Other studies show variable, but usually tenous links between the two. Class is not a common factor in American studies, however, Gordon (2006) claims the LBM to be free of social stigma.

2.2.6 Potential future expansion of the merger

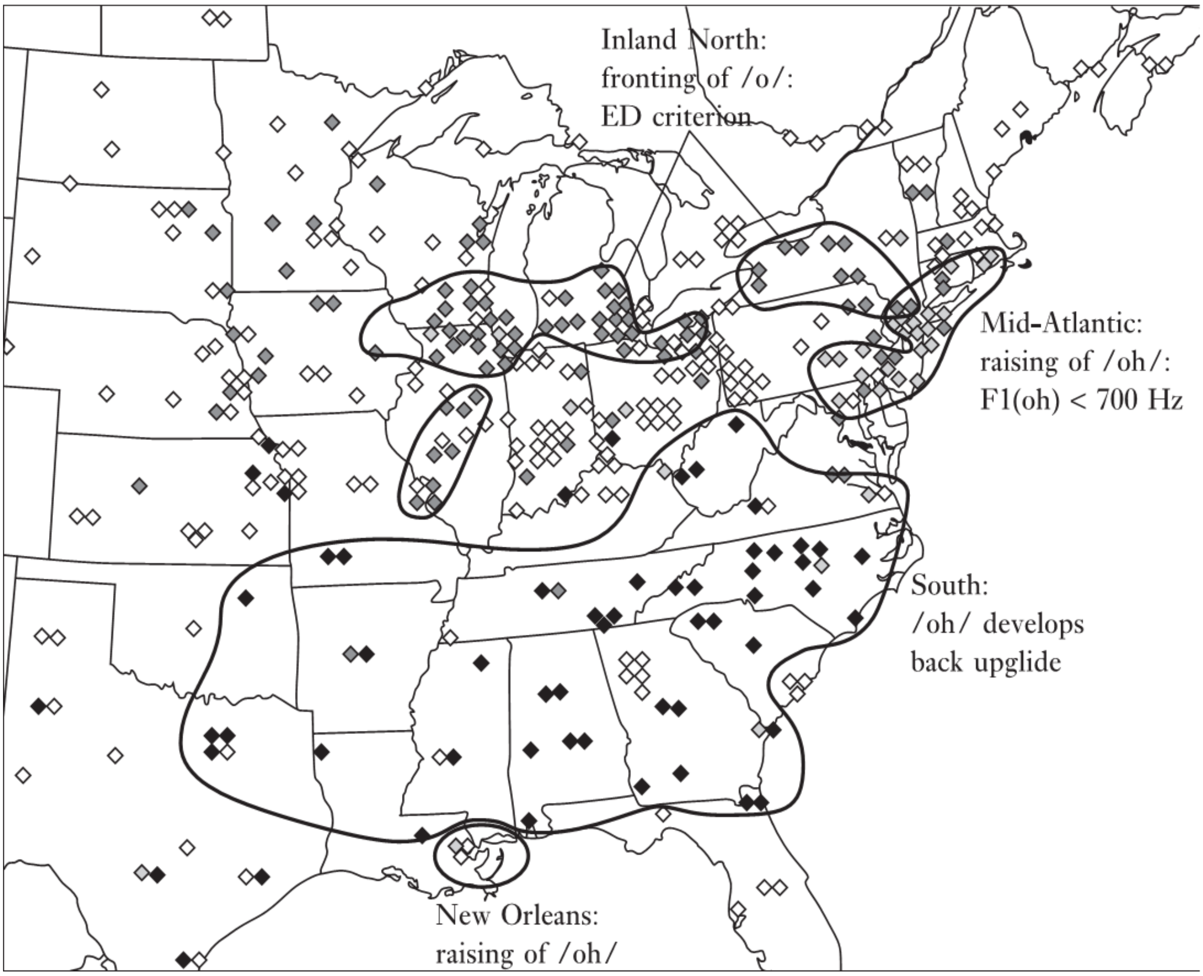


Figure 2.2: Isogloss showing proposed retardants to the LBM, taken from Labov (2010, 176).

The potential future spread of the LBM is chiefly dependent on the maintenance of the aforementioned retardants of the merger. Figure 2.2 reiterates these retardants and their distribution in a close up. As can be observed, it has been slightly revised from the *Atlas of North American English* isogloss in order to reflect recent studies, but the data included is the same.

The area of resistance most likely to be affected by the merger in the future is probably the area in South affected by the back upglide. In this area the respective vowels are already merged realization, but a merger is not in effect due to the upglide being in place, thus maintaining a distinction. As established by Irons (2007), the distribution of this feature is decreasing in Kentucky, and is represented by a revision of the back upglide area in Figure 2.2 over Figure 2.1. As Irons (2007, 166-167) points out, this feature is connected to local identity, and one might continue to see a decrease in the distribution of this feature alongside an increase in the loss or outright rejection of local identity.

The other areas seem more secure in their resistance, but one should not assume that the areas affected by the Northern Cities Shift could not also be affected by LBM simultaneously, creating a realization where both vowels are fronted, yet still merged.

2.3 The Northern Cities Shift

The Northern Cities Shift is a vowel shift effected in the Inland North, and involves the rotation of six short vowels. Traditionally, the Northern Cities Shift has been considered a chain shift. A chain shift is “a series of two or more related sound changes, the end result of which is a rearrangement of the phonetic realizations of the phonemes involved without the loss or gain of any phonemic contrast” (Gordon 2001: 7).

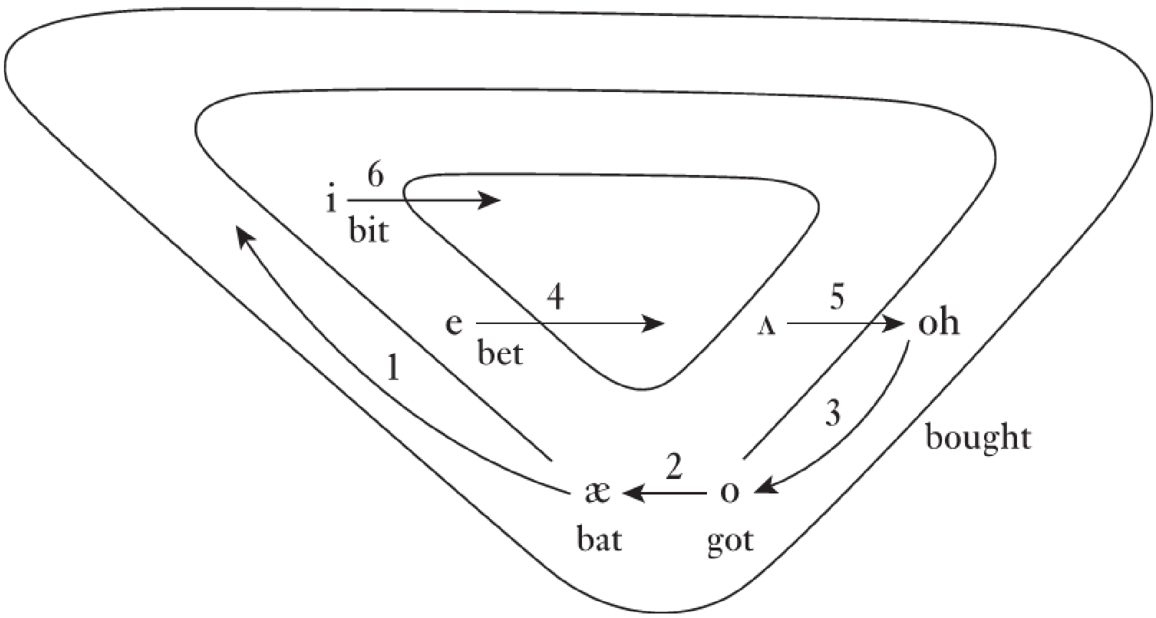


Figure 2.3: Illustration of NCS shifting according to Labov (2010, 112).

The proposed sequence of sound changes is represented in Figure 2.3 above. However, since the tradition of American researchers is to avoid IPA, or like here, to use it randomly, some clarification is probably in order.

The six outlined steps are as follows (Labov 2010, 14):

1 /æ/ (TRAP) is fronted and raised resulting in a realization resembling the vowel of DRESS, and in extreme cases as far as KIT.
2 /ɑ/ (LOT) is fronted, resulting in a realization resembling /ɐ/.
3 /ɔ/ (THOUGHT) is lowered and fronted moving into the space previously occupied by LOT.
4 /ɛ/ is backed and lowered, resulting in a vowel quality reminiscent of schwa.
5 /ʌ/ is backed, resulting in a realization close to unshifted THOUGHT.
6 /ɪ/ is backed and lowered.

As Gordon (2001, 1) points out, however, this representation is a simplification and abstraction of a very complex phonetic situation. In reality, a number of the vowels involved move in multiple directions, and there is an ongoing debate as to whether the Northern Cities Shift constitutes a chain shift. There is evidence to suggest that the order outlined above is not always the order in which the changes are implemented. Moreover, there is reason to doubt whether distinction is always maintained between all the changes involved. This is currently a central issue in the discussion of the Northern Cities Shift, but is is sadly outside the scope of the present study. For now it shall have to suffice to refer any interested party to, for instance, Gordon (2001).

2.3.1 The distribution of the Northern Cities Shift

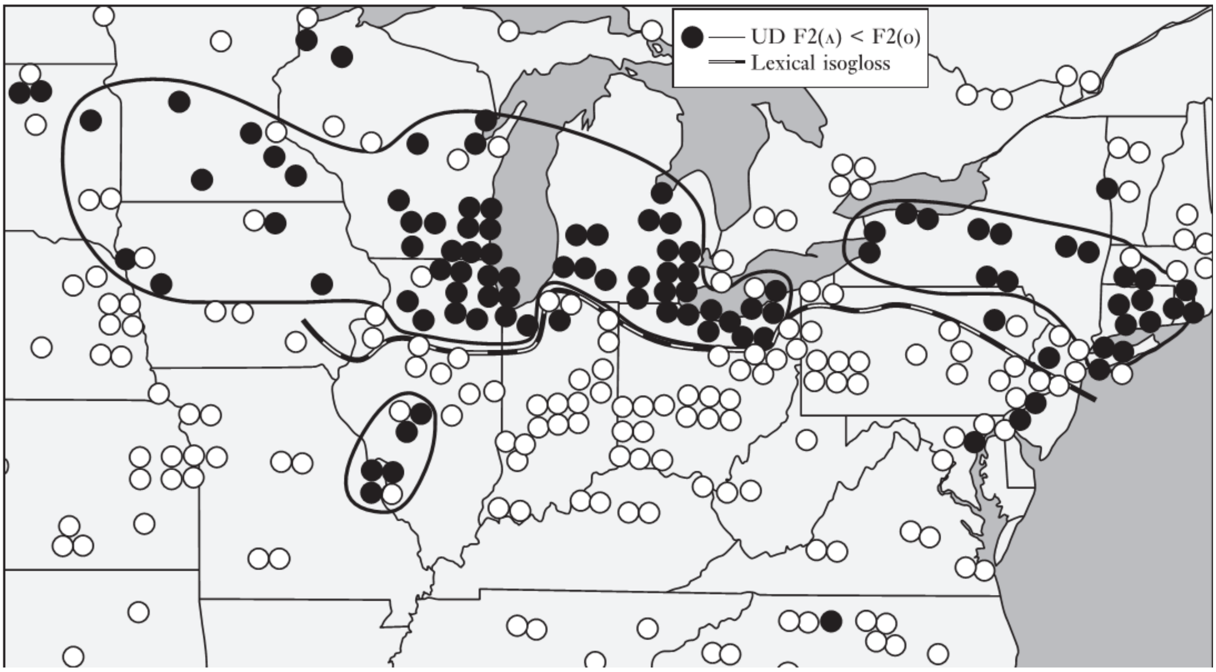


Figure 2.4: Isogloss showing diffusion of NCS according to Labov (2010, 117). Black dots indicate speakers for which STRUT realization is further backed than LOT, a standard Labov employs to confirm the presence of NCS.

Like the LBM, the distribution of the Northern Cities Shift has not been surveyed to any great extent. As with the LBM, the *Atlas of North American English* can afford us a general overview. Figure 2.4 above presents this data.

Given that six sound changes are involved, a problem necessarily presents itself when discussing the geographical diffusion of the shift, namely which of the previously outlined steps must be realized in order to count as being affected by the shift. The black dots on the isogloss above show the areas where respondents' /ʌ/ (STRUT) is farther back than /ɑ/ (LOT) (the white dots represents speakers for whom this is not the case), thus requiring steps two and four to have been completed.

From this we can observe that the shift is fairly advanced in the North Atlantic states, The Great Lakes region, extending into Northern Iowa and Minnesota, as well as the Chicago –St. Louis corridor.

2.3.2 Chronological diffusion of the Northern Cities Shift

Much like the LBM the chronology of the geographical diffusion of the Northern Cities Shift cannot be established, except through conjecture, and is not really of any importance to this study. Of greater interest is the chronological occurrences of the sound changes involved. Again, this is not really available to any great extent, but there is evidence to support that the raising of /æ/ (TRAP) was indeed the catalyst of these changes.

Gordon (2001, 25) relates a study by Herndobler in Chicago, wherein a small minority of informants born at the turn of the last century exhibited raising of /æ/ (TRAP), and these subjects also exhibited fronting of /ɑ/ (LOT). In other words, the process of the sound changes involved in the shift may have started as early as the turn of the last century.

The rest of the process is rather elusive, and complicated a great deal by the fact that researchers, for a long period of time, failed to observe the nature of these changes. The interconnectedness of these changes were first explored in 1972 by Labov, Yaeger, and Steiner, a full 70 years after these changes presumably started.

2.3.3 Distribution by linguistic context

There has not been a lot of research conducted on the influence of linguistic context on the sound changes involved in the Northern Cities Shift, but some data is available, and it does suggest that the shift spreads gradually through the linguistic contexts.

While the number of studies examining the effect of linguistic conditioning are not many, the results for all six variables are too lengthy to list here. There are, however, discussed in full in chapter 5 whereever they concern the present study.

2.3.4 Social factors

Three primary social factors are of interest in a variationist study: age, sex, and class. The present author is not aware of any study of the NCS taking into account class. As for age, the results are mixed. Both Gordon (2001) and Labov, Yaeger, and Steiner (1972) found conflicting results, wherein older speakers would lead in shifting for some variables, while the younger speaker would lead in shifting for other. These results are discussed in more detail in chapter 5. As for speaker sex, previous studies clearly indicate that the expected female lead in innovative forms is effected. Gordon (2001, 179-180) found women to elicit significantly more shifted tokens than men with four of the six variables. (KIT, TRAP, LOT, and THOUGHT.)

2.4 Research questions

Having thus introduced the phenomena examined in the present study, it is, perhaps, prudent at this point to reiterate the research questions outlined in chapter 1. On the basis of the nature of the LBM and the Northern Cities Shift, and their potential effects on each other in an area where their zones of influence meet, the current study has been devised to address the following questions: Does the Northern Cities Shift act as a retardant on the spread of the LBM, or are the two perhaps not mutually exclusive? Further, given the varying findings on the nature of the LBM, the current study aims to shed light on the nature of the LBM, whether it be by approximation or expansion, insofar that a merger can be established. Finally, given the evidence of the effect of linguistic conditioning on both the LBM and the Northern Cities Shift in previous research, the current study aims to investigate this effect further.

3. METHODOLOGY

3.1 Sample

Given the nature of the study, neither a sample size nor the distribution of features among the speakers therein could be designed or anticipated in advance. A sample was, however, necessarily produced by effecting the study. The impossibility of designing a sample, however, does not mean that certain types of distribution among the speakers sampled was not desired. These desires, along with a discussion of whether they were achieved as well as the implications for the study, are found below.

In order to account for the social distribution of the variables, speaker differentiation was sought in three categories. Firstly, samples were desired from both female and male speakers, in order that any significant differences in the distribution of the variables between genders might be examined and discovered. Secondly, samples were desired from speakers of multiple social tiers, allowing for the examination of any potential differences between speakers of different social groups. Thirdly, and most importantly, samples were desired from speakers of several age groups, in order that, in line with the principles of apparent time studies, any changes currently in progress might be discovered.

Data collection ultimately produced fourteen usable samples, eleven of which were male, the remaining three female. Their ages ranged from eighteen to sixty-two. The speakers sampled nearly exclusively identified with the middle class. The make-up of the sample will have the following implications for the present study:

The failure to produce a sufficient number of samples of female speakers, means that the effects of gender will not be addressed in the present study, as no meaningful comparison could be made between the genders with so few speakers, and consequently the data gathered from the three female speakers have been discarded.

For the distinction of social groups, data about the nature of the speaker’s current employment was gathered. The plan was that these data might be used as the basis on which to group speakers into different social categories between which differences might be examined. The rather vague nature of the answers, however, coupled with the fact that most of the speakers sampled identified their work as decidedly middle or upper middle class jobs, such as finance and insurance, meant that on the basis of these data, no meaningful distinctions could be made, and as such these data, too, were discarded for the purposes of this study.

The speakers sampled ranged in age from eighteen to sixty-two years. While the majority of speakers were in their early 50s, it was deemed that a meaningful comparison of the speakers below 40 years of age, and those above 40 years of age could be made. With a fairly large gap between subject ages, with no subjects in the range of 36-49 years, 40 also establishes itself as a natural cut off point. These two age groups were consequently established and used in the analysis of the variables in order to establish any potential changes that may have occurred.

Ultimately, the final sample of the study amounts to eleven speakers, all male. Their exact ages along with their answers to the discarded job data are given in the appendix.

3.2 Data Collection

The data were collected in downtown Des Moines, Iowa over two weeks in October 2012. Random passers-by were solicited to partake in a study and asked whether they grew up in the general Des Moines area. Upon agreement, both to participation and to the recording thereof, they were subjected to a battery of three tests, the design of which is detailed in 3.2.1 below. Upon completion they were asked their age, their occupation, and finally to confirm for the recording that they grew up in the general Des Moines area.

3.2.1 Data collection difficulties

Several unfortunate circumstances conspired to produce the low subject count, a number of which were anticipated and some that were not. Additionally, many of the anticipated concerns were of greater severity than expected. A number of these issues will be explored below.

The chief difficulty in conducting the data collection was weather. This was anticipated, but not much can be done about the unpredictability of weather. October was perhaps too late in the year. A good 2/3 of the data collection days were lost due to severe winds. The recording set-up chosen for the study worked quite well at moderate winds, but was quite at a loss with the severe winds experienced most days. Another difficulty anticipated was a low response rate, coupled with an assumption that many inhabitants of Des Moines may not have been raised there. This was partially met, insofar that less than 10% of the people who agreed to be part of the study identified themselves as having been raised in the general Des Moines area. Response rate, however, was much higher than anticipated. While no tally was kept, it is anticipated that as many as 30% of people asked agreed to take part.

Among the unanticipated challenges was the design of the city. The design of the study assumed a certain flow of people only achievable in a city of a certain size. Des Moines proved too small to meet this requirement. Downtown Des Moines contains nothing but office buildings, and consequently very few people are ever on the street, and only ever during lunch hour, which considerably hindered data collection. There is little doubt that the ideas on which the present study is designed could work in a larger city, where people actually live, even though it failed to live up to expectations in Des Moines.

3.2.2 Design of the Study

The design of the study was largely the product of one criterion, time, or rather, the lack thereof, not only in terms of the time allotted to the design of the study and the time allotted to effecting it, but also in terms of how long one could conceivably expect random passers-by to be willing to entertain these tests.

While there can be little doubt that conversational data would be desirable, given the lack of any contacts that might arrange it, and the lack of time to arrange linguistic interviews independently, the decision was made not to pursue conversational data for the present study. It must be noted, however, that even if conversational data could have been obtained, it is highly unlikely that the time frame of the study would have allowed for proper acoustic analysis of the data (See 3.3.1 below).

Ultimately, it was decided that the only feasible way to gather appropriate data would be through the solicitation of random passers-by. To this end a battery of three tests was designed to elicit tokens of the relevant variables. In addition it was decided to design the tests so that data could be gathered on the effect of the following consonant on each of the variables. This decision was made chiefly on the basis of Gordon's (2001) findings that a following consonant was particularly salient. It was decided that differentiation should be made between three places of articulation: labial, coronal, and dorsal, and between four manners of articulation: fricative, nasal, lateral, and plosives. It was decided that the whole procedure should take no more than three minutes.

The three tests were as follows:

To start off the subjects were asked to read a word list of twenty-two words. The words were each printed on a large laminated piece of paper and held up for the speaker. In order to facilitate the examination of any potential effect the following consonant might have on the variables, the words were especially chosen to this end. For each of the six variables one word was chosen that reflected each of the three examined places of articulation, and the four manners of articulation.

The words chosen were as follows:

STRUT:

- Labiodental fricative: BUFF
- Alveolar nasal: RUN
- Alveolar lateral: PULSE
- Velar Plosive: JUG

TRAP:

- Labiodental fricative: GAFF
- Alveolar nasal: ANT
- Alveolar lateral: SHALL
- Velar Plosive: BAG

DRESS:

- Labiodental fricative: THEFT
- Alveolar nasal: PEN
- Alveolar lateral: BELL
- Velar Plosive: EGG

KIT:

- Labiodental fricative: LIFT
- Alveolar nasal: SKIN
- Alveolar lateral: FILL
- Velar Plosive: SICK

THOUGHT:

- Alveolar fricative: SAUCE
- Velar Plosive: HAWK
- Labial Plosive: GAWP

LOT:

- Alveolar fricative: WASP
- Velar Plosive: COG
- Labial Plosive: STOP

For the variables THOUGHT and LOT no example with a following nasal or lateral could be identified except for the words already used in the second test.

The second test was a minimal pair test that was designed to test for the presence of the LBM in the speaker. The following minimal pairs were selected: *cot-caught*, *odd-awed*, *collar-caller*, *don-dawn*, and *pond-pawned*. Each word of each pair was printed on either side of a piece of paper, and were presented to the speaker one at a time. The subjects were not aware in advance which two words they were asked to compare. After both words of a pair had been read, the speaker was asked whether the two words sounded the same. A choice was offered between the same, different, and nearly the same. In this way both production and perception of the merger could be sampled.

The third, and final, test consisted of asking the speaker to read a prepared passage that was specifically written to elicit the relevant tokens in the relevant environments. To keep down the time it would take to read the text, it was decided best to produce a new reading passage for this purpose. The passage was as follows:

> *"**When** I was **young**, I **stocked** the **shelves** of a grocery store. **One dull** day, as I had just **finished** a **stack** of **cat** food **cans** – only **one dollar** each, a low **profit** item - I spied a lady **with** a **funny hat walking across** the aisle **ahead** of me. She suddenly **coughed** violently, and I turned too quickly and **knocked** the **cans** down over me. Some time **lapsed**, but eventually I came to. I was **stuck**. I **wiggled** around for a **bit**, and eventually I **managed** to **crawl** out of there. I had **bit** my **lip** and my **neck** hurt. A **small** crowd had **gathered**, and I **ran** the proverbial **gauntlet back** to the **stock** room. My **boss**, Mr. **Vaughan**, noticed I was bleeding from my **scalp**. He **called** for **Jeff** to **fetch** the first aid **kit**, and as he applied a **bandage** to my **head**, he **said**: "**Don**, you should be more careful. You could have been **killed**. Go home! I **think** you've had enough for today."*

The reading passage renders 50 relevant tokens. Eight tokens of DRESS, nine tokens of KIT, six tokens of LOT, six tokens of STRUT, nine tokens of THOUGHT, and twelve tokens of TRAP (the relevant tokens are given in bold). The discrepancies in number between the tokens sampled per variable is due to the fact that the tokens inadvertently added through passages in the text needed to maintain cohesion, and is not by inherent design.

3.2.3 Recording

The recordings were made using a *Zoom H2* digital recorder uncompressed at 44100Hz using an external *Olympus ME52W* microphone. Using a small clip-on microphone like this allowed for recordings to maintain a level of fidelity that would not otherwise have been possible in an outside environment.

3.3 Data Analysis

For the analysis of the data, the decision was made to eschew auditory analysis in favor of acoustic analysis. Chiefly this was done due to the greater level of fidelity afforded in the results, and partly for comparability with previous studies.

3.3.1 Acoustic Analysis

Sound is the phenomenon experienced when vibration in the air stimulates the ear drum, causing it to move, providing neural impulses in the brain that we interpret as sound (2012, Chapter 1.1). These vibrations may be recorded, and subsequently reproduced. Acoustic analysis involves the extraction of vowel formant data from such an audio recording, and is based on the findings that the first two vowel formants correspond to the impressionistic vowel triangle. The first formant value (F1) has a negative correlation with vowel height, and the second vowel formant has a positive correlation with vowel frontness (Johnson 2012, Chapter 6.1).

Acoustic analysis was performed using the *Praat* (Boersma and Weenink n.d.) computer software. This choice was made chiefly on the grounds that the software is free. On the basis of a spectrogram, the midpoint of each vowel token was identified, whereupon the F1, F2, and F3 formants were extracted using *Praat*'s built in algorithms. For tokens where the exact midpoint was unstable, an alternative stable point was sought. If no stable point could be located, the token was rejected. Each reading was confirmed visually against the spectrogram to ward against errors in the automatic detection.

The necessary filters for acoustic analysis (Kent and Read 2002, 63-64), including pre-emphasis filters and cut-off filters, are automatically applied by *Praat* using the *burg* algorithm (ppgb). Specific algorithm details are available in *Praat*'s user manual if additional details are of interest.

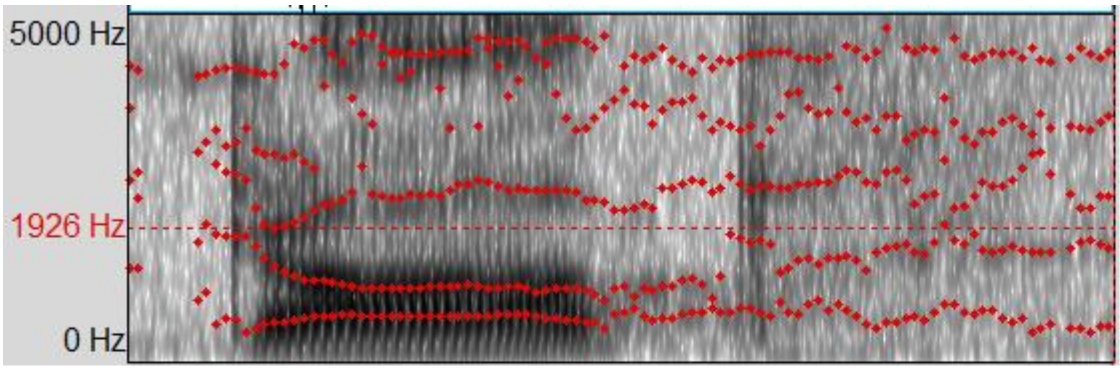


Figure 3.1: A spectrogram of the word *gawp* with formants represented by dots.

3.3.2 Vowel Normalization

A major issue with the acoustic analysis of audio data is that every speaker has different anatomical features. Their vocal tracts and oral cavities differ in size from one another, and as a result acoustic analysis will reveal differences in Hz values that must be attributed to anatomical features. Vowel formant normalization is a process that aims to eliminate the differences attributable to anatomical differences while retaining all other difference (Flynn, 1-2).

A multitude of approaches to vowel formant normalization have been proposed, each with their own proponents. A full exploration of the implementation of the various methods is far beyond the scope of this study, but a few things must be noted.

Adank et al. found that "[…]procedures using information across vowels performed better than procedures using only information within vowels and procedures using information within formants performed better than those using information across formants. (2004, 3106)"

NORM: The Vowel Normalization and Plotting Suite (Thomas and Kendall 2010) provides an internet service through which data may be subjected to all the major vowel formant normalization procedures automatically, and whereupon the data may be compared. Thomas and Kendall (2010) point out that the vowel extrinsic methods will skew the results unless all vowels are present. The present study only involves six vowels. A test was conducted among the available approaches which revealed significant skewing with most of the processes. The lack of the inclusion of upper vowels in the present study significantly shifted all the vowels upwards by about 150 Hz.

Labov et al.'s (2006) procedure was the only one that did not produce any shifting, so the ultimate choice of vowel normalization procedure was an easy one. This is the only vowel normalization procedure offered by *NORM* that is speaker extrinsic, that is, the vowel formants are corrected by a value computed from all speakers, instead of the vowels only being normalized in relation to other vowel instances by the same speaker. It does this by computing a G-value. As Thomas and Kendall (2010) point out, however, this G-value is subject to change until a floor of 345 subjects has been reached. A decision was therefore made to use the G-value from the TELSUR project.

3.3.3 Statistics

Statistical tests were employed to test the statistical significance of the findings of the study. A choice was made to employ nonparametric statistical tests to this end. While parametric tests offer better power-efficiency, they make basic assumptions about the data that do not hold true for the data collected for this study. Specifically, the data collected for this study do not meet the criterion that the standard deviations be equal between groups (Siegel and Castellan 1988, 20). F-tests conducted revealed significant differences in standard deviation between most groups. As Siegel and Castellan (1988, 34) point out, studies in the behavioral sciences rarely meet the criteria for parametric tests.

Two different types of group comparisons were needed for the present study, comparisons between two groups, and comparisons between three or more groups, for which different statistical tests were needed.

For comparisons between two groups (word list vs. reading passage, over vs. under 40) the Mann-Whitney test for independent samples was employed. This test is the nonparametric alternative to the t-test (Siegel and Castellan 1988, 128-129).

For comparisons between three or more groups (place and manner of articulation) the Kruskal-Wallis one-way analysis of variance by ranks was employed. This is a nonparametric equivalent to the one-way Anova (Graphpad Software, Inc.). A subsequent Dunn's multiple comparisons test was performed to ascertain significant differences between the groups.

A proper explanation of the formulae involved in these statistical tests is beyond the scope of this study. All statistical tests reported were conducted in *Graphpad Prism* (Graphpad Software, Inc.), a piece of computer software distributed by *Graphpad Software Inc*, incorporating all of the aforementioned statistical tests.

4. DATA PRESENTATION

In the present chapter the data gathered will be presented, however, the discussion and interpretation of said data will be conducted in chapter 5. This has been done in order to hopefully allow for a less cluttered discussion.

4.1 The DRESS variable /ɛ/

The DRESS variable constitutes Labov's proposed fourth step in the NCS. For the DRESS variable, then, one would expect an instance affected by the NCS to be backed, lowered, or a combination of the two. It constitutes the second chain involved in the shift, and is not motivated by the shifting of any other variable. In addition to these two expected trajectories, one speaker was variably affected by the PIN-PEN merger.

The mean result across all speakers is given below in figure 4.1, and it clearly shows that the DRESS vowel is affected by the NCS. It is both significantly backed and lowered. In fact, it's mean realization is equal to Peterson & Barney's result for the TRAP vowel.

4.1.1 Differences between word list and reading passage

The mean F1 and F2 values from the word list and the reading passage are represented below, along with the mean values from Peterson & Barney (1952) and Hillenbrand et.al's (1995) studies, in figure 4.2. A difference in means of 13,8 on the F1 scale, and 143 on the F2 scale is observed. A Mann-Whitney test reveals the differences between F1 values to non-significant at P=0,4772. A second Mann-Whitney test reveals the differences between F2 values to be highly significant at P=0,0005.

These data make it abundantly clear that there are significant differences for this variable between words being read from a list, and words uttered embedded in sentences. Although the heights are, for all intents and purposes, the same, the instances from the text are significantly backed in relation to the instances from the word list. There may be several reasons for this. Speakers may have been more actively monitoring their speech while reading the word list than while reading the text. Another potential factor is speed. The instances gathered from readings of the text were read at higher speeds than words from the word list. Given more time, an examination of any potential correlation between length of utterance and backing of the variable, would be interesting. For the purposes of the current study, it shall have to suffice to note that there is a significant difference, and the mean values from the word list more closely resemble the means from previous studies than do the values from the text.

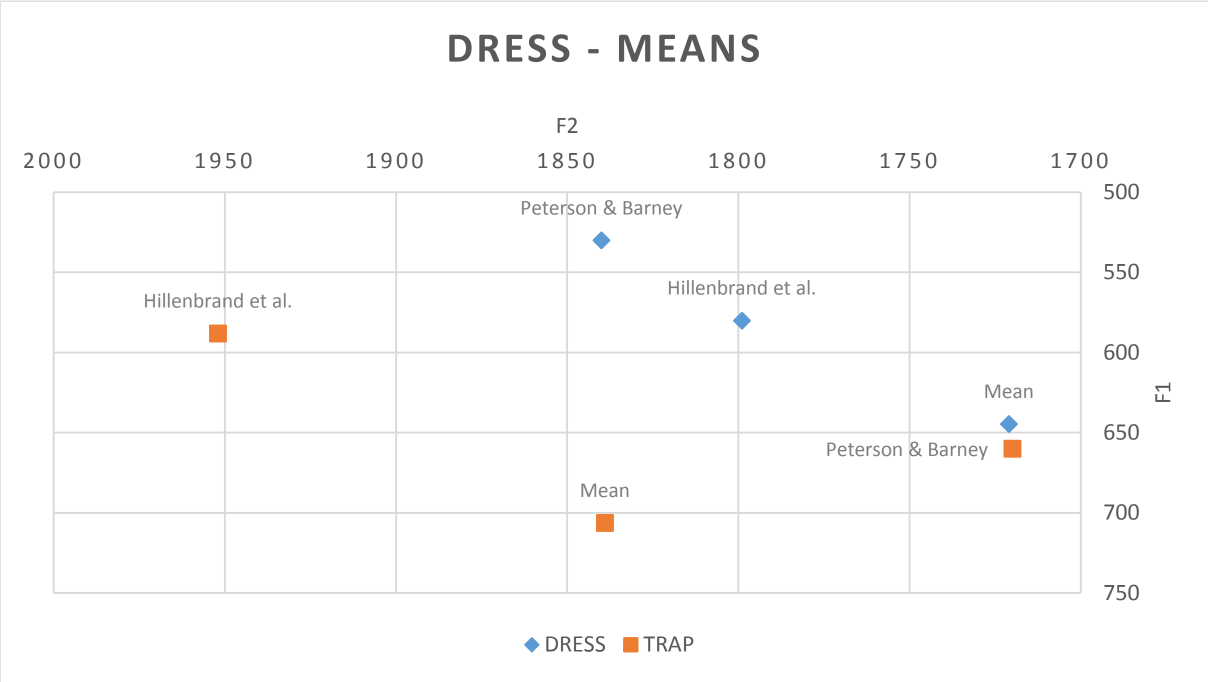


Figure 4.1: Group mean across all speakers for the DRESS variable. TRAP values are given for comparison.

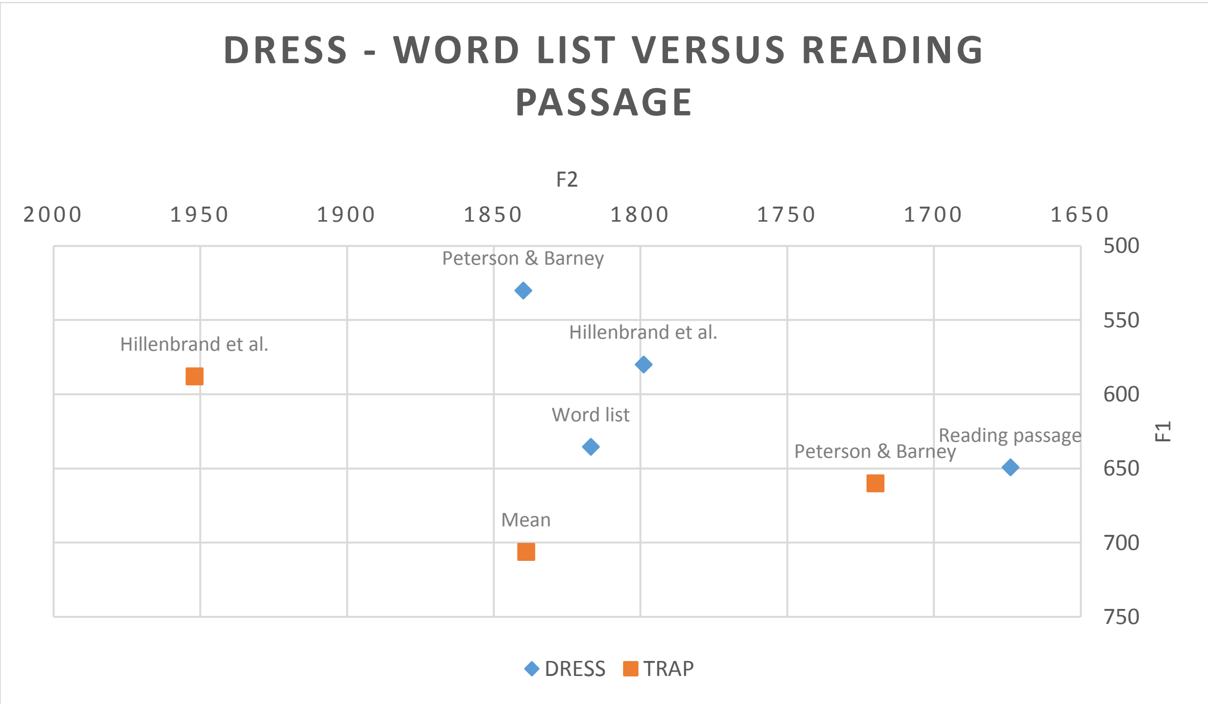


Figure 4.2: Group means across all speakers for the word list and reading passage data for the DRESS variable. TRAP values are given for comparison.

4.1.2 The effects of age

If one were to assume a change to be in progress, one would expect to find a difference between age groups. The mean values from the previously established Over 40 and Under 40 age groups are given below in Figure 4.3.

As can be observed, while both age groups are backed and lowered compared to standardized results from previous studies, the age groups do not differ significantly from one another on either scale. The Mann-Whitney tests show a significance of P=0,4316 and P=0,353 for differences in F1 and F2 values respectively.

These data suggest that the backing and lowering of this variable is not a change in progress, but rather a change that has already taken place, insofar that the sample could be considered representable.

4.1.3 The effect of place of articulation

For place of articulation a differentiation was made between labial, coronal, and dorsal. The average means are presented below in figure 4.4.

Two Kruskal-Wallis tests were conducted on the groups of F1 and F2 values, respectively, to establish the significance of the differences. The P-values are P=0,5969 and P=< 0,0001 for F1 and F2, respectively. The results of the Dunn's multiple comparisons tests are presented below in table 4.1.

These data strongly suggest that the following consonant conditions the variable. As can be observed, a following dorsal produces a vowel that is significantly different from the vowel that is produced with a following labial and coronal on the F2 scale. In other words, following labials and coronals are environments that favor backing of the vowel. The results on the F1 scale show that there are no significant differences in vowel height that may be derived from place of articulation.

4.1.4 The effect of manner of articulation

For the analysis of the effect of manner of articulation on the variable distinctions were made between fricatives, nasals, laterals, and plosives. The mean values are presented below in figure 4.5.

The two Kruskal-Wallis tests conducted on the F1 and F2 values reveal significances of P= 0,0613 and P= 0,0001 respectively. In other words, the differences in height between the groups come close, but ultimately fall just short of significance, while the difference in F2 values is highly significant. The results of the Dunn's multiple comparison tests of the results are presented below in table 4.2.

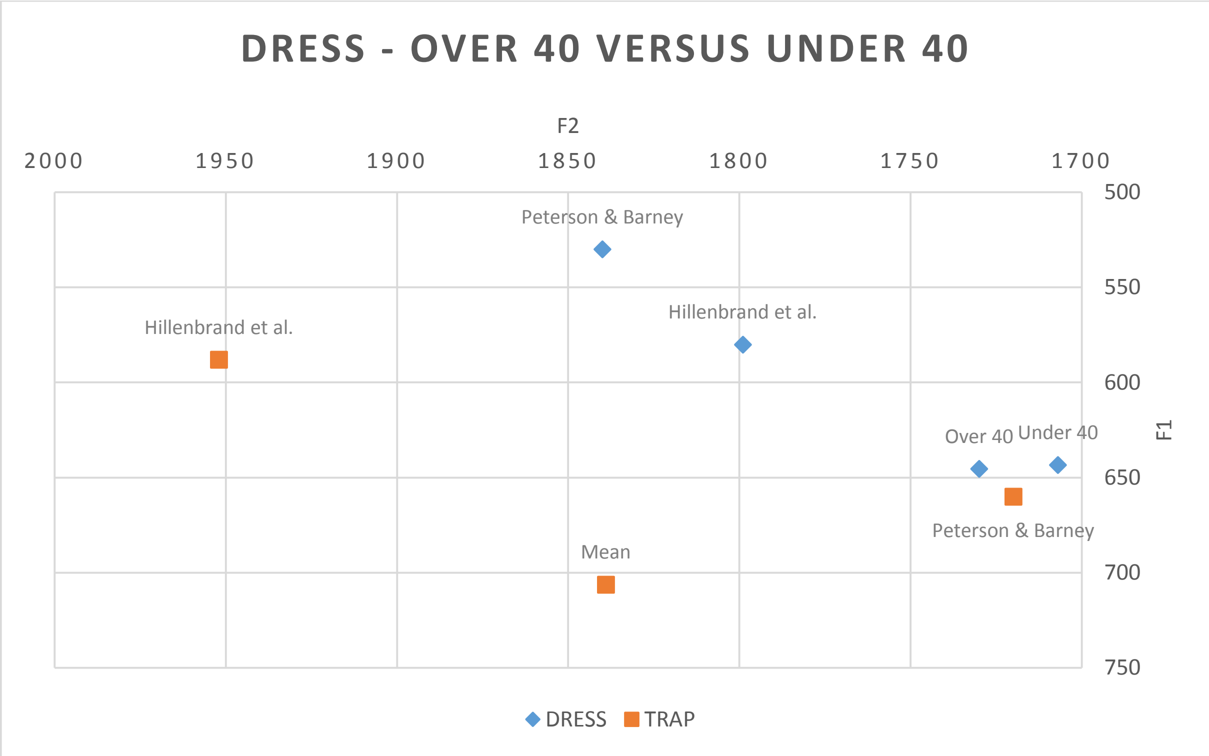


Figure 4.3: Group means across all speakers for both age groups for the DRESS variable. TRAP values are given for comparison.

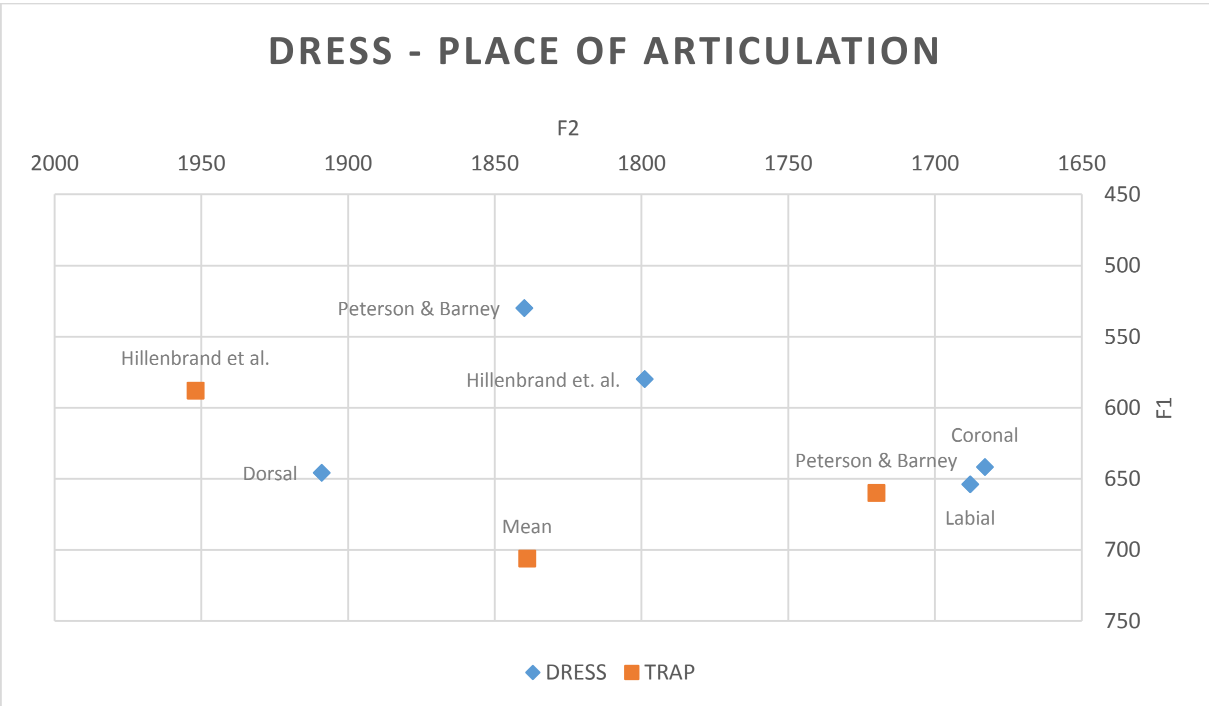


Figure 4.4: Group means across all speakers for places of articulation for the DRESS variable. TRAP values are given for comparison.

Table 4.1: The results of the Dunn's multiple comparisons tests for place of articulation for the DRESS variable.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	9,165	No	ns	0,9445
Labial vs. Dorsal	6,023	No	ns	> 0,9999
Coronal vs. Dorsal	-3,142	No	ns	> 0,9999
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	-3,369	No	ns	> 0,9999
Labial vs. Dorsal	-48,43	Yes	****	< 0,0001
Coronal vs. Dorsal	-45,06	Yes	****	< 0,0001

Table 4.2: The results of the Dunn's multiple comparisons tests for manner of articulation for the DRESS variable.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	-9,977	No	ns	> 0,9999
Fricative vs. Lateral	12,91	No	ns	> 0,9999
Fricative vs. Plosive	13,25	No	ns	0,9567
Nasal vs. Lateral	22,89	No	ns	0,2835
Nasal vs. Plosive	23,23	No	ns	0,082
Lateral vs. Plosive	0,3409	No	ns	> 0,9999
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	-9,318	No	ns	> 0,9999
Fricative vs. Lateral	17,36	No	ns	0,7934
Fricative vs. Plosive	-23,32	No	ns	0,0798
Nasal vs. Lateral	26,68	No	ns	0,1244
Nasal vs. Plosive	-14	No	ns	0,8228
Lateral vs. Plosive	-40,68	Yes	****	< 0,0001

These data reveal that the only significant difference is between the F2 values of instances of the variable followed by a lateral and the F2 values of instances followed by a plosive. However, on the F1 scale, the difference between instances followed by a nasal and instances followed by a plosive comes very close to being significant.

These data seem to suggest that instances of the variable followed by a lateral are especially susceptible to backing.

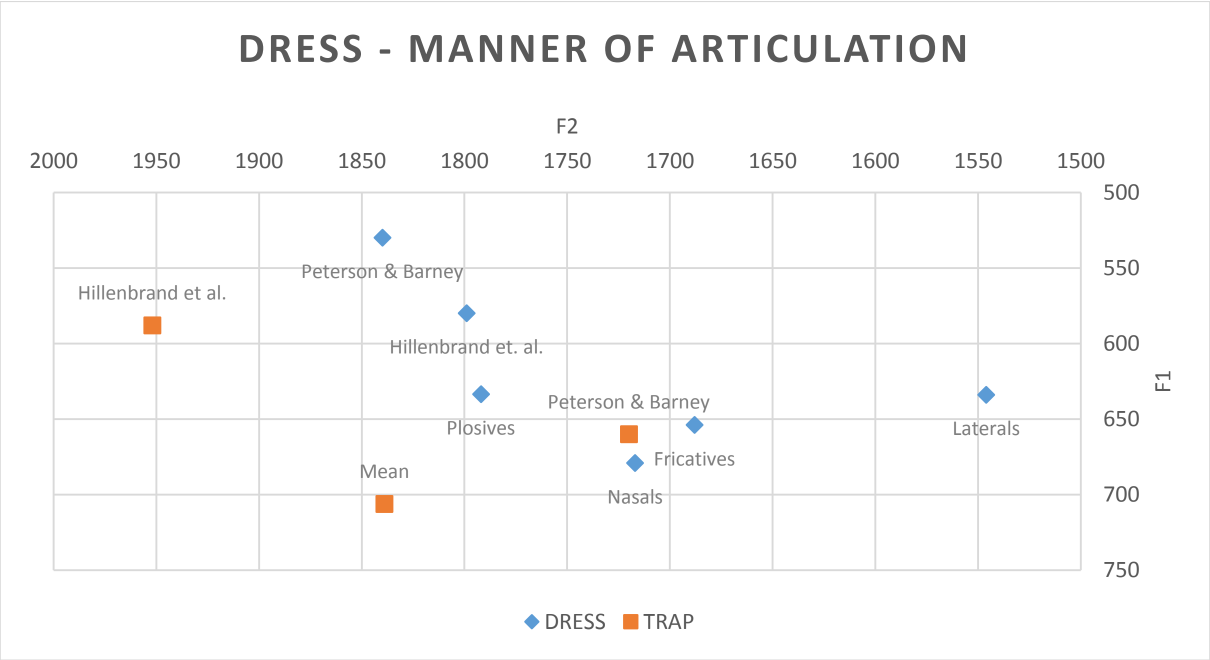


Figure 4.5: Group mean results across all speakers for manner of articulation for the DRESS variable. Values for the TRAP variable are given for comparison.

4.2 The KIT variable /ɪ/

The KIT variable is the sixth step in the NCS according to Labov. It is an independent shift not related to the shifting of any of the other variables. An instance of the KIT variable affected by the NCS is expected to be lowered, backed, or a combination of the two. Figure 4.6 below shows the average means for the KIT variable across all the speakers in the study.

The mean value across all speakers for the KIT variable clearly shows that it is affected by the NCS. It is not only significantly lowered, but also significantly backed, and as a result occupies the same vowel space as the expected standard values for the DRESS variable. Distinction between the two variables is, however, still maintained by the collective group of speakers.

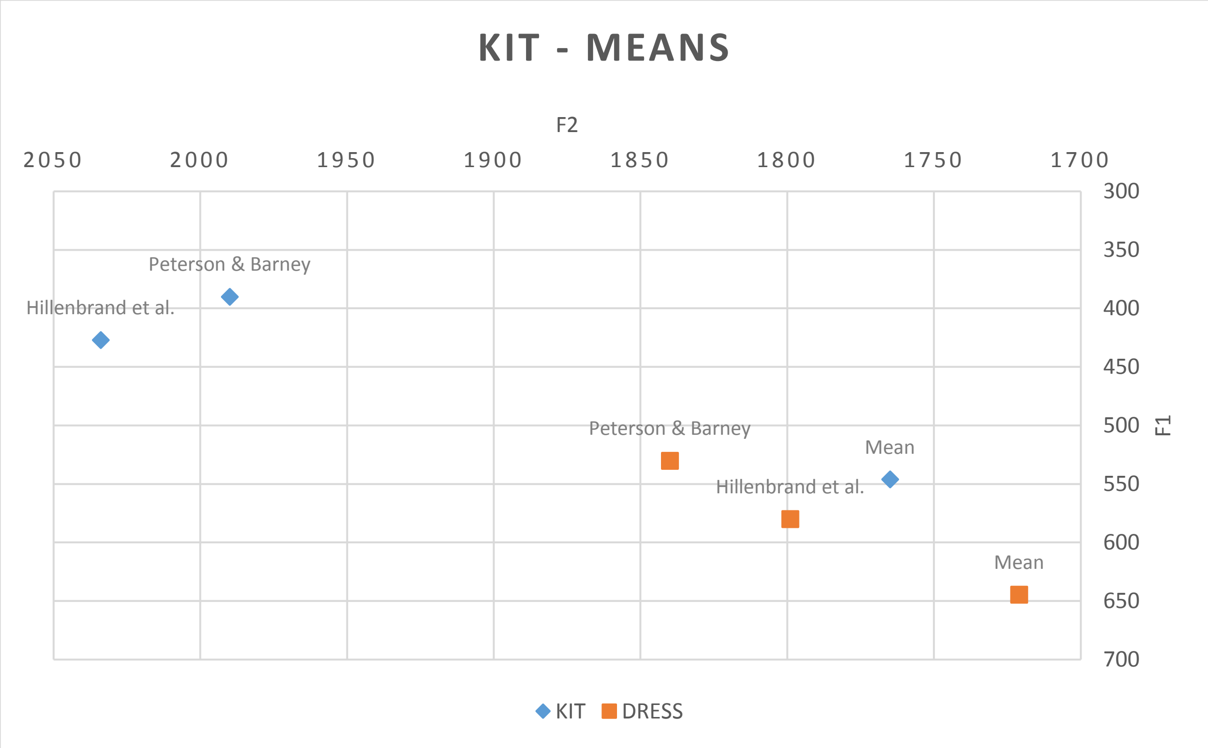


Figure 4.6: Group mean values across all speakers for the KIT variable. Values for the DRESS variable given for comparison.

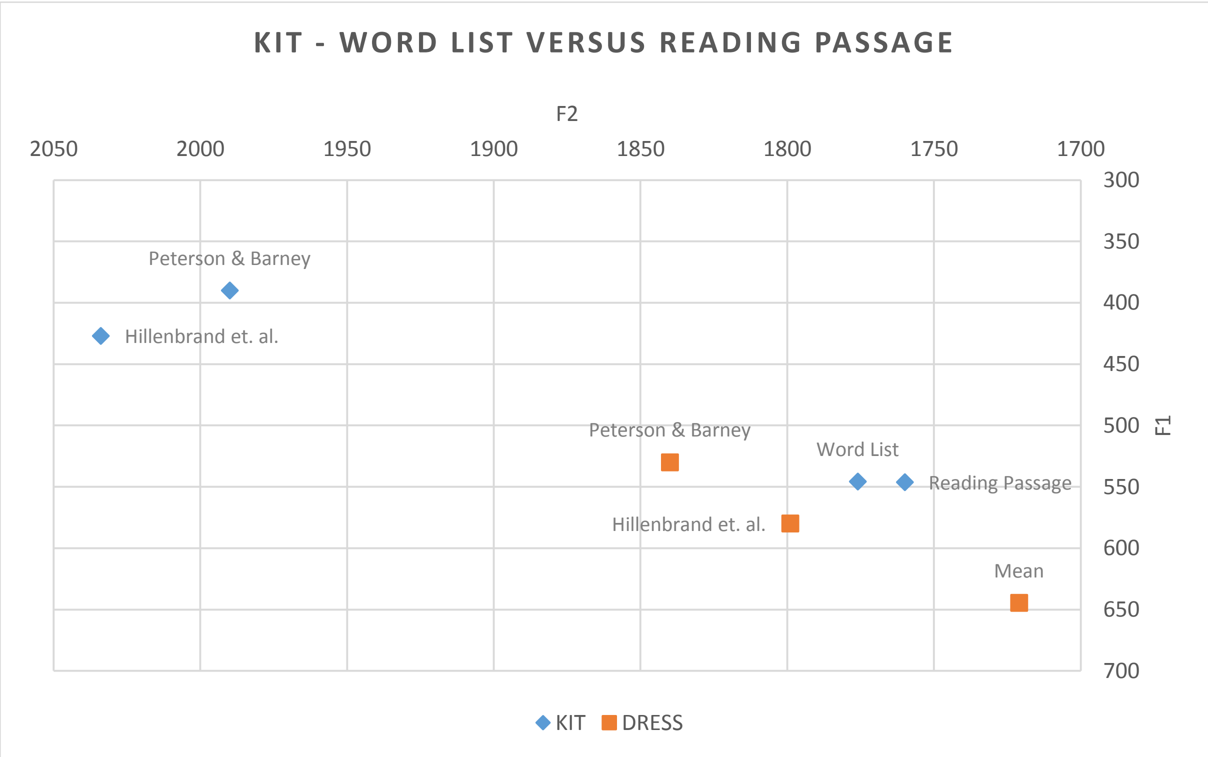


Figure 4.7: Group mean values across all speakers for the word list and reading passage data for the KIT variable. Values for the DRESS variable given for comparison.

4.2.1 Differences between word list and reading passage

The mean value across all speakers for the reading passage and the word list are given above in figure 4.7.

As can be seen, unlike the DRESS variable, the results clearly show that for the KIT variable there is only an insignificant variation between the tokens rendered from reading the word list, and tokens rendered from reading complete sentences in the reading passage. A Mann-Whitney test reveals no significance, with P-values of P=0.9470 and P=0.9611 for the F1 and F2 values, respectively.

4.2.2 The effects of age

Like the DRESS variable, the KIT variable shows no sign of significant changes having taken place between the age groups.

The results are fairly close in both height and frontness. A Mann-Whitney test reveals no statistical significance, with P-values of P=0.1459 and P=0.4860 for the F1 and F2 ranges. While far wide of statistical significance, one could perhaps argue that a P-value as low as P=0.1459 could be seen as a potential tendency. In this case, however, it must be noted that the actual difference between the two groups on the F1 scale is a mere 10 Hz, which is far less than the expected intra-speaker variation, and must as such be seen a fully random result. The results are given below in figure 4.8.

4.2.3 The effects of place of articulation

The data collected for the KIT variable suggest that place of articulation is a relevant factor for this variable.

As can be seem from figure 4.9 below, there is a clear distinction between tokens followed by coronals and dorsals, and tokens followed by labials. Kruskal-Wallis tests reveal P-values of P=0.0885 for the F1 range, and P=0.0404 for the F2 range. In other words, the difference in frontness is statistically significant, while the difference in height is not.

The results of the Dunn’s multiple comparisons tests are given below in table 4.3. They reveal a statistical significance between tokens followed by coronals and tokens followed by a labial in the F2 range.

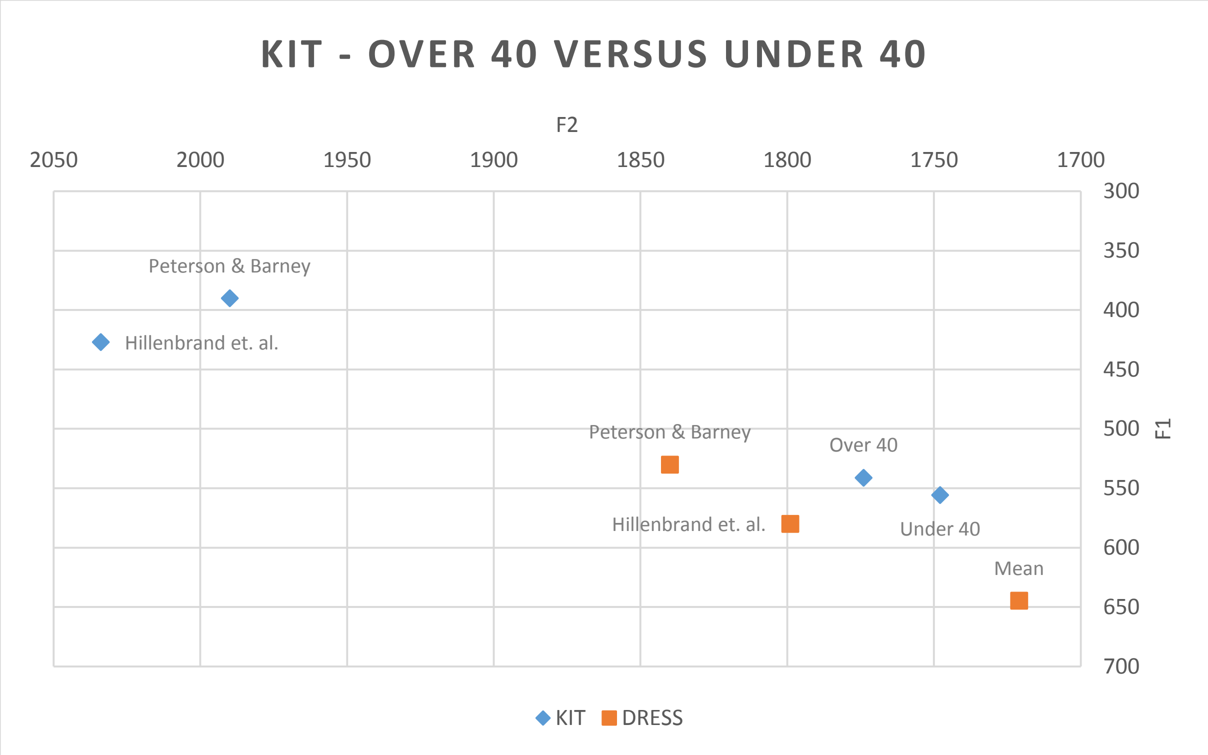


Figure 4.8: Group mean values across all speakers for the age groups for the KIT variable. Values for the DRESS variable are given for comparison.

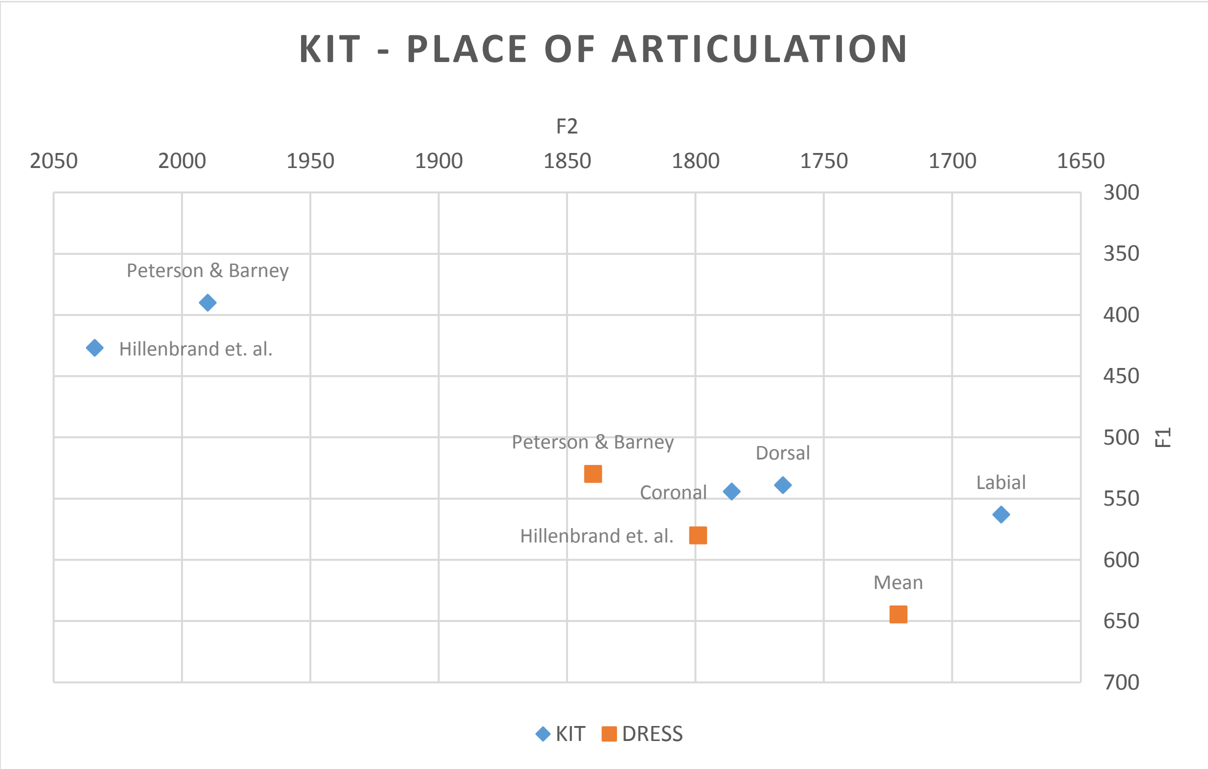


Figure 4.9: Group mean values across all speakers for place of articulation for the KIT variable. Values for the KIT variable are given for comparison.

Table 4.3: The results of the Dunn's multiple comparisons test for place of articulation.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	18,72	No	ns	0,1568
Labial vs. Dorsal	23,18	No	ns	0,1096
Coronal vs. Dorsal	4,459	No	ns	> 0,9999
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	-24,43	Yes	*	0,034
Labial vs. Dorsal	-19,56	No	ns	0,233
Coronal vs. Dorsal	4,872	No	ns	> 0,9999

Table 4.4: The results of the Dunn's multiple comparisons tests for manner of articulation.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	-22,76	No	ns	0,2655
Fricative vs. Lateral	11,29	No	ns	> 0,9999
Fricative vs. Plosive	-23,4	No	ns	0,1239
Nasal vs. Lateral	34,04	Yes	*	0,0157
Nasal vs. Plosive	-0,6418	No	ns	> 0,9999
Lateral vs. Plosive	-34,68	Yes	**	0,0036
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	-52,73	Yes	****	< 0,0001
Fricative vs. Lateral	-36,93	Yes	*	0,0179
Fricative vs. Plosive	-27,59	Yes	*	0,0382
Nasal vs. Lateral	15,8	No	ns	0,9747
Nasal vs. Plosive	25,14	Yes	*	0,0231
Lateral vs. Plosive	9,34	No	ns	> 0,9999

4.2.4 The effects of manner of articulation

The results given in figure 4.10 below clearly show that manner of articulation is highly salient for the pronunciation of the KIT variable.

Differences are observable in both F1 and F2 values. Tokens followed by nasals and tokens followed by plosives occupy the same height, while tokens followed by laterals and tokens followed by fricatives occupy a separate higher space. Moreover, there are clear differences in frontness; tokens followed by laterals and tokens followed by plosives occupy a middle-ground of sorts, while tokens followed by nasals are significantly fronted, and tokens followed by fricatives significantly backed in comparison.

The Kruskal-Wallis tests reveal statistical significance in both the F1 and the F2 range, with P-values of $P=0.0012$ and $P<0.0001$ respectively. In other words, the differences in height and frontness between the four groups are highly significant.
The results of the Dunn's multiple comparisons tests are given above in table 4.4, and reveal statistically significant differences between several of the groups.

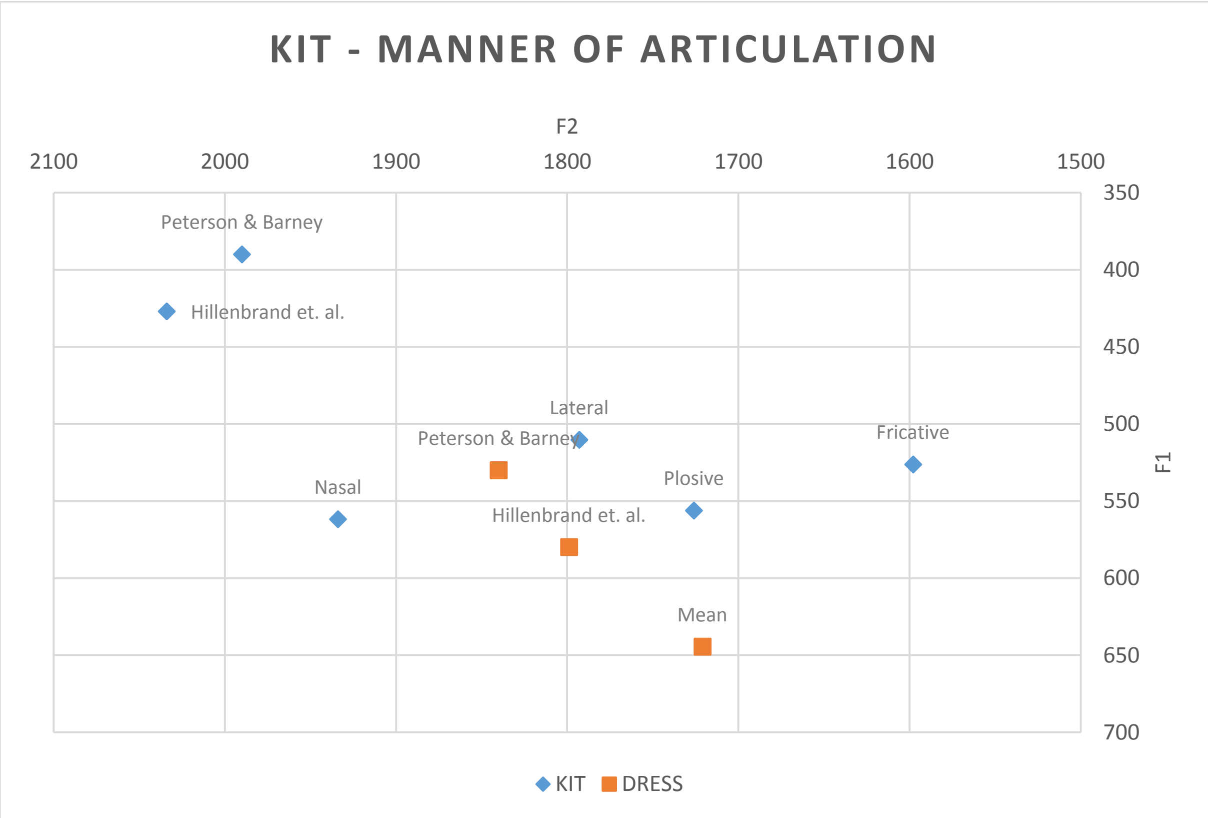


Figure 4.10: Group mean values across all speakers for manner of articulation for the KIT variable. Values for the DRESS variable given for comparison.

4.3 The variable STRUT /ʌ/

The STRUT variable constitutes the fifth step of the NCS according to Labov. A STRUT token affected by the NCS is expected to be backed, and potentially lowered into something resembling the vowel of THOUGHT, acting upon the previous backing of the DRESS variable.

The mean value for the STRUT variable is given below in figure 4.11. As can be seen, the findings do not accord with what one would expect were the variable to be affected by the NCS. There is no indication of backing whatsoever, not only is it not backed, it is in fact fronted in comparison with the expected values, albeit not by enough to rule out coincidence.

4.3.1 Word list versus reading passage

As with the KIT variable, the STRUT variable does not seem to be greatly affected by whether the tokens were produced in isolated words or in complete sentences. The difference between the two groups is well within the deviation one would expect to find within the groups. A Mann-Whitney test reveals no significance in the F1 nor the F2 range, with P-values of P=0.7847 and P=0.8602 respectively. Results are given in figure 4.12 below.

4.3.2 The effects of age

As with both the DRESS and the KIT variable, STRUT also shows no sign of being affected by age. The results for both age groups are virtually the same. A Mann-Whitney test shows no significance with P-values of P=0.1254 and P=0.5525 for F1 and F2 values respectively. Again one must point out that although the P-value for the F1 range could be seen as an indication, the actual difference in Hz involved is too small to read anything into it. Results are given in figure 4.13 below.

4.3.3 The effects of place of articulation

The results presented below in figure 4.14 suggest that place of articulation is a salient feature in determining the pronunciation of the STRUT variable. The data clearly show that the tokens followed by coronals occupy the expected vowel space, with the tokens followed by labials and dorsals in various fronted states. The Kruskal-Wallis tests reveal statistical significance in both vowel height and frontness, with P-values of P=0.0470 and P<0.0001 for the F1 and F2 ranges respectively. The results of the Dunn's multiple comparisons tests are given below in table 4.5 and show that while there is statistical significance overall in the F1 range, there are no statistically significant differences between any two of the three groups. Moreover, it shows, as expected that there is extremely high significance between the dorsal and coronal groups in the F2 range.

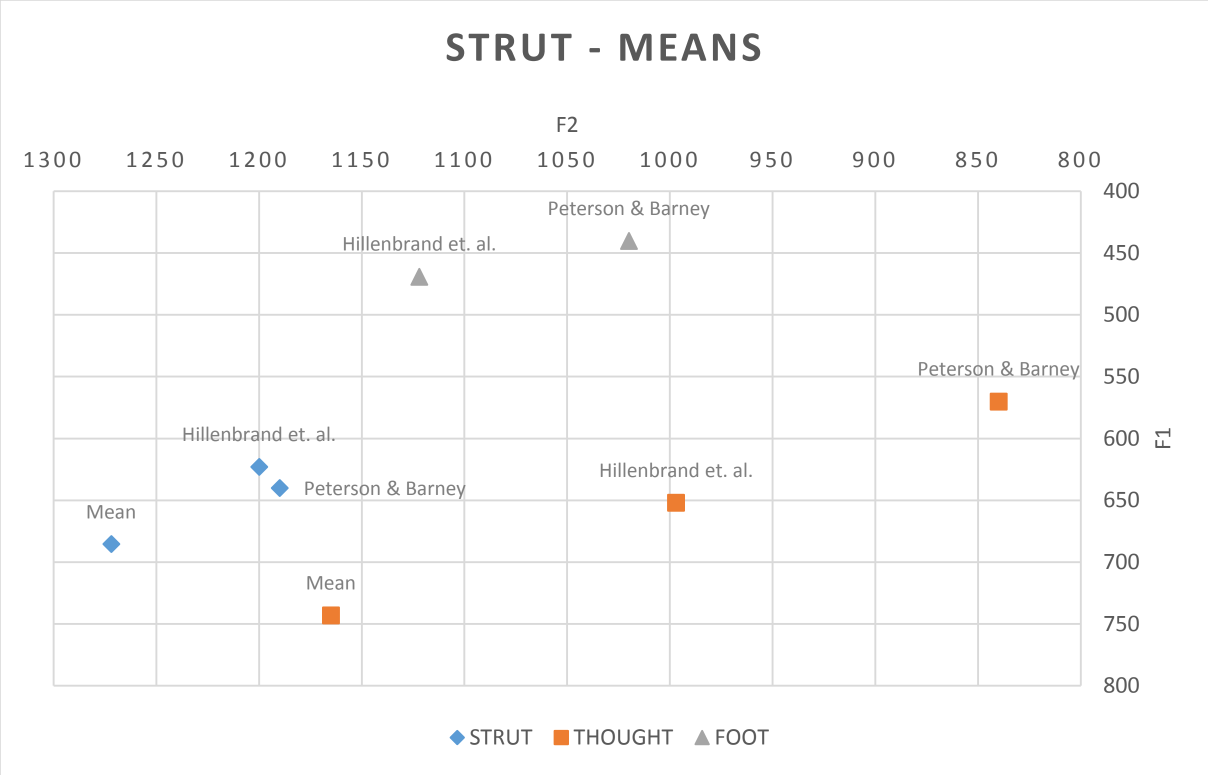


Figure 4.11: Group mean values across all speakers for the STRUT variable. Values for THOUGHT and FOOT are given for comparison.

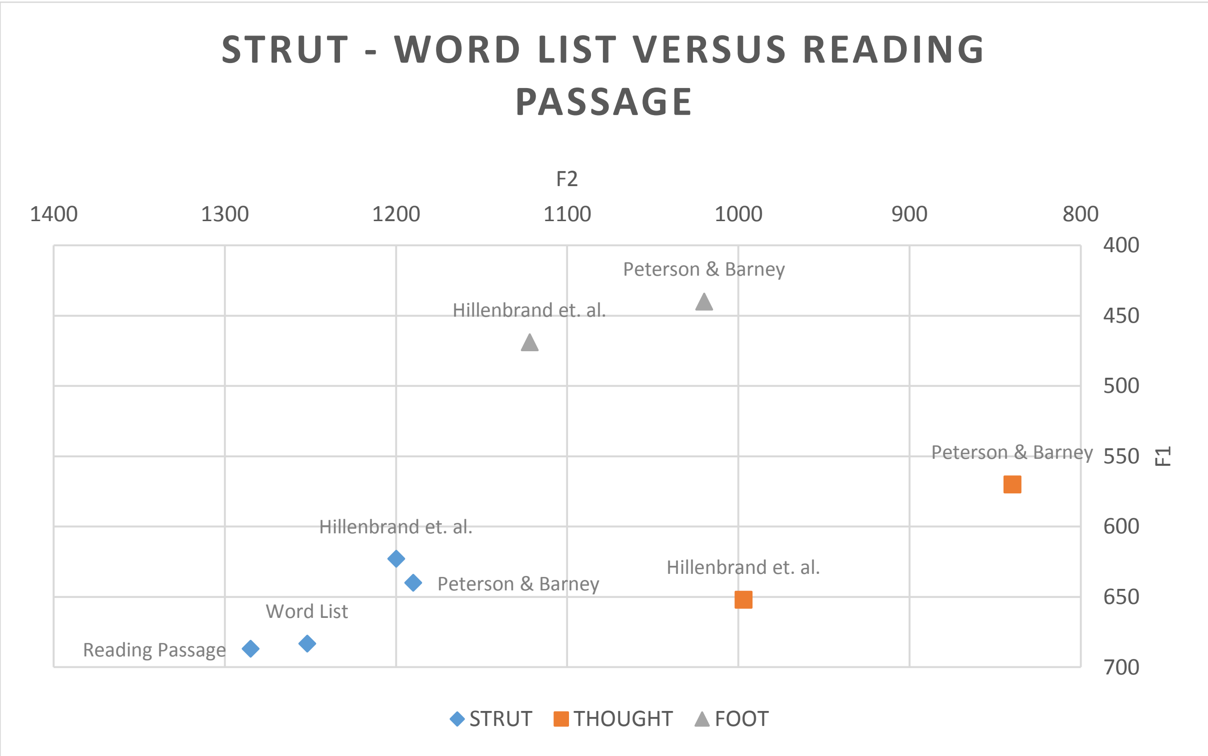


Figure 4.12: Group mean values across all speakers for the word list and reading passage data for the STRUT variable. Values for THOUGHT and FOOT are given for comparison.

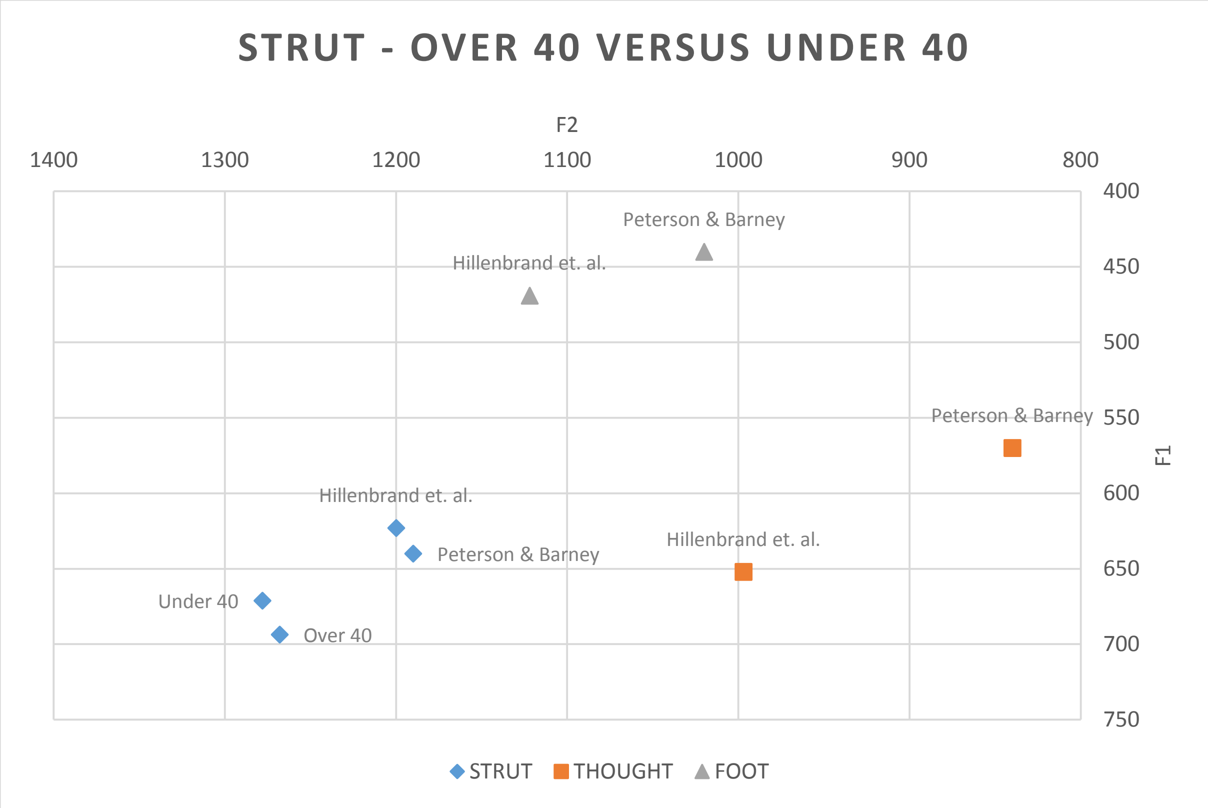


Figure 4.13: Group mean values across all speakers for the age groups for the STRUT variable. Values for THOUGHT and FOOT are given for comparison.

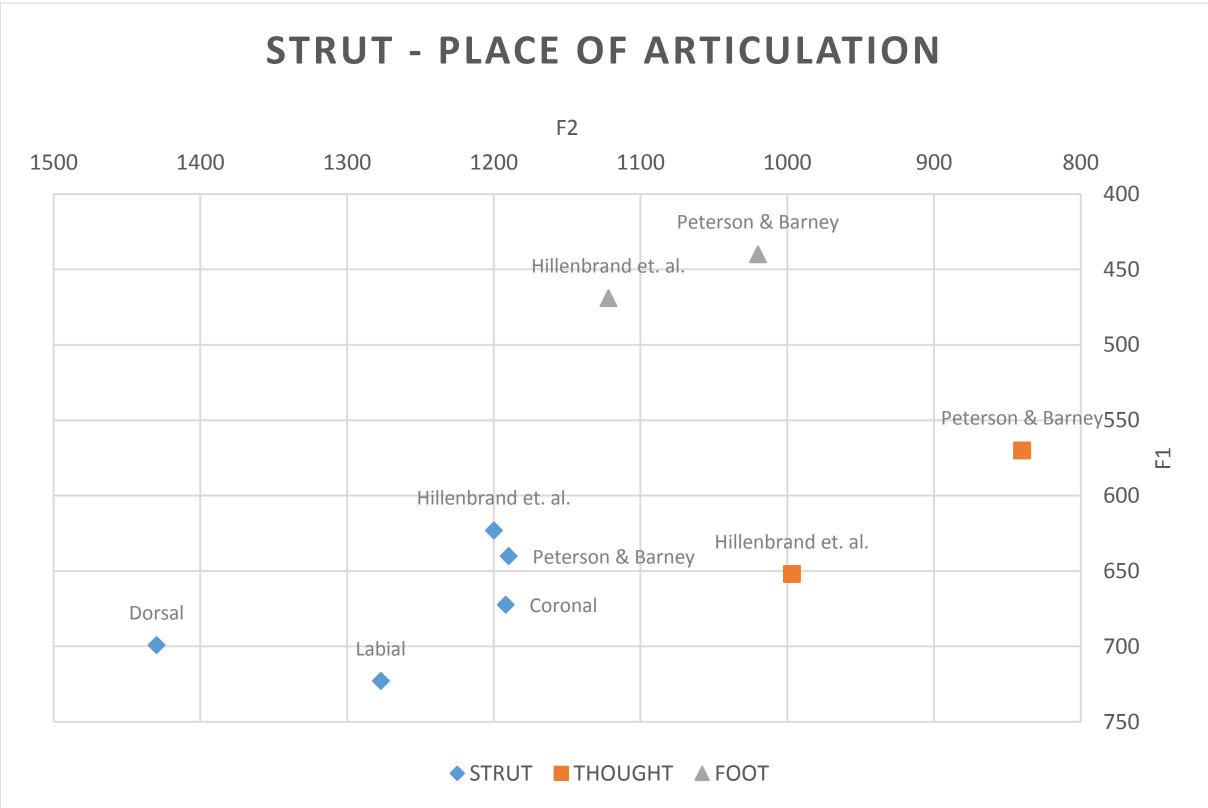


Figure 4.14: Group mean values across all speakers for place of articulation for the STRUT variable. Values for THOUGHT and FOOT are given for comparison.

Table 4.5: The results of the Dunn's multiple comparisons tests for place of articulation.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	23,48	No	ns	0,0715
Labial vs. Dorsal	13,48	No	ns	0,6741
Coronal vs. Dorsal	-10	No	ns	0,4245
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	10,23	No	ns	0,9748
Labial vs. Dorsal	-27,88	Yes	*	0,0363
Coronal vs. Dorsal	-38,11	Yes	****	< 0,0001

Table 4.6: The results of the Dunn's multiple comparison's tests for manner of articulation.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	10,87	No	ns	> 0,9999
Fricative vs. Plosive	14,95	No	ns	> 0,9999
Fricative vs. Lateral	48,55	Yes	***	0,0002
Nasal vs. Plosive	4,082	No	ns	> 0,9999
Nasal vs. Lateral	37,67	Yes	****	< 0,0001
Plosive vs. Lateral	33,59	Yes	**	0,0029
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	-8,073	No	ns	> 0,9999
Fricative vs. Plosive	-26,32	No	ns	0,153
Fricative vs. Lateral	35,36	Yes	*	0,0162
Nasal vs. Plosive	-18,25	No	ns	0,1404
Nasal vs. Lateral	43,44	Yes	****	< 0,0001
Plosive vs. Lateral	61,68	Yes	****	< 0,0001

4.3.4 The effects of manner of articulation

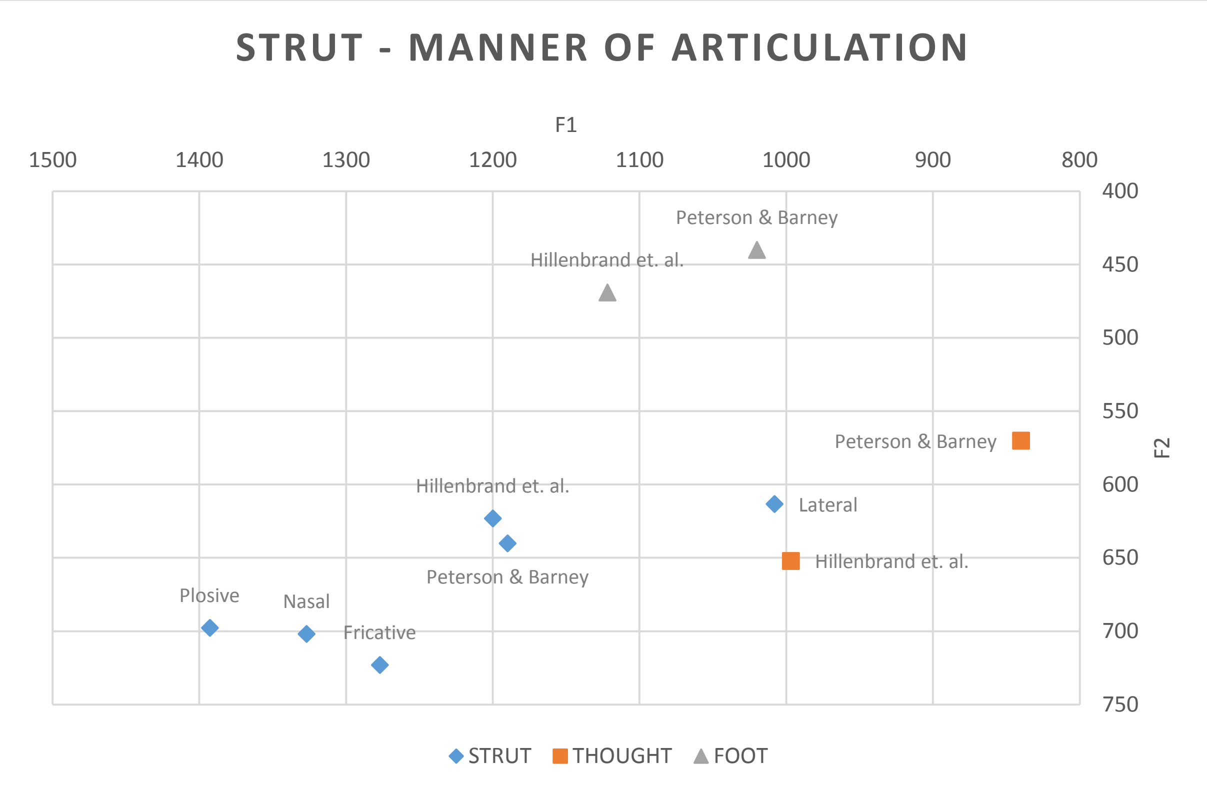


Figure 4.15: Group mean values across all speakers for manner of articulation for the STRUT variable. Values for THOUGHT and FOOT are given for comparison.

Figure 4.15 above shows the distribution of the STRUT variable by manner of articulation. It shows that manner of articulation is highly salient for the realization of the STRUT variable. In particular, a vast difference may be observed between the tokens followed by laterals and all other tokens.

The Kruskal-Wallis tests show high statistical significance in both the F1 and F2 ranges with a P-value of P<0.0001 for both ranges. The results from the Dunn's multiple comparisons tests are given above in table 4.6 and show that in addition to the overall statistical significance between the groups, statistically significant differences exist between a number of them in both the F1 and F2 ranges.

4.4 The variable TRAP /æ/

The TRAP variable constitutes the first step on the NCS according to Labov. A TRAP token affected by the NCS is expected to be raised and potentially fronted, rendering a realization closer to what one would expect of DRESS, or potentially as high as KIT.

The mean value for the TRAP variable across all speakers is given below in figure 4.16. The results show that the TRAP variable in the present study does not conform to the expectations of the NCS. There is certainly no indication whatsoever of any raising. There is, however, some indication of fronting. At this point the massive discrepancy between Hillenbrand et al.'s study and Peterson and Barney's study in regards to the TRAP variable is particularly salient. The assumption inherent in the NCS is that in standard speech, DRESS would be further fronted than TRAP, thus the expectation that TRAP be fronted as well as raised to realize as DRESS. Peterson and Barney's data support this notion. It is beyond the present author how Hillenbrand et al. could get results with such a fronted TRAP value.

As can be seen, the TRAP variable in the present study is fronted in comparison with the DRESS variable, and this would seem to indicate that while it is not raised, it has been fronted.

4.4.1 Word list versus reading passage

The mean values for the word list and the reading passage for the TRAP variable are given below in figure 4.17. As with every variable except DRESS, STRUT shows no sign of being affected one way or the other from being realized in separate words or in complete sentences. The differences are well within the intra-group standard deviations, and the Mann-Whitney tests show no statistical significance with P-values of P=0.5880 and P=0.5357 for the F1 and F2 ranges respectively.

4.4.2 The effects of age

In common with all the variables surveyed in the present study, TRAP shows no sign of being affected by age. The data is presented below in figure 4.18, and show that the two age groups produced virtually identical results. A Mann-Whitney test revealed no statistical significance with P-values of P=0.1825 and P=0.9510 for the F1 and F2 ranges respectively.

4.4.3 The effects of place of articulation

The mean values for the three surveyed places of articulation for the TRAP variable clearly show that place of articulation is salient in the realization of the variable. Specifically, there is a distinct difference between the tokens with a following coronal and the other groups. It is pretty clear from the chart presented below in figure 4.19 that the tokens followed by coronals make up all of the fronting observable in the collated data.

The Kruskal-Wallis tests confirm statistical significance in both the F1 and F2 ranges with P-values of P<0.0001 and P=0.0005 respectively. The results of the Dunn's multiple comparisons tests are given below in table 4.7 and reveal statistical significance between several of the groups.

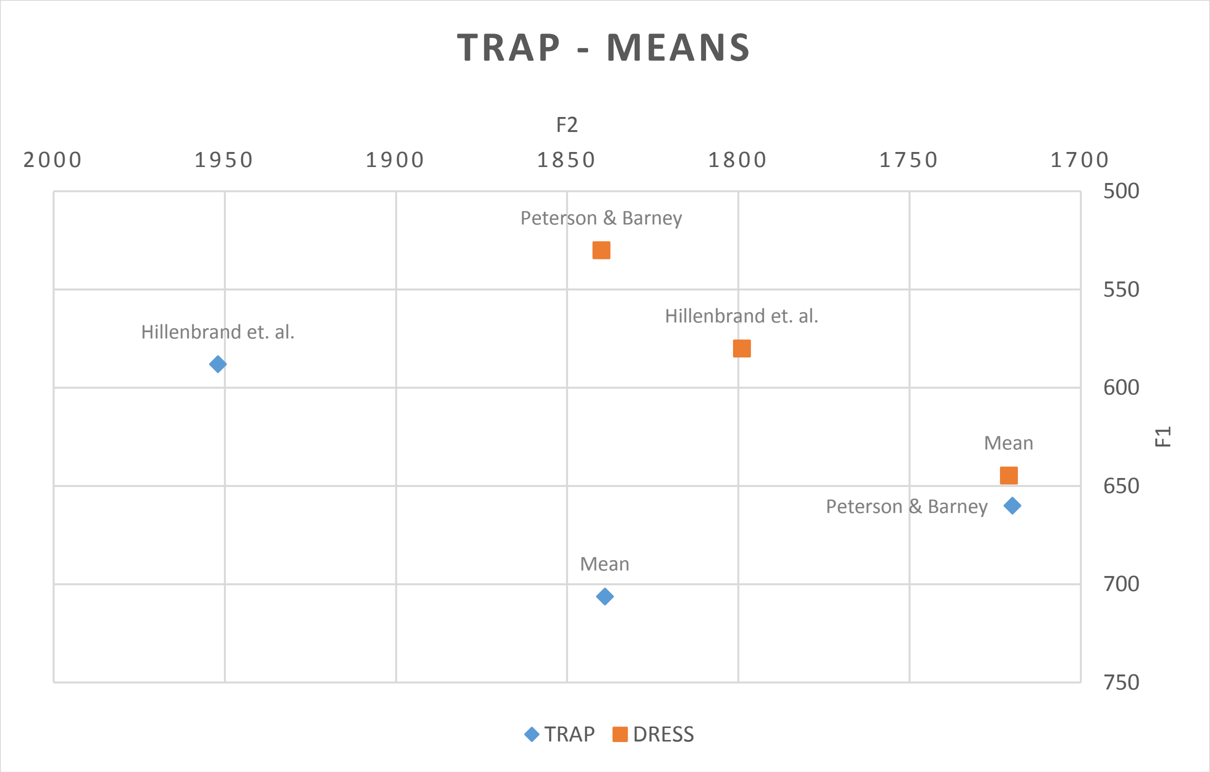


Figure 4.16: The mean value across all speakers for the TRAP variable. Values for the DRESS variable are given for comparison.

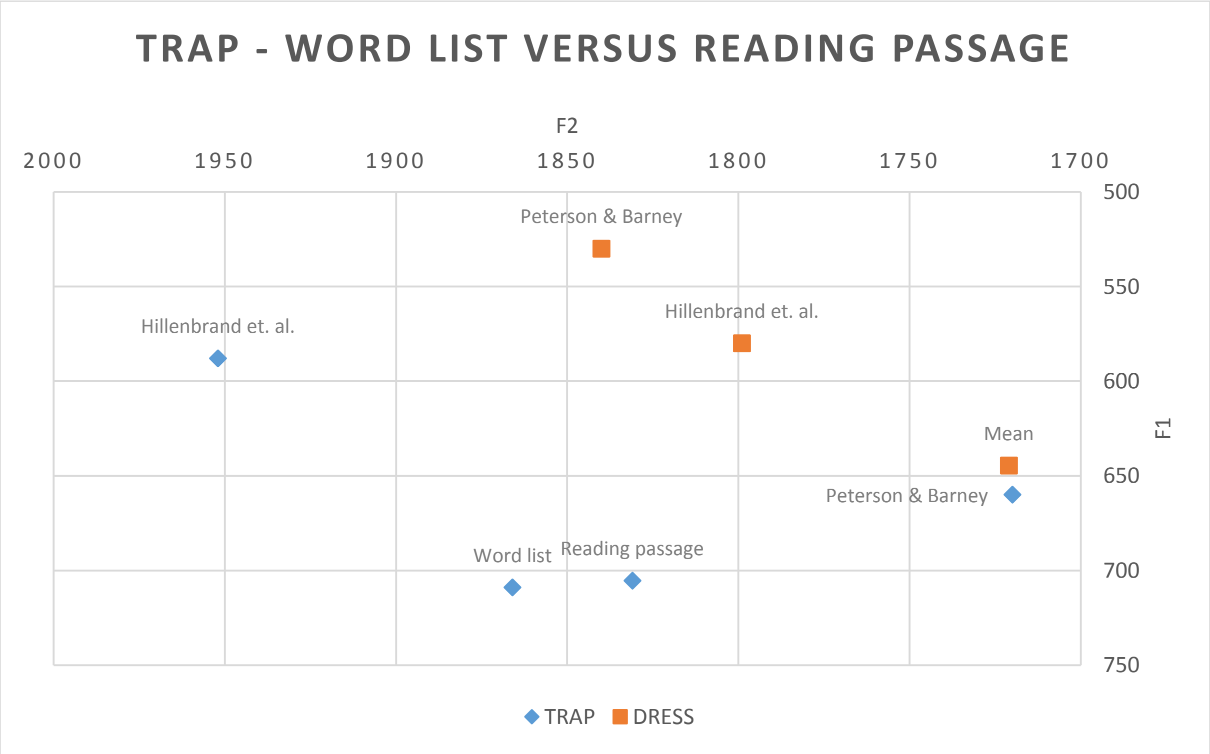


Figure 4.17: Mean values for the word list and reading passage for the TRAP variable. Values for DRESS given for comparison.

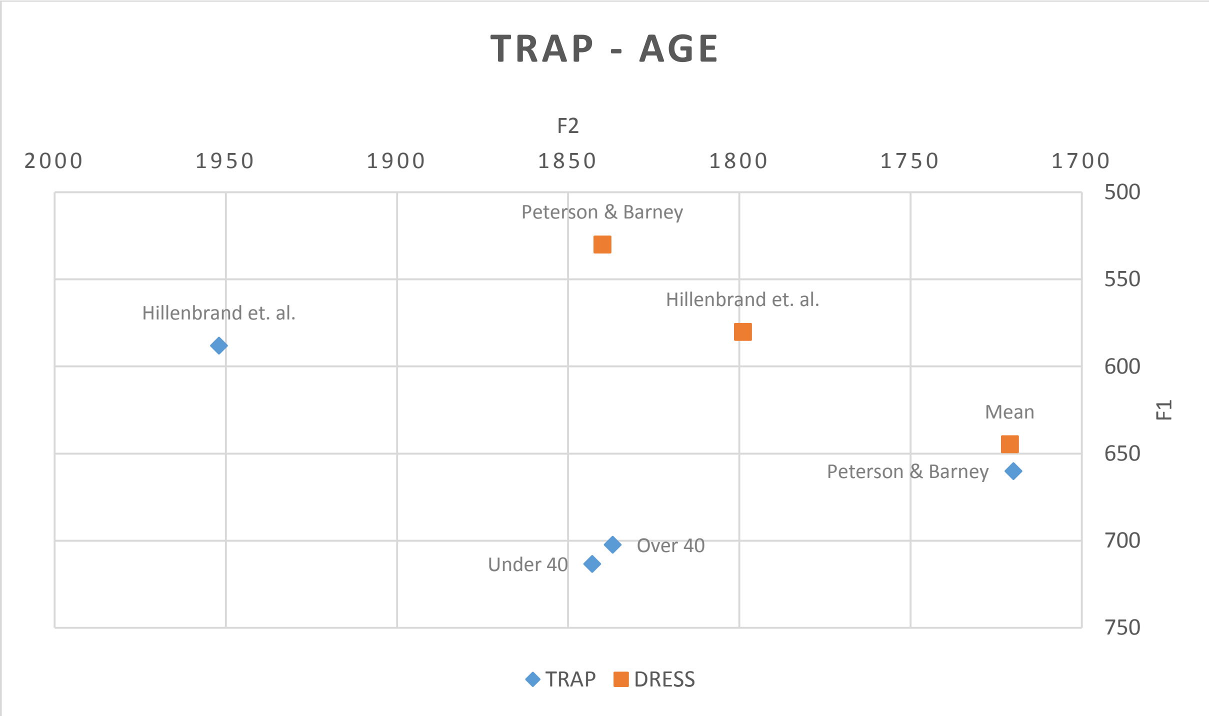


Figure 4.18: Mean values for the two age groups for the TRAP variable. Values for DRESS are given for comparison.

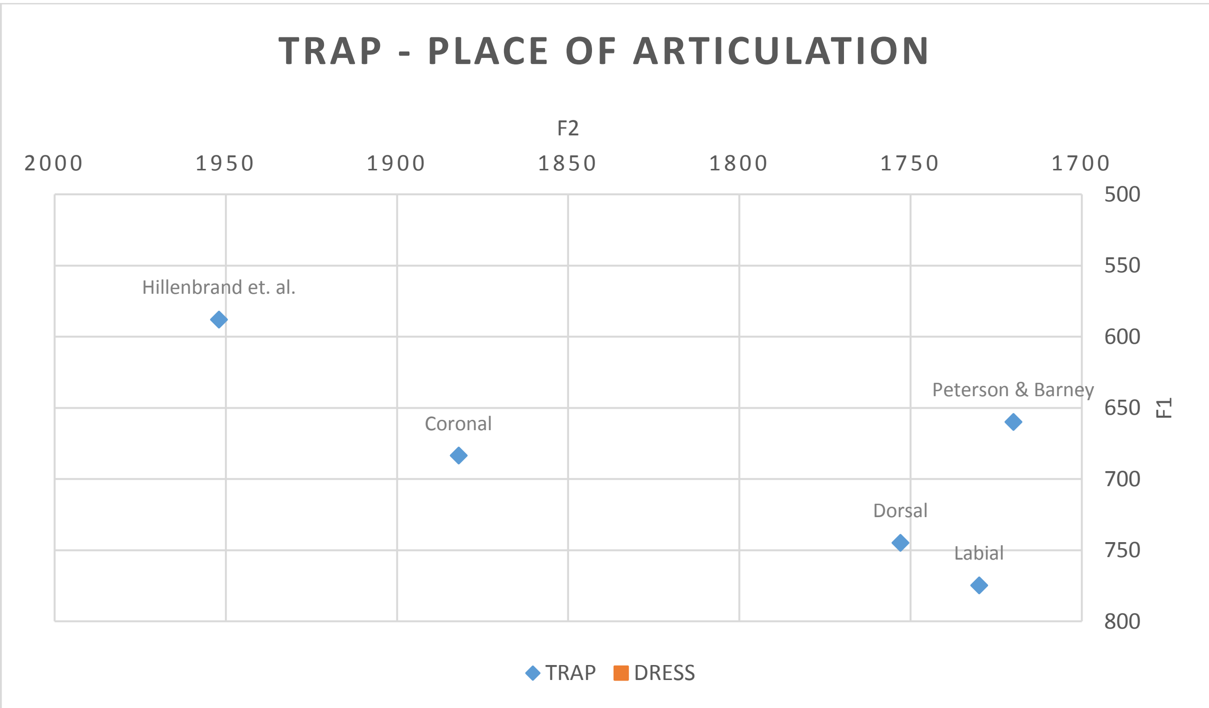


Figure 4.19: Mean values for the three places of articulation for the TRAP variable. Values for DRESS are given for comparison.

Table 4.7: The results of the Dunn's multiple comparisons tests for place of articulation.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	57,75	Yes	****	< 0,0001
Labial vs. Dorsal	17,09	No	ns	0,6731
Coronal vs. Dorsal	-40,67	Yes	***	0,0001
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	-34,38	Yes	*	0,0118
Labial vs. Dorsal	-4,037	No	ns	> 0,9999
Coronal vs. Dorsal	30,34	Yes	**	0,0066

Table 4.8: The results of the Dunn's multiple comparisons tests for manner of articulation.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	50,92	Yes	***	0,0003
Fricative vs. Lateral	-11,1	No	ns	> 0,9999
Fricative vs. Plosive	-22,84	No	ns	0,4222
Nasal vs. Lateral	-62,01	Yes	****	< 0,0001
Nasal vs. Plosive	-73,76	Yes	****	< 0,0001
Lateral vs. Plosive	-11,75	No	ns	> 0,9999
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	-51,13	Yes	***	0,0003
Fricative vs. Lateral	37,76	No	ns	0,091
Fricative vs. Plosive	8,926	No	ns	> 0,9999
Nasal vs. Lateral	88,9	Yes	****	< 0,0001
Nasal vs. Plosive	60,06	Yes	****	< 0,0001
Lateral vs. Plosive	-28,84	No	ns	0,1342

4.4.4 The effects of manner of articulation

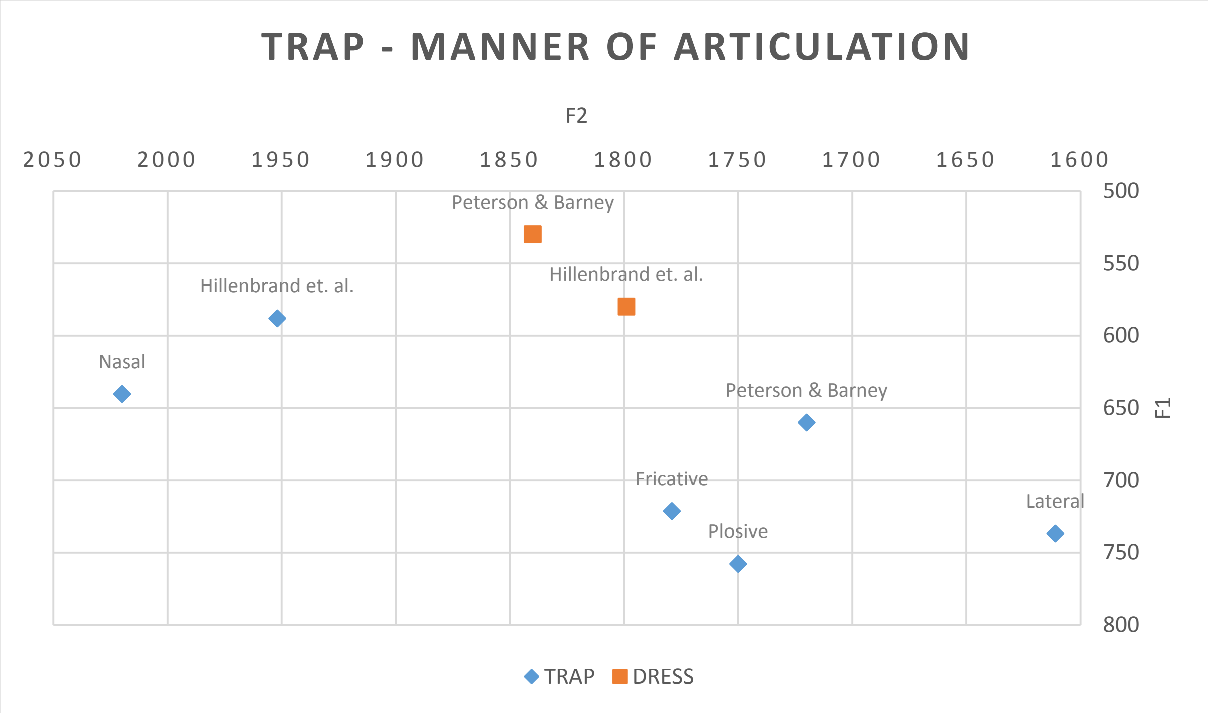


Figure 4.20: Mean values for the four manners of articulation for the TRAP variable. DRESS values are given for comparison.

Figure 4.20 above presents the means values of the four manners of articulation surveyed for the TRAP variable. As can be seen, manner of articulation is highly salient on the realization of this variable. The data suggest that tokens with following nasals are subject to fronting, and tokens followed by laterals are subject to backing.

The Kruskal-Willis tests show statistical significance in both the F1 and F2 ranges, with a P-value of P<0.0001 for both ranges. The results of the Dunn's multiple comparisons tests are given above in table 4.8, and show statistically significant differences between several of the groups.

4.5 The variable LOT /ɑ/

The LOT variable constitutes the second step of the NCS according to Labov. A token of the LOT variable affected by the NCS would be expected to be fronted, acting on the previous raising of the TRAP variable.

The mean value across all speakers for the LOT variable is given below in figure 4.21. It shows that THOUGHT is indeed lowered as anticipated, and that LOT is indeed slightly fronted in comparison, albeit not as far as would be expected. Consequently, there is only a slight distinction between the LOT and THOUGHT variables.

4.5.1 Word list versus reading passage

As with all the other variables except DRESS, LOT shows no sign of being affected by whether the tokens were realized in separate words or in the context of complete sentences.

A Mann-Whitney test reveals P-values of P=0.1272 and P=0.0027 for the F1 and F2 ranges respectively. In other words the difference in the F2 range are statistically significant, however, the actual difference of about 90 Hz is far less than the intra-group standard deviations, and is as such insignificant even though it is statistically significant. The results are given in figure 4.22 below.

4.5.2 The effects of age

As with all the other variables, LOT also shows no sign of being affected by age, insofar that the two age groups established are representable. As can be seen below in figure 4.23, the values for the two groups are virtually identical in both F1 and F2 ranges. A Mann-Whitney test reveals no statistically significant differences, with P-values of P=0.0726 and P=0.3820 for the F1 and F2 ranges.

4.5.3 The effects of place of articulation

The mean values for the three places of articulation surveyed are given below in figure 4.24. These data reveal that place of articulation is salient for the realization of this variable. Specifically, the data suggest that tokens followed by coronals is more backed than tokens followed by dorsals and labials.

The Kruskal-Wallis tests reveal statistical significance on both the F1 and F2 ranges with P-values of P=0.0336 and P=0.0009 respectively. The results of the Dunn's multiple comparisons tests are given below in table 4.9, and reveal statistical differences between several of the groups.

4.5.4 The effects of manner of articulation

The mean values for the four manners of articulation surveyed are presented below in figure 4.25. These data suggest that manner of articulation is particularly salient for the realization of this variable.

The Kruskal-Wallis tests reveal statistical significances in both the F1 and F2 ranges, with P-values of P=0.0003 and P=0.0001 respectively. The results of the Dunn's multiple comparisons tests are given below in table 4.10, and reveal significant differences between tokens followed by fricatives and tokens followed by plosives in both the F1 and F2 range.

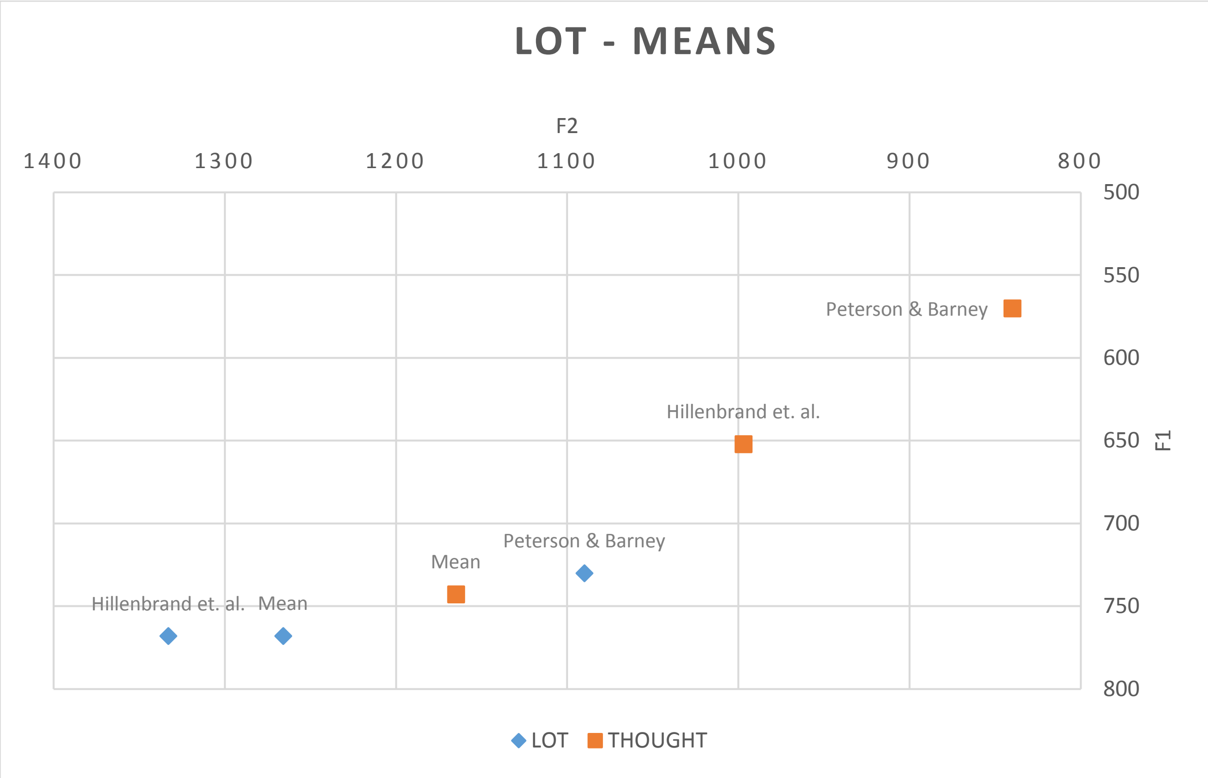


Figure 4.21: Mean values across all speakers for the LOT variable. Values for the THOUGHT variable are given for comparison.

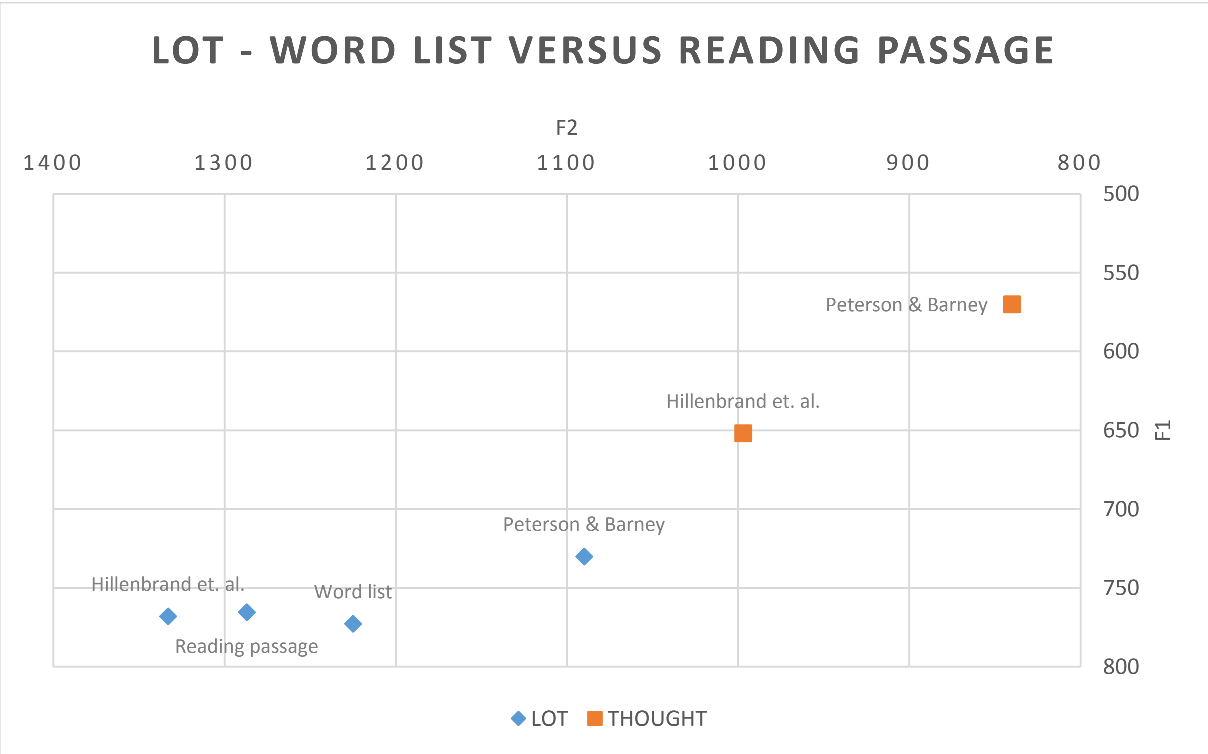


Figure 4.22: Mean values for the word list and reading passage for the LOT variable. THOUGHT values given for comparison.

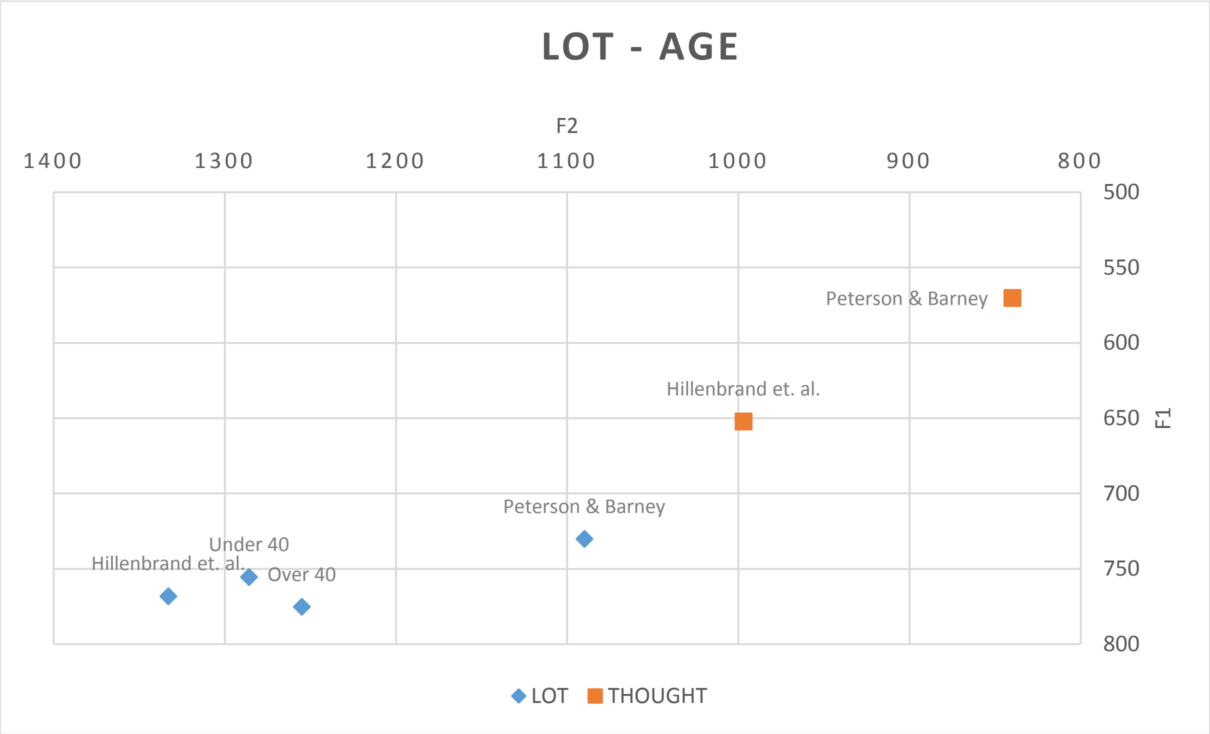


Figure 4.23: Mean values for the two age groups for the LOT variable. Values for THOUGHT are given for comparison.

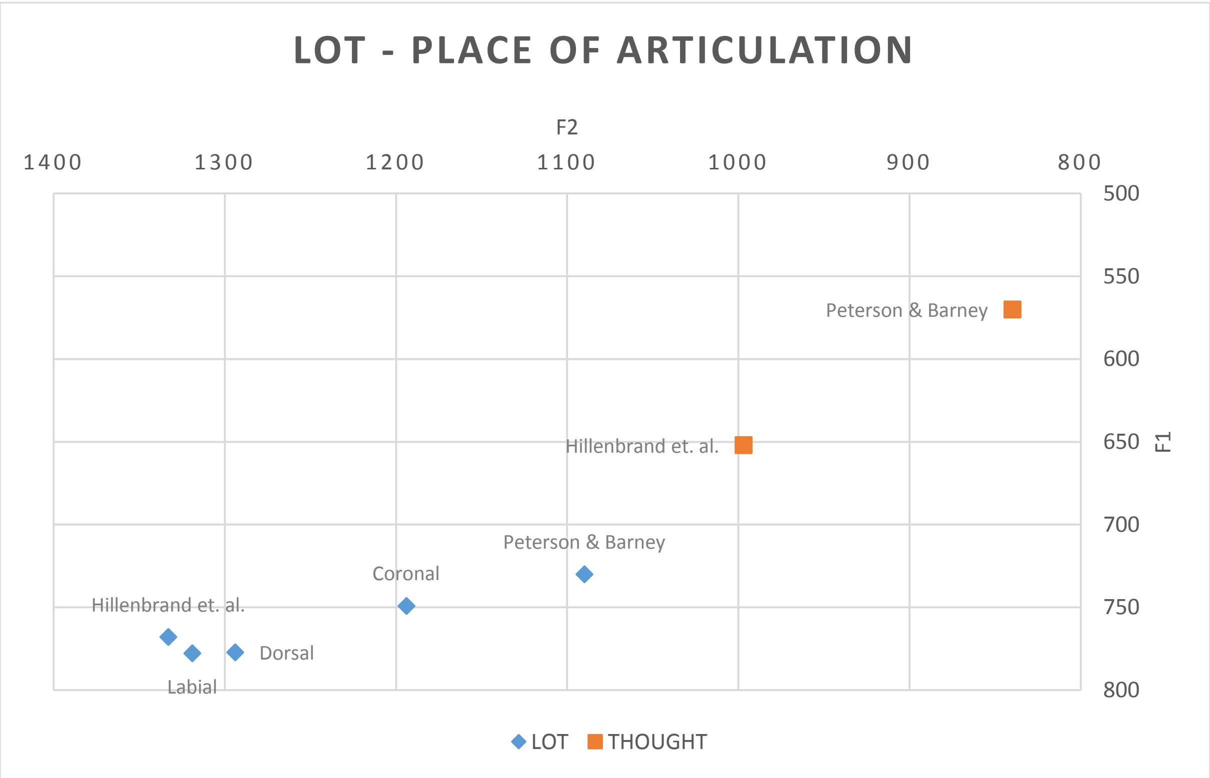


Figure 4.24: Mean values for the three places of articulation for the LOT variable. Values for THOUGHT are given for comparison.

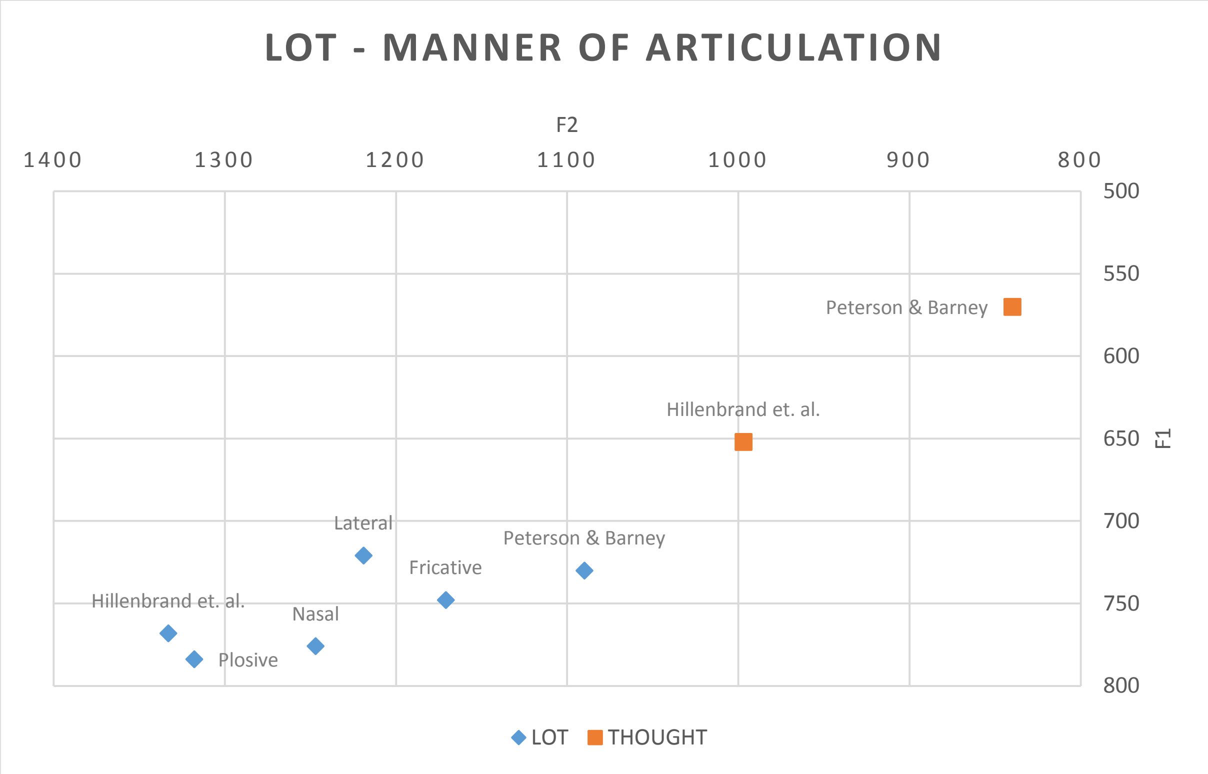


Figure 4.25: Mean values for the four manners of articulation for the LOT variable. Values for THOUGHT are given for comparison.

Table 4.9: The results of the Dunn's multiple comparisons tests for place of articulation.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	14,29	No	ns	0,2123
Labial vs. Dorsal	-2,33	No	ns	> 0,9999
Coronal vs. Dorsal	-16,62	Yes	*	0,0361
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	21,58	Yes	*	0,0191
Labial vs. Dorsal	-2,068	No	ns	> 0,9999
Coronal vs. Dorsal	-23,64	Yes	**	0,0011

Table 4.10: Results of the Dunn's multiple comparisons tests for manner of articulation.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	-10,8	No	ns	> 0,9999
Fricative vs. Lateral	17,66	No	ns	0,5759
Fricative vs. Plosive	-19,33	Yes	*	0,0459
Nasal vs. Lateral	28,45	No	ns	0,1212
Nasal vs. Plosive	-8,536	No	ns	> 0,9999
Lateral vs. Plosive	-36,99	Yes	***	0,0006
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	-17,36	No	ns	0,6101
Fricative vs. Lateral	-11,18	No	ns	> 0,9999
Fricative vs. Plosive	-31,76	Yes	****	< 0,0001
Nasal vs. Lateral	6,182	No	ns	> 0,9999
Nasal vs. Plosive	-14,4	No	ns	0,7746
Lateral vs. Plosive	-20,58	No	ns	0,1805

4.6 The variable THOUGHT /ɔ/

A token of the THOUGHT variable affected by the NCS is expected to be lowered, and occupy the vowel space of LOT. As was pointed out in section 4.5, the THOUGHT variable has indeed been lowered, and the mean value across all speakers is reported in figure 4.26 below.

4.6.1 Word list versus reading passage

As with all the variables except DRESS, THOUGHT shows no indication of difference between the word list and the reading passage, outside of what might reasonably be considered random results. The results are given below in figure 4.27.

The Mann-Whitney tests show statistical significance in the F1 range with a P-value of P<0.0001, but no statistical significance in the F2 range with a P-value of P=0.4049. Again it must be noted, that even though the differences in F1 values are considered highly significant statistically, the actual difference of some 50 Hz is completely insignificant.

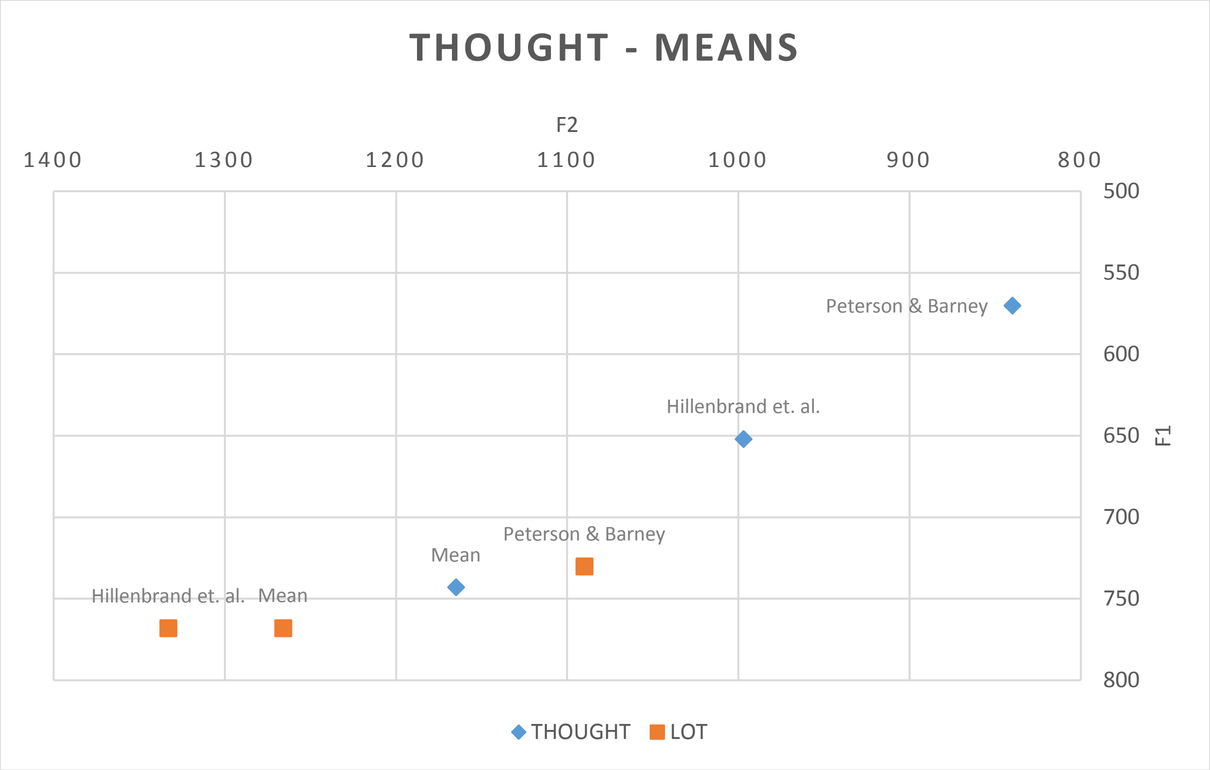
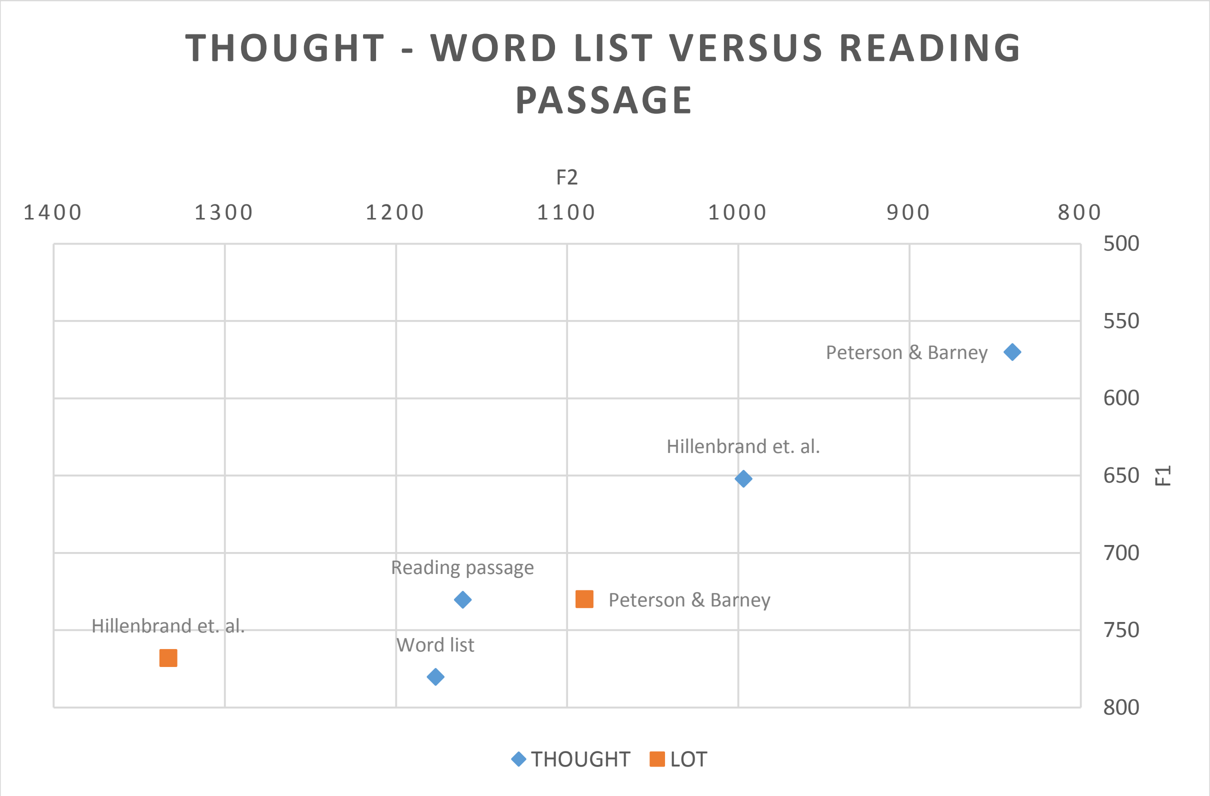


Figure 4.26: Mean values for the THOUGHT variable. Values for the LOT variable are given for comparison.



4.27: Mean values for the word list and reading passage for the THOUGHT variable. Values for LOT are given for comparison.

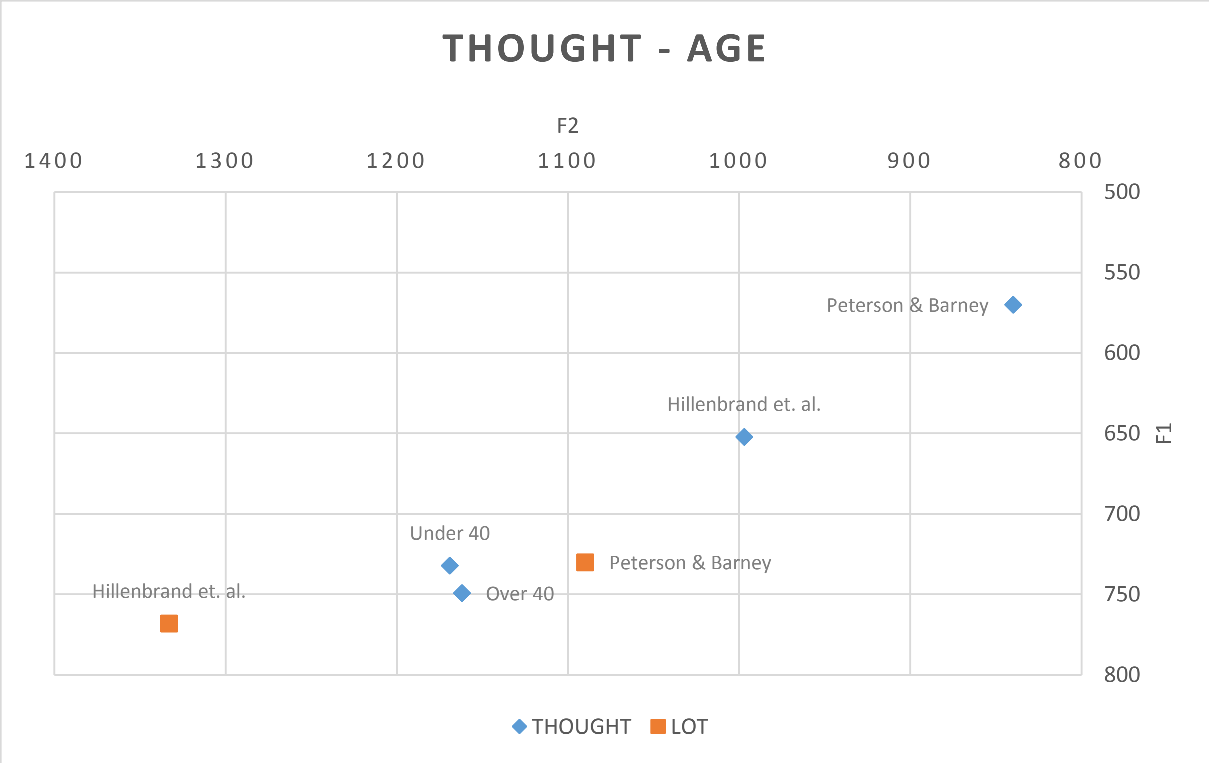


Figure 4.28: Mean values for the two age groups for the THOUGHT variable. Values for LOT are given for comparison.

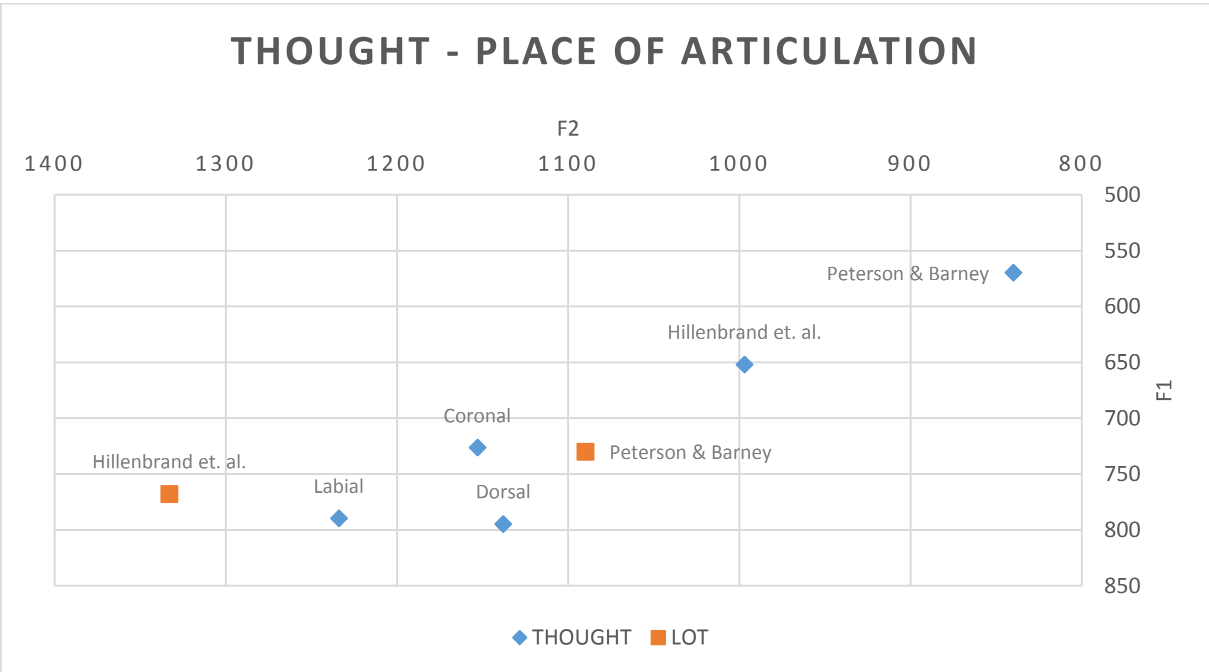


Figure 4.29: Mean values for the three places of articulation for the THOUGHT variable. Values for LOT are given for comparison.

4.6.2 The effects of age

Completing the pattern, THOUGHT also shows no sign of being affected by age. The differences between the two groups are yet again completely insignificant. The results are given above in figure 4.28. The Mann-Whitney tests show no statistical significance with P-values of P=0.2357 and P=0.9668 in the F1 and F2 ranges respectively.

4.6.3 The effects of place of articulation

The mean values of the three places of articulation surveyed is given above in figure 4.29. These data suggest that, like all the other variables, THOUGHT is affected by the place of articulation.

The Kruskal-Wallis tests reveal that the differences in both F1 and F2 ranges are highly significant, with P-values of P<0.0001 and P=0.0084 respectively. The results of the Dunn’s multiple comparisons tests are given below in table 4.11 and show statistically significant differences between several groups.

Table 4.11: Results of the Dunn’s multiple comparisons tests for place of articulation.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	32,94	Yes	***	0,0007
Labial vs. Dorsal	-8,227	No	ns	> 0,9999
Coronal vs. Dorsal	-41,17	Yes	**	0,002
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Labial vs. Coronal	27,31	Yes	**	0,0069
Labial vs. Dorsal	28,45	No	ns	0,1273
Coronal vs. Dorsal	1,147	No	ns	> 0,9999

4.6.4 The effects of manner of articulation

The mean values for the four manners of articulation surveyed are given below in figure 4.30, which clearly shows that manner of articulation is a salient feature in the realization of this variable. Specifically, tokens followed by laterals seem to be less affected by fronting and lowering.

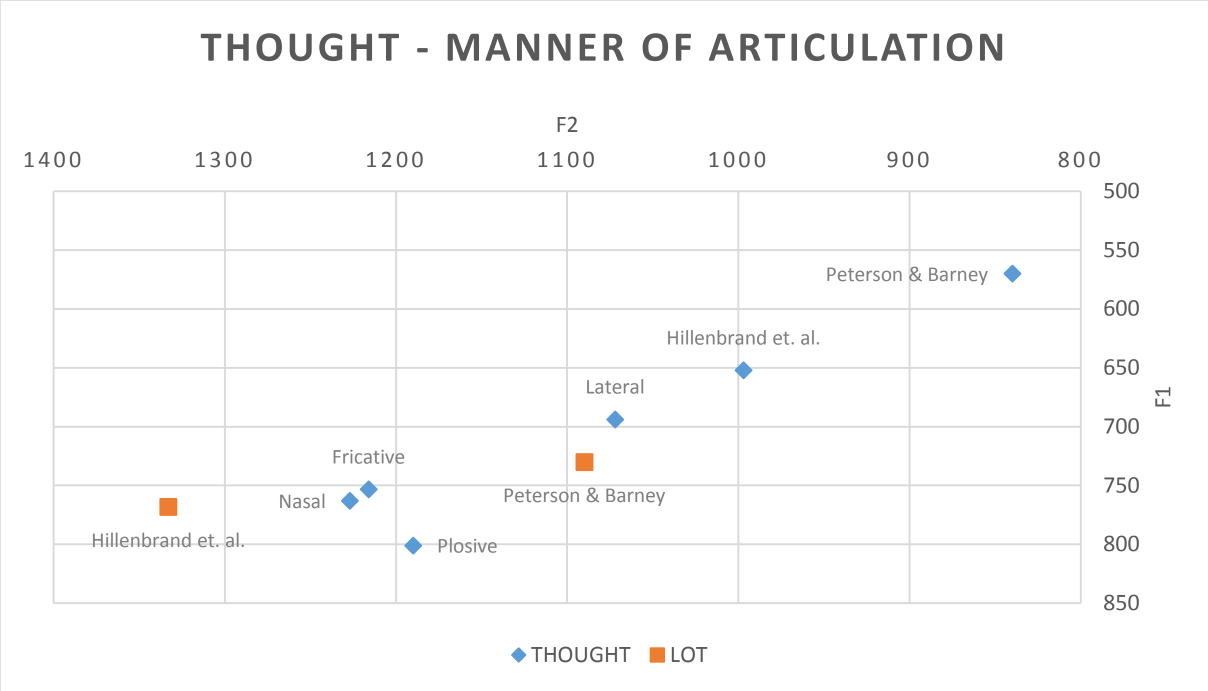


Figure 4.30: Mean values for the four manners of articulation for the THOUGHT variable. Values for the LOT variable given for comparison.

Table 4.12: Results of the Dunn's multiple comparisons tests for manner of articulation.

Dunn's multiple comparisons test (F1)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	-8,871	No	ns	> 0,9999
Fricative vs. Lateral	36,94	Yes	****	< 0,0001
Fricative vs. Plosive	-25,12	No	ns	0,0697
Nasal vs. Lateral	45,81	Yes	****	< 0,0001
Nasal vs. Plosive	-16,25	No	ns	0,9344
Lateral vs. Plosive	-62,06	Yes	****	< 0,0001
Dunn's multiple comparisons test (F2)	Mean rank diff.	Significant?	Summary	Adjusted P Value
Fricative vs. Nasal	-1,148	No	ns	> 0,9999
Fricative vs. Lateral	45,9	Yes	****	< 0,0001
Fricative vs. Plosive	7,534	No	ns	> 0,9999
Nasal vs. Lateral	47,05	Yes	****	< 0,0001
Nasal vs. Plosive	8,682	No	ns	> 0,9999
Lateral vs. Plosive	-38,36	Yes	***	0,0007

The Kruskal-Wallis tests show statistical significance with a P-value of $P<0.0001$ for both F1 and F2 ranges. The results of the Dunn's multiple comparisons tests are given below in table 4.12, and show statistical significance in differences between several groups.

4.7 The minimal word pairs test

The data collected from the minimal word pair tests have been analyzed separately from the word list and reading passage data. Chiefly, this has been done because it was feared that the way the word pairs were juxtaposed would influence the realizations of the tokens, and that any such influence would in turn skew the mean results of the word list and reading passage data. Additionally, since the minimal word pair data involve only two vowels, no vowel normalization procedures are applicable, and consequently, the data have not been subjected to vowel normalization. It must be noted that this reduces the inter-speaker comparability of the results. However, it is the intra-speaker differences that are of chief interest here.

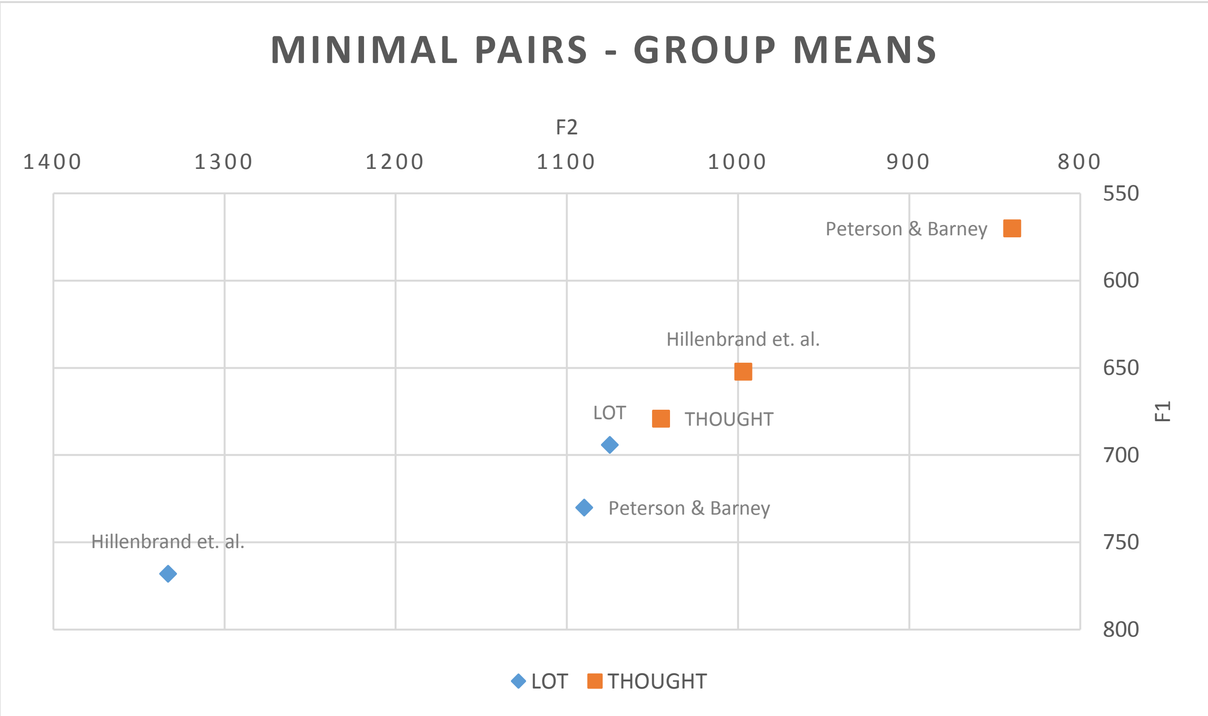


Figure 4.31: Group means for the minimal pairs test.

Figure 4.31 above presents the group means of the minimal pairs test. It reveals some interesting findings. Most notably it shows that for the minimal pairs test, there is a complete merger between LOT and THOUGHT. This was not the case for the word list and reading passage data, where some distance (albeit not a great distance) between the two was maintained by the fronting of LOT. This may lend credence to the initial assumption made that the juxtaposition of the variables might influence results, and led to the data being treated separately.

Of equal interest is the fact that the minimal pairs test data show no tendency of LOT fronting. There is nothing in this data set to suggest that LOT is affected by the NCS, unlike the data collected in the word list and reading passage data.

Moreover, the individual speaker data, presented below in figure 4.32, reveals that this is typical speaker behavior, and not the odd result of group averages. In fact, only a single speaker among the ten who successfully completed the minimal pairs test maintains distinct realizations of LOT and THOUGHT. It must be noted in this regard, while distances may appear significant from the figure, the scale must be taken into account when reading it. Distances that may seem significant are in fact not. In actuality, these results, while accurate in their measurement of vowel realizations, are somewhat misleading in the suggestion of a merger, but this will be dealt with in the discussion in the next chapter.

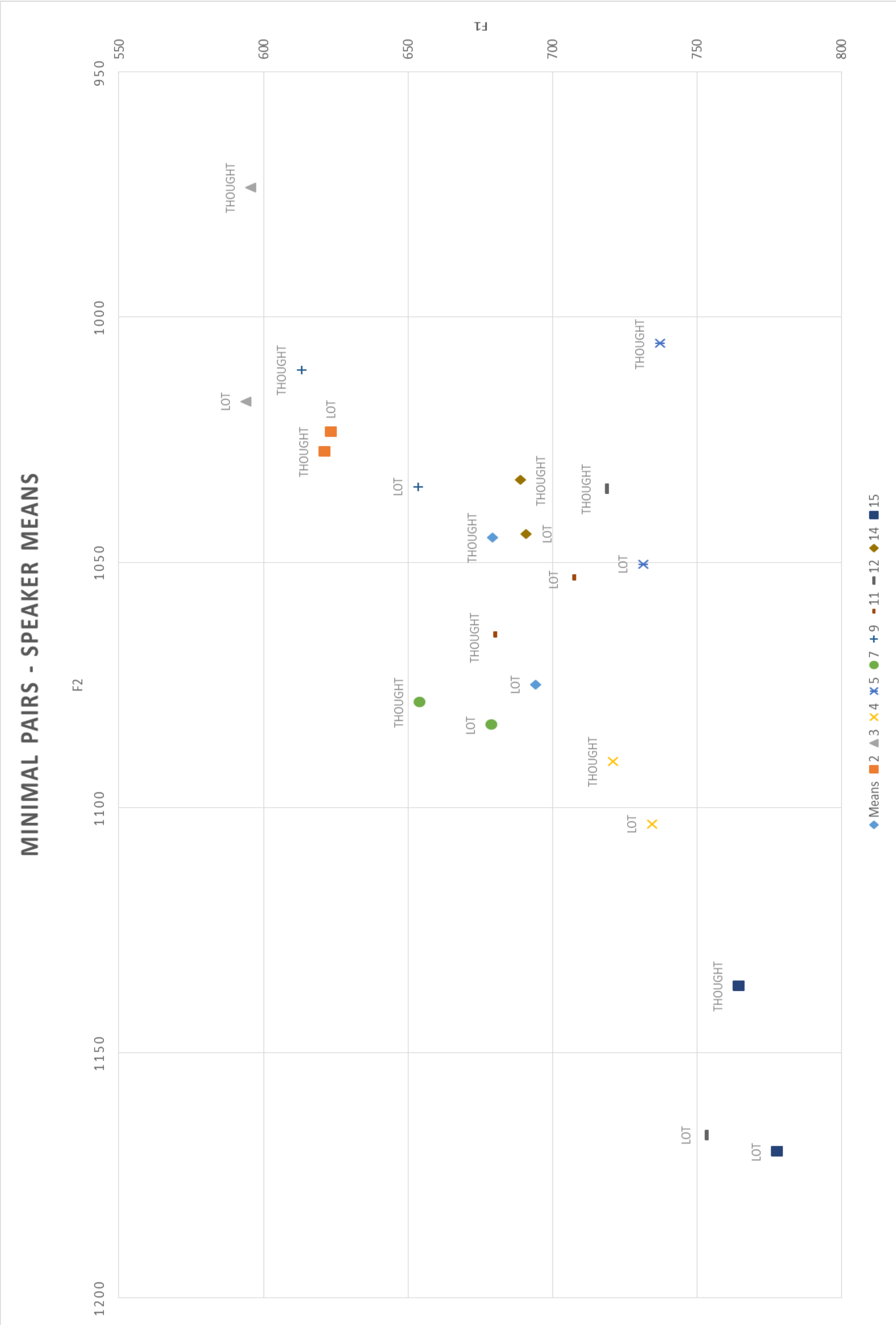


Figure 4.32: Individual speaker means for the minimal pairs test.

5. DATA DISCUSSION

In the present chapter the findings of the study will be discussed and compared to the findings of previous studies. So far only group averages have been discussed, and while those do, for the most part, accurately reflect the average speaker, in cases where the group is split in realization between two clear alternatives, the group average will reflect a realization not found in any speaker. These inconsistencies will be pointed out in the discussion below.

5.1 The NCS

The general finding of the present study in regard to NCS, is that four of the six variables associated with the NCS were affected to some degree by the expected shifting, those four variables being DRESS, KIT, THOUGHT, and LOT, the two variables not affected being TRAP and STRUT. This is illustrated in figure 5.2 below alongside the previously established standard values from Peterson & Barney (1952) and Hillenbrand et al.'s (1995) studies.

As noted, the present study only examines mean group data, and this obscures all the variant trajectories elicited from the individual speakers. Consequently, for elucidation a brief account of these trajectories will be given below. Care has been taken for each variable to select the speaker exhibiting the greatest variance in trajectories, however, for some variables no single speaker exhibits all observed trajectories.

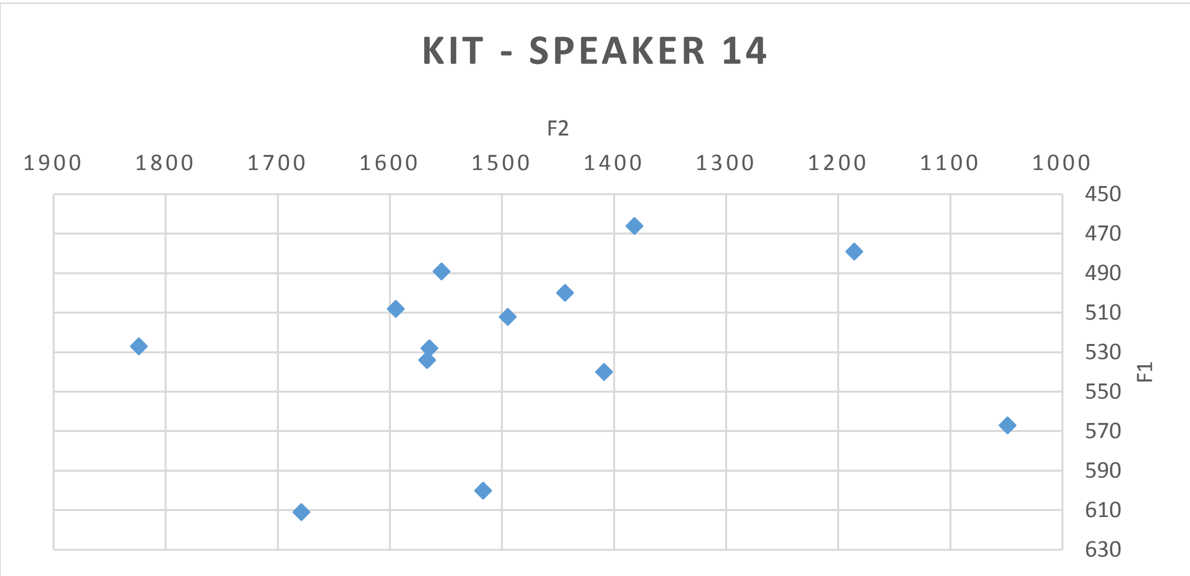


Figure 5.1: All KIT tokens elicited from speaker 14.

Speaker 14's KIT tokens show clearly two trajectories. A stable group is observed, from which some tokens are in varying states of backness. A few tokens are lowered, and one is both.

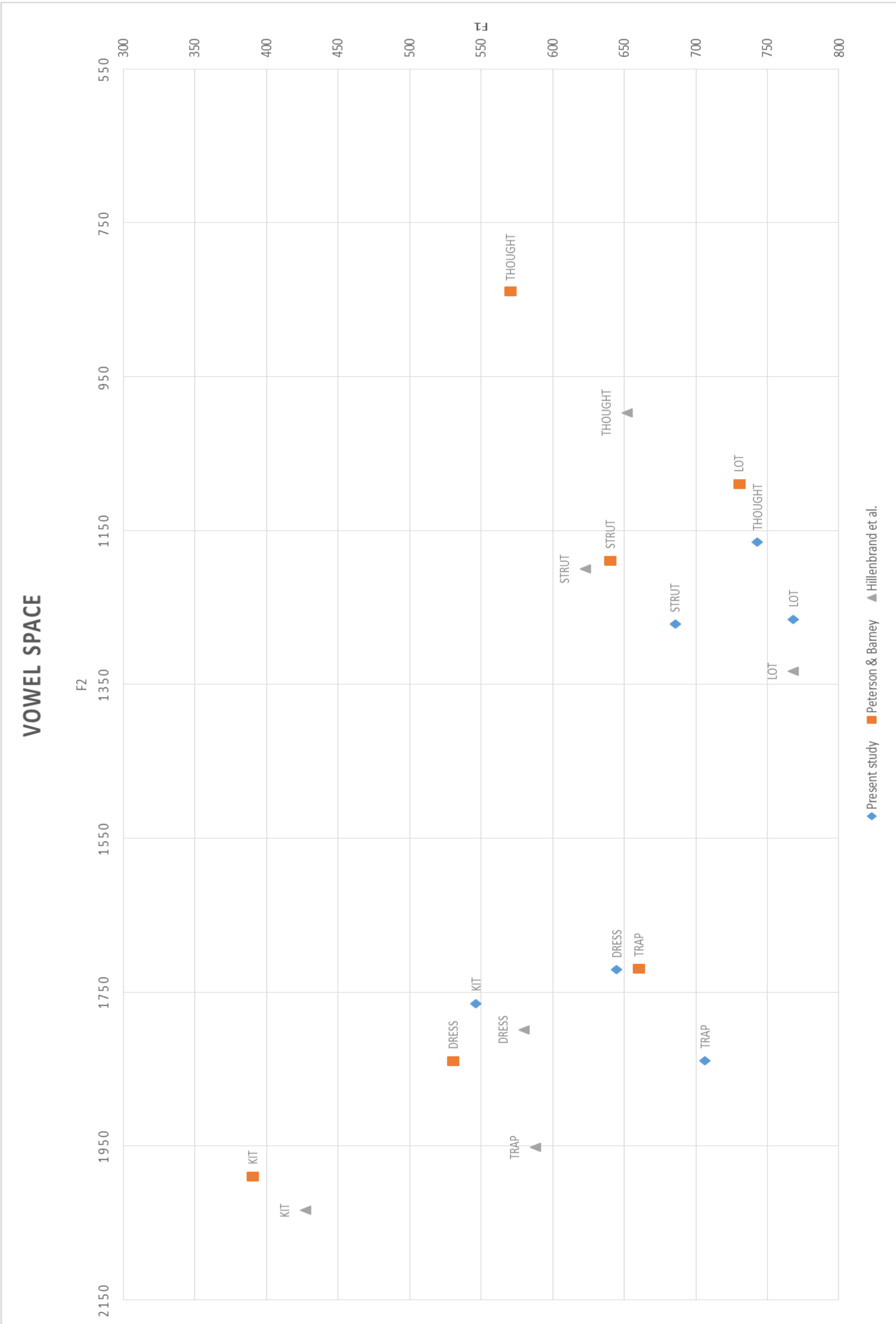


Figure 5.2: Mean values across all speakers for all variables.

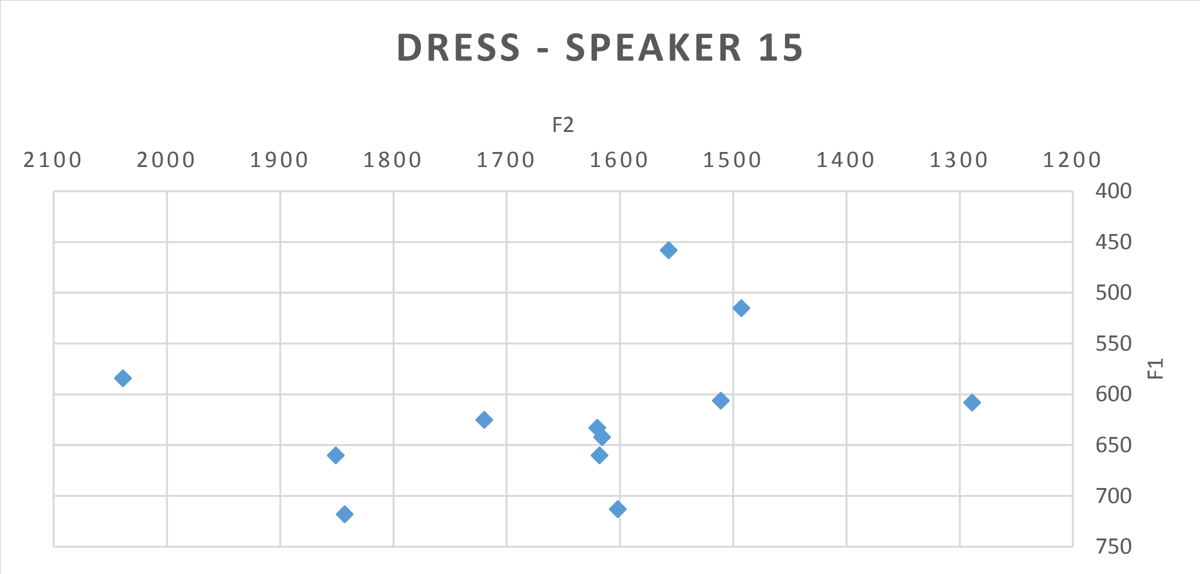


Figure 5.3: All DRESS tokens elicited from speaker 15.

Speaker 15’s DRESS tokens are interesting. They show both of the trajectories anticipated by the NCS. There are tokens that are tokens that are lowered, and tokens that are backed, as well as tokens that are both.

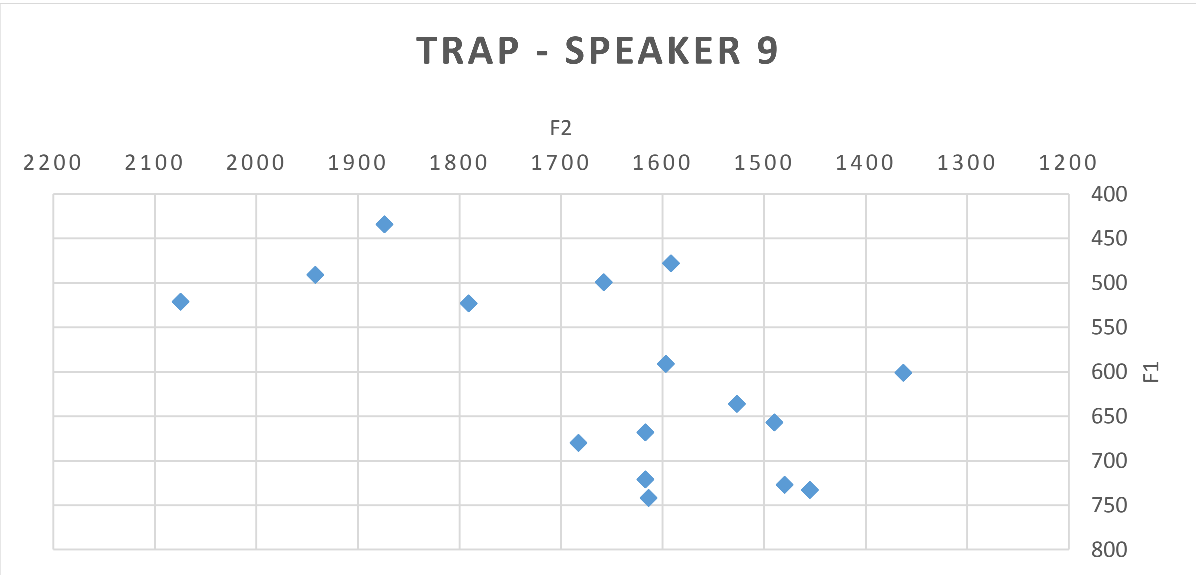


Figure 5.4: All TRAP tokens elicited from speaker 9.

To illustrate the trajectories observed in the shifting of the TRAP vowel, a speaker which exhibited raising was selected. Both the fronting as well as the raising anticipated by the NCS is observed. Interestingly, counter to the overall mean results, there is no real indication of fronting without raising.

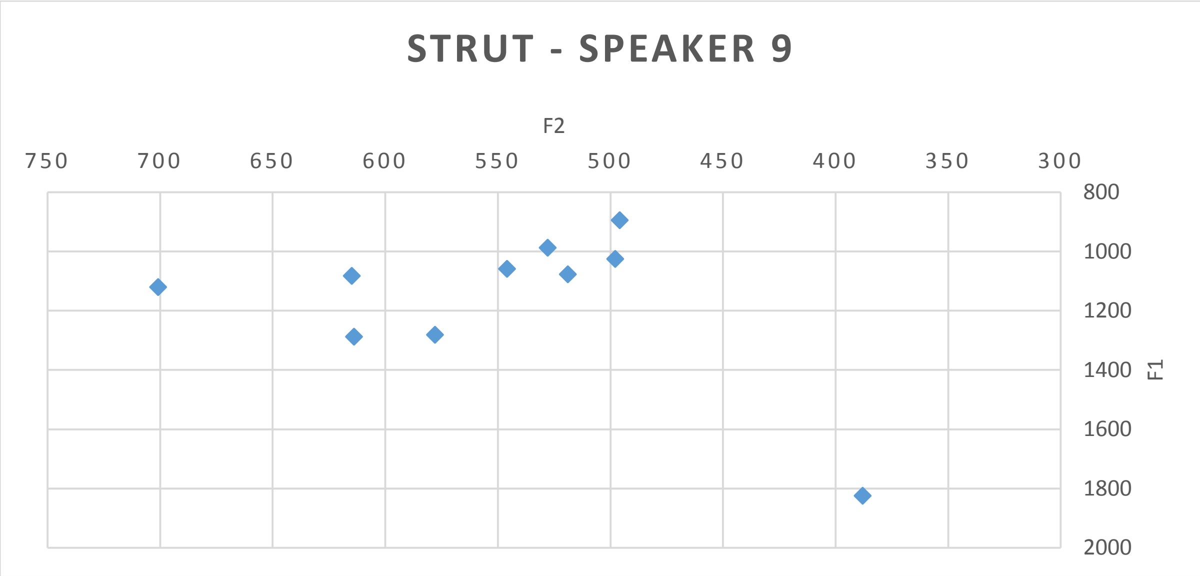


Figure 5.5: All STRUT tokens elicited from speaker 9.

Speaker 9's distribution of STRUT tokens is fairly typical. As noted, no shifting of note was observed for the STRUT variable, and this is reflected in speaker 9's distribution.

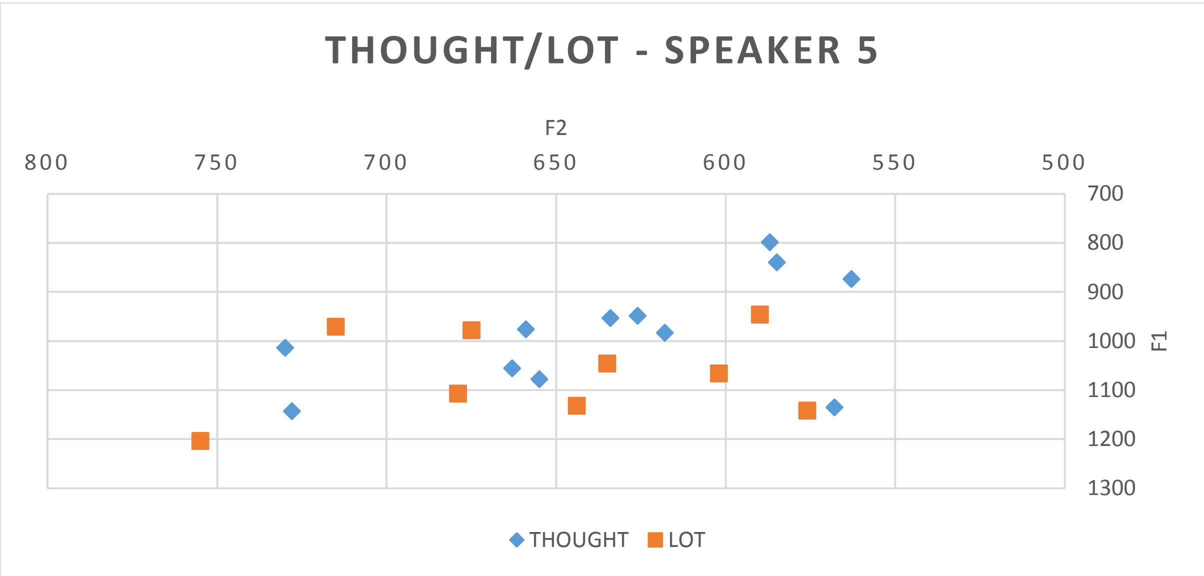


Figure 5.6: All LOT and THOUGHT tokens elicited from speaker 5.

Given their connection in regard to the present study, the THOUGHT and LOT variables are presented together here. A speaker was chosen who exhibited full merger. Specifically, speaker 5 exhibits clearly a case of merger by expansion. It is clear that the two vowels are merged, but equally so that no new realization is formed, rather the vowel space unique to each is now shared by both.

Given the findings, the following discussion is mostly concerned with the phonological conditioning of the variables. Before addressing this, however, note must be made of the results of the differences found between the word list and the reading passage. The results clearly show that there is no difference, except for the DRESS variable, for which it is substantial. This discrepancy is hard to resolve. It could be that this particular variable is more affected by the level of attention paid to its realization. However, it would seem that this discrepancy is probably caused by a flaw in the design of the study, wherein the word list had more tokens of word-initial vowels than did the reading passage.

5.1.1 The phonological conditioning of the variables

The present study is founded on the belief that language change is gradual, and that language change spreads from one linguistic environment to another. Were this assumption to be true, one would expect to see differences in the degree and frequency of shifting between various linguistic environments, as long as the change is not already complete in all environments.

The present study was designed to test this assumption in regards to one type of linguistic context, the phonological context. Specifically, the phonological context of the type of following consonant. (Avenues not explored in the present study include the context of the preceding consonant, voicing, word length, syllable length and several more.)

The results of the present study indicate that both the manner and the place or articulation of the following consonant are highly salient in the realization of all six variables, thus confirming the initial assumption of gradual diffusion of language change.

5.1.1.1 Comparisons with previous studies

Few studies deal with the NCS as a whole, most only deal with one or a subset of the six variables, and of the ones that do, only a small subset deal extensively with the effects of phonological conditioning. Consequently, the basis for comparison is rather thin.

Only Gordon's (2001) study of two small towns in Michigan has data on all six variables. In addition to Gordon's study, the study of Labov, Yaeger, and Steiner (1972) provides some data for the lower half of the shift. (i.e. TRAP, THOUGHT, and LOT.) A handful of other studies offer additional data on one variable.

No previous study has been conducted in Des Moines nor in Iowa, so data is not directly comparable as such, but if one can assume the same mechanisms to be driving the shift, one would presume the results of the phonological conditioning to be largely the same.

Some issues regarding the comparability of these studies with the present study need to be addressed. While Labov, Yaeger, and Steiner's study, like the present study, is acoustic in nature and uses degree of shifting to indicate favorable and disfavorable contexts, Gordon's study is auditory in nature, and uses frequency of shifting as a metric. Moreover, the data used from Gordon's study conflates the various directions of shifting into one score, thereby conflating all the trajectories. Consequently, the comparisons with Gordon's study may only reveal favorable and disfavorable contexts for shifting, while the data used from the present study maintains the distinction between the various trajectories of shifting. It must be noted that Gordon's study includes frequency data for multiple trajectories, but seeing as how it is based on frequency, and for most variables include more than two trajectories, no feasible way of comparing these frequency data to degree data of the present study could be conceived of. Even though the present study is based on degree, and the main study of comparison is based on frequency of shifting, it is perhaps not improbable that the contexts that favor shifting are also the contexts that show the greatest shifting. It must, however, be noted that the discrepancies below may well, at least in part, be attributed to this difference in design between the studies.

For the DRESS variable, Gordon's study is the only with which comparisons may be made. Gordon (2001, 63) found that manner of articulation was statistically significant, while place of articulation was not. Particularly salient was the context of a following /l/. Gordon also notes that a following nasal disfavors shifting. Gordon (2001, 155) also cites Eckert as having found a correlation between backing and a following /l/.

These findings partly match and partly contradict the findings of the present study. Like the studies of Gordon and Eckert, the present study also finds that a following lateral favors backing. There is, however, no indication in the present data that following nasals disfavor it. There is, on the other hand, data to suggest that following plosives disfavor it.

Moreover, unlike Gordon's study, the present study found place of articulation to be statistically significant, with following velars strongly disfavoring backing.

For the KIT variable, Gordon's study is again the only frame of reference to phonological conditioning. Gordon (2001, 87) finds both place and manner of articulation to be statistically significant, as does the present study. For place of articulation he found that following labials favored shifting, while following interdentals disfavored shifting. For manner of articulation he finds that following stops and /l/ slightly favor, while a following nasal strongly disfavors shifting.

Again, Gordon's finding somewhat match, and somewhat contradict the present findings. Like Gordon's study, the present study finds that following laterals favor shifting. There is nothing in the present data to suggest any particular disfavoring among the other places of articulation surveyed. For manner of articulation, the present study also finds that following nasals strongly disfavor shifting (although only in terms of backing, it is the most shifted in terms of lowering), following laterals and plosives, however, do not distinguish themselves in terms of shifting (at least not for backing). Following fricatives, unlike Gordon's findings, are shown to be strongly favorable to backing.

For the STRUT variable, Gordon's study is again the main source for comparison. Gordon (2001, 106) found the context of a following stop to favor shifting, and the context of a following fricative to disfavor shifting. Further, Gordon (2001, 155) cites Eckert in having noted a correlation between backing and adjacent laterals. As Gordon points out, this finding contradicts his own findings. It is, however, supported by the findings of the present study. However, the averaged group result for STRUT with a following lateral (Figure 4.14) is misleading to say the least. As can be seen, the average realization would be in the expected vowel space of THOUGHT. However, not one single token was realized thus. The hidden cause of this averaged realization is that about half of the speakers realized all STRUT tokens with a following lateral with the vowel of FOOT (i.e. pulse = /pʊls/). This accounts for all of the raising, and most of the backing. There is nothing in the present data to suggest that following fricatives disfavor shifting. In fact, following fricatives is the group that's backed the most (except for laterals). However, the manners of articulation are not substantially differentiated to suggest anything.

For the lower half of the shift (i.e. TRAP, THOUGHT, LOT) there is more data to use for comparison. For the TRAP variable, Gordon (2001, 130) found that the contexts of a following nasal and a following lateral favor shifting, while the contexts of a following palatal, a following velar, and a following fricative disfavor shifting. Labov, Yaeger, and Steiner (1972, 79-88) similarly found that following nasals favored raising. They further investigated the effects of following voiceless stops, finding that palatals most favored shifting, then alveolars, then bilabials, and then velars. Interestingly, Callery (1975, 162-164) found that following nasals did not favor shifting, except in certain lexical items. Further he found that following velars were particularly favorable to shifting.

Again, the findings of the aforementioned studies are a mixed bag when compared to the present findings. The findings of Gordon mostly accord with the findings of Labov, Yaeger, and Steiner, but clearly contradict the findings of Callery. As for the present study, the general finding was that TRAP was not affected by the NCS, and as such these previously observed correlations were not observed in the present data. A note must be made, however, that following nasals greatly favor fronting, yet not raising. With no significant difference between the age groups, it might be unwarranted to assume it is a first step, however, it seems likely to be the result of NCS influence.

For the LOT variable Gordon (2001, 136) found that the contexts of following interdentals, velars, and laterals favored shifting, while the context of a following palatal disfavored shifting. Labov, Yaeger, and Stein (1972, 118-124) again examined only following stops, and found that palatals favored shifting the most, followed by alveolars, then velars. It is interesting to note that the two studies contradict each other here. Gordon found palatals to disfavor shifting, while Labov, Yaeger, and Stein found them to favor it. While palatals are part of the dorsal category of the present study, no tokens with a following palatal was collected, so comment cannot be made to this. Of note, however, is that in the present study the context of a following dorsal (made up entirely of velar tokens) favors shifting, while laterals favor forward shifting, but does not favor lowering. Further, the present study shows that following nasals somewhat favors shifting, and that following labials most strongly favor shifting.

For the THOUGHT variable Gordon (2001, 145) found that the contexts of following labials and velars favored shifting. Labov, Yaeger, and Stein (1972, 118-124) found that following velars favored shifting, while following alveolars disfavored shifting. The present study shows that following labials favor shifting the most, with both lowering and fronting, while following dorsals (again, exclusively velars) also favor shifting, but only lowering. This accords well with the finding of Gordon. Further, it also shows that following coronals (all alveolars) most strongly disfavors shifting, which accords with the findings of Labov, Yaeger, and Stein. Finally, the present study reveals that following plosives strongly favor shifting, and the following laterals strongly disfavor it.

In summary, while not all data match, the major findings about which conditions most favor shifting mostly match previous studies. Different contexts favor shifting of different vowels, but the context of following laterals is clearly the stand out context. It does not favor shifting in all the vowels, but where it does the shifting is very significant. Figure 5.7 below is provided to illustrate this. It shows the very significant shifting that occurs with following laterals for the DRESS, TRAP, and STRUT variables. These findings are not entirely surprising given the results of prior research, nor is it without precedent for laterals to influence vowel realization. For instance, the Southern accent is subject to shading and breaking of lax vowels with following laterals (Wells 1982, 550).

5.1.2 The effects of age

As part of the present study, the respondents were grouped according to age, in order that any change in progress might be revealed. The general finding of the present study is, perhaps somewhat surprisingly, that age is not a statistically significant factor in any of the four variables deemed to be affected by the NCS in the present study. For the two variables deemed not affected, age reveals no difference whatsoever. Of some note, for three of the four affected variables (DRESS, KIT, and LOT) the under 40 group shows the more advanced shifting of the two groups.

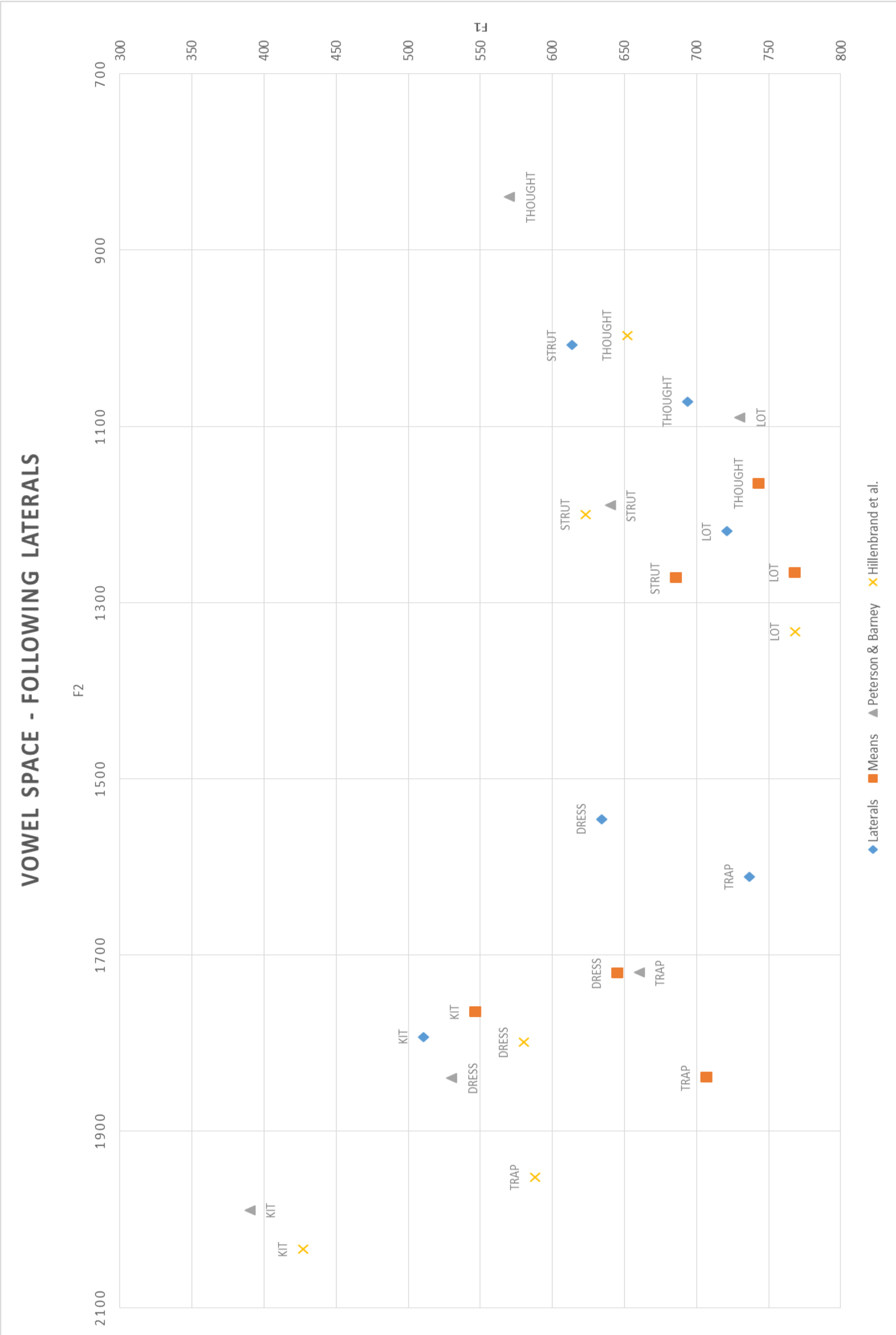


Figure 5.7: All mean variable results with a following lateral.

For the THOUGHT variable the two groups show little difference in shifting. Consequently, on could perhaps argue a general tendency, but the differences between the groups being as small as they are, coupled with the low sample size, would make such an argument speculative at best.

These results are somewhat unexpected, but not greatly so. The NCS is usually considered a change in progress, but previous results have also revealed mixed results. Both Gordon (2001) and Labov, Yaeger, and Steiner (1972) found that certain variables favored shifting among the younger, and other variables among the elder speakers, which would speak to a change in progress on one hand, and change in reversal on the other. Either way, age does not appear to be the deciding factor, as it were, in the distribution of NCS features.

5.2 The low back merger

While some of the findings in regard to the LBM have been discussed above as part of the NCS, there are other findings that merit discussion of their own.

As noted in chapter 4, the results from the word list and reading passage data, and the results from the minimal pairs test contradict each other as to the nature of the merger. While the minimal pairs test data revealed a full merger in the group average, the word list and reading passage data showed that some distance is maintained by the fronting of LOT.

It was further noted that nine of the ten speakers had full mergers in the minimal pairs test, and that while accurate in the depiction of the vowel realizations, it was somewhat misleading. This will be explored thus.

Of the aforementioned nine cases of full merger, only three are actual mergers. The remaining six, while fully merged in vowel realization, maintain clear distinction between the LOT and THOUGHT variables by means of an off-glide in the latter. This was discovered purely by chance while listening to the recordings, and serve as a reminder of the downsides of relying exclusively on acoustic measurement. This was a much unexpected finding. It was noted in chapter 2 that such an off-glide was the barrier that kept the merger out of parts of the South, and while the off-glides recorded in the present study are perhaps not as extreme as one might expect a Southern off-glide to be, it is nevertheless the major factor by which the speakers in the present study distinguish THOUGHT from LOT. A note was made as regards the present data, however, that the off-glides were more prominent, both in realization and frequency, among the older speakers, and this might indicate that this way of maintaining distinction is on the decline. The present data is, however, nowhere near extensive enough to confirm such a hypothesis.

It was noted in chapter 2 that potential future decline on the use of the off-glide might open the South to the spread of the merger, and it seems possible that such changes are already taking place in Des Moines.

The responses collected to examine perception are not exceptionally revealing. The single speaker who produced distinct vowels correctly identified all but one as different. The rest all mostly answered that they were the same or similar, with perhaps a slight tendency for the speakers not affected by the off-glide to identify as same rather than similar. This would seem to indicate a general aptitude among the speakers polled for the present study in identifying the nature of their own realizations. However, it is pretty clear from the nature of the answers that most, if not all, the similar responses are due to hedging. The complete data are included in the appendix. Various realizations of the merger found in previous studies were discussed in chapter 2. Of particular interest to the present discussion is whether the merger is effected by approximation or expansion. For the present merger this means whether THOUGHT has come to approximate LOT, or whether THOUGHT and LOT have merged by expanding their possible realizations (i.e. THOUGHT and LOT both share the full space previously available to each). Previous studies reported in chapter 2 have found both of these realizations of the merger, suggesting that the merger might be effected differently depending on location. The findings of the present study make it somewhat difficult to ascertain the nature of the merger. Preferably, one would have to observe a merger in progress to properly comment on how it came to be. With the merger in the present study, to the extent that there is one, already complete, a basis for comparison with pre-merger vowel realizations is missing, and consequently such a basis can only be arrived at by conjecture. This does not, however, disqualify nor demerit further investigation.

Neither the group means nor the speaker means are particularly useful in ascertaining the nature of the merger. Some general conclusions may be drawn on their basis, however. One could argue that the present data suggest a merger by approximation. Clearly, THOUGHT has moved down and front towards LOT. This does, however, assume that the original position of THOUGHT was raised from its current place of realization.

To better explore the merger individual speaker data is needed. Such data is given below in figures 5.8 and 5.9 for two of the speakers. Figure 5.8 presents the individual token data from the minimal pairs test for speaker 12, the 50 year old male who was the only speaker to maintain distinction in place of realization between the two variables. Figure 5.9 presents the individual token data from the minimal pairs test for speaker 2, a 28 year old male with a complete merger, one of the three speakers not affected by an off-glide.

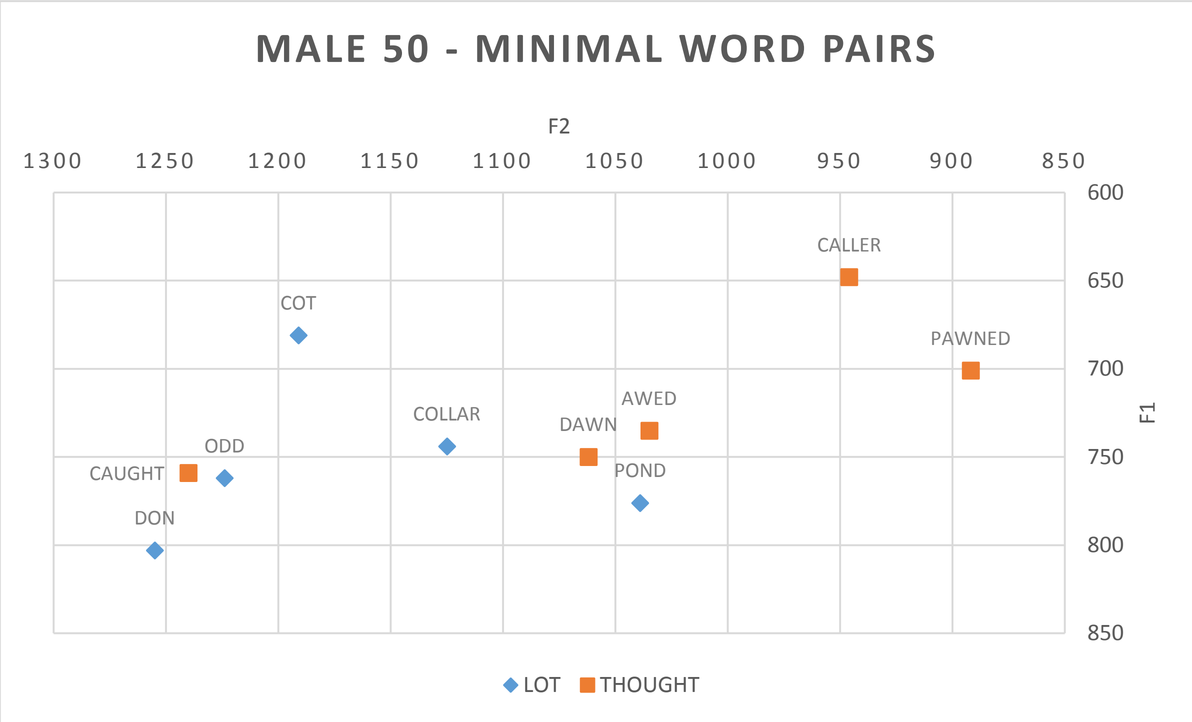


Figure 5.8: All minimal word pair token for speaker 12. No merger.

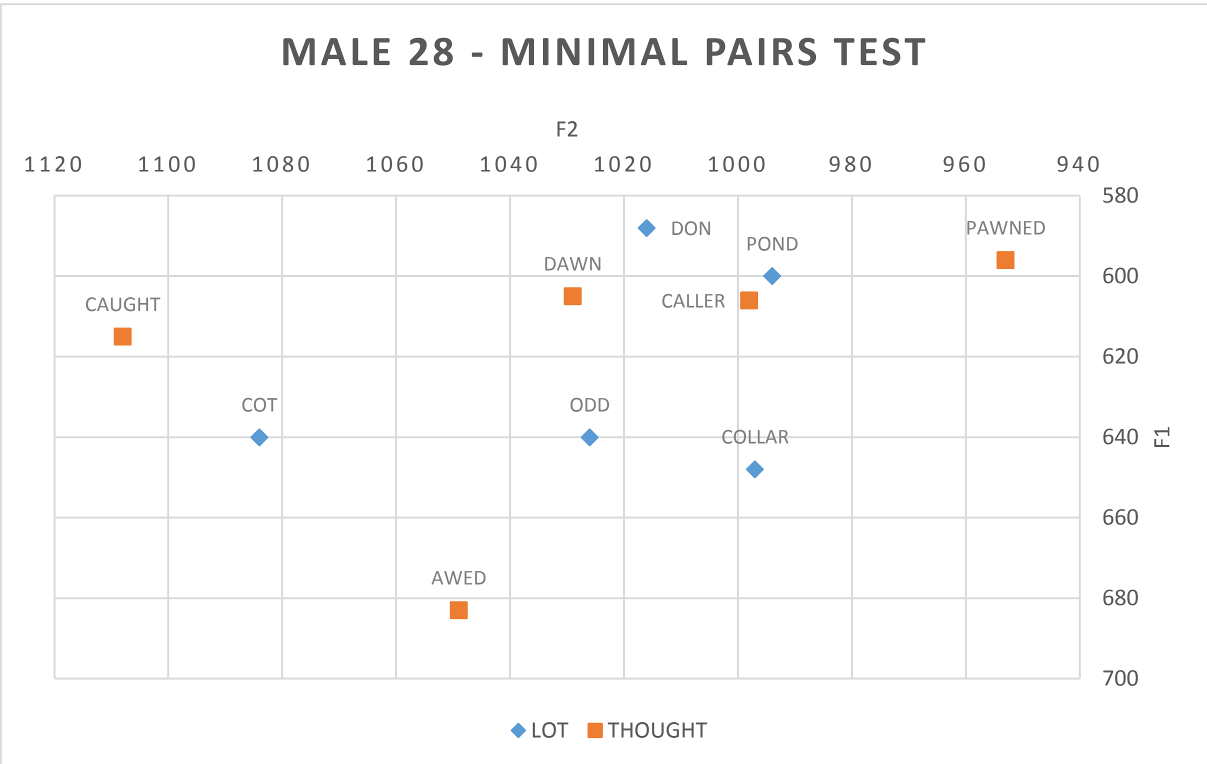


Figure 5.9: All minimal word pair tokens for speaker 2. Full merger. No off-glide.

These figures afford some further insight into the process of the merger. As is clear, even speaker 12, who maintains a non-off-glide distinction, has already undergone the expected lowering of THOUGHT. Distinction is maintained, however, by the lack of fronting, although some confusion is observed.

Speaker 2 reveals an interesting distribution of realizations. As can be observed, there is full confusion, THOUGHT tokens include the most backed, most fronted, and the most lowered token.

These patterns of distribution might indicate a combination of approximation and expansion. It is clearly a merger of approximation in the sense that THOUGHT is lowered to approximate LOT. However, the distribution of tokens in the vowels space between LOT and the lowered THOUGHT would seem to indicate a potential merger by expansion, where LOT tokens are allowed realizations further backed than normal, and THOUGHT tokens vice versa. It is impossible to conclude, however, without firm data from speakers fully unaffected by the merger.

6. CONCLUSION

6.1 Summary

Having summed up the findings of note in the previous chapter, we are left the task of discussing how the findings relate to the research questions outlined in the introduction, to what degree the present study achieved its aims, as well as suggest further avenues of research that might prove fruitful, taking into account the current findings.

The study aimed to examine the nature of and ascertain the spread of the NCS and LBM features in Des Moines. The findings were inconclusive and somewhat of a mixed bag. The results show that certain of the vowels involved in the NCS are clearly affected in the ways one would expect them to be. The average group mean show that for the group as a unit, the DRESS variable is decidedly lowered and backed, the KIT variable is also lowered and backed, the LOT variable is fronted to some degree, and the THOUGHT variable is lowered and fronted. The TRAP and STRUT variables, however, were not found to be affected by any shifting overall, except a slight tendency for TRAP to be fronted in certain contexts.

The results leave open to interpretation whether the NCS is in effect in Des Moines or not. It rests on the definition with which one defines the NCS. As noted in chapter 2, Labov defined speakers affected by the NCS as having a more fronted LOT vowel than STRUT vowel. The present findings fall just short of this in average. The average means show that STRUT is slightly more fronted than LOT; however, the differences are insignificant, and most of the speakers exhibit more fronted STRUT realizations than LOT realizations. In these, too, however, the differences are insignificant. The establishment of this criterion by Labov, however, rests on the assumption that STRUT backing and LOT fronting in combination would fulfill this requirement. In the present study, LOT fronting alone comes close to achieving it.

In conclusion, the NCS exists in some form in Des Moines; however, the lack of participation by two of the vowels raises doubt as to whether these features were implemented by chain shift. The differences in the observed data versus the expected findings in a *perfect* instance of the NCS is illustrated below in figures 6.1 and 6.2 below.

The results for the LBM are equally mixed. They show the process of merger in vowel realization to be mostly complete in the minimal pairs test, but also show the vowels to be distinct in the word list and reading passage data due to LOT fronting not present in the minimal pairs data. Further complicating matters is the finding that a majority of the speakers for which the vowel realizations are merged employ an off-glide to maintain distinction. If the sample is representative, one can hardly claim that the LBM has a foothold in Des Moines. Only a tiny minority of the speakers sampled have fully merged vowels.

One of the study's main research questions was what happened when the influence of the NCS and the LBM competed. It was speculated that the area might not be affected by the LBM, as LOT would be fronted, and consequently merger would not occur. Alternatively, it was speculated that the features might combine, fronting THOUGHT as well as lowering it, thus fulfilling a merger, while allowing for the LOT fronting anticipated by the NCS. Evidence of both theories were found. The word list and reading passage data showed fronting of LOT and lowering and fronting of THOUGHT. However, LOT was more fronted than THOUGHT, thus avoiding merger. The minimal pairs test revealed complete merger in the vowel realizations, where both variables were still fronted, but with LOT less fronted than in the word list and reading passage data.

In conclusion, the theory that the NCS acts as a retardant on the spread of the LBM appears true, although, the effects of the LBM are also clearly visible.

6.2 Further research

While the results of the present study are mixed, and based on a very small sample size, it clearly shows that further research could prove fruitful. The entire Midland area is somewhat lacking in studies, but even for Des Moines further avenues worthy of pursuit are obvious. The present study only took into account the context of type of following consonant with regard to phonological conditioning. It would be of great interest to pursue other contexts in future studies. Of particular interest would be a study successful in sampling speakers of other social groups. The present study succeeded only in surveying middle class speakers, and as previous studies have shown, class can be an important factor for the diffusion of the NCS. The present study showed no statistically significant differences between the two established age groups, and while previous studies have also shown that age is not always among the more important factors, a study which succeeded in gathering more data from younger speakers would be of great interest. Finally, the present study failed to gather usable data on female speakers, to great detriment to the results. Future studies of Des Moines based on the same type of data collection as the present study, would do well to factor in the difficulties involved in recruiting female speakers.

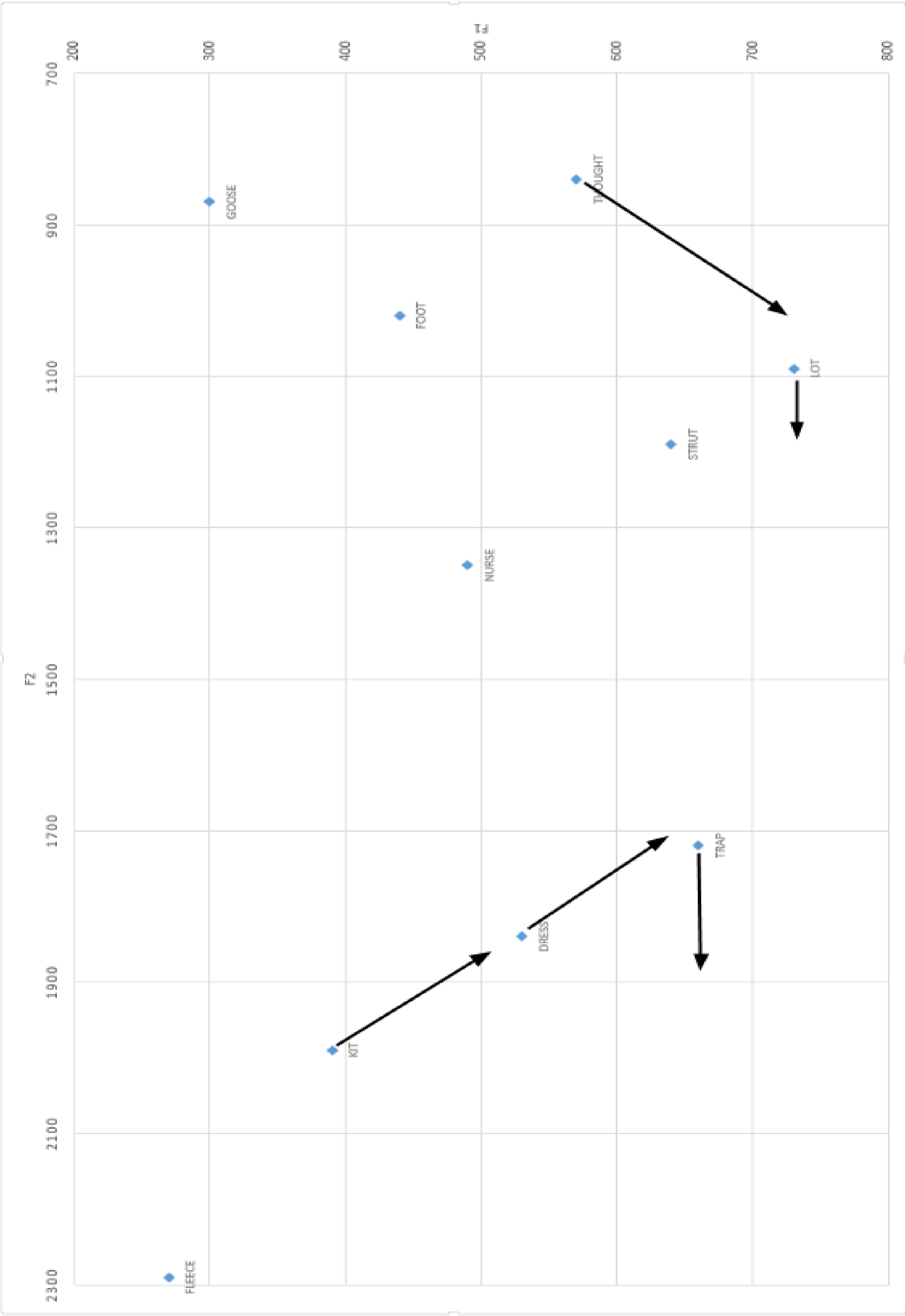


Figure 6.1: The results of the present study. The arrows show the shifting observed. The vowel positions are Peterson and Barney’s (1952).

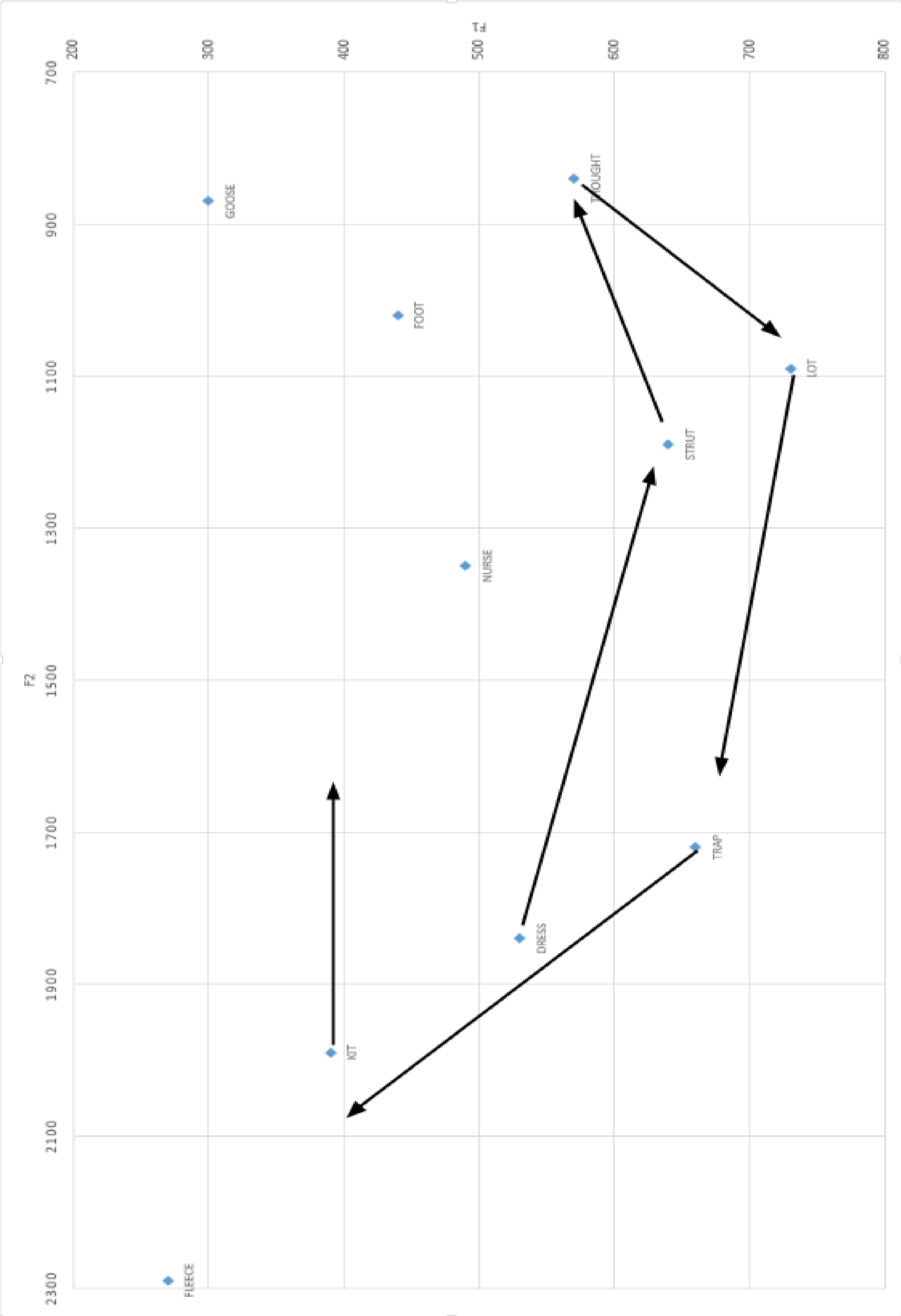


Figure 6.2: The NCS adopted from Labov (2010).

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APPENDIX

In this appendix all raw data from the study will be given. In the tables, speakers are referred to by an arbitrary number assigned to them. The speaker details are thus:

Speaker 15 is an 18 year old male student.

Speaker 2 is a 28 year old male graphic designer.

Speaker 9 is a 32 year old male in finance.

Speaker 14 is a 36 year old male waiter.

Speaker 3 is a 49 year old male in finance.

Speaker 12 is a 50 year old unemployed male.

Speaker 10 is a 50 year old unemployed male.

Speaker 4 is 51 year old male creative director.

Speaker 11 is a 56 year old male blender.

Speaker 7 is a 56 year old male programmer.

Speaker 5 is a 62 year old male security guard.

Word list data

Speaker	Lexical set	Word	F1	F2	F3
15	TRAP	Ant	721	2087	2639
15	TRAP	Bag	680	1787	2522
15	DRESS	Bell	633	1620	2362
15	STRUT	Buff	650	1187	2375
15	LOT	Cog	775	1124	2619
15	DRESS	Egg	584	2039	2608
15	KIT	Fill	557	1705	2383
15	TRAP	Gaff	717	1612	2316
15	THOUGHT	Gawp	911	1289	2560
15	THOUGHT	Hawk	744	1094	2628
15	STRUT	Jug	636	1310	2382
15	KIT	Lift	499	1722	2452
15	DRESS	Pen	718	1843	2644
15	STRUT	Pulse	707	985	2509
15	STRUT	Run	721	1461	2476
15	THOUGHT	Sauce	762	1184	2579
15	TRAP	Shall	799	1546	2327
15	KIT	Sick	536	1732	2540
15	KIT	Skin	675	1850	2767
15	LOT	Stop	840	1286	2523
15	DRESS	Theft	660	1618	2427
15	LOT	Wasp	702	1060	2638

2	TRAP	Ant	464	1985	2421
2	TRAP	Bag	672	1481	2414
2	DRESS	Bell	573	1345	2522
2	STRUT	Buff	605	1121	2533
2	LOT	Cog	628	1027	2337
2	DRESS	Egg	521	1620	2440
2	KIT	Fill	491	1427	2428
2	TRAP	Gaff	628	1567	1975
2	THOUGHT	Gawp	640	1167	2276
2	THOUGHT	Hawk	633	972	2570
2	STRUT	Jug	506	1291	2003
2	KIT	Lift	493	1463	2552
2	DRESS	Pen	586	1536	2477
2	STRUT	Pulse	447	743	2680
2	STRUT	Run	566	1115	2837
2	THOUGHT	Sauce	603	973	2533
2	TRAP	Shall	493	1537	2115
2	KIT	Sick	490	1561	2411
2	KIT	Skin	504	1645	2330
2	LOT	Stop	676	1123	2371
2	DRESS	Theft	560	1425	2518
2	LOT	Wasp	617	951	2566
9	TRAP	Ant	521	2075	2571
9	TRAP	Bag	721	1617	2480
9	DRESS	Bell	544	1487	2598
9	STRUT	Buff	615	1082	2671
9	LOT	Cog	665	1105	2485
9	DRESS	Egg	513	1801	2640
9	KIT	Fill	457	1522	2517
9	TRAP	Gaff	680	1683	2460
9	THOUGHT	Gawp	710	1244	2342
9	THOUGHT	Hawk	686	1038	2727
9	STRUT	Jug	578	1281	2450
9	KIT	Lift	451	1535	2540
9	DRESS	Pen	419	1838	2739
9	STRUT	Pulse	528	987	2689
9	STRUT	Run	701	1120	2436
9	THOUGHT	Sauce	505	886	2496
9	TRAP	Shall	727	1480	2461
9	KIT	Sick	410	1664	2582
9	LOT	Stop	773	1325	2425
9	DRESS	Theft	622	1589	2584
9	LOT	Wasp	562	972	2447
14	TRAP	Ant	652	1858	3046
14	TRAP	Bag	702	1486	2240

14	DRESS	Bell	665	1305	2374
14	STRUT	Buff	682	1187	2447
14	LOT	Cog	697	1070	2376
14	DRESS	Egg	469	1932	2307
14	KIT	Fill	500	1444	2397
14	TRAP	Gaff	728	1450	2198
14	THOUGHT	Gawp	711	1013	2315
14	THOUGHT	Hawk	760	1180	2395
14	STRUT	Jug	621	1138	2357
14	KIT	Lift	512	1495	2375
14	DRESS	Pen	628	1672	2260
14	STRUT	Pulse	538	1129	1997
14	STRUT	Run	701	1303	2766
14	THOUGHT	Sauce	671	1066	2243
14	TRAP	Shall	679	1353	1951
14	KIT	Sick	508	1595	2168
14	KIT	Skin	611	1679	2214
14	LOT	Stop	732	1173	2223
14	DRESS	Theft	658	1389	2325
14	LOT	Wasp	653	964	2482
3	TRAP	Ant	436	1968	2304
3	TRAP	Bag	567	1603	2360
3	DRESS	Bell	561	1404	2244
3	STRUT	Buff	573	1113	2198
3	LOT	Cog	639	982	2393
3	DRESS	Egg	466	1612	2408
3	KIT	Fill	436	1429	2270
3	THOUGHT	Gawp	637	1045	2370
3	THOUGHT	Hawk	634	942	2365
3	STRUT	Jug	550	1174	2186
3	KIT	Lift	486	1233	2507
3	DRESS	Pen	429	1541	2342
3	STRUT	Pulse	458	608	2457
3	STRUT	Run	557	1252	2169
3	THOUGHT	Sauce	604	981	2202
3	KIT	Sick	499	1381	2492
3	KIT	Skin	414	1856	2301
3	LOT	Stop	616	1075	2313
3	DRESS	Theft	571	1467	2294
3	LOT	Wasp	601	948	2313
12	TRAP	Ant	657	1979	2446
12	TRAP	Bag	735	1685	2495
12	DRESS	Bell	638	1717	2532
12	STRUT	Buff	733	1328	2759
12	LOT	Cog	729	1038	2655

12	DRESS	Egg	592	1990	2671
12	KIT	Fill	515	1763	2330
12	TRAP	Gaff	623	1827	2461
12	THOUGHT	Gawp	763	1026	2579
12	THOUGHT	Hawk	836	874	2869
12	STRUT	Jug	604	1484	2464
12	KIT	Lift	537	1538	2683
12	DRESS	Pen	698	1915	2574
12	STRUT	Pulse	562	805	2765
12	STRUT	Run	759	1305	2534
12	THOUGHT	Sauce	736	1070	2703
12	TRAP	Shall	835	1411	2422
12	KIT	Sick	545	1752	2661
12	KIT	Skin	477	1991	2514
12	LOT	Stop	842	1421	2614
12	DRESS	Theft	658	1653	2595
12	LOT	Wasp	804	1211	2686
10	TRAP	Ant	578	2413	3173
10	TRAP	Bag	763	2060	2347
10	DRESS	Bell	621	1740	2420
10	STRUT	Buff	800	1391	2405
10	LOT	Cog	884	1190	2351
10	DRESS	Egg	556	1871	2406
10	KIT	Fill	461	1599	2893
10	TRAP	Gaff	805	1937	2342
10	THOUGHT	Gawp	1003	1292	2379
10	THOUGHT	Hawk	865	1200	2688
10	STRUT	Jug	675	1122	2363
10	KIT	Lift	566	1628	3204
10	DRESS	Pen	656	1812	2219
10	STRUT	Pulse	587	1426	2190
10	STRUT	Run	804	1347	2173
10	THOUGHT	Sauce	825	1172	2438
10	TRAP	Shall	798	1824	2400
10	KIT	Sick	561	1924	2577
10	KIT	Skin	592	2076	2838
10	LOT	Stop	1004	1414	2377
10	DRESS	Theft	703	1866	2625
10	LOT	Wasp	834	1068	2195
4	TRAP	Ant	516	2194	2475
4	TRAP	Bag	698	1661	2217
4	DRESS	Bell	560	1441	2355
4	STRUT	Buff	654	1058	2454
4	LOT	Cog	688	1030	2249
4	DRESS	Egg	539	1767	2222

4	KIT	Fill	484	1381	2343
4	TRAP	Gaff	750	1326	2141
4	THOUGHT	Gawp	765	1151	2296
4	THOUGHT	Hawk	766	1062	2595
4	STRUT	Jug	597	1233	2253
4	KIT	Lift	501	1364	2415
4	DRESS	Pen	586	1881	2180
4	STRUT	Pulse	505	750	2527
4	STRUT	Run	690	1035	2221
4	THOUGHT	Sauce	747	1119	2561
4	TRAP	Shall	697	1504	2116
4	KIT	Sick	549	1476	2237
4	KIT	Skin	428	1798	2066
4	LOT	Stop	796	1133	2730
4	DRESS	Theft	581	1451	2165
4	LOT	Wasp	688	967	2292
11	TRAP	Ant	667	2257	3193
11	TRAP	Bag	695	1731	2480
11	DRESS	Bell	639	1741	2502
11	STRUT	Buff	730	1157	2571
11	LOT	Cog	563	913	2407
11	DRESS	Egg	559	2007	2581
11	KIT	Fill	407	2026	2546
11	TRAP	Gaff	671	1811	2358
11	THOUGHT	Gawp	656	973	2553
11	THOUGHT	Hawk	727	1076	2600
11	STRUT	Jug	697	1288	2617
11	KIT	Lift	446	1857	2690
11	DRESS	Pen	611	1773	2577
11	STRUT	Pulse	634	952	2462
11	STRUT	Run	755	1383	2903
11	THOUGHT	Sauce	683	1066	2553
11	TRAP	Shall	637	1895	2594
11	KIT	Sick	495	1860	2621
11	KIT	Skin	480	2039	2607
11	LOT	Stop	480	2039	2607
11	DRESS	Theft	608	1754	2647
11	LOT	Wasp	769	1066	2707
7	TRAP	Ant	611	1850	2300
7	TRAP	Bag	634	1638	2350
7	DRESS	Bell	493	1487	2264
7	STRUT	Buff	642	1154	2405
7	LOT	Cog	654	1103	2195
7	DRESS	Egg	526	1772	2327
7	KIT	Fill	502	1545	2241

7	TRAP	Gaff	559	1733	2222
7	THOUGHT	Gawp	642	1136	2291
7	THOUGHT	Hawk	641	1001	2423
7	STRUT	Jug	595	1298	2317
7	KIT	Lift	479	1524	2280
7	DRESS	Pen	560	1684	2223
7	STRUT	Pulse	580	950	2670
7	STRUT	Run	644	1248	2450
7	THOUGHT	Sauce	672	1095	2411
7	TRAP	Shall	686	1294	2159
7	KIT	Sick	492	1603	2284
7	KIT	Skin	506	1773	2335
7	LOT	Stop	675	1085	2278
7	DRESS	Theft	616	1386	2304
7	LOT	Wasp	677	1042	2273
5	TRAP	Ant	553	1101	2246
5	TRAP	Bag	526	1673	2450
5	DRESS	Bell	537	1475	2552
5	STRUT	Buff	613	1091	2606
5	LOT	Cog	715	971	2784
5	DRESS	Egg	502	1730	2457
5	KIT	Fill	400	1516	2557
5	TRAP	Gaff	622	1711	2104
5	THOUGHT	Gawp	728	1143	2616
5	THOUGHT	Hawk	730	1014	3104
5	STRUT	Jug	545	1118	2411
5	KIT	Lift	475	1429	2612
5	DRESS	Pen	619	1875	2588
5	STRUT	Pulse	598	781	2879
5	STRUT	Run	645	1216	2573
5	THOUGHT	Sauce	659	976	2884
5	TRAP	Shall	599	1510	2304
5	KIT	Sick	500	1516	2350
5	KIT	Skin	571	1159	1551
5	LOT	Stop	755	1204	2554
5	DRESS	Theft	590	1362	2412
5	LOT	Wasp	675	978	2772

Reading passage data

Speaker	Lexical set	Word	F1	F2	F3
15	DRESS	When	713	1602	2555
15	STRUT	Young	633	1611	2674
15	LOT	Stocked	710	1248	2514
15	DRESS	Shelves	608	1289	2400

15	STRUT	One	640	996	2286
15	STRUT	Dull	661	928	2922
15	KIT	Finished	495	1365	2260
15	TRAP	Stack	667	1496	2537
15	TRAP	Cat	657	1667	2448
15	TRAP	Cans	677	1995	2639
15	STRUT	One_2	670	1014	2436
15	LOT	Dollar	659	1020	2523
15	LOT	Profit	652	1048	2385
15	KIT	With	478	1512	2504
15	STRUT	Funny	693	1172	2431
15	TRAP	Hat	743	1695	2275
15	THOUGHT	Walking	581	963	2307
15	THOUGHT	Across	657	1029	2275
15	DRESS	Ahead	642	1616	2168
15	THOUGHT	Coughed	724	1018	2460
15	LOT	Knocked	757	1425	2707
15	TRAP	Cans_2	675	2072	2564
15	TRAP	Lapsed	786	1550	2362
15	STRUT	Stuck	657	1333	2449
15	KIT	Wiggled	498	1508	2294
15	KIT	Bit	580	1630	2465
15	TRAP	Managed	699	1894	2526
15	THOUGHT	Crawl	632	968	2400
15	KIT	Bit_2	507	1854	2473
15	KIT	Lip	581	1495	2386
15	DRESS	Neck	660	1851	2574
15	THOUGHT	Small	740	932	2242
15	TRAP	Gathered	646	1641	2045
15	TRAP	Ran	656	1851	2070
15	THOUGHT	Gauntlet	648	1327	1919
15	TRAP	Back	670	1634	2446
15	LOT	Stock	689	1134	2638
15	THOUGHT	Boss	682	1070	2547
15	THOUGHT	Vaughan	784	1034	2559
15	TRAP	Scalp	659	1365	2307
15	THOUGHT	Called	646	1010	2535
15	DRESS	Jeff	606	1511	2353
15	DRESS	Fetch	515	1493	2353
15	KIT	Kit	502	1889	2570
15	TRAP	Bandage	615	1981	2321
15	DRESS	Head	625	1720	2483
15	DRESS	Said	458	1557	2531
15	LOT	Don	685	1221	2500
15	KIT	Killed	446	1927	2467

15	KIT	Think	535	1906	2561
14	DRESS	When	695	1489	2280
14	STRUT	Young	722	1291	2190
14	LOT	Stocked	696	1109	2307
14	DRESS	Shelves	630	1085	2398
14	STRUT	One	593	1046	2182
14	STRUT	Dull	624	857	2478
14	KIT	Finished	600	1517	2144
14	TRAP	Stack	682	1542	2293
14	TRAP	Cat	692	1443	2046
14	TRAP	Cans	632	1771	2227
14	STRUT	One_2	661	1088	2298
14	LOT	Dollar	658	1083	2441
14	LOT	Profit	667	1186	1942
14	KIT	With	466	1382	2141
14	STRUT	Funny	709	1254	2111
14	TRAP	Hat	725	1512	2251
14	THOUGHT	Walking	638	879	2264
14	THOUGHT	Across	662	1089	1896
14	DRESS	Ahead	610	1550	2475
14	THOUGHT	Coughed	691	1069	2215
14	LOT	Knocked	716	1179	2168
14	TRAP	Cans_2	619	1884	2280
14	TRAP	Lapsed	718	1443	2215
14	STRUT	Stuck	675	1200	2182
14	KIT	Wiggled	479	1186	2142
14	KIT	Bit	534	1567	2066
14	TRAP	Managed	620	1820	2346
14	THOUGHT	Crawl	648	955	2030
14	KIT	Bit_2	489	1554	2255
14	KIT	Lip	540	1409	2492
14	DRESS	Neck	658	1538	2153
14	THOUGHT	Small	662	942	1978
14	TRAP	Gathered	730	1451	2219
14	TRAP	Ran	629	1777	2184
14	THOUGHT	Gauntlet	689	1120	1948
14	TRAP	Back	734	1446	2222
14	LOT	Stock	674	1224	2243
14	THOUGHT	Boss	692	1060	2193
14	THOUGHT	Vaughan	694	1083	2000
14	TRAP	Scalp	688	1278	2104
14	THOUGHT	Called	664	984	2459
14	DRESS	Jeff	631	1450	2172
14	DRESS	Fetch	646	1462	2202
14	KIT	Kit	528	1565	2244

14	TRAP	Bandage	548	1915	2258
14	DRESS	Head	651	1548	2173
14	DRESS	Said	635	1441	2128
14	LOT	Don	697	1104	2603
14	KIT	Killed	567	1049	2551
14	KIT	Think	527	1824	2303
12	DRESS	When	830	1469	2605
12	STRUT	Young	693	1365	2839
12	LOT	Stocked	775	1183	2559
12	DRESS	Shelves	550	1607	2452
12	STRUT	One	733	1120	2483
12	STRUT	Dull	585	806	2824
12	KIT	Finished	612	1672	2319
12	TRAP	Stack	713	1570	2629
12	TRAP	Cat	694	1704	2381
12	TRAP	Cans	598	2074	2703
12	STRUT	One_2	673	1222	2694
12	LOT	Dollar	731	1282	2525
12	LOT	Profit	722	1176	2212
12	KIT	With	338	2087	2372
12	STRUT	Funny	730	1323	2350
12	TRAP	Hat	634	1872	2560
12	THOUGHT	Walking	785	917	2754
12	THOUGHT	Across	722	1174	2236
12	DRESS	Ahead	586	1724	2528
12	THOUGHT	Coughed	652	1082	2424
12	LOT	Knocked	804	1255	2718
12	TRAP	Cans_2	605	2096	2585
12	TRAP	Lapsed	814	1590	2467
12	STRUT	Stuck	665	1466	2448
12	KIT	Wiggled	455	1246	2300
12	KIT	Bit	519	1783	2504
12	TRAP	Managed	678	1651	2456
12	THOUGHT	Crawl	656	1192	1807
12	KIT	Bit_2	510	1931	2529
12	KIT	Lip	558	1600	2589
12	DRESS	Neck	663	1739	2463
12	THOUGHT	Small	681	976	3025
12	TRAP	Gathered	723	1606	2381
12	TRAP	Ran	729	1770	2407
12	THOUGHT	Gauntlet	763	1195	2204
12	TRAP	Back	750	1615	2425
12	LOT	Stock	740	1233	2613
12	THOUGHT	Boss	727	1038	2680
12	THOUGHT	Vaughan	759	1027	1931

12	TRAP	Scalp	767	1342	2363
12	THOUGHT	Called	607	923	2822
12	DRESS	Jeff	580	1751	2725
12	DRESS	Fetch	660	1572	2453
12	KIT	Kit	554	1846	2477
12	TRAP	Bandage	676	1683	2188
12	DRESS	Head	620	1645	2417
12	DRESS	Said	599	1682	2504
12	LOT	Don	766	1111	2317
12	KIT	Killed	393	2014	2409
12	KIT	Think	508	1909	2492
11	DRESS	When	722	1584	2498
11	STRUT	Young	664	1625	2477
11	LOT	Stocked	706	1180	2615
11	DRESS	Shelves	592	1757	2485
11	STRUT	One	771	1322	2749
11	STRUT	Dull	681	1115	2607
11	KIT	Finished	512	1861	2407
11	TRAP	Stack	686	1693	2535
11	TRAP	Cat	707	1662	2298
11	TRAP	Cans	675	2047	2614
11	STRUT	One_2	738	1233	2566
11	LOT	Dollar	680	1075	2505
11	LOT	Profit	682	1122	2241
11	KIT	With	509	1594	2533
11	STRUT	Funny	718	1411	2133
11	TRAP	Hat	688	1942	3706
11	THOUGHT	Walking	629	1035	2296
11	DRESS	Ahead	560	1742	2563
11	THOUGHT	Coughed	716	1252	2469
11	LOT	Knocked	718	1239	2418
11	TRAP	Cans_2	601	2031	2493
11	TRAP	Lapsed	719	1785	2603
11	STRUT	Stuck	805	1272	2514
11	KIT	Wiggled	465	1374	2162
11	KIT	Bit	527	1866	2540
11	TRAP	Managed	660	1769	2567
11	THOUGHT	Crawl	655	1054	2130
11	KIT	Bit_2	521	1898	2603
11	KIT	Lip	517	1907	2631
11	DRESS	Neck	629	1795	2683
11	THOUGHT	Small	679	989	2507
11	TRAP	Gathered	649	1783	2462
11	TRAP	Ran	654	1797	2541
11	THOUGHT	Gauntlet	752	1090	2946

11	TRAP	Back	752	1723	2558
11	LOT	Stock	676	1069	2715
11	THOUGHT	Boss	693	1069	2617
11	THOUGHT	Vaughan	704	1030	2654
11	TRAP	Scalp	671	1542	2136
11	THOUGHT	Called	657	1134	2508
11	DRESS	Jeff	520	1855	2558
11	DRESS	Fetch	598	1842	2138
11	KIT	Kit	523	1928	2671
11	TRAP	Bandage	640	1863	2502
11	DRESS	Head	569	1881	2366
11	DRESS	Said	537	1772	2836
11	LOT	Don	872	959	2868
11	KIT	Killed	440	1946	2659
11	KIT	Think	482	2035	2736
10	DRESS	When	809	1405	2562
10	STRUT	Young	787	1071	2510
10	LOT	Stocked	847	1321	2231
10	DRESS	Shelves	680	1145	2263
10	STRUT	One	644	967	2208
10	STRUT	Dull	503	766	2522
10	KIT	Finished	630	1658	2874
10	TRAP	Stack	832	1924	1989
10	TRAP	Cat	867	1441	1837
10	TRAP	Cans	494	1163	2551
10	STRUT	One_2	574	936	2058
10	LOT	Dollar	690	1051	2909
10	LOT	Profit	867	1336	2342
10	KIT	With	474	1358	1705
10	STRUT	Funny	649	1200	2198
10	TRAP	Hat	773	1347	2000
10	THOUGHT	Walking	817	1139	2113
10	THOUGHT	Across	832	1421	2207
10	DRESS	Ahead	649	1843	2499
10	THOUGHT	Coughed	899	1308	2150
10	LOT	Knocked	881	1288	2129
10	TRAP	Cans_2	575	1492	2492
10	TRAP	Lapsed	835	1673	2271
10	STRUT	Stuck	752	1321	2240
10	KIT	Wiggled	523	1197	1823
10	KIT	Bit	554	1452	2203
10	TRAP	Managed	688	1419	2138
10	THOUGHT	Crawl	713	1127	2322
10	KIT	Bit_2	507	1633	2051
10	KIT	Lip	573	1500	2149

10	DRESS	Neck	731	1398	2438
10	THOUGHT	Small	620	901	2277
10	TRAP	Gathered	716	1472	2421
10	TRAP	Ran	679	1849	2316
10	THOUGHT	Gauntlet	776	953	2075
10	TRAP	Back	827	1727	2348
10	LOT	Stock	799	1326	2101
10	THOUGHT	Boss	860	1360	2204
10	THOUGHT	Vaughan	806	1136	1930
10	TRAP	Scalp	774	1483	2128
10	THOUGHT	Called	619	862	2318
10	DRESS	Jeff	633	1422	2452
10	DRESS	Fetch	635	1858	2395
10	KIT	Kit	515	1748	2911
10	TRAP	Bandage	622	1904	3096
10	DRESS	Head	637	1470	2652
10	DRESS	Said	579	1398	2668
10	LOT	Don	801	992	2200
10	KIT	Killed	510	1603	1963
10	KIT	Think	590	2458	2834
9	DRESS	When	445	1132	2225
9	STRUT	Young	388	1824	2424
9	LOT	Stocked	678	1277	2397
9	DRESS	Shelves	458	1287	2423
9	STRUT	One	519	1077	2610
9	STRUT	Dull	496	894	2627
9	KIT	Finished	474	1390	2256
9	TRAP	Stack	636	1527	2487
9	TRAP	Cat	668	1617	2407
9	TRAP	Cans	491	1942	2337
9	STRUT	One_2	498	1025	2541
9	LOT	Dollar	611	1152	2421
9	LOT	Profit	622	1008	2419
9	STRUT	Funny	546	1058	2606
9	TRAP	Hat	742	1614	2519
9	THOUGHT	Walking	613	931	2438
9	THOUGHT	Across	622	1153	2250
9	DRESS	Ahead	420	1465	2437
9	THOUGHT	Coughed	680	1088	2508
9	LOT	Knocked	816	1260	2478
9	TRAP	Cans_2	434	1874	2042
9	TRAP	Lapsed	733	1455	2638
9	STRUT	Stuck	614	1287	2386
9	KIT	Wiggled	419	1040	2342
9	KIT	Bit	479	1518	2510

9	TRAP	Managed	478	1592	2227
9	THOUGHT	Crawl	568	980	2348
9	KIT	Lip	455	1460	2386
9	DRESS	Neck	594	1575	2414
9	THOUGHT	Small	561	940	2458
9	TRAP	Gathered	591	1597	2187
9	TRAP	Ran	499	1658	2185
9	THOUGHT	Gauntlet	624	1239	2536
9	TRAP	Back	657	1490	2396
9	LOT	Stock	662	1289	2342
9	THOUGHT	Boss	670	1119	2488
9	THOUGHT	Vaughan	641	1076	2262
9	TRAP	Scalp	601	1363	2306
9	THOUGHT	Called	573	862	2799
9	DRESS	Jeff	498	1520	2376
9	DRESS	Fetch	534	1468	2370
9	KIT	Kit	463	1736	2437
9	TRAP	Bandage	523	1791	2448
9	DRESS	Head	492	1731	2514
9	DRESS	Said	477	1514	2440
9	LOT	Don	574	1358	2689
9	KIT	Killed	425	1704	2422
9	KIT	Think	376	1957	2386
7	DRESS	When	683	1399	2114
7	STRUT	Young	598	1193	2411
7	LOT	Stocked	695	1184	2590
7	DRESS	Shelves	571	1093	2548
7	STRUT	One	572	1086	2355
7	STRUT	Dull	538	1085	2355
7	KIT	Finished	447	1496	2459
7	TRAP	Stack	630	1510	2165
7	TRAP	Cat	585	1566	2276
7	TRAP	Cans	545	1764	2453
7	STRUT	One_2	597	1056	2252
7	LOT	Dollar	614	1157	2357
7	LOT	Profit	643	1086	2392
7	KIT	With	437	1143	2151
7	STRUT	Funny	608	1157	2351
7	TRAP	Hat	625	1402	2179
7	THOUGHT	Walking	520	1075	2310
7	THOUGHT	Across	644	1181	2054
7	DRESS	Ahead	541	1586	2386
7	THOUGHT	Coughed	642	1019	2208
7	LOT	Knocked	682	1205	2461
7	TRAP	Cans_2	524	1762	2165

7	TRAP	Lapsed	693	1382	2407
7	STRUT	Stuck	644	1218	2447
7	KIT	Wiggled	461	1199	2062
7	KIT	Bit	464	1588	2294
7	TRAP	Managed	614	1651	2431
7	THOUGHT	Crawl	524	1007	1979
7	KIT	Bit_2	457	1634	2286
7	KIT	Lip	513	1460	2306
7	DRESS	Neck	613	1574	2351
7	THOUGHT	Small	628	976	2451
7	TRAP	Gathered	543	1659	2179
7	TRAP	Ran	582	1615	1970
7	THOUGHT	Gauntlet	688	1177	2022
7	TRAP	Back	661	1392	2319
7	LOT	Stock	657	1203	2304
7	THOUGHT	Boss	643	1048	2298
7	THOUGHT	Vaughan	673	1009	2226
7	TRAP	Scalp	656	1222	2278
7	THOUGHT	Called	564	1017	2286
7	DRESS	Jeff	502	1513	2459
7	DRESS	Fetch	537	1454	2215
7	KIT	Kit	471	1691	2372
7	TRAP	Bandage	580	1600	2415
7	DRESS	Head	542	1579	2295
7	DRESS	Said	497	1637	2326
7	LOT	Don	651	1168	2126
7	KIT	Killed	434	1642	2210
7	KIT	Think	462	1838	2310
2	DRESS	When	583	1251	2214
2	STRUT	Young	563	1273	2447
2	LOT	Stocked	609	1151	2233
2	DRESS	Shelves	511	1068	2760
2	STRUT	One	475	835	2276
2	STRUT	Dull	496	829	2671
2	KIT	Finished	509	1453	2221
2	TRAP	Stack	594	1443	2274
2	TRAP	Cat	599	1395	2353
2	TRAP	Cans	438	1841	2228
2	STRUT	One_2	527	951	2218
2	LOT	Dollar	585	1026	2645
2	LOT	Profit	601	1041	2298
2	KIT	With	420	1137	2422
2	STRUT	Funny	567	1051	1861
2	TRAP	Hat	635	1488	2333
2	THOUGHT	Walking	537	866	2292

2	THOUGHT	Across	568	1072	1973
2	DRESS	Ahead	482	1469	1887
2	THOUGHT	Coughed	622	975	2502
2	LOT	Knocked	652	1154	2261
2	TRAP	Cans_2	475	1921	2313
2	TRAP	Lapsed	642	1235	2491
2	STRUT	Stuck	564	1193	2581
2	KIT	Wiggled	435	1116	2335
2	KIT	Bit	479	1459	2485
2	TRAP	Managed	513	1676	2174
2	THOUGHT	Crawl	567	877	2652
2	KIT	Bit_2	458	1590	2606
2	KIT	Lip	482	1500	2487
2	DRESS	Neck	585	1550	2419
2	THOUGHT	Small	560	925	2042
2	TRAP	Gathered	579	1459	2277
2	TRAP	Ran	506	1574	2050
2	THOUGHT	Gauntlet	618	1092	2443
2	TRAP	Back	655	1329	2385
2	LOT	Stock	611	1169	2322
2	THOUGHT	Boss	604	970	2625
2	THOUGHT	Vaughan	568	966	2508
2	TRAP	Scalp	593	1234	2332
2	THOUGHT	Called	539	939	2730
2	DRESS	Jeff	552	1384	2302
2	DRESS	Fetch	571	1366	2049
2	KIT	Kit	443	1582	2504
2	TRAP	Bandage	508	1592	2126
2	DRESS	Head	483	1417	2147
2	DRESS	Said	479	1422	2377
2	LOT	Don	586	1017	2353
2	KIT	Think	442	1918	2491
3	DRESS	When	493	1197	2379
3	STRUT	Young	546	1231	2311
3	LOT	Stocked	596	1130	2014
3	DRESS	Shelves	449	1565	2304
3	STRUT	One	455	1090	2123
3	STRUT	Dull	450	746	2551
3	KIT	Finished	483	1263	2043
3	TRAP	Stack	558	1454	2304
3	TRAP	Cat	587	1361	2274
3	TRAP	Cans	455	1984	2183
3	STRUT	One_2	431	1337	2440
3	LOT	Dollar	588	959	2266
3	LOT	Profit	614	1004	1922

3	KIT	With	445	1293	2293
3	STRUT	Funny	533	1292	2192
3	TRAP	Hat	555	1499	2295
3	THOUGHT	Walking	607	907	2092
3	THOUGHT	Across	560	1116	2027
3	DRESS	Ahead	516	1467	2350
3	THOUGHT	Coughed	585	1076	2196
3	LOT	Knocked	549	1149	2093
3	TRAP	Cans_2	470	1668	2430
3	TRAP	Lapsed	621	1364	2223
3	STRUT	Stuck	630	1240	2246
3	KIT	Wiggled	412	902	2236
3	KIT	Bit	519	1576	2305
3	TRAP	Managed	516	1521	2231
3	THOUGHT	Crawl	593	988	2054
3	KIT	Bit_2	475	1559	2281
3	KIT	Lip	485	1482	2342
3	DRESS	Neck	564	1548	2249
3	THOUGHT	Small	559	867	2164
3	TRAP	Gathered	600	1412	2187
3	TRAP	Ran	510	1618	2251
3	THOUGHT	Gauntlet	580	1149	2363
3	TRAP	Back	572	1345	2235
3	LOT	Stock	619	1098	2070
3	THOUGHT	Boss	632	1024	2209
3	THOUGHT	Vaughan	557	979	2262
3	TRAP	Scalp	508	1701	2287
3	THOUGHT	Called	537	838	2282
3	DRESS	Jeff	554	1276	2085
3	DRESS	Fetch	492	1286	2174
3	KIT	Kit	488	1514	2259
3	TRAP	Bandage	476	1770	2243
3	DRESS	Head	566	1476	2233
3	DRESS	Said	516	1518	2353
3	LOT	Don	595	1073	2330
3	KIT	Killed	431	1702	2357
3	KIT	Think	423	2287	3221
5	DRESS	When	539	1198	2249
5	STRUT	Young	602	1107	2495
5	LOT	Stocked	644	1132	2314
5	DRESS	Shelves	548	907	2492
5	STRUT	One	584	1153	2391
5	STRUT	Dull	496	1027	2684
5	KIT	Finished	466	1379	2362
5	TRAP	Stack	604	1472	2264

5	TRAP	Cat	573	1616	2351
5	TRAP	Cans	574	1957	2544
5	STRUT	One_2	616	1092	2233
5	LOT	Dollar	602	1066	2521
5	LOT	Profit	590	946	1616
5	KIT	With	438	1144	2305
5	STRUT	Funny	559	1095	2332
5	TRAP	Hat	612	1782	2877
5	THOUGHT	Walking	618	983	2317
5	THOUGHT	Across	568	1135	2383
5	DRESS	Ahead	562	1438	2388
5	THOUGHT	Coughed	663	1056	2589
5	LOT	Knocked	679	1107	2559
5	TRAP	Cans_2	524	1917	2390
5	TRAP	Lapsed	677	1495	1921
5	STRUT	Stuck	608	1124	2355
5	KIT	Wiggled	446	1461	2081
5	KIT	Bit	490	1491	2509
5	TRAP	Managed	586	1607	2175
5	THOUGHT	Crawl	585	840	2384
5	KIT	Bit_2	485	1563	2688
5	KIT	Lip	524	1468	2508
5	DRESS	Neck	616	1596	2561
5	THOUGHT	Small	587	799	2736
5	TRAP	Gathered	594	1595	2354
5	TRAP	Ran	531	1763	2248
5	THOUGHT	Gauntlet	655	1078	2574
5	TRAP	Back	598	1418	2185
5	LOT	Stock	576	1142	2333
5	THOUGHT	Boss	634	953	2658
5	THOUGHT	Vaughan	626	949	2595
5	TRAP	Scalp	609	1335	2346
5	THOUGHT	Called	563	874	2639
5	DRESS	Jeff	548	1477	2289
5	DRESS	Fetch	530	1407	1933
5	KIT	Kit	544	1458	2438
5	TRAP	Bandage	551	1799	2512
5	DRESS	Head	584	1503	2431
5	DRESS	Said	506	1356	2518
5	LOT	Don	635	1046	2642
5	KIT	Killed	409	1651	2353
5	KIT	Think	509	1458	2382
4	DRESS	When	546	1123	2678
4	STRUT	Young	716	1142	2269
4	LOT	Stocked	712	1085	2435

4	DRESS	Shelves	557	1253	2243
4	STRUT	One	643	1081	2623
4	STRUT	Dull	551	941	2453
4	KIT	Finished	387	1543	2032
4	TRAP	Stack	591	1494	2285
4	TRAP	Cat	616	1727	2231
4	TRAP	Cans	451	1817	2156
4	STRUT	One_2	644	1054	2094
4	LOT	Dollar	658	1069	2336
4	LOT	Profit	660	1086	2033
4	KIT	With	552	1104	2251
4	STRUT	Funny	729	1090	2085
4	TRAP	Hat	728	1673	2027
4	THOUGHT	Walking	661	1016	2243
4	THOUGHT	Across	649	1075	1977
4	DRESS	Ahead	585	1353	2307
4	THOUGHT	Coughed	715	1079	2418
4	LOT	Knocked	773	1160	2550
4	TRAP	Cans_2	477	1443	2055
4	TRAP	Lapsed	759	1437	2283
4	STRUT	Stuck	660	1256	2348
4	KIT	Wiggled	493	885	2058
4	KIT	Bit	487	1451	2278
4	TRAP	Managed	655	1813	2246
4	THOUGHT	Crawl	645	893	2312
4	KIT	Bit_2	466	1624	2357
4	KIT	Lip	508	1363	2278
4	DRESS	Neck	685	1658	2266
4	THOUGHT	Small	665	893	2650
4	TRAP	Gathered	622	1596	2144
4	TRAP	Ran	644	1742	1902
4	THOUGHT	Gauntlet	691	1229	1876
4	TRAP	Back	693	1447	2338
4	LOT	Stock	698	1148	2256
4	THOUGHT	Boss	699	1058	2406
4	THOUGHT	Vaughan	706	1066	2826
4	TRAP	Scalp	631	1490	2131
4	THOUGHT	Called	557	863	2384
4	DRESS	Jeff	551	1477	2220
4	DRESS	Fetch	596	1395	2204
4	KIT	Kit	447	1677	2262
4	TRAP	Bandage	535	1668	2071
4	DRESS	Head	605	1576	2282
4	DRESS	Said	509	1384	2205
4	LOT	Don	779	1132	2041

4	KIT	Killed	454	1583	2186
4	KIT	Think	489	1696	2156

Minimal pair data

Subject: 2	F1	F2	F3	Same?
LOT words:				
COT	640	1084	2280	Same
ODD	640	1026	2591	Same
COLLAR	648	997	2554	Same
DON	588	1016	2658	Same
POND	600	994	2169	Same
THOUGHT words:				
CAUGHT	615	1108	2367	Same
AWED	683	1049	2570	Same
CALLER	606	998	2664	Same
DAWN	605	1029	2476	Same
PAWNED	596	953	2001	Same
Subject: 3				
LOT words:				
COT	656	1071	2168	Similar
ODD	605	1033	2243	Similar
COLLAR	616	1019	2417	Similar
DON	552	1002	2381	Different
POND	541	961	2381	Different
THOUGHT words:				
CAUGHT	663	1049	2219	Similar
AWED	615	960	2316	Similar
CALLER	518	761	2408	Similar
DAWN	609	1128	2406	Different
PAWNED	573	970	2527	Different
Subject: 4				
LOT words:				
COT	761	1255	2393	Same
ODD	701	1045	2469	Same
COLLAR	719	1042	2430	Same
DON	786	1157	2486	Same
POND	705	1018	3268	Same
THOUGHT words:				
CAUGHT	799	1191	2414	Same

AWED	717	1006	3219	Same
CALLER	685	1005	2500	Same
DAWN	820	1191	2634	Same
PAWNED	583	1060	2842	Same
Subject: 5				
LOT words:				
COT	764	1123	2971	Similar
ODD	753	1059	2763	Similar
COLLAR	669	942	3073	Similar
DON	726	1108	2966	Different
POND	744	1020	3161	Similar
THOUGHT words:				
CAUGHT	800	1158	2866	Similar
AWED	755	1036	3003	Similar
CALLER	647	834	2477	Similar
DAWN	757	1010	2959	Different
PAWNED	726	989	2573	Similar
Subject: 7				
LOT words:				
COT	706	1081	2287	Same
ODD	671	1106	2405	Similar
COLLAR	694	1077	2624	Same
DON	661	1099	2371	Same
POND	661	1053	2114	Same
THOUGHT words:				
CAUGHT	640	1135	2185	Same
AWED	675	1081	2789	Similar
CALLER	661	1047	2235	Same
DAWN	659	1109	2345	Same
PAWNED	634	1021	2583	Same
Subject: 9				
LOT words:				
COT	739	1236	2470	Same
ODD	626	1003	2670	Different
COLLAR	651	971	2669	Same
DON	648	964	2506	Same
POND	603	999	2769	Same
THOUGHT words:				
CAUGHT	675	1195	2438	Same

AWED	584	895	2613	Different
CALLER	626	947	2656	Same
DAWN	592	1059	2182	Same
PAWNED	589	958	2633	Same
Subject: 11				
LOT words:				
COT	736	1103	2292	Same
ODD	696	1092	2190	Same
COLLAR	696	1080	2592	Same
DON	NA	NA	NA	Same
POND	701	939	2876	Same
THOUGHT words:				
CAUGHT	673	1103	2411	Same
AWED	709	958	2615	Same
CALLER	701	1184	2795	Same
DAWN	NA	NA	NA	Same
PAWNED	637	1016	2947	Same
Subject: 12				
LOT words:				
COT	681	1191	2466	Same
ODD	762	1224	2548	Different
COLLAR	744	1125	2501	Different
DON	803	1255	2595	Different
POND	776	1039	2756	Different
THOUGHT words:				
CAUGHT	759	1240	2400	Same
AWED	735	1035	2693	Different
CALLER	648	946	2597	Different
DAWN	750	1062	2503	Different
PAWNED	701	892	2857	Different
Subject: 14				
LOT words:				
COT	700	1126	2155	Similar
ODD	685	987	2122	Similar
COLLAR	655	945	2304	Same
DON	699	1104	2186	Similar
POND	715	1059	2132	Similar
THOUGHT words:				
CAUGHT	700	1099	2076	Similar

AWED	NA	NA	NA	Similar
CALLER	645	949	2321	Same
DAWN	691	1027	2058	Similar
PAWNED	719	1058	2251	Similar
Subject: 15				
LOT words:				
COT	808	1289	2481	Same
ODD	823	1247	2483	Different
COLLAR	722	1001	2606	Same
DON	759	1202	2600	Different
POND	775	1112	2002	Different
THOUGHT words:				
CAUGHT	726	1115	2484	Same
AWED	778	1149	2492	Different
CALLER	770	1146	2556	Same
DAWN	785	1222	2515	Different
PAWNED	762	1050	1979	Different

Norwegian abstract:

Denne studien er en sosiolingvistisk studie av språkutviklingen i Des Moines, Iowa. Den tar sikte på å utforske hva som skjer i grenseland mellom to dialektområder. Des Moines befinner seg i et slikt grenseområde. I vest finner man General American, til sør sørstatsengelsk, og i øst nordstatenes dialektområde. Dette skaper en unik situasjon hvor den lokale dialekten presses av tre forskjellige dialektområder samtidig.

Denne studien tar for seg to forandringer i det engelske talemål som er i aktiv endring, hvis spredningsområde begge stopper rundt Des Moines. Disse to forandringene er den såkalte Low Back Merger og The Northern Cities Shift. Begge disse forandringene påvirker uttalen av de to lave bakre vokalene, de forandrer seg dog ikke på samme vis, og denne studien ser spesielt på hva som skjer når disse to forandringene påvirker ett og samme område. Vinner ett av mønstrene frem over det andre, eller slår de seg kanskje sammen?

Utover dette utforskes også den generelle tilstanden i Des Moines vis-a-vis de to forannevnte forandringene. Av særskilt viktighet er analysen av i hvilke lingvistiske kontekster spredningen er størst.

Tilfeldig forbipasserende ble ble stoppet og spurt om de kunne tenke seg å ta del i en studie som angikk dialekt. Det ble så gjort opptak av disse, og disse opptakene ble senere analysert akkustisk, og disse dataene danner grunnlaget for studiet.

Resultatene er delte. De kan tyde på at disse to forandringene faktisk slår seg sammen. I resultatene angående lingvistisk kontekst påpekes det en relasjon mellom avvikende uttale og påfølgende lateraler. Det konkluderes med at både Low Back Merger og Northern Cities Shift finnes i Des Moines, men i variende grad.