The Western Vowel Shift in Northern Arizona[1]

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Abstract

Dialect geographies have had little to say about the English spoken in Arizona because of its relatively recent settlement history. Only in the late 20th century could a sizeable population of European Americans[2] claim multigenerational affiliation to the Western US, thereby creating fertile ground for a study of emerging speech patterns. This paper will demonstrate Arizona's developing linguistic alignment with Oregon, Utah, and California English, and introduce suggestive data on some of the variation among different varieties of Arizona English.

Productions of fronted nuclei from the back vowels /uw/ (as in *too, dude,* and *shoe*) and /ow/ (as in *go, boat,* and *so*) are taken as evidence for Arizona's dialectological unification with the other Western states. The analysis of these variables suggests that vowel shift patterns are spreading eastwards from the Pacific Coast and into the Southwest. The data show that the variants pattern quite differently from one another in regards to speaker age and sex. Further investigation of /uw/ production shows that Northern Arizona is actually a location of two /uw/-fronting varieties of American English. The analysis of both /uw/ and /ow/ further shows that a speaker's affiliation or lack of affiliation to the locally defined ranching culture is vital to understanding that speaker's pattern of vowel production. Finally, while most dialect studies have regarded the fronting of /uw/- and /ow/-nuclei as two parallel and related vowel changes, I take this complex social situation as suggestive evidence that the two variables should be considered separately, at least for some speakers.

Introduction

Dialect geographies traditionally divide the United States into five regions: the Northeast, the Northern Cities (Inland North), the Midlands, the South, and the West (see Labov, Ash, & Boberg's *Atlas of North American English*, forthcoming). Given its relatively recent settlement history, the Western US is perhaps the least studied region and an area of great potential in dialect research (see Reed, 1977:42; Carver, 1987:205). Only in the late 19th century did European Americans settle permanently throughout the Western states, and only by the late 20th century could large communities lay claim to a multigenerational heritage and local affiliation with the West. It is this establishment of a new local-based identity that has created fertile ground for an examination of emerging speech patterns.

While the West has been a largely understudied dialect region, the Inland West (as opposed to the Pacific West) has been even less studied. Fought's (2002) perceptual dialectology study found that some California speakers consider the Inland West to be essentially dialect-less, or in other words, not regionally marked. Arizonans are both perceived by outsiders and perceive themselves as speakers of a variety of English that is entirely uninteresting as well as equal to the perceived 'Standard' American English. Perhaps consequently, no description of Arizona English has been proposed, and the question of which variables might characterize Arizona English has never been addressed. My aim is to discuss two sound changes that suggest Arizona's regional alignment with Oregon, Utah, and California.

The first descriptions of Western speech were mainly based on the geographical distribution of Northeastern US, Southeastern US, and Mexican lexical items and phonological features that had been extended into the areas (Reed, 1954:51-71; Metcalf, 1970; Carver, 1987: 217). This evidence was correlated with migration patterns and the only few innovative Western lexemes were those derived from Mexican Spanish, such as *ranch,* which dialectologists glossed

as "farm," and *arroyo*, referring to a "dry creek bed" (Reed, 1954:52-54; see also Kurath, 1972). The primary methods traditional dialect geographers (see Chambers and Trudgill, 1980) are to map isogloss boundaries of word use and the occurrence of phonological variables. Such mapping of English in the Western US had rather few phonological changes to report because settlement populations had yet to stabilize (see DeCamp, 1953).

Labov (1991; 1998) has described the West in combination with the Midland states and Canada, forming the "Third Dialect" area, primarily defined as that dialect not participating in either the Northern Cities Shift or the Southern Shift. The Third Dialect does not have any chain shift to speak of, and is in fact defined by having little vowel movement in general. However, detailed research in areas of the Western States has unearthed a number of interesting vowel changes. The studies have been largely centered on California (DeCamp, 1953; Reed, 1954; Metcalf, 1970; Hinton et al., 1987; Luthin, 1987; Moonwomon, 1992 & 1987; Hagiwara, 1997; Guenter, 2001; Eckert & Staum, 2003), but a few additional studies have focused on Utah (Cook, 1969; Di Paolo, 1998; Di Paolo & Faber, 1990), Oregon (Conn, 2000; Ward, 2003), and rural New Mexico (Bateman, in progress). These studies form the basis for comparison to the data from Arizona.

The present paper is the first to begin to systematically describe the English varieties spoken in Arizona. The data is representative of the varieties of English spoken in and around Flagstaff, the major city in the northern half of the state. Previous dialect research in Arizona is few and far between. Even in the older descriptions of word geographies, "no systematic information is available from Arizona" (Reed, 1977: 56). To my knowledge there have been no sociophonetic studies of English varieties spoken in Arizona, outside of the four speakers included in the TELSUR survey and the Atlas of North American English (Labov, Ash, & Boberg, forthcoming).

Figure 1: Flagstaff, Arizona (modified from Mack, 2003)

Methods: Data Collection

The data were obtained from one-on-one interviews[3] that I (a resident of Flagstaff since age 5) conducted between June and December 2002. All the speakers in this study were residents of Flagstaff or were living within half-an-hour of Flagstaff at the time of the interview. All the speakers had also lived in the Flagstaff area since age 7 or earlier, although many of them had spent some time outside of Northern Arizona (mostly for college). The speakers ranged in age from 18 to 75 years old, with 13 females and 24 males. Although the larger corpus of Flagstaff, Arizona interviews includes 12 persons of color, the present paper presents only data from the 37 European Americans.[4] Each interview lasted from 30 to 45 minutes.

A speaker's socioeconomic class (SEC) was initially defined as a combination of a speaker's occupation (or pre-retirement occupation) and level of education. 8 of the speakers were still in college and were given the SEC rating of their parents. However, there is reason to question the validity of this method of operationalizing SEC. Given that the Southwestern US is

an understudied community, a fundamental part of the data collection would have done well to explore a locally appropriate definition of the SEC demographic for Flagstaff. The consequences of this oversight unquestionably bear on the results in this paper.

My lifetime familiarity with the people of Flagstaff and the relatively small size of the community enabled me to identify potential interviewees who encompassed a diverse range of lifestyle types. Interviewees were contacted by an unstructured snowball method which yielded speakers from a 1st-order to a 5th-order degree distance from me. The people in this study consequently represent only those who had the time and willingness to be interviewed, so while this study has, e.g., speakers from all adult age groups, it does not have exactly equal numbers of people for comparison of, e.g., speaker age. Despite this drawback I believe that the study has enough speakers to permit highly suggestive analyses.

The interview questions focused on issues that I determined to be important to the local community, such as urban development and expansion. Other questions focused on the speaker's attitudes toward Northern Arizona and other communities in Arizona, and on general aspects of the speaker's life, such as family, occupation, and leisure. Word lists were recorded at the close of the interview, but I will make only sparing use of these data in the analysis.[5]

Methods: Introduction to the Variables

The best-established vowel change that distinguishes the Western US among American English dialects is the merger or near-merger of the low-back vowels /a/, /ɑ/, and /ɔ/ (Labov, Ash & Boberg, forthcoming). Besides the negative definition of simply not being Northern Cities or Southern, Labov's Third Dialect is defined by this low back vowel movement. The original TELSUR study (1996) documented the merger in its sample of four speakers from Arizona, one of whom included a resident of Flagstaff. For the purposes of this study I will assume that this

change has stabilized as at least a near-merger and will not discuss it much further (see DeCamp, 1953, for its first documentation, in California; also Cook, 1969; Moonwomon, 1987:213; and see Di Paolo, 1988, for the analysis of this change as a real vs. near-merger).

In-depth studies in the West (cited above) have generally focused on these additional (although not necessarily correlated) vowel shifts:

1a. the fronting of the nucleus of the back vowel /uw/ before non-liquids

b. the fronting of the nucleus of the back vowel /ow/ before non-liquids

2a. the raising (and fronting) of the fronted low vowel /æ/ before nasals

b. the backing (and lowering) of the fronted low vowel /æ/ before orals

The current study examines patterns (1a) and (1b), and an analysis of (2a) and (2b) is currently in progress. Both studies are based on the analysis of 3,412 vowel formant measurements from mostly monosyllabic, stressed words to gather quantitative evidence for the occurrence of the Western Vowel Shift in the speech of Northern Arizonans (for a seminal paper in this methodology, see Labov, Yaeger, & Steiner, 1972). The results show that, while some speakers in Arizona are participating in the fronting of back vowel nuclei, other speakers show a contrastive pattern of use for the two vowels, and may even be leading in one change while resisting the other.

The Fronting of Back Vowels in the West

The nuclei of both back vowels /uw/ and /ow/ have often been found to shift to the front in English in general, including particular varieties of New World English, such as central Illinois (Habick, 1993), central Ohio (Thomas, 1989/1993), Pennsylvania (Labov, 1994; Labov, Ash, Boberg, forthcoming), Texas (Labov, Yaeger, & Steiner, 1972), parts of Canada (Clark, Elms, and Youssef, 1995), and parts of the South (Feagin, 2003; see Thomas, 2001, for a recent

summary). Parallel fronting of the /uw/ and /ow/ nuclei do not necessarily co-occur, but when they do, the /uw/ nucleus is always 'further front' (e.g., has a greater change in F2 value) than that of /ow/. This 'lag' of /ow/ nuclei partially results from the articulatory fact that high vowels have greater freedom of movement along the F2 dimension than the mid vowels have. In addition, Labov (1994:208) has claimed that /ow/ nuclei never front without corresponding, parallel fronting of /uw/ nuclei (hereafter, '/uw/-fronting' or '/ow/-fronting'.) Despite evidence from multiple geographic sources, it is, in fact, difficult to pinpoint specific regions of North America where the fronting of /uw/ and /ow/ do not co-occur, in the local European American variety. There is no attested US English variety to which the current dataset is comparable where /ow/ fronts but /uw/ does not. One area of contrast may be the Inland Upper North, where /uw/ is fronted but /ow/ is not (Ash, 1996). The present data show that, while parallel fronting phenomena are characteristic of varieties in the West (Hinton et al., 1987), a resistance to /ow/ fronting that is similar to the Inland Upper North may be evidenced in the speech of some Arizonans, even though it is not characteristic of the general areal dialect.

Additionally, some areas of the US still keep all of their back vowels back. No evidence for fronting has been recorded in most of New England, the Northern Great Plains, or New York. The changes in Arizona and the Western US can be seen as contrastive with these varieties, as well as with the standard phonetic descriptions of US English back vowel nuclei (Peterson & Barney, 1952; Hillenbrand, et al., 1995; see Hagiwara, 1997).

Back vowel fronting has been documented in the West since the 1980s and was rarely present before the 1950s (Bremner, 1986; Hinton et al., 1987). By comparing the speech from interviews with San Francisco natives in the 1980s with the *Linguistic Atlas of the Pacific Coast* (compiled by D.W. Reed in the 1950s), researchers documented evidence of fronted and unrounded /uw/ and /ow/ productions that had not previously been attributed to the speech of

California or any part of the West. Additional evidence from speech parodies – in stand-up comedy and music (Hinton et al., 1987) – is a good indication that vowel fronting had emerged by the 1980s as a salient stereotypical marker of Californian English. Since then, back vowel fronting has also been documented in Portland, Oregon (Conn, 2002; Ward, 2003), in Utah (Di Paolo & Faber, 1990), and in New Mexico (Bateman, in progress). The evidence for fronting /uw/ and /ow/ in Arizona in this paper indicates that, on a whole, the Southwestern states are participating in this change.

Those speakers from Hinton, et al. (1987) who fronted /uw/ and /ow/ the most were middle-class, White or Asian American, ages 16-22, and urban or suburban. In 1997, Hagiwara supported the evidence for these social correlates with an acoustic analysis of vowel formant structure in the English of 15 Southern Californian college students of varying ethnicities and similar socioeconomic backgrounds. His data again showed evidence of the /uw/- and /ow/-nuclei fronting, with the /uw/ nuclei more advanced than the /ow/ nuclei. Among the Arizona speakers, the data further support the claim that /ow/ is less fronted than /uw/, but the correlations with speaker sex suggest that social motivations are greater than are phonetic consequences.

Internal Constraints: Fronting of Back Vowels

Previous work has found the fronting of /uw/ and /ow/ in the Western States to be subject to certain constraints due to consonant environment. Some of these constraints are the same for /uw/ versus /ow/, while some of these constraints differ. In addition, those constraints that are due to preceding environment tend to promote fronting, while constraints imposed by the nature of the following consonant tend to inhibit fronting.

The presence of a following liquid consonant inhibits the fronting of both /uw/ and /ow/ nuclei (Luthin, 1987; Di Paolo & Faber, 1990; Thomas 2001). The productions of these pre-liquid occurrences, henceforth called /uwL/ and /owL/, occasionally overlap in the vowel space, but based on the evidence presented here they will be considered distinct, unmerged phonemes (e.g., *cool* and *coal* are distinct acoustically, by average F1 value, as well as perceptually; see Di Paolo and Faber, 1990, for a counterclaim). The /ow/ nucleus can also be inhibited from fronting by the presence of a following nasal environment, such as in *own* and *home* (Luthin, 1987; Watt & Tillotson, 2001; Ward, 2003). The effect of the nasal is not as strong as the liquid, i.e. a production of /ow/ is more likely to be fronted when it follows a nasal than when it follows a liquid. The presence of a following nasal has not been documented as affecting the /uw/ nucleus.

When an /uw/ nucleus follows a coronal consonant, as in *two* and *Sue*, it is more likely to have a higher F2 value than an /uw/ nucleus that follows a consonant with a posterior tongue body articulation (Stevens & House, 1963). In other words, an /uw/ token is more likely to be fronted if it follows a coronal consonant. Since the current study is examining the fronting movement of /uw/, this constraint is a crucial one, and the methodological design in this study will account for this particular phonological influence. A preceding coronal has not been found to affect the fronting of /ow/, at least in the studies listed here, and all /ow/ tokens will be considered regardless of preceding consonant.

Methods of Analysis: Fronting of Back Vowels

Words were chosen from the interviews for analysis based on syllabicity (preference for monosyllables), stress (preference for primary), and phonological environment (based on internal constraint criteria). F1 and F2 measurements[6] were made for all vowels, both at what was approximately the middle of the nucleus steady state and then again at the offset if the vowel was

a diphthong. Each vowel was coded[7] for F1, F2, duration, stress, consonantal environment, and the conversation topic in which the word occurred. Data was collected for each speaker from five to ten occurrences of {iy, ey, o/oh/ah, æw}, at least ten occurrences of {æ, ow, uw[8]} and at least five additional occurrences of /uwL/ and /owL/, or whatever amount was necessary to obtain a representative sample of a speaker's location of production for that particular vowel.

Given the internal constraints, the pre-liquid occurrences were taken as reference points from which to measure the degree of back vowel fronting. Due to the inherent variation from one speaker to another in productive vowel spaces, these calculations cannot be compared outright. Without some kind of normalization, simply analyzing absolute vowel frequencies skews any between-speaker comparison and can give particularly misleading results for an analysis based on social categories such as age and sex, as well as misrepresent how the vowel is actually perceived (Ladefoged and Broadbent, 1957). Several methods of vowel normalization are available that alter an individual speaker's vowel space by applying an algorithm designed to expand or contract that speaker's vowels in relation to the other speakers in the sample (Nearey, 1977; Watt & Fabricius, 2003). One of the problems of such techniques is that the algorithm considers the location of all vowels without differentiation between those involved in the vowel shift in question and those that are stable. These techniques thus have the potential for altering a speaker's vowel space in such a way as to actually mask the extent to which certain vowel changes occur.

To avoid these difficulties, I chose to normalize the Arizona data based on only those vowels that are stable in the Arizona vowel system. The extent to which a particular /uw/ or /ow/ token is fronted is calculated based on the relative difference in hertz between that fronted vowel (e.g., /uw/) and that vowel's stable, back, counterpart (e.g., /uwL/) to the entire size of the speaker's productive vowel space along the F2, or front-to-back, dimension. For /uw/ and /ow/,

this measurement of size is defined by the distance between the average frontmost stable vowel (in the same F1 space as /uw/ or /ow/, respectively) and the average backmost stable vowel (the pre-liquid counterpart). The fronting of a particular /uw/ or /ow/ token is therefore calculated based on its location in the span of F2 values between the /iy/ average and the pre-liquid average.[9]

This relation can be represented as:

$$\%\ /\text{uw}/\ \textit{fronting} = (\text{uw } F_2) - (\text{uwL } F_2) \,/\, (\text{iy } F_2) - (\text{uwL } F_2)$$

For example, a speaker who produces /iy/ with the average F2 value of 2500 Hz, and who produces /uwL/ with an average F2 value of 1000 Hz, and who produces /uw/ with an average F2 value of 2000 Hz, will have the following /uw/-fronting score:

$$\begin{aligned} \%\ /\text{uw}/\ \textit{fronting} &= (\text{uw } F_2) - (\text{uwL } F_2) \,/\, (\text{iy } F_2) - (\text{uwL } F_2) \\ &= (2000) - (1000) \,/\, (2500) - (1000) \\ &= 1000 \,/\, 1500 \\ &= 67\% \end{aligned}$$

The speaker has an /uw/-fronting score of 67%. Note that what this score represents is in contrast to a score showing that a speaker fronts /uw/ 62% *of the time,* which is an expression of a given speaker's overall *frequency* of fronting. The score value on the other hand is an expression of the amount to which any given back vowel of a given speaker is fronted. This formula applies equally for obtaining a score of fronting for /ow/-production, in relation to /ey/ at the front of the vowel space and /owL/ at the back. All measurements used in calculations came from the steady state of the vowel nucleus; the trajectory and form of the vowel off-glide was fairly consistent across speakers, and is therefore excluded from the current analysis. The results indicate, however, that off-glide information is a crucial aspect to interpreting certain social patterns in the data.

The /uw/ F2 and /ow/ F2 values were calculated by determining the *median* point of each speaker's /uw/ tokens *only after coronals* (/Tuw/) and for /ow/ tokens *excluding those before nasals* (/owN/). The median (rather than the mean, which was used for calculating a speaker's endpoint values) was chosen to minimize the chance of outliers skewing the fronting percentage value. Analysis of /uw/ is particularly vulnerable to skewed data due to the relatively low frequency of /uw/ realizations in a corpus of English sociolinguistic interviews (Ash, 1996). In my corpus, each speaker has fewer than 15 recorded tokens of each vowel. Additionally, only post-coronal /uw/ tokens were included because of their predictable fronting effect and because post-coronals were the most frequent phonetic environment (largely due to lexical class; see Ash, 1996). Analyzing data from only the post-coronal tokens allows for a cross-speaker comparison of fronting that is less likely to be skewed by an uneven distribution of tokens in comparable phonetic environments. Finally, based on the observation that /ow/ is less likely to be fronted before nasals, all /owN/ tokens were excluded from the calculations of the /ow/ median (and from the /owL/ mean, as well).

Results

The entire data set used in the present study is given in Appendix II.[10] For purposes of discussion, I illustrate the results with data from only some of the speakers.

Figure 2 is the vowel space of Mandy[11], born in 1975, who has lived in Flagstaff since she was 18 months old. Mandy's speech exemplifies the production of back vowel fronting that aligns the Northern Arizona townspeople with the speakers of other cities in the Western US. All Mandy's /uw/ tokens (circles with back-glide arrows) and /ow/ tokens (diamonds with back-glide arrows) are fronted, with the exclusion of /uwL/ (crossed diamonds), and tokens of /owN/ (labeled; here, only the token *only*) or /owL/ (crossed circles). It should be noted that Mandy's

fronting percentages are roughly average for the Flagstaff population sample; 14 other speakers front /uw/ even further than she does and 5 other speakers front /ow/ further than she does. Mandy was chosen because her pattern of vowel production allows for a clear visual example of the changes taking place.

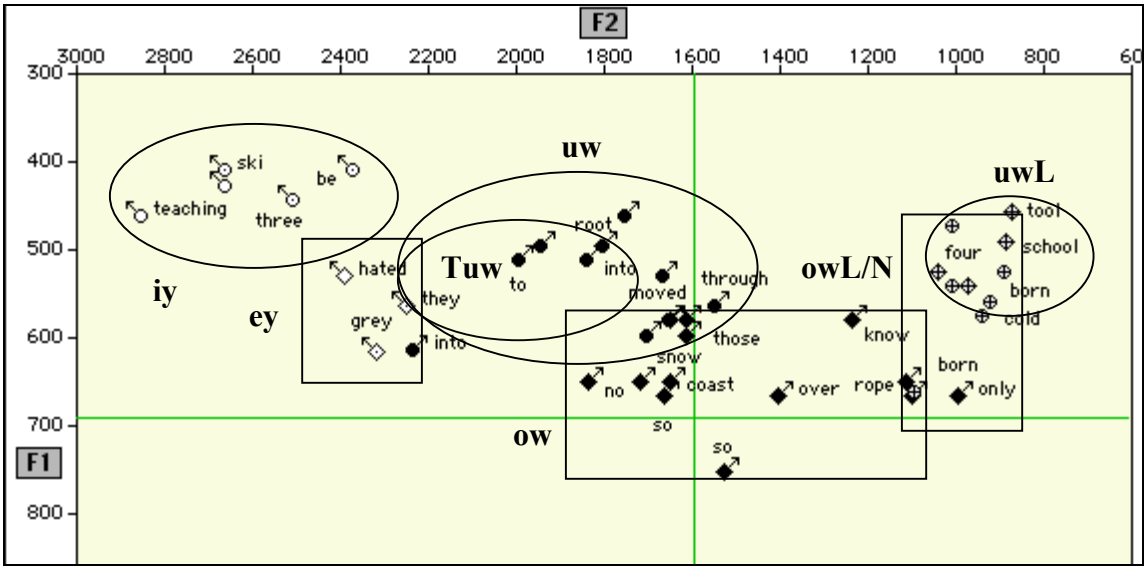
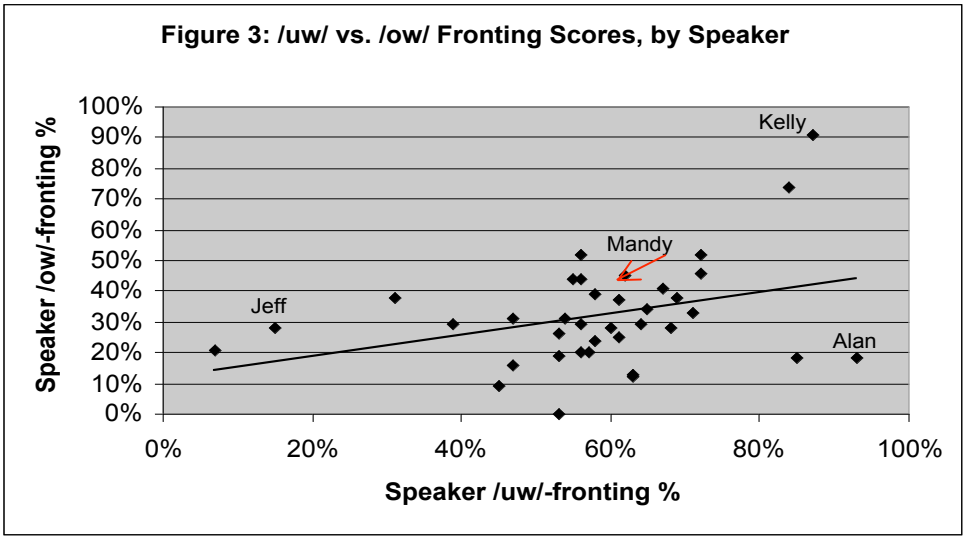


Figure 2: ***Mandy, born in 1975***

Mandy's median /Tuw/ token is fronted 62% of the distance between her average F2 of /uwL/ and her average F2 of /iy/. Figure 2 shows these points (Tuw) as well as other tokens of /uw/ that did not enter into the analysis. Mandy's /ow/ is also fronted, although not as far as /uw/. Mandy's median /ow/ is fronted 45% of the distance between /owL/ and /ey/. Her data support the lag of /ow/ attested in the literature and consistent across most speakers. As the results show, many of the speakers in this sample have back vowel productions that resemble Mandy's. This is robust evidence that at least some aspects of the Western vowel shift can be found in the speech of Northern Arizonans.

/uw/ vs. /ow/ as parallel changes

The Flagstaff data indicate, overall, that the fronting of /uw/ and the fronting of /ow/ are parallel processes. Figure 3 shows the percentage of /uw/-fronting vs. /ow/-fronting for all Arizona speakers. Each point represents one speaker, the ordinate value indicating a speaker's /ow/-fronting score and the abscissa indicating that speaker's /uw/-fronting score, with /uw/-fronting percentages increasing from left to right on the abscissa and /ow/-fronting percentages increasing from bottom to top. For example, Mandy produces a median /Tuw/ nucleus that is fronted 62% of her productive vowel space, and a median /ow/ nucleus that is fronted 45%. Jeff's /Tuw/ productions are only 15% fronted, while his /ow/ are 28% fronted. In contrast, Alan produced /Tuw/ nuclei around 93% of his horizontal vowel space, but only fronts /ow/ about 18%. Finally, Kelly fronts /Tuw/ tokens at 87% and /ow/ tokens at 91%.

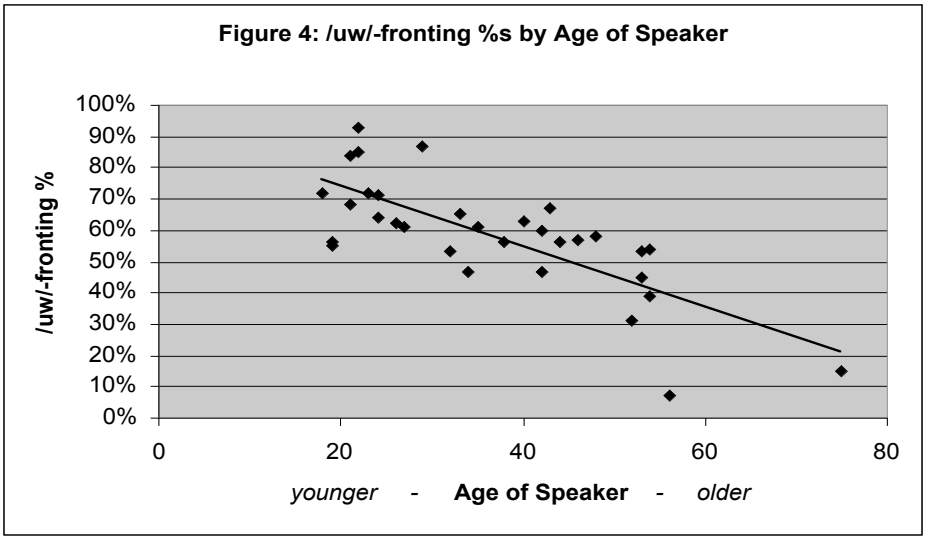


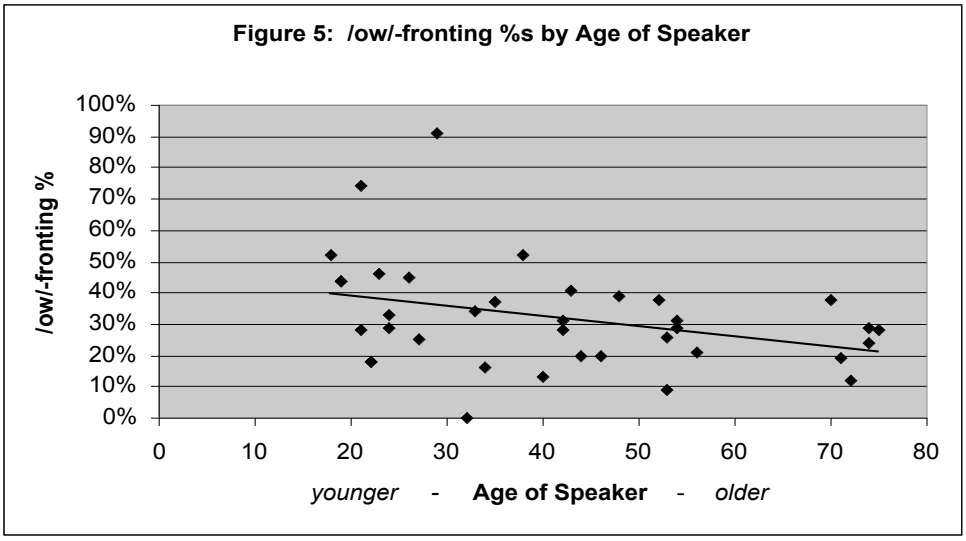
The fronting of /uw/ generally correlates with the fronting of /ow/, with a value of 0.35, at $p \leq 0.04$. The shallow slope of the line indicates the attested 'lag' of /ow/-fronting to /uw/-fronting. However, it is of initial importance that the data vary quite a bit. For example, some

speakers front /uw/ considerably, but don't front /ow/ at all. I return to a few of these cases at the conclusion of the analysis of back vowel fronting, and argue that particular social correlates beyond age, sex, and socioeconomic class may account for this particular vowel production pattern and may stand in meaningful contrast to the urban Western changes. If supported, then this claim would suggest separate social meanings for /uw/ and /ow/. For now, however, the /uw/- and /ow/-fronting movements will be considered to be parallel, with both indicating Arizona's participation in the general Western vowel shift.

Social Factors: *Age*

The age of a Flagstaff speaker is the most significant social correlate in predicting a speaker's production of the Western vowel shift. Figure 4 shows the results of /uw/ fronting according to age; the correlation is -0.53, at $p \leq 0.00001$. Figure 5 shows the results of /ow/ fronting according to age; the results are less stunning, but still significant, with a correlation of -0.34, at $p \leq 0.05$.



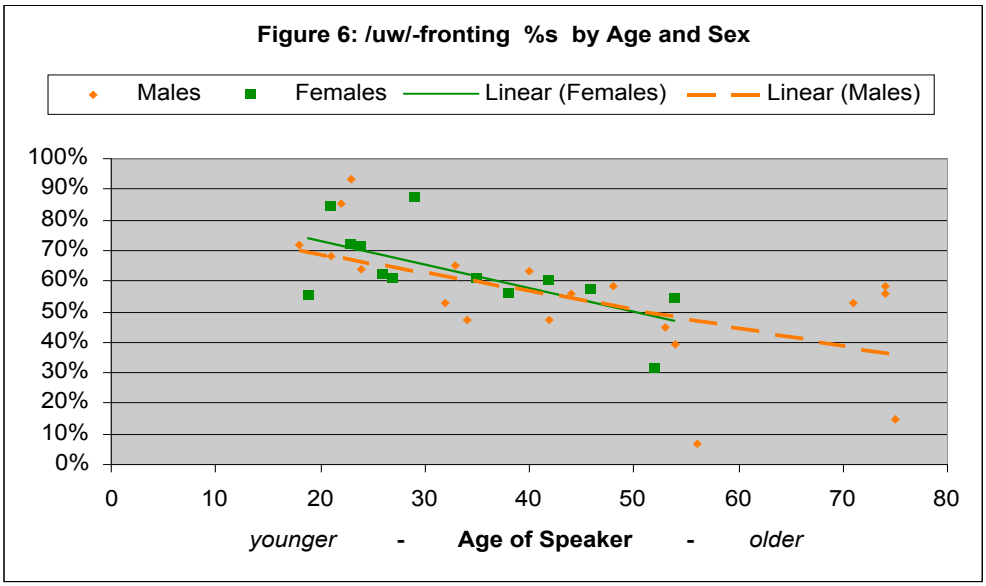


Initially, these results seem to reflect the fact that the movement of /uw/ is more advanced compared to /ow/, overall. However, another interpretation is that /uw/ correlates strongly with age, while /ow/ correlates weakly. The question is whether these are two parallel sound changes, differing in how quickly speakers adopt them, or if they are two unrelated sound changes, differing in what kinds of speakers adopt them. An analysis of sex elaborates on this issue.

Social Factors: *Sex*

Many studies of change-in-progress find that women, especially younger women, are in the vanguard of regional sound changes (see Labov, 1994: 156). This has been suggested for the California vowel shift (e.g. Hinton, et al., 1987; see also Eckert & Staum, 2003). If these changes in Arizona English do indicate participation in a broader change-in-progress in the West, then it might not be surprising to see females leading males in both the fronting of /uw/ and the fronting of /ow/. Interestingly, however, the two variables pattern differently, with no difference in the fronting of /uw/ between males and females, but with females patterning differently from males in the fronting of /ow/.

Figure 6 shows the percentage of /uw/-fronting distributed according to age of speaker and separated according to speaker sex. Age increases on the abscissa from left to right, and fronting percentage increases from bottom to top; each point represents a single speaker, and the orange represents the males while the green represents the females. Figure 7 shows a corresponding configuration for /ow/-fronting.



The data for speaker sex are presented here with speaker age because of the critical interaction between in social variables; the effect of sex is likely to differ depending on the age group in question (see Eckert, 1989). Abstracting away from this interaction would tend to yield less informative results. This motivation may not be entirely obvious from looking only at the /uw/ variable, where the correlation coefficient of fronting percentage to age, for speakers of each sex group, is very similar: -0.47 for males ($p \leq 0.003$) and -0.65 for females ($p \leq 0.016$). The overlap of the regression lines further indicates that /uw/-fronting does not differ

significantly by sex and speaker age is a much more critical variable for predicting an individual's production of /uw/.

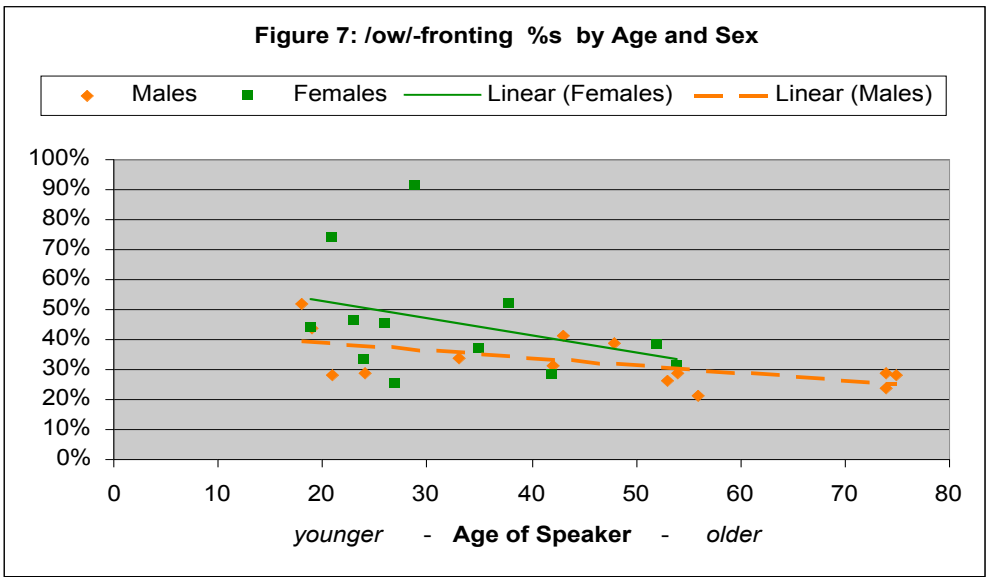


Figure 7 presents a different situation for /ow/, showing that females have suggestively higher percentages of /ow/-fronting than males overall. A Chi^2 test, based on the number of speakers who fronted /ow/ 0-33%, 34-66%, or 67-100%[12] of their vowel space, further supports this finding with a value of 6.67 at $p \leq 0.04$. This is in contrast to /uw/-fronting, which yielded a completely insignificant Chi^2 value for the same test. It appears that the production of /ow/ is further front for females than males. The correlations of fronting percentage with age are also different for each sex group: -0.15 for males and for -0.41 for females, and both non-significant ($p \leq 1$ and $p \leq 0.151$, respectively). Age barely correlates at all with fronted-/ow/ production, for males, but does suggestively correlate, although weakly, for females. In other words, the fronting of /ow/ is *not* a sound change-in-progress that male speakers generally attend to. The

trend data, however, show not only that females produce /ow/ further front then males do overall, but suggest that females produce /ow/ further front the younger they are.

Note that this distinction does not necessarily answer the question of whether /uw/- and /ow/-fronting movements are parallel or distinct. On the one hand, if females do indeed lead in sound changes, then perhaps the fronting of /uw/ is an old sound change that has gone to completion and is no longer stratified by sex, and the fronting of /ow/ is such a new change that only females are doing it, so far. On the other hand, perhaps /uw/-fronting is a change that carries no particular meaning associated with speaker sex (and suppose also that women are not always in the vanguard of the sound change), whereas the fronting of /ow/ is a marker of some aspect of style that may index 'female', or, some feature that stands in contrast to some other feature that indexes 'male.' At this point, the question remains open. I will return to these issues after presenting the data and present further social information about the speakers that support to a more in-depth analysis.

Social Factors: *Socioeconomic Class*

Percentages of /uw/- and /ow/-fronting were compared across speakers primarily according to the speaker's level of education and secondarily to their occupation (see Appendix I). Each speaker was assigned to a SEC classification of UWC (upper working class), MC (middle class), UMC (upper middle class), or UC (upper class). Speakers with only high school or less education were assigned UWC unless their occupation countered that assignment. Speakers who were still in college were assigned the same SEC level as their parents or their siblings. The only speakers who were assigned UC were those who belonged to one of two families that were locally known[13] for their wealth and long-term establishment in the Flagstaff community.

A Chi^2 analysis comparing these four SEC divisions to both /uw/- and /ow/-movement found an insignificant distribution, at $p \leq 0.20$ for /uw/ and $p \leq 1$ for /ow/. A closer (speaker-by-speaker) examination of the data supports this finding. For example, the data indicate that 5 speakers front /uw/ and /ow/ in ways not correlated with SEC. For example, Scot, who is male, age 42, and who I've determined to be upper working class, fronts /uw/ 47% and fronts /ow/ 31%, while Fred, who is male, age 33, and from a very wealthy family, fronts /uw/ 65% and /ow/ 34%, resembling Scot's pattern of variable use. It appears that back vowel fronting may not correlate with the socioeconomic class of the speaker.

However, another possibility is that the method of defining class and the method of analysis were not adequate to obtain a fair comparison of socioeconomic class in the Flagstaff community. It is possible that /uw/- and /ow/-fronting do correlate, in some way, with socioeconomic class, but that occupation and education may be poor measures of an Arizonan's amount of social power and locally recognized prestige. Ward (2003) notes that a strictly traditional approach to urban socioeconomic class stratification, which I interpret here as the ranking of a person's occupation and education, may be inadequate for sociolinguistic studies in the Western US. If this is true for Arizona, I believe that the causes are multiplex. Firstly, there are few Flagstaff citizens who are part of either an extremely rich class or an extremely impoverished class. Consequently, there may be more socially meaningful differentiation within the middle class that is obscured by methods such as those implemented here. The problem may simply be the absence of appropriate measures to tease apart and locate what are the subtle but significant divisions within an Arizonan stratification of socioeconomic class. In other words, these measures are crucially Arizonan. Measures of socioeconomic class should be defined for a particular community based on the social realities of that community.

In Flagstaff, neighborhoods are just as divided by the categorization of "in the town" versus "on a ranch" as they are for socioeconomic class. Such community-defined contrastive categories intersect and overlap with socioeconomic strata, but they do so in complex ways that obscure the need for an analysis of socioeconomic class, per se, and encourage attention to locally meaningful social categories (Rickford, 1986; Eckert, 2000). The socioeconomic hierarchy is not completely irrelevant to the community, but the class system in the West may not lend itself to the precise kind of operationalizing of SEC seen in other urban dialectology studies (e.g., Labov, 1966).

Only further ethnographic research can begin to satisfy the question of socioeconomic class in Northern Arizona, but I would like to suggest that traditional conceptions of socioeconomic class appear inappropriate. An exploration of phonetic variation according to locally defined social categories is a necessary step toward completing a picture of back vowel fronting in Northern Arizona.

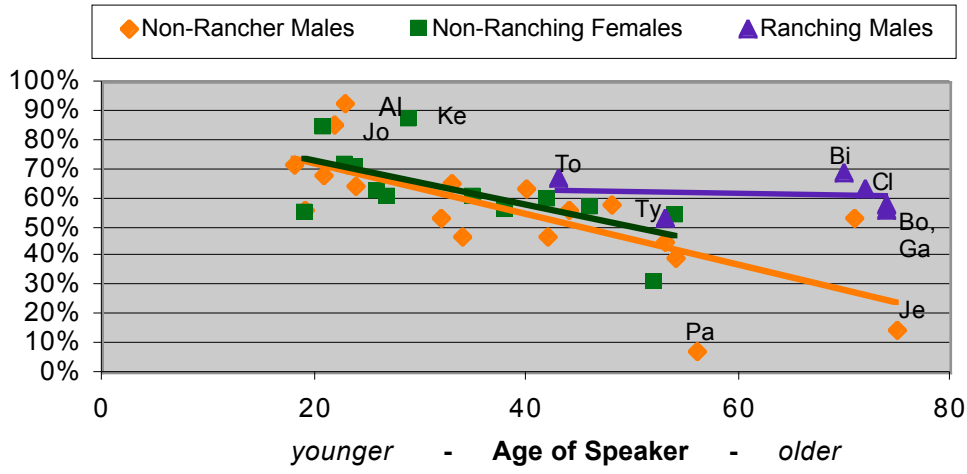
Variation in /uw/, or, Different Ways of Being Arizonan

Do /uw/-movement and /ow/-movement occur in parallel, representing the same change, or are they independent, but coincidentally following the same trajectory? Throughout this paper I have deliberately treated the two as parallel indicators for the Western Shift. Many of the speakers, seen in Figure 3, lend support to this position, with increased /uw/-fronting correlating with increased /ow/-fronting. Yet, if the lag of /ow/ behind /uw/ were only an effect due to articulation and the age of the change, then we would expect a higher correlation coefficient for Figure 3 (with, simply, a low slope value). The results, instead, show patterns of speaker variation that are crucially different between /uw/ and /ow/. In looking at Figure 6, the greatest variation in /uw/ production seems to be among speakers between the ages of 55 and 75 years

old, while Figure 7 shows that, the greatest variation in /ow/ production is among speakers between the ages of 18 and 40 years old. The motivations for these patterns are multiplex, some of which may be brought to light through a closer examination of speaker's social roles in the Flagstaff community.

Figure 6 is reproduced here as Figures 8, with different groups of speakers highlighted. Orange diamonds still indicate individual male speakers, and green squares again represent individual female speakers. The separate categories represent three contrasting social groups of males between ages 55 and 75, highlighting their differences in /uw/-production. Two additional data points are added to these graphs that were excluded from the initial analysis, but which now come to bear on the interpretation of the data: Billy (Bi), age 70, and Clyde (Cl), age 72. I will explain their presence, as well as the motivations for these groupings, in the following analysis.

Figure 8: /uw/-fronting %s by Age and Sex



The population under age 55 years is quite consistent in its realization of fronted /uw/, with a robust correlation between increased /uw/ fronting and decrease in the age of the speaker. This is exemplified by some of the youngest speakers, Alan (Al), Joe (Jo), and Kelly (Ke), who front /uw/ the most out of the whole population sample. Following this trend into the oldest population, the logical conclusion looks something like speaker Jeff (Je), age 75, who doesn't really front /uw/ at all. Jeff most likely fits into an age-graded pattern of /uw/ production. I've included Patrick (Pa) here as well, although he would be expected to front /uw/ a bit more than he does, because the important fact is that he is older than the other Western Shift speakers and he patterns like Jeff in not fronting /uw/ at all. There appears to be a general prediction that older people in Flagstaff will not front /uw/. What then of the other category seen here?

What emerges from this data is that participation in the Western Shift may not be the sole motivation for fronting /uw/ in Northern Arizona. Those speakers highlighted here in purple – Billy, Clyde, Bob (Bo), Gary (Ga), Tony (Ty) and Tom (To) – represent an important, locally salient social division that had not entered into the analysis thus far. They are ranchers, or at least, two of them – Billy and Clyde – are ranchers, while the others are either related by family or affectively affiliated to ranching culture. These speakers help explain why high fronting percentages are found among some of the oldest speakers in the population; they appear to be fronting /uw/[14] *not* because of participation in the Western Shift, but because of possible participation in an entirely different speech variety in general: 'country.' The data from Billy and Clyde were initially left out of the analysis because their social roles as ranchers potentially implicated speech patterns that were not comparable to the rest of the population sample. However, it appears that there are some speakers in the sample who, although not professional ranchers, produce speech patterns that are similar to Billy and Clyde. I propose that these speakers are *affiliated* to ranching either through family lineage or through personal affect and

personal practice (i.e., participating in rodeos on the weekends), and that this affiliation is evidenced in their speech.

The explanation for this critical social variable lies in a brief sketch of Arizona migration history. While the developing urban culture in Northern Arizona reflects new migration from urban California, the surrounding rural culture retains elements from an older history of migration from the Oklahoma area. Northern Arizona was initially populated (non-indigenously) by the migrant workers who came from the South or the Midwest in the late 1880s to work for the railroad, the logging industry, or on cattle ranches. Migration westward into Arizona continued steadily and rose during the Dust Bowl in the 1930s, bringing many migrants into Flagstaff via the Route 66 highway. Today, ranchers, their descendants, and the children of Dust-Bowlers comprise a large portion of the population both in Flagstaff and on the outskirts of town. The rest of the population has arrived later, with most new migrants moving eastward out of California (Corcoran, 2003). Patterns of /uw/-fronting are therefore reflective of a speaker's familial migration history and the subsequent retention of the related culture. The data suggest that /uw/-fronting among ranchers may be attributed to dialect features retained from early migration out of the Oklahoma region, whereas the /uw/-fronting found in urban speakers is due to participation in a general Western Shift. Further interviews with rancher women and younger ranchers are needed to complete the picture of 'country talk' in Northern Arizona.

Discussion

To claim that the movements of /uw/ and /ow/ are unrelated is still unresolved, simply in light of comparison to the many other regions where the fronting movements have been described as parallel (New York, Philadelphia, Southern Britain, and the Southern US; mostly in Labov, Yaeger, & Steiner, 1972:124). Perhaps one way to entertain the parallel movement

assumption given much of the Arizona data is to posit that /uw/-fronting was a change-in-progress at one point that has now 'gone-to-completion' [*sic*] while remaining an age-graded variable, whereas /ow/-fronting is still in progress. However, the question is what sort of data would be necessary to substantiate such a theory. This same issue was raised in 1987, when these Western vowel changes were first documented in California, and Hinton, et al., raised the question of whether back-vowel fronting movements were changes-in-progress or evidence of stable age grading (i.e., the establishment of a "Valley Girl" variety). Not only is the concept of stability a problematic one, but the broader question remains open. As in any dialect survey, the best method we have to ascertaining the trajectory of language change is through diachronic analysis.

What is evident is that /uw/-fronting and /ow/-fronting have differing patterns of social correlation. The fronting of /uw/ is an established sound change in the Western US that has taken hold in the speech of Northern Arizonans. The fronting of /ow/ is also a regional change, but one that is mainly being adopted by females. Furthermore, the highly suggestive data from the ranchers and the people affiliated with ranching demonstrate that /uw/-fronting alone does not indicate a speaker's participation in the Western Shift. The most striking pattern of back vowel production is the evidence that speakers may produce fronted /uw/ for one of two socially contrastive reasons. Speakers who front back vowels are presumed to be doing so for one of two reasons: either they are participating in a change characteristic of the urban West, or they are participating in a rural speech style based on Dust Bowl migration patterns. Arizona and the rest of the Southwest is a crucial area of study because of the intersection, overlap, and mutual influence of two /uw/-fronting dialect areas.

This dichotomy of meanings for /uw/-fronting highlights a final issue, that is that back vowel fronting is now so widespread across US English varieties that is could perhaps be

considered 'uninteresting', or more importantly, loose its status as a regional dialect variable. Labov (p.c.) notes that back vowel fronting is nearly "everywhere." While it is true that back vowel fronting can be found in a number of US varieties, it is certainly not found everywhere, and even more certainly it is not attested in all speakers everywhere (such as, e.g., some of the older Arizona speakers seen here). In addition, even if back vowel fronting is widespread, there is no reason to expect that the meaning of these variables would be interpreted the same in any two different locations, and examining back vowel fronting in the context of Northern Arizona is critically different then studying 'the same' vowel movement in another locale. Yet, if it is true that we are witnessing the gradual spread of back vowel fronting into all US varieties and US speakers, this is itself an interesting phenomenon that points to the development of what were previously markers of regional varieties into some kind of national norm, the social motivations of which would be potentially fascinating. On the other hand, the data from Arizona as well as other California studies (e.g., Hinton, et al.) clearly show that back vowel fronting is still socially meaningful and therefore an enlightening subject of inquiry.

Conclusion[15]

Northern Arizona is participating in at least one vowel shifting pattern that appears to typify the Western United States: the fronting of back vowels /uw/ and /ow/. This evidence suggests that many of the speakers in this part of the Southwestern US are dialectologically aligned with parts of California, Utah, and Oregon. If Labov's notion of the Third Dialect is correct, then the results here not only reconfirm Arizona's place in the Third Dialect, but further support a characterization of the Third Dialect based on the fronting of /uw/ and /ow/ in addition to the (near-)merger of the low back vowels (Clarke, Elms, & Youssef, 1995). To reiterate

Labov's 1991 conclusion, "it is obvious that the stability of the third dialect was overestimated" (referring to his 1980 drafts of the same manuscript).

The data show very robust results for the spread of /uw/- and /ow/-fronting from other parts of the Western US into Arizona. The strongest social correlate with these variables, for European Americans, is the age of the speaker. The younger the speaker, the further fronted that speaker's post-coronal /uw/ production will be. The younger the female speaker, the further fronted her /ow/ production will be. The results in this paper implicate a general change-in-progress, yet the question posed in Hinton, et al., (1987), of socially demarcated age-grading, still remains.

Sex is not a relevant factor for /uw/-fronting, but males front /ow/ much less than females, and males display no difference in /ow/-fronting based on age. Some young males whose /uw/ production parallels that of the females do not have parallel /ow/ production, which may suggest that the fronting of these two back vowels might be considered as two unrelated vowel shifts, or at least two related vowel shifts that currently have very different social lives.

Finally, the intersection of two contrasting communities of migration has led to particular social distinctions in the Southwestern US that are essential to an interpretation of the variables. Related measures of socioeconomic class as well as ethnicity also need to be investigated in the Southwest, particularly for the complex intersection between rancher identity and socioeconomic class. For example, not only do ranchers tend to be much wealthier than their ranch-hands, but most of the ranchers are European American, while many of the ranch-hands are either Navajo or Chicano. Future research in Northern Arizona and other areas of the Southwestern US is critical to addressing these and other unanswered questions.

References

Ash, Sharon. 1996. "Freedom of Movement: /uw/-fronting in the Midwest." In *Sociolinguistic Variation: Data, Theory, and Analysis*. Jennifer Arnold, Renée Blake, Brad Davidson, Scott Schwenter, & Julie Solomon, eds. Stanford, CA: CSLI Publications. pp. 3-25.

Bateman, Jodey. Personal Communication. September 28, 2003.

Blomstrom, David. 1998-2001. *Geobopological Survey*. Date accessed: 15 March 2004. <http://www.geobop.com/world/NA/Counties/Area/>

Bremner, Sue. 1986. "The story of /u/." Unpublished manuscript.

"Californians biggest segment of Ariz. newcomers." *Arizona Daily Sun*. 18 November 2002. <http://www.azdailysun.com/non_sec/nav_includes/story.cfm?storyID=53500&syr=2002>. Date accessed: 23 September 2003.

Carver, Craig M. 1987. *American Regional Dialects.* Ann Arbor: Univ. of Michigan Press.

Chambers, J.K. and Peter Trudgill. 1980. *Dialectology*. Cambridge: CUP.

Clarke, Sandra, Ford Elms, and Amani Youssef. 1995. "The Third Dialect of English: Some Canadian Evidence." *Language Variation and Change*. 7: 209-228.

Conn, Jeff. 2002. "It's Not All Rain and Coffee: An Investigation into the Dialect of Portland, Oregon." *NWAV 31*, Stanford University, October 2002.

Conn, Jeff. 2000. "The Story of /æ/ in Portland." MA thesis, Portland State University. See also: <http://www.pds.pdx.edu/index.htm>.

Cook, Stanley Joseph. 1969. "Language Change and emergence of an urban dialect in Utah." University of Michigan Dissertation.

Corcoran, Katherine. "More Residents Consider State: Census logs California's first migration loss to other parts of U.S." *San Jose Mercury News*. 06 August 2003.

Coupland, Nikolas. (2001). "Age in social and sociolinguistic theory." In *Sociolinguistics and Social Theory*. Coupland, Nikolas, Srikant Sarangi, and Christopher N. Candlin, eds. Essex, England: Pearson Education Limited. p. 185-211.

Craig, Beth. 1998. "American Indian English." in *Handbook of Dialects and Language Variation*. ed. by Michael D. Linn. San Diego: Academic Press.

DeCamp, David. 1953. "The pronunciation of English in San Francisco." In Williamson and Burke, eds. *A various language: perspectives on American dialects*. New York: Holt, Rinehart, and Winston. 549-569.

Di Paolo, Marianna and Alice Faber. 1990. "Phonation differences and the phonetic content of the tense-lax contrast in Utah English." *Language Variation and Change*. 2:155-204.

Di Paolo, Marianna. 1988. "Pronunciation and categorization in sound change." In K. Ferrara et al., (eds). *Linguistic Change and Contact, NWAV XVI*. Austin: Department of Linguistics, The University of Texas, 84-92.

Eckert, Penelope and Laura Staum. 2003. "From kid talk to adolescent talk: Vowels on the preadolescent heterosexual market." *NWAV 32*. University of Pennsylvania, Philadelphia, PA, October 2003.

Eckert, Penelope. 2000. *Linguistic Variation as Social Practice*. Oxford: Blackwell. 7-45.

Eckert, Penelope. 1997. "Age as a sociolinguistic variable." In: F. Coulmas, (ed.), *Handbook of Sociolinguistics*, Oxford: Blackwell. 151-167.

Eckert, Penelope. 1989. "The whole woman: Sex and gender differences in variation." *Language Variation and Change*. 1:245-267.

Feagin, Crawford. 2003. "Vowel Shifting in the Southern States." *English in the Southern United States*. ed. by Stephen J. Nagle and Sara L. Sanders, pp. 126-140. Cambridge: Cambridge University Press.

Fought, Carmen. 2003. *Chicano English in Context.* Palgrave/MacMillan Publishers

Fought, Carmen. 2002. "California Student's Perceptions of, You Know, Regions and dialects?" *Handbook of Perceptual Dialectology*. Long, Daniel & Dennis Preston, eds. v2, p113-134.

Fought, Carmen. 1999. "A Majority Sound Change in a Minority Community: /u/-Fronting in Chicano English." *Journal of Sociolinguistics*. v3, n1, p5-23.

Gaud, Bill. "Rio de Flag History: Influence of Railroads in Flagstaff." <http://jan.ucc.nau.edu/~gaud/RiodeFlag/rdf_rr.htm> Date accessed: 04 October 2003.

Guenter, Joshua Samuel. 2001. "The Vowels of California English before /r/, /l/, and /n/." *Dissertation Abstracts International*, *Section A: The Humanities and Social Sciences*. Ann Arbor, MI. 61: 7: 2681.

Habick, Timothy. 1991. "Burnouts versus Rednecks: Effects of group membership on the phonemic system." In *New Ways of Analyzing Sound Change*, Penelope Eckert, ed. San Diego, CA: Academic Press. Pp. 185-212.

Hagiwara, Robert. 1997. "Dialect Variation and formant frequency: The American English vowels revisited." *Journal of the Acoustical Society of America*. 102: 655-658.

Hall-Lew, Lauren. 2003. "One shift, two groups: When fronting alone is not enough." *NWAV 32*. University of Pennsylvania, Philadelphia, PA, October 2003.

Hall-Lew, Lauren and Malcah Yaeger-Dror. 2002. "Totally California? The Occurrence of /ow/-Fronting in Arizona English." *NWAV 31*. Stanford University, Stanford, CA, Oct. 2002.

Hillenbrand, James, Laura A. Getty, Michael J. Clark, and Kimberlee Wheeler. 1995. "Acoustic characteristics of American English Vowels." *Journal of the Acoustical Society of America*. 97:3099-3111.

Hinton, Leanne, with Sue Bremmer, Hazel Corcoran, Jean Learner, Herb Luthin, Birch Moonwomon, and Mary Van Clay. 1987. "It's not just Valley Girls: A study of California English." *Proceedings of the Annual Meeting of the Berkeley Linguistics Society*. 13: 117-127.

Kurath, Hans. 1998. "The Sociocultural Background of Dialect Areas in American English." In *Handbook of Dialects and Language Variation*. M.D. Linn, (ed.), pp. 105-122. San Diego: Academic Press.

Kurath, Hans. 1972. *Studies in Area Linguistics*. Indiana: Indiana University Press.

Labov, William. Personal communication. January, 2003.

Labov, William 1998. "The three dialects of English." In *Handbook of Dialects and Language Variation*. M.D. Linn (ed.), pp. 39-81. San Diego: Academic Press.

Labov, William. 1994. "Principles of Linguistic Change: Internal Factors." *Language and Society*. Vol 20. Oxford: Blackwell.

Labov, William. 1966. *The Social Stratification of English in New York City.* published in 1982, by the Center for Applied Linguistics. Washington, D.C.

Labov, William. 1963. "The social motivation of a sound change." *Word* 19:273-309. Reprinted in C. Scott and J. Erickson (eds.), 1968. *Readings for the History of the English Language*. Boston: Allyn and Bacon, p. 345-379.

Labov, William, Sharon Ash and Charles Boberg. Forthcoming. *Phonological Atlas of North American English*. Berlin: Mouton de Gruyter.

Labov, William, Malcah Yaeger and Richard Steiner. 1972. *A Quantitative Study of Sound Change in Progress*. Vol. 1. "Report on National Science Foundation Contract NSF-GS-3287." University of Pennsylvania.

Ladefoged, Peter and D.E. Broadbent. 1957. "Information conveyed by vowels." *Journal of the Acoustical Society of America*. 29:98-104.

Lerner, Jeanie. 1986. "California [æ]." Unpublished Manuscript.

Luthin, Herbert W. 1987. "The Story of California /ow/: The Coming-of-Age of English in California." *Variation in Language NWAV-XV at Stanford: Proceedings of the Fifteenth Annual Conf. on New Ways of Analyzing Variation*. Denning, Keith M. et al., (eds.)

Luthin, Herbert W. 1986. "'Ew: This Wall's On Fire!"' and other Stories of /ow/." Unpublished Manuscript.

Mack, Joseph. 2003. "Online Map Creation using AZ_PROJ v1.1.6: Platform Independent Azimuthal Equidistant Mapping Software." <http://www.wm7d.net/azproj.shtml> Date accessed: May 20, 2004.

McElhinny, Bonnie. 1999. "More on the Third Dialect of English: Linguistic constraints on the use of three phonological variables in Pittsburgh." *Language Variation and Change*. 11, 171-195.

Metcalf, Allan. 1970. "Directions of Change in Southern California English." *Annual meeting of the American Dialect Society*, New York City. December 27, 1970.

Moonwomon, Birch. 1992. "Sound Change in San Francisco English." *Dissertation Abstracts Intn'l*, *Section A: The Humanities and Social Sciences*. Ann Arbor, MI. 53: 2: 483A.

Moonwomon, Birch. 1987. "Truly awesome: (ɔ) in California English." *Variation in Language NWAV-XV at Stanford: Proceedings of the Fifteenth Annual Conference on New Ways of Analyzing Variation*. Denning, Keith M. et al., (eds.)

Nearey, Terence. 1977. *Phonetic Feature System of Vowels.* Ph.D. dissertation. University of Conneticut.

Payne, Arvilla. 1980. "Factors controlling the acquisition of the Philadelphia dialect by out-of-state children. In William Labov, (ed.), *Locating Language in Time and Space*. New York: Academic Press. 143-178.

Peterson, Gordon, and Barney, Harold. 1952. "Control Methods Used in a Study of the Vowels." *Journal of the Acoustical Society of America.* 24:175-184.

Reed, Carroll E. 1977. *Dialects of American English.* 2nd Ed. Massachusetts: The University of Massachusetts Press.

Reed, D.W., ms. (Compiled 1952-59). *Linguistic Atlas of the Pacific Coast*.

Reed, D.W. 1954. "Eastern Dialect Words in California." *Publication of the American Dialect Society.* No. 21. pp. 3-15.

Rickford, John. 1986. "The Need for New Approaches to Class Analysis in Sociolinguistics." *Language and Communication*. 6: 215-221.

Syrdal A.K. and H.S. Gopal. 1986. "A Perceptual Model of Vowel Recognition Based on the Auditory Representation of American English Vowels." *Journal of the Acoustical Society of America.* Vol. 79, No. 4.

Thomas, Erik R. 2002. "Instrumental Phonetics." *The Handbook of Language Variation and Change*. J.K. Chambers, Peter Trudgill, and Natalie Schilling-Estes, eds. Oxford: Blackwell.

Thomas, Erik R. 2001. *An Acoustic Analysis of Vowel Variation in New World English*. Publication of the American Dialect Society. Duke Univ. Press. Num. 85.

Thomas, Erik R. 1989/93. "Vowel Changes in Columbus, Ohio." *Journal of English Linguistics*. 22:205-215.

Trudgill, Peter. 1974. "Linguistic Change and diffusion: description and explanation in sociolinguistic dialect geography. *Language in Society*. 2:215-246

U.S. Census Bureau; "Census 2000 Redistricting Data (Public Law 94-171) Summary File;" <http://factfinder.census.gov/bf/_lang=en_vt_name=DEC_2000_PL_U_QTPL_geo_id=16000US0423620.html> Date accessed 23 September 2003.

Ward, Michael. 2003. *Portland Dialect Study: The fronting of /ow,o,uw/ in Portland, Oregon.* MA thesis, Portland State University. <http://www.pds.pdx.edu/index.htm>.

Watt, Dominic and A. Fabricius. 2003. "Evaluation of a technique for improving the mapping of multiple speakers' vowel spaces in the F1~F2 plane. *Leeds Working Papers in Linguistics & Phonetics.* 9: 159-173.

Watt, Dominic and Jennifer Tillotson. 2001. "A spectrographic analysis of vowel fronting in Bradford English." *English World-wide*. Benjamins. 22:2, 269-302.

Weinreich, Uriel, William Labov, and M. Herzog. 1968. "Empirical Foundations for a Theory of Language Change." in *Directions for Historical Linguistics*, ed. by W.P. Lehmann and Y. Malkiel.

Notes

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[2] American Indians, of course, claim a multigenerational affiliation to the Southwestern lands that dates back centuries. Their role is vital in shaping the linguistic landscape of the Southwest. Evidence (see, e.g., Craig, 1998) indicates that a general American Indian English variety exists that is distinct from European American English. Whether or not the American Indian population of Northern Arizona is participating in the regional sound changes discussed in this paper (based on urban, European American populations) is a highly interesting question that is beyond the scope of the current paper.

[3] Recordings of the interviews were made on either a digital mini-disc recorder [*Sharp MDSR60S mini-disc player/recorder*] or a digital wave recorder [*Olympus W-10 handheld voice recorder*]. The interviews were then transferred to digital wave files and analyzed on Praat [*http://www.fon.hum.uva.nl/praat/*].

[4] African American, Asian American, Latina/o, American Indian, and Mixed Race speakers were also interviewed, but their speech is excluded from the present analysis based on my intuition that most of them speak a variety of English that is not directly comparable to the speakers in the present study. Ideally, a dialect survey would be representative of the community as a whole, but at the present time the data is not sufficient for analysis.

[5] Use of word list data is explicitly identified in Appendix I. If no tokens from the word list were used, the speaker is labeled with "No." If words from the word list were used to characterize that speaker's productive vowel space, the number of tokens, followed by the target vowel, are indicated in the table. Generally, tokens of /uw/ were taken from the word list when the speaker had no occurrences of /uw/ in the interview that weren't post-coronal. These wordlist tokens are always either *boo* or *boot,* or, if all of the speaker's /uw/ was post-/t/, tokens of *dupe* and *dude* were taken. Similarly, tokens of /uwL/ were taken from the word list when the speaker had no occurrences of /uwL/ in the interview that weren't *school*. These wordlist tokens are always either *tool* or, sometimes, *cool*.

[6] By convention, first and second formant frequency values are plotted in the negative-negative quadrant to achieve a graph of a speaker's vowel space that loosely correlates with place of constriction in the oral cavity (Peterson & Barney, 1952). The values for F1 are inversely related to the height of the vowel, and the F2 values are directly related to frontedness of the vowel. It has long been established that "F1/F2 stimuli produce satisfactory identification of cardinal vowels (Cooper, Liberman & Borst, 1951), of English vowels (Peterson & Barney, 1952), and of vowel systems in general" (Fant, 1958: 296-97; all cited in Labov, Yaeger, & Steiner, 1972).

[7] All vowel space figures in this paper were created on PLOTNIK, which was developed by William Labov in 1992 (and is continuously updated), and can be obtained through the United States Regional Survey, Linguistics Laboratory, University of Pennsylvania, 3550 Market Street Suite 201, Philadelphia, PA 19104. It is currently only available for Macintosh. See also: *http://www.ling.upenn.edu/~wlabov/Plotnik.html.*

[8] It should be noted that no tokens of /iw/, that is, words where a fronted articulation was a historical variant of the word, such as {*dew, new, Tuesday*}, were included in the analysis because any fronted production of these variables is not an indicator of the emergent /uw/-fronting shift (see Ash, 1996).

[9] For example, a token of /uw/ was considered more or less fronted based on whether the difference in F2 values between that token and the average F2 for that speaker's /uwL/ tokens was a higher or lower percentage of the difference between the average F2 values of that speaker's /iy/ tokens and /uwL/ tokens. This is not established convention, though see Fought (2000: 116-118) for a comparable method of normalization.

[10] Appendix II, containing a complete collection of all the data, is 68 pages long, and will be provided upon request.

[11] All names are pseudonyms.

[12] These divisions, into thirds, were chosen over, e.g., deciles, because of the low number of speakers overall.

[13] The evaluation of this local knowledge was not collected in a rigorous manner. Rather, this determination was made due to how some of the informants referred to these (two) families in their interviews, and from my own local knowledge. Criticism of this method is well taken.

[14] Preliminary analysis, not shown here, suggests that the quality of the fronted /uw/ may be monophthongal for the rancher speakers, while it is diphthongal for the Western Shift speakers. In other words, the younger speakers front just the vowel nucleus, while the ranchers front the entire vowel. However, this generalization does not always hold, especially for the "rancher-affiliated" speakers. The observation awaits support from further data from more ranchers.

[15] This paper is limited in describing the movement of only two vowels in the Western shift and ideal follow-up research would examine the entire vowel space, in particular, the split of environmentally conditioned /æ/ allophones, and the lowering of front lax vowels. In addition, the motivations for this particular sound change have compelling implications for the balance of vowel space systems in general. For example, while back vowel fronting is probably not correlated with the merger of /a/, /ɑ/, and /ɔ/, it has been speculated that the (a) merger is one possible motivation for movement of /æ/ (Thomas, 2001; cf. Moonwomon, 1992).