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Do you hear what I hear? Experimental measurement of the perceptual salience of acoustically manipulated vowel variants by Southern speakers in Memphis, TN

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ABSTRACT

For the past twenty-five years, the results of most sociolinguistic research suggest productive changes serve as social indices, uniting and dividing groups of speakers by gender, class, ethnicity, and so forth (Eckert, 1988, 2000; Labov, 1994, 2000; Milroy, 1980; Trudgill, 1974). Although the reoccurrence of patterned use of linguistic variants by different groups within communities appears to suggest a paralinguistic social function for variation, the effect of low-level phonetic variation on the perception of social traits is still relatively unexplored. To this end, the current article is an attempt to study speakers' perceptual awareness and social evaluation of specific vowel variants using acoustically manipulated speech samples. For the study, guises of the same speaker were manipulated according to Southern and Northern regional shifts to determine whether such differences function as perceptual cues for listeners. Although experimental in design, this study provides a method of measuring speakers' sensitivity to slight changes in formant position and attempts to determine whether such subtle phonetic changes are indeed used as socially salient categorization cues by speakers.

PRODUCTIVE CHANGES IN AMERICAN DIALECTS

Much work in the variationist paradigm has focused on describing and instrumentally measuring the productive changes affecting speakers in a variety of American dialects. The discovery of two very distinct and systemwide shifts affecting vowels in Northern American dialects (Northern Cities Shift or NCS) and Southern American dialects (Southern Vowel Shift or SVS) are among the most striking recent findings of this research (see work by Clarke, Elms, & Amani, 1995; Eckert, 2000; Evans, 2001; Feagin, 1986; Fridland, 2000, 2001, 2003; Gordon, 1997; Labov, 1991, 1994, 2000; Labov, Yeager, & Steiner, 1972; Tho-

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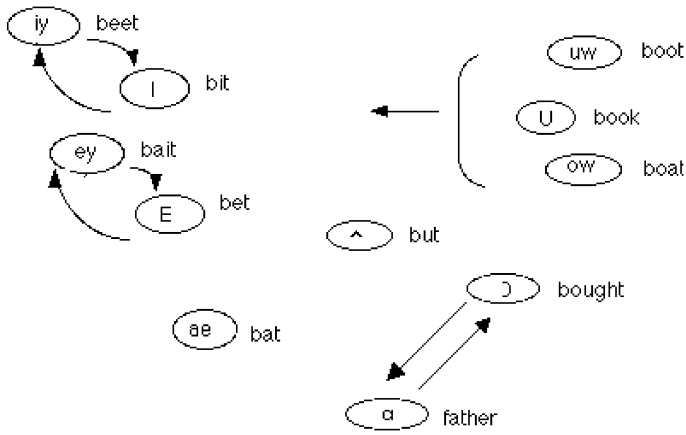

FIGURE 1. Vowel changes affecting Southern American dialects.

mas, 1997a, 1997b, 2001). Both of these shift patterns describe a number of interrelated changes affecting the vowel systems of White urban Northern speakers and White Southern speakers, respectively, and have become very relevant in the examination of the convergence/divergence issue in American dialects. In addition, ethnic group participation in the shifts across dialect regions is quite distinct, with Northern African-Americans generally not participating in the shifts affecting Northern speech (Labov, 1994), while African-Americans in Memphis show very similar productive shift patterns to those of European-American speakers (Fridland, 2003).

As Figures 1 (SVS) and 2 (NCS) show, the changes affecting the front vowels in the South and North are creating greater differentiation in the two dialects, with the high and mid front system effectively moving in opposite directions. Acoustically, the formant structure of the realigned front vowels is associated with changes along both the first and second formants, F_1 and F_2, respectively (roughly, along the height and advancement dimensions). The most prominent change in the Southern front system is the reversal in acoustic position of the /ey/ (*bait*) and /E/ (*bet*) class, with /ey/ appearing lowered and centralized, resulting in a higher F_1 and a lower F_2, and /E/ becoming higher and peripheral, resulting in a lower F_1 and a higher F_2 relative to /ey/. The position of /iy/ (*beat*) and /I/ (*bit*) is also similarly affected in some Southern dialects, although these changes are not as prevalent, particularly in parts of the Mid-South. In the NCS, the raising of /æ/ class is the earliest and most advanced shift, followed by the movement of the (low) /a/ and /ɔ/ classes. Subsequently, the vowel /E/ appears to shift downward or, in some cases, back in the system toward the space occupied by /∧/, creating either a lower F_1 or a lower F_2. The /ey/ class remains higher and

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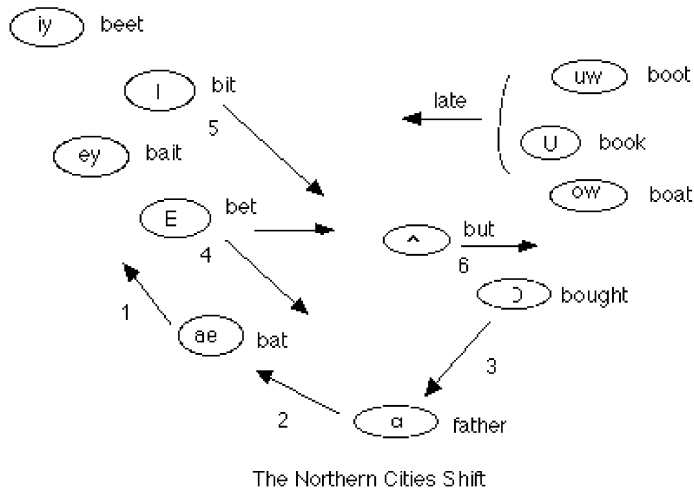

FIGURE 2. Vowel changes affecting Northern American dialects.

more peripheral than /E/ in the Northern system. As a result, the /ey/ and /E/ class maintain the traditional alignment in Northern speech, whereas this relative alignment is reversed in Southern speech. Emerging from these changes is a picture of greater distinction between Southern speakers' and Northern speakers' front vowels, suggesting the North/South dichotomy is both a very salient and very powerful influence on the selection of particular vowel variants.

In contrast, the changes affecting the back vowels involving the fronting of /uw/, /U/, and /ow/ (affecting the second formant acoustically), appear parallel in the two dialects (and are also present in Western varieties, Philadelphia, and the Ohio Valley). Generally, extreme fronting of back vowel tokens is more common in the South than the North and is often accompanied by lowering. In both these dialects, /uw/ fronting is the first back vowel to be affected by change, with /ow/ and /U/ shifting subsequently in an analogic pattern in more advanced systems. The /ow/ class is rarely shifted in Northern speech and generally fronted only in younger Southern speakers (Ash, 1996; Fridland, 2001; Thomas, 1989). The low vowel system, including /ae/, /a/, and /ɔ/, shows more of a mixture of trends, with both dialects showing a tendency for raised /ae/ (although much more extensively present in NCS), but a low-back vowel merger spreading from the West to many Southern, but not Northern, systems. As a result of the composite of these various shifts, a number of conflictingly divergent and convergent tendencies appear to be at work in regional American dialects. We know little, at this point, about the awareness of such changes to speakers within each region and what kinds of social information they may or may not transmit.

In light of recurrent evidence of the importance of ideology and social affiliation in the spread of sound change, it is important to establish the perceptual

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dimension of regional dialect differences in terms of what they signal for local speakers. In his research on the folk-linguistic beliefs and attitudes of speakers toward both Northern and Southern speech varieties, Preston (1989, 1993) found that speakers were very adept at correctly placing speech samples on a map along a North–South continuum with three different degrees of North/South identification after hearing only a brief sample of each speaker. Obviously, there are clearly prominent features of Southern and Northern speech that untrained respondents quickly and overwhelmingly attend to and use in the categorization of speakers they encounter. The current study extends this research on the perception of regional boundaries to more specifically examine which aspects of vowel quality play a role in this ability to identify the regional affiliation of speakers.

The research presented here, grounded in sociolinguistics, but borrowing methodology used more widely in experimental phonetics research, manipulates the formant patterns of vowel classes that are serving to both distinguish and unite the varieties of speech spoken in the Southern and Northern United States. The study attempts to determine whether Southerners from Memphis, TN are able to perceive certain vowel formant positions as Southern or Northern, and whether, because of the apparently divergent nature of the changes, front vowel positioning is more salient as a regional identifier than back vowel positioning. In addition, the study explores whether speakers are more perceptually aware of changes they themselves take part in, such as the /ey/ and /E/ reversal, widely exhibited by speakers in Memphis, in contrast to the /iy/ and /I/ reversal, which is absent in Memphis.

EARLIER WORK ON PERCEPTION AND LANGUAGE ATTITUDES

Most sociolinguistic research on variation suggests that sound changes hold social salience for the speakers who use particular variants and those who do not, often providing the presumed underlying (and often unconscious) motivation for adoption or rejection of shifts. Certainly, it seems reasonable that groups of speakers who use the same phonetic variant(s) and share some recognizable social characteristic are using that variant as a marker of that membership, particularly when nonmembers use a distinctly different variant and mark this social difference in other clear nonlinguistic ways (dress, music, food). However, we know little of what sorts and degrees of phonetic variations are perceptually distinguishable for speakers and what they may in fact signal. To solidly connect the dots in the relationship between what speakers say and what speakers hear, investigators are becoming more interested in exploring the connection between production and perception.

Such research includes several studies using speech production data to measure participants' ability to recognize and categorize vowel variants regionally or ethnically. Wolfram, Hazen, and Schilling-Estes (1999), for example, used recordings of /ɔ/ variants raised and monophthongized to varying degrees to measure how this affected listeners' ratings of variants on Northerness and Southerness

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scales. Labov and Ash (1997) examined the role of regional sound changes on listener identification of Southern vowels using real speech data from speakers in Birmingham, Alabama. In controlled vowel-identification and gating tests, they found speakers to be surprisingly bad at correctly identifying what words they heard, even when they were from the same dialect as the target speaker. However, local listeners did show some advantage over raters from areas not affected by the Southern sound changes. In addition, the study suggested that greater exposure to national norms made the recognition of local norms more problematic.

Niedzielski (1999) used recordings of a Detroit speaker's raised /aw/ variant, which she alternately introduced to raters as being produced by either a Canadian or Michigan speaker, to show that speech stereotypes play a role in the selection of the /aw/ variant listeners believed they had heard. Clopper and Pisoni (2001) used sentences solicited from young men from regionally diverse dialect areas of the United States to measure how well listeners were able to identify the sentence producer's regional affiliation. They then acoustically measured how certain stereotypical regional variants, such as /ay/ monophthongization, were correlated with the sentences rated most accurately by region, suggesting that those variants are most responsible for triggering regional association. These studies suggest that speakers do use phonetic cues in classification of sounds and social traits, revealing that we are perceptually aware of this phonetic variation and its related social embedding and use it to organize our experience.

Using synthetically-altered speech stimuli, several studies have looked at the effect of prosodic damping and various other features on speaker identification. For example, Van Bezooijen and Gooskens (1999) designed a study that examined the effect of manipulation of different levels of linguistic features, including voice quality, segmental features, and prosody, on the identification of Dutch and British language varieties. Speech samples were resynthesized through low-pass filtering and monotonization, and raters were asked to place, regionally, the various samples. Overall, their results suggest that pronunciation rather than prosody plays a much greater role in allowing listeners to place speakers regionally, but this varies to some degree by language type. In a third and related study, it was found that speakers were quite good at identifying varieties on the basis of phonetic cues alone.

In addition, other studies have used acoustic manipulation of vowel formants to see how such manipulation alters the participants' classification of the vowel tokens. Ladefoged and Broadbent (1957) tested subjects who heard a target sentence in which the formant pattern of select vowels was created instrumentally. They played the sentences both with an acoustically controlled priming sentence and without a priming sentence, and found that subjects altered their interpretation of the target vowels depending on whether they were primed or not. With no priming, subjects seemed to use background knowledge of some appropriate acoustic range in categorizing the vowel. However, when subjects were played a phonetically altered unambiguous sentence before they heard the target sentence, they seemed to analyze the acoustic range used for vowels exhibited in the prim-

ing sentence to determine the proper vowel quality of the selected vowels in the target sentences (referred to in later literature as the formant normalization effect).

In another vowel identification study, Assmann, Neary, and Hogan (1982) found that exposure to the same talker's vowels aided listeners' identification of vowel category, but that even without such (talker or linguistic) context, listeners showed a high rate of vowel identification. The results of these studies suggest that speakers are remarkable in their ability to disambiguate the highly variable acoustic input they receive, and the way listeners perceive acoustic characteristics is not absolute, but relative. Yet, the fact that listeners are able to correctly identify vowels in the absence of calibration to an individual talker suggests that they also have some internalized default norms they use in making judgments about vowel quality. In a sociolinguistically-based study, Graff, Labov, and Harris (1986) examined Philadelphia speakers' awareness of Black and White differences in the production of the /aw/ and /ow/ vowels. Using acoustically altered vowel variants, the researchers found that listeners were generally able to make judgments about the ethnicity of the guise speakers based on the distinctive production of these two vowels.

The results of these studies suggest that speakers are able to meaningfully perceive low-level variation in vowel quality based on a default assignment of values associated with their own dialect and that their ability to assign vowel quality is fluid, should they receive perceptual cues suggesting that there is a different range of relevant acoustic positions. Based on such results, the current study assumes that speakers are sensitive to unconscious changes in vowel's F_1 and F_2 formant structure, and seeks to determine whether this sensitivity to vowel formant structure carries information about regional dialect characteristics for listeners.

This study is designed to address the issue of speaker recognition of local production norms using methodological insights from the arena of acoustically-based speech perception research. First, to limit variability, resynthesized speech from the same two speakers is used as the different guises for listener judgment solicitation. As all other speech characteristics beyond the first and second formant positions are therefore held constant, any change in speaker judgment must be attributed to that specific change in formant structure. Second, all speech stimuli consist of a single monosyllabic word per guise, limiting prosodic and semantic influences from playing a role in speaker judgment. Such a design attempts to ensure that any changes in listener judgments must center on the very low-level phonetic variations between the guises, giving us insight into how sensitive listeners are to changes in vowel quality, and whether social characteristics can be assigned on the basis of phonetic variation.

DESIGN OF THE PRESENT STUDY

For the present study, two European-American speakers, a male and a female from Memphis, TN, read a word list of single monosyllabic words containing the

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/iy/, /I/, /ey/, /E/, /uw/, /U/, and /ow/ vowels. Based on earlier research on the extent of the SVS in Memphis (Fridland, 2000, 2001), the two sample speakers did participate in moderate Southern shifting, as realized more generally in Memphis. The word lists read by the two speakers were identical and consisted of two different word tokens for each vowel class (e.g., 'dave' and 'paid' were the sample tokens for the /ey/ class). These vowel classes were selected because they are the most pivotal vowel classes in the Southern Shift in terms of further defining a separate Southern/Northern vowel system (the front vowels), on one hand, and lessening the distance between the acoustic position of the Southern and Northern system (the back vowels), on the other hand. The /iy/ and /I/ classes were included in the experiment, even though they remain traditionally aligned in the speech of Memphians (unlike other parts of the South) to determine if participation in the particular aspect of a shift affects the perception of that form as a socially salient feature. In addition to /uw/ fronting, which is found widely in both the North and South, the /U/ and /ow/ classes were included in the study to determine whether advancement in parallel stages of shift encourages recognition of those aspects of shift as local norms or if they are simply considered extensions of a larger general shift pattern.

To obtain a variety of guises with single vowel classes shifted, the F_1 and F_2 formant structure of the selected classes were resynthesized using the ASL speech synthesis software for Kay Elemetrics Computer Speech Lab (CSL). The original word list tokens were first down-sampled to 10 kHz and low-pass filtered at 4 kHz. Because of the difficulty of achieving natural, not mechanical, sounding synthesized speech, real speech data were resynthesized, rather than fully synthesizing a speech sample. However, only individual parameters were altered for each guise, thereby ensuring the constancy of the other characteristics across guises. To replicate Southern varieties, different aspects of front shift and back shift were highlighted for several guises. For example, the word '*bait*' was lowered and centralized in one guise versus peripheral in another, and guises with greater and lesser degrees of the same shift were also resynthesized. To replicate Northern speech positions, the formant structure of vowels was altered to represent traditional /iy/, /I/ and /ey/, /E/ alignments and back vowel positions, and again, greater and lesser degrees of the same relative positioning were also included in several guises.

Because original formant measurements were based on real speech data from two Southerners reading word-list data, measurements were taken for the trajectories across the vowel's entire duration for each vowel class. Table 1 contains original vowel trajectory values, from representative initial-to-final readings for each vowel class (values indicate nucleus reading through glide reading where relevant), and the frequency alterations (ΔF) made to the original values for the Southern and Northern synthesized tokens. In altering the vowel trajectories, naturalness was a great concern, and much of the alteration was by trial-and-error dependent on the resultant token's naturalness. For the synthesis, it was determined that the most natural sounding tokens resulted from the same degree of formant change (ΔF) along the entire vowel trajectory. That is, for example, when

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TABLE 1. *Original and shifted token formant trajectories by vowel class and shift type*

Vowel Class	Original F_1 Trajectory	Original F_2 Trajectory	ΔF (F_1)	ΔF (F_2)	Shift Type
iy token 1	320–230	2300–2800			South
			+150	−300	South
			−75	+200	North
iy token 2	350–280	2430–2700			South
			+175	−250	South
			−75	+150	North
I token 1	400–465	2200–2120			South
			−150	+300	South
			+150	−200	North
I token 2	400–500	2380–2000			South
			−100	+125	South
			+75	−125	North
ey token 1	700–300	1850–2500			South
			+100	−400	South
			−200	+300	North
ey token 2	700–260	1850–2700			South
			+100	−200	South
			−125	+125	North
E token 1	530–600	2050–1900			South
			−150	+300	South
			+100	−150	North
E token 2	520–620	2100–1900			South
			−125	+250	South
			+125	−125	North
uw token 1	420–300	2050–1700			South
				+200	South
				−600	North
uw token 2	480–320	1990–1900			South
				−600	North
			−100	−600	North
U token 1	500–485	1600–1350			South
				−400	North
			−75	−400	North
U token 2	490–530	1700–1550			South
				−500	North
			−150	−500	North
ow token 1	620–330	1500–1100			South
				+200	South
				−200	North
ow token 2	650–420	1700–1500			South
				−450	North
			−75	−450	North

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a token was shifted along the F_2 dimension by (–) 250 Hz, the change was applied along the entire trajectory. This decision was made for two reasons. First, to preserve the original relative initial-to-final trajectory relationship from the original token, particularly important in nuclear/glide contexts because the rate of frequency change rather than absolute values may be important (Gay, 1968; Kent & Read, 2002), and, second, to avoid the difficulty of cutting and splicing a synthesized segment within a larger unsynthesized vowel segment without chirping or splicing noise. Target values for synthesized tokens were roughly based on the frequency ranges for vowel trajectories observed in earlier work on the realization of the Southern Shift (Fridland, 2000, 2001, 2003) and on the mean frequency ranges provided for American speakers by a number of different researchers, summarized in Kent and Read (2002). Admittedly, the process is far from perfect, and often token synthesis in terms of how much a token could be modified was highly dependent on how the resulting token sounded. This study was intended as a preliminary attempt to bring methodological insights from work in experimental phonetics into a sociolinguistic context, and it uses a somewhat rough-and-ready application in its attempts to do so, particularly because it uses natural speech data.

Although the formant alterations generally included two degrees of shifting towards Southern targets and two degrees of shifting towards Northern targets within each vowel class, participants accuracy in discerning greater and lesser degrees of shift within the larger Northern and Southern categories will be examined as part of the larger ongoing study. The main goal of the present study was to determine, when given a choice between two tokens with slight differences in formant structure, if subjects were able to use dialect experience to recognize the more Southern formant structure, and so these graded-shift categories were collapsed into larger South and North category memberships.

After the synthesis was completed, naturalness was tested in a pilot test containing a mix of nonsynthesized and synthesized tokens (all were recorded onto the test tape after low-pass filtering using the Computer Speech Lab (CSL) 4300B software). Six English graduate students with some phonology/general linguistics experience were asked to listen to a single-word token pronounced in two different ways and to write down which pronunciation sounded more Southern. After the test, each was questioned about their responses to the test and any comments they had. None of the graduate students realized that they were listening to a mix of real and synthesized data and were surprised when they were informed that synthesized tokens were involved. The majority of their comments centered around how they felt the two pronunciations of each token were generally so similar sounding that it was difficult to select the more Southern-sounding variant or determine any difference between them.

After the speech samples were resynthesized, they were randomly ordered into a test tape and answer sheet (Appendix) consisting of a series of two token stimuli representing two different pronunciations of a single vowel token (e.g., 'boot'… 'boot'), presented alternatingly in male and female guises. One hundred and forty-one African-American and European-American respondents native to

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TABLE 2. *Participant ethnicity and gender breakdown*

	Gender	
Ethnicity	Male	Female
African-American	10	51
European-American	31	49

Memphis, TN were asked to respond to each of the two token sets in a matched-guise testing procedure. Speakers were asked to choose which member of each token pair sounded more Southern. Each token pair was repeated twice for listeners.

All participants from Memphis were asked to fill out demographic information prior to participating in the survey to control for background differences. All participants were raised in Memphis or Shelby County (in which Memphis lies) from the age of four until early adulthood. Each participant was also required to have at least one parent from the South (e.g., Tennessee or one of its neighboring states). Only those meeting both requirements were included in the sample data. A breakdown of the participants by ethnicity and gender is included in Table 2 above.

Each session had anywhere from 1 to 30 participants; however, most sessions included between four and six participants at a time. The study was administered in a small psychology laboratory room with only the participants and the administrator present. A tape player was positioned a few feet from the participants. Participants were asked to listen closely to the recordings and circle both the word that sounded more Southern as well as a numerical rating for how different the two pronunciations sounded from each other. There were a total of 37 tokens included in this forced-choice test, and the response to the first token presented (repeated later in the study) was discarded. As part of the larger ongoing study, participants' reactions to the various guises on competence and solidarity measures were also solicited in a subsequent test.

RESULTS

Paired comparisons *t*-tests were run on the results to measure whether Memphians are accurate in their selection of the most Southern guises and whether accuracy is affected by the degree of participation in various aspects of shift. (Not surprising, considering their productive similarity, ANOVAs comparing African-American and European-American raters in Memphis showed no significant differences in their ratings and so their responses were considered collectively.) For reference, Table 3 provides a summary of the results of production studies done in the Memphis area (from Fridland, 2000, 2001, 2003).

Table 4 lists all the means and standard deviations for the vowel classes used in the comparisons. Participants were measured for accuracy in the selection of

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TABLE 3. *Memphis speakers' participation in SVS productive changes*

	Front Vowel Shifts	Back Vowel Shifts
Most extreme shift →	/ey/	/uw/ and /U/
Some shift →	/E/	/ow/ (younger participants)
Rarely shifted →	/iy/ and /I/	/ow/ (older participants)

From Fridland, 2000.

TABLE 4. *Mean and standard deviation for variables*

Mean and Standard Deviation for Variables in Rating the More Southern Word Accurately		
Vowel Class	Mean	SD
/iy/	.67	.19
/I/	.39	.23
/ey/	.84	.21
/E/	.49	.27
/uw/	.54	.28
/U/	.51	.24
/ow/	.62	.23
/iy/, /I/	.55	.15
/ey/, /E/	.66	.16
/iy/, /I/, /ey/, /E/	.60	.12
/uw/, /U/, /ow/	.56	.17
All vowels	.58	.01

the most Southern guises, according to the rating systems discussed earlier. The results for each vowel class, vowel subsystem, and cross-system comparison will be discussed separately. Participants were accurate at identifying which word was the more Southern shifted token at an overall rate of 58%, $t(140) = 10.02$, $p < .01$, with accuracy rates for individual vowels varying from 84% to 39%. In addition, participants were more accurate in choosing the more Southern guise for the front subsystems as a group than for the back subsystems as a group, $t(140) = 2.23$, $p < .05$.

Individual front vowels

Within the front vowels, the midfront vowels appeared more salient. Participants were significantly more accurate in choosing the more Southern shifted token within the /ey/ pairs and the /E/ pairs combined as a group than within the /iy/ pairs and the /I/ pairs combined as a group, $t(140) = 6.73$, $p < .01$.[1] In fact,

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participants chose the more Southern shifted token with higher accuracy within /ey/ token pairs than within any of the other vowel token pairs. In comparing accuracy for choosing the more Southern guise with /iy/ pairs and /ey/ pairs, participants chose /ey/ token pairs with more accuracy, $t(140) = 7.90$, $p < .01$. Between the short front vowels, participants chose the more Southern shifted token in the /E/ pairs with greater accuracy, $t(140) = 3.42$, $p < .01$. Participants were also significantly more accurate in identifying the more Southern guise with /iy/ token pairs than with /I/ token pairs, $t(140) = 11.43$, $p < .01$, and with /ey/ token pairs than with /E/ token pairs, $t(140) = 12.09$, $p < .01$. Participants selected the more Southern tokens with /ey/ token pairs more accurately than with /I/ token pairs, $t(140) = 17.06$, $p < .01$; and between /iy/ pairs and /E/ pairs, participants were more accurate in identifying the more Southern /iy/ pairs, $t(140) = 6.69$, $p < .01$.

Individual back vowels

Looking at the back vowels, the more established changes affecting the /uw/ and /U/ classes appear less salient than the more recent change affecting the back vowel /ow/. Participants showed a higher accuracy for choosing the more Southern shifted token within the /ow/ pairs than in the /uw/ pairs, $t(140) = 3.28$, $p < .01$, or the /U/ pairs, $t(140) = 4.07$, $p < .01$. There was not a significant difference in how accurately the participants identified the more Southern shifted variant with /u/ token pairs and /U/ token pairs.

Front vowels to individual back vowels

Participants were significantly more accurate at choosing the more Southern guise for the front vowels as a group than they were for /uw/ token pairs, $t(140) = 2.40$, $p < .05$, or for /U/ token pairs, $t(140) = 3.96$, $p < .05$. In comparing accuracy rates for the more Southern guise in the front vowel tokens as a group against the /ow/ token pairs, there was not a significant difference.

Taken as a group, the pairs containing the /ey/ or /E/ vowels had the more Southern shifted token identified at a higher accuracy rate than the /uw/, $t(140) = 4.39$, $p < .01$, and /U/ token pairs, $t(140) = 6.45$, $p < .01$. This was not the case for comparing the /uw/ pairs and the /U/ pairs as a group to the /iy/ pairs and /I/ pairs as a group.

Participants were, however, significantly more accurate at choosing the more Southern guise with /ow/ token pairs than with /iy/ and /I/ pairs as a group, $t(140) = 3.34$, $p < .01$. There was not a significant difference in how accurately the participants identified the more Southern guise with /ey/ and /E/ token pairs measured against /ow/ token pairs.

Back vowels to individual front vowels

There was also a higher accuracy rate for choosing the more Southern guise in the /ey/ token pairs than in the back vowel pairs as a group, $t(140) = 13.27$, $p < .01$. Participants were significantly more accurate at choosing the more

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Southern guise for the /iy/ token pairs than for the back vowel token pairs as a group, $t(140) = 5.23$, $p < .01$. On the other hand, the back vowel pairs as a group were identified as more Southern at a significantly higher accuracy rate than were both the /I/ token pairs, $t(140) = 6.81$, $p < .01$, and the /E/ token pairs, $t(140) = 2.71$, $p < .01$.

DISCUSSION

Overall, results suggest that there is a degree of correlation between productive and perceptual aspects of vowel quality. That is, the ability of participants to accurately rate differences between vowel variants and assign scores appears to vary, depending on whether the local community speech norms involve those particular variants and whether those variants are shared with other regions (e.g., back vowel fronting).

As the statistics reported here show, the midfront vowel shifts are generally more socially identifying than the shifts affecting the back vowels. This pattern is consistent for /uw/ and /U/, but not for /ow/, a shift rarely found in Northern speakers and mainly only in younger Southern speakers. These results suggest that fronted /uw/ and /U/ are not of great perceptual salience in terms of regional marking, whereas fronted /ow/ variants are more readily identifiable as a particularly Southern, and probably White, feature. From these results, it certainly appears that /uw/ and /U/ fronting are quietly spreading through North American dialects with little social significance attached.

The front vowel changes, however, do appear to be making some noise, so to speak. As mentioned in the introduction, the /ey/ shift is the most active front shift in the Memphis system, followed by /E/ shift (though comparably a less prominent shift). These shifts are also present in the African-American system in Memphis. The shifts in the /iy/ and /I/ classes, in contrast, are almost completely absent in the White and Black Memphis system, although they have been found to affect European-Americans in other Mid-Southern and Southern coastal regions (Labov, 1994; Labov, Ash, & Boberg, 1999). This productive difference seems to play a role in the perceptual salience of the front vowel variants, as the mid-vowel classes appear to be the most consistently regionally identifying, with /ey/, which is the earliest most advanced shift in the front subsystem, being significantly more salient as a Southern marker than any other vowel, including /iy/. Similarly, the shift affecting /E/ is also significantly more recognizable as Southern compared to /I/, the other short front vowel affected in some areas by the Southern shift process.

From these results, the strong salience of the midfront vowels as both local and Southern markers appears clear. What is interesting about the results reported here is the degree of match between production and perception. The vowel shifts most prominently affecting the Southern Memphis system, but not affecting the Northern system, are most clearly identified as Southern features. The shift that occurs most widely across dialects, namely /uw/ fronting, is the least regionally

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identifying. The shift that occurs most actively and most locally, /ey/ centralization, is the most regionally identifying. So, the shifts that affect Memphians in particular, not only Southerners in general, appear to be most salient perceptually to listeners. Both short front vowels are also perceptually less salient than the front tense vowels, suggesting that duration and glide transitioning make a vowel more noticeable perceptually to listeners.

These results have two important implications: (1) listeners are able to make social judgments on the basis of very low-level and quick phonetic clues, with vowel quality playing an important role in this categorization, and (2) speakers' productive systems and perceptive systems are crucially interlinked, although directionality is not established. Although this work points to the important role of formant structure on listener judgments, much more work is needed on how phonetic cues and higher-level phonological, morphological, and syntactic cues are perceived and categorized by listeners. Hopefully, however, this study has shown that controlled experimentation using computerized instrumental measurement and manipulation techniques can go far in helping us move from a global view of which features affect language perception and attitudes to a microview of the specific role that individual speech characteristics play in the assignment of social traits.

NOTE

1. A Bonferroni correction was employed to control for the experimentwise error rate, and the majority of the comparisons were still significant.

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APPENDIX

Scoring sheet for Southerness and degree of difference ratings

Please circle the pronunciation in each pair that sounds the most Southern to you and then indicate on a scale from 1 to 3 how different you think the two pronunciations sound.

Word you will hear		How different? (1 = not very different, 3 = very different) Not different ↔ Very different		
Took1	Took2	1	2	3
Pete1	Pete2	1	2	3
Boot1	Boot2	1	2	3
Says1	Says2	1	2	3
Paid1	Paid2	1	2	3
Boot1	Boot2	1	2	3
Coat1	Coat2	1	2	3
Dave1	Dave2	1	2	3
Did1	Did2	1	2	3
Beat1	Beat2	1	2	3
Foot1	Foot2	1	2	3
Coat1	Coat2	1	2	3
Did1	Did2	1	2	3
Bed1	Bed2	1	2	3
Duke1	Duke2	1	2	3
Boot1	Boot2	1	2	3
Says1	Says2	1	2	3
Took1	Took2	1	2	3
Bed1	Bed2	1	2	3
Pete1	Pete2	1	2	3
Coat1	Coat2	1	2	3
Took1	Took2	1	2	3
Paid1	Paid2	1	2	3
Did1	Did2	1	2	3
Duke1	Duke2	1	2	3
Paid1	Paid2	1	2	3
Beat1	Beat2	1	2	3
Coat1	Coat2	1	2	3
Bed1	Bed2	1	2	3
Took1	Took2	1	2	3
Did1	Did2	1	2	3
Coat1	Coat2	1	2	3
Beat1	Beat2	1	2	3
Bed1	Bed2	1	2	3
Coat1	Coat2	1	2	3
Paid1	Paid2	1	2	3
Took1	Took2	1	2	3

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