POSSIBLE BACK PRELATERAL MERGERS IN OKLAHOMA

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ABSTRACT

Prelateral mergers occur in American English with a loss of vowel distinction before /l/, often between tense-lax pairs (/il-ɪl/ *feel-fill*, /el-ɛl/ *sale-sell*, /ul-ʊl/ *pool-pull*). This study examined non-low back/ central prelateral vowels in Oklahoma, where plain counterparts /u, o, ʊ, ʌ/ are fronted and earlier work found /ul/-lowering. Formants (F1, F2) from 113 adults reading words and passages were measured mid-vowel. All four prelaterals were backed, without /ul/-lowering but with /ʊl/ varying in height between /ol/ and /ul/, and /ʌl/ varying between plain /ʌ/ and /ol/ or higher. While many speakers overlapped /ʊl/ and/or /ʌl/ with /ol/, none showed definitive three-way /ʊl-ʌl-ol/ merger. Instead, a correlation between /ʊl/- and /ʌl/-raising suggests a chain shift that might allow only one /ol/-merger per speaker – or two lax-tense mergers (/ʊl-ul/ *pull-pool*, /ʌl-ol/ *hull-hole*). However, wide individual variation is not well explained by demographics, leaving the direction and social meaning of these changes unsettled.

Keywords: Prelateral merger, vowel shift, sound change, American English, variationist dialectology

1. INTRODUCTION

Conditioned vowel mergers are sound changes over time in which phonemes lose distinction in certain phonetic environments, in this case before /l/. Several prelateral mergers have been described as advancing through generations of various American English regions, often between tense-lax pairs, with front pairs laxing in the South (/il-ɪl/ *feel-fill*, /el-ɛl/ *sale-sell*) but back vowels often tensing in the Midland and West (/ul-ʊl/ *fool-full*, /ʊl-ol/ *bull-bowl*, /ʌl-ol/ *hull-hole*, /ʌl-ol-ʊl/ *pulp-pole-pull*, /ʊl-ol-ul/ *pull-pole-pool*) [1, 2, 3, 4, 5, 6]. Oklahoma is in a dialect transition zone with a mix of regional features, including Southern /u, o/-fronting, Midland /o, ʊ, ʌ/-fronting, and Western /a-ɔ/ *caught-cot* merger [1, 7]. Thus, we might expect any combination of prelaterals to shift toward each other, with age differences indicating change over time and gender, rurality, or register indicating social meaning.

Past studies in Oklahoma reported the laxing of three prelaterals /il, el, ul/ advancing over time [1, 7, 8, 9, 10], but they either had very few participants or did not include lax counterparts, and none detailed any mid-back prelaterals. The present study provides a deeper examination of four back prelaterals, seeking to describe their arrangements and identify possible mergers in progress. The youngest speakers in earlier work would now fit into the two older age ranges in the present study (Table 1), and speakers in the most recent work [7] overlap the three oldest age ranges here, providing a continuation in apparent time. Age, gender, rurality, and reading style will be explored as factors that often differentiate stages of change.

2. METHODS

2.1. Participants

Speakers were 113 adults aged 18–92 (*M* = 33) who were native speakers of English raised in Oklahoma with no speech disorders post-childhood. Males and females were sought from four age groups (college-age, early adult, middle-aged, senior; see Table 1), and three city sizes: City (urban/suburban Oklahoma City and Tulsa), Town (populations > 20,000), and Country (rural). Ethnicity was not considered in recruitment but roughly reflected the overall makeup of Oklahoma: most were White, with 17 identifying as Native American and 4 as Hispanic, Asian, or Middle Eastern (solely or in addition to White).

Table 1: Numbers of participants by age range, city size, and gender (Male, Female, Other).

	City		Town		Country		
Age	M	F	M	F	M	F	O
18–24	9	17	4	9	2	13	
25–39	3	5	3	3	8	7	1
40–59	2	4		3	3	5	
60+	2	1		4	2	3	

City: Tulsa/Oklahoma City metro; Town: pop. >20,000.

In preliminary analyses, the two younger and two older age groups each patterned together, as did the Town and Country speakers (similar to past work in Oklahoma [8, 9]), so these groups were collapsed for the present results. As seen in Table 2, distributions were skewed toward people under 40, women, and rural residents. (With only one non-binary participant, analyses with gender as a factor only included male and female speakers.)

Table 2: Total participants by age group, rurality, and gender.

	Urban		Rural			Totals		
Age Group	M	F	M	F	O	M	F	Age
Younger <40	12	22	17	32	1	29	54	84
Older >40	4	5	5	15		9	20	29
Totals	16	27	22	47	1	38	74	
	43		70					113

Urban = City; Rural = Town + Country.

2.2. Materials and procedures

Most participants recorded themselves using personal devices (phones, laptops) in 2020; 14 were recorded in a sound-attenuated booth before the COVID-19 pandemic. Each read a 129-item word list from which 69 monosyllabic words were used here, with three for each American English monophthong before /t, d/ or no coda, plus 3–6 words for each of the eight non-low vowels before /l/ [11, 12]. They also read three short passages (69-word "Please Call Stella" [13] and two new stories, 140 words each), from which 78 total stressed vowels were measured (2–8 per vowel-environment, except /ʌl/, which was mistakenly omitted from the text).

Participants were recruited primarily through a university email list and the first author's students forwarding emails to personal contacts. Consent, demographics, and instructions were presented/ collected in Qualtrics (qualtrics.com; consent was collected on paper for those recorded in person). Participants provided informed consent and received $5 cash or gift card in compensation. Students in the first author's phonetics course could opt for extra credit instead of payment (or do an alternative extra credit activity). All procedures were approved by the university's institutional review board.

2.3. Measurements and analysis

Transcripts of the word list and passages were run through DARLA [14] for forced alignment. The vowel boundaries in the resulting TextGrids were examined in Praat [15] and corrected when necessary. The aligner's method of separating vowel and lateral appeared to be consistent across vowel qualities and was therefore left unadjusted. A simple Praat script measured the first and second formants (F1, F2) at 50% of vowel duration for plain vowels and at 35% for prelaterals to reduce the effects of lateral coarticulation. The settings for most speakers were 5 formants and a maximum formant value of 5000 Hz, with some speakers adjusted to 6 formants or 5500 Hz to improve formant tracking. Each speaker's raw formants were plotted in NORM [16] with ellipses of 1 *SD* around vowel means to enable quick visual identification of outliers, which were then verified or remeasured. All speakers' formants from all vowels in both tasks were normalized together using the Nearey 2 formula in the R package phonR [17, 18].

To support descriptions of prelaterals as backed and/or raised from plain counterparts, linear mixed-effects (LME) models were run for each normalized formant of each vowel using the R package lme4 [19], with Environment (plain, prelateral) as the fixed effect and Speaker and Word as random effects.

Pillai scores were used to characterize the degree of overlap between various pairs of vowels. Pillai-Bartlett statistics ('Pillai score' for short [20]) are output from multivariate analyses of variance (MANOVA) and indicate a degree of distinction between distributions, accounting for multiple dependent variables (F1, F2). They range from 0 to 1, with lower scores indicating greater similarity. However, there are no standard cut-offs to determine merger status, and it can be difficult to define degrees of shifting between distributions that are clearly separate. Thus, indices were created to quantify the relative locations of /ʊl/ and /ʌl/, which varied between speakers.

The WOOL Raising Index (WRI for /ʊl/ in a Wells-style convention of using non-minimal pairs to label vowel classes) was calculated for each speaker as a proportion of the Euclidean distance between their mean /ul/ and /ol/, with 0 as the midpoint, +1 as even with /ul/, and –1 as even with /ol/ [21]. The same was done for /ʌl/ to create a GULF Shifting Index (GSI) between 0 at plain /ʌ/ and 1 at /ol/. (Note: three speakers with no measurable /ʌl/ tokens were excluded from GSI calculations.) The respective three vowels did not always appear in a straight line, so a perpendicular line was drawn from the target vowel to a line connecting the anchors, with the index calculated at the intersection as a proportion of the length of the anchor-line (see [11] for examples).

ANOVAs tested effects of categorical factors on WRI and GSI: Age (Younger/Older than 40), Gender (Male, Female), Rurality (Urban, Rural), and for WRI, also Style (Reading Passage, Word List) (/ʌl/ only appeared in the word list). Spearman correlations were run between WRI and GSI, and between various Pillai scores, to look for possible chain relationships between moving vowels.

3. RESULTS

Figure 1 plots all speakers' plain vowels with ellipses around vowel means. It is essentially a West-Midland arrangement, with low-back /a-ɔ/ merger, raised /e/, and notable fronting of all four /u, o, ʊ, ʌ/ [1]. (Not shown: Southern *pin-pen* merger, /aɪ/ glide loss.)

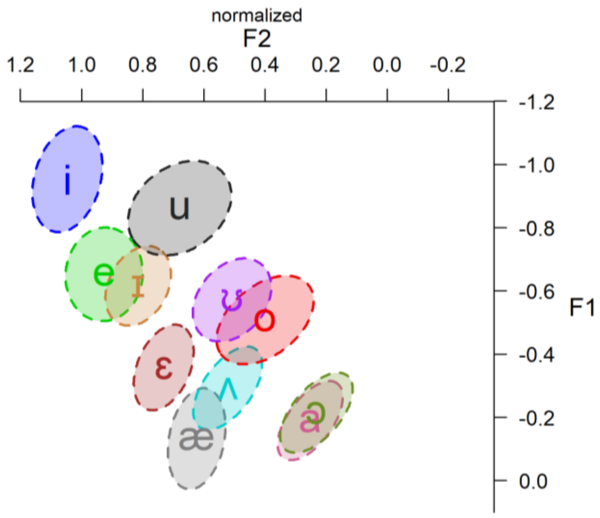

Figure 1: Plain vowels, 0.5-*SD* ellipses

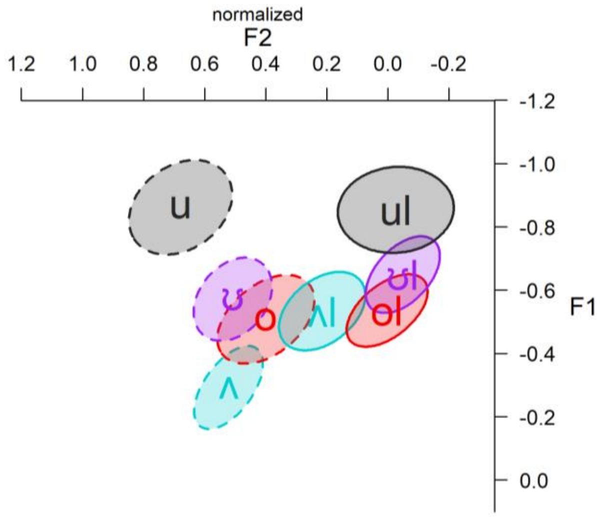

Figure 2: Non-low back/central vowels, 0.5-*SD* ellipses (dotted: plain; solid: prelateral).

Figure 2 plots all non-low back and central vowels in plain vs. prelateral environments. In line with recent work in Oklahoma [7], the prelaterals were not fronted (as in the Midland but not the South [1]). Contrary to earlier work reporting /ul/-lowering [1, 8, 9, 10], tense /ul, ol/ were nearly straight back from their plain fronted counterparts, differing from them only in F2 (/u/: $\beta = -.68$, $SE = .06$, $t(1971) = -12.25$, $p < .001$; /o/: $\beta = -.38$, $SE = .04$, $t(2184) = -9.13$, $p < .001$). Lax /ʊl/ was also slightly raised, appearing between /ol/ and /ul/ and differing from plain /ʊ/ in both F1 ($\beta = -.08$, $SE = .03$, $t(1086) = -2.95$, $p < .05$) and F2 ($\beta = -.56$, $SE = .02$, $t(1086) = -28.08$, $p < .001$). Notably, /ʌl/ was partially backed but also raised, landing front of /ol/ and differing from plain /ʌ/ in both F1 ($\beta = -.24$, $SE = .02$, $t(878) = -12.85$, $p < .001$) and F2 ($\beta = -.30$, $SE = .03$, $t(878) = -10.09$, $p < .001$). This backing was much greater than occurred with front prelaterals (not shown), which were only slightly backed and lowered among these speakers, maintaining partial to substantial overlap with their plain counterparts [12].

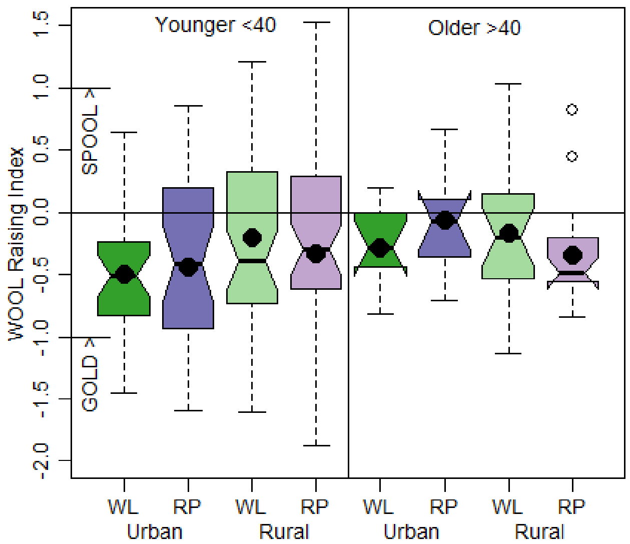

Figure 3: WOOL Raising Index (WRI, /ʊl/) by age, rurality, style (RP: passage, WL: word list; dots: means, notches: 95% CIs; 7 outliers not shown).

With all speakers together (Figure 2), /ʊl, ʌl/ were raised, but there were no clear mergers among back prelaterals. Amounts of overlap between /o/ and its neighbors were similar between environments (Pillai scores: /o-ʊ/ .30 vs. /ol-ʊl/ .28 and /o-ʌ/ .59 vs. /ol-ʌl/ .54), and raised /ʊl/ overlapped /ul/ only somewhat (Pillai .54). However, between speakers, the height of /ʊl/ and degree of shifting of /ʌl/ varied considerably.

Figure 3 shows the WOOL Raising Index (WRI) divided by speaker age, rurality, and reading style. An ANOVA with these and gender as independent variables found no significant effects, but Younger speakers showed greater individual variation, with wide distributions extending through the full range of heights between /ul/ (1 "SPOOL" in the graph) and even lower than /ol/ (–1 "GOLD"). (Additionally, 7 Younger outliers are not shown: 2 RP WRI > 2; 4 RP and 1 WL WRI < 2). In contrast, Older speakers' /ʊl/ distributions were more tightly centered a bit below 0, the midpoint between /ol, ul/, with only a few Older Rural Word Lists reaching either /ol/ or /ul/.

Figure 4 shows the effects of age, gender, and rurality on the GULF Shifting Index (GSI). An ANOVA with all three independent variables found a main effect on GSI for Gender ($F(1) = 10.27$, $p < .01$) and a three-way interaction ($F(1) = 9.83$, $p < .01$). In Tukey post-hoc comparisons, mean GSI differed significantly between Males ($M = .58$) and Females ($M = .72$; $p < .01$, 95% CI = [–.22, –.05]). This effect might be driven by Rural speakers, as mean GSI also differed significantly between Rural Males ($M = .57$) and Rural Females ($M = .74$; $p < .05$, 95% CI = [–.32, –.02]). The three-way interaction was driven by the gender difference among Older Rural speakers, the most and least raised on average (but recall the small

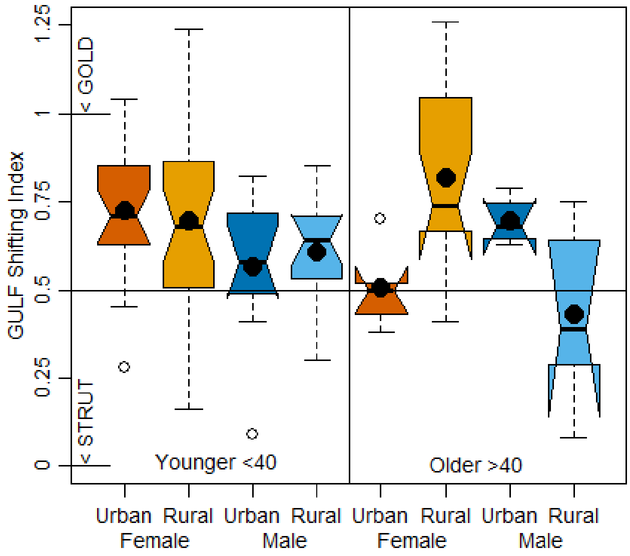

Figure 4: GULF Shifting Index (GSI, /ʌl/) by age, gender, rurality (dots: means, notches: 95% CIs).

number of Older speakers overall) (Male $M = .43$; Female $M = .82$; $p < .05$, 95% CI = [–.73, –.05]). In addition, the /ʌl/ distributions of Female speakers, especially Rural Females, extended the highest, sometimes surpassing the height of /ol/.

In testing for relationships between /ʊl/- and /ʌl/-raising, the correlation between WRI and GSI was weak but significant ($\rho = .26$, $p < .01$). However, any parallels in raising did not indicate equivalent paths toward /ul/ and /ol/ mergers, as there was no correlation between /ʊl-ul/ and /ʌl-ol/ Pillai scores.

4. DISCUSSION

This study illustrates the acoustic positions of four back prelaterals among adults in Oklahoma. To our knowledge, it is the first to identify variable raising of lax /ʊl, ʌl/, which could predict multiple possible *tensing* mergers (/ʊl-ul/, /ʌl-ol/, /ʌl-ol-ʊl/), rather than the /ul/-laxing found previously.

While the West-Midland configuration of plain monophthongs matched prior work in Oklahoma [1, 7, 8, 9, 10], prelaterals did not. Mainly, no speaker group laxed (lowered) /ul/. Instead, tense /ul/ and /ol/ were straight back from their plain fronted counterparts /u, o/, and lax /ʊl, ʌl/ raised to various degrees toward/between them. This contradicts the direction of change reportedly moving steadily across past generations, with the then-innovative /ul/-laxing led by the young, urban, educated, and female, culminating in high proportions of /ul/-laxing among speakers who would now be in this study's oldest age groups [8, 9]. Now, the apparent lack of /ul/-laxing, and /ʊl-ul/ overlap being more prevalent in rural speakers and casual styles [21], may indicate a reversal, possibly even within those generations as they aged (age grading).

However, with wide individual variation, about a third of speakers (39) across demographics did lower /ul/ in one or both reading tasks. Less than half of these overlapped /ʊl-ul/, mostly by raising /ʊl/ so the two 'met in the middle.' Only 5 speakers lowered /ul/ to an unraised /ʊl/, the pattern suggested by past descriptions of *pool-to-pull* laxing. However, most past work on Oklahoma [7, 8, 9] did not include /ʊl/ tokens (or had only 2-4 speakers with variation between them [1, 10]), so it is not clear if (near-) merger was truly achieved through /ul/-lowering.

Prior work also did not include mid /ʌl, ol/, so past states are unknown, but as younger, urban, and female speakers often lead sound changes, the patterns here suggest trends in more /ʌl/-raising but less /ʊl/-raising, which could lead to convergence around /ol/ (as found in Kansas City and Utah [2, 5]), possibly someday a three-way merger. However, only two speakers showed much /ʊl-ʌl/ overlap (Pillai < .5), none showed definitive three-way merger (all three pairs with similarly low Pillai scores), and there was no correlation between /ʊl-ol/ and /ʌl-ol/ Pillai scores to suggest convergence within speakers.

Instead, most speakers kept /ʊl/ and /ʌl/ apart, even when one or both overlapped /ol/ (usually on different sides, as in Figure 5a, 5f). Although weak, the correlation between /ʊl/ and /ʌl/ indices suggests a possible chain shift. A raising shift could keep all four prelaterals separate (Figure 5a) or result in two lax-tense mergers (/ʊl-ul/ *pull-pool*, /ʌl-ol/ *hull-hole*, Figure 5b). Or, opposition to /ʊl/-raising could lead to /ʊl-ol/ *bull-bowl* merger (Figure 5d, [3, 4]). With /ʌl/ apparently trending toward raising, it could stay close to /ol, ʊl/ to form a three-way near-merger (Figure 5e, 5f, found in Utah [5]) or even surpass the two in height (Figure 5c, 5f). All these patterns are attested in the data with varying frequencies similar to recent findings in Midland Kansas City [2].

So much variation, particularly in younger ages, indicates a community in flux. Future work will examine trajectories, lip rounding, and social factors like education, SES, and rootedness [11] to explain patterns of change in prelateral shifting.

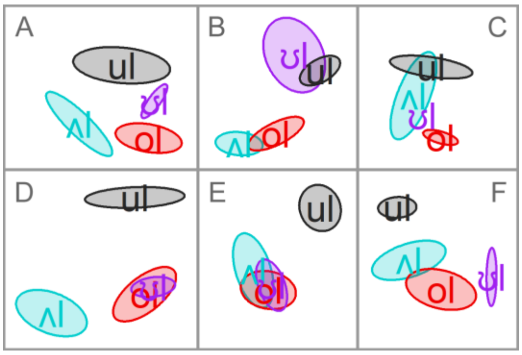

Figure 5: Example prelateral patterns, individual speakers (all Young, B-F Female, C-E Urban).

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