

Embodying “tech”: Articulatory setting, phonetic variation, and social meaning

Teresa Pratt 

University of Duisburg-Essen, Germany

Correspondence

Teresa Pratt, Universität Duisburg-Essen,
Institut für Anglophone Studien, R12 S04
H81, 45141 Essen, Germany.
Email: teresa.pratt@uni-due.de

Abstract

This article examines the co-occurring realization of two sociophonetic variables within a style—the LOT vowel in English and word-initial /l/—to explore the link between *articulatory setting* and stylistic practice. At an arts-focused high school in the San Francisco Bay Area, the curricular and social practices of students in the technical theatre department centre around manual labour. Ethnographic analysis demonstrates that “tech” constitutes a locally enregistered persona, informed by tech students’ positioning as working-class subjects through their bodily, sartorial, and technological practices. Tech students also produce higher and more rounded variants of LOT, and more velarized productions of /l/, than their non-tech peers, and I suggest that articulatory setting is at play in the cohesive indexicality of these variants. I advocate for the continued exploration of co-occurring sociolinguistic variables which treat the body as a broader stylistic context, and propose that studies of co-occurring features focus on the ideological processes by which combinations of variables come to index thematic styles.

Este artículo examina la realización concurrente de dos variables sociofonéticas, la vocal LOT (en inglés) y la palabra inicial /l/, para explorar el vínculo entre la configuración articulatoria y la práctica estilística. En una escuela secundaria centrada en las artes en el área de la bahía de San Francisco, las prácticas curriculares y sociales de los

alumnos en el departamento de teatro técnico se centran en el trabajo manual. El análisis etnográfico demuestra que “tech” constituye una persona reconocido localmente, caracterizado por la posición de los alumnos de tech como sujetos de clase trabajadora a través de unas prácticas corporales, sartoriales y tecnológicas. Los alumnos “tech” también producen variantes más altas y más redondeadas de LOT, y producciones más velarizadas de /l/, que sus compañeros que no son “tech,” y sugiero que la configuración articulatoria está en juego en la indexicalidad cohesiva de estas variantes. Abogo por la exploración continua de variables sociolingüísticas coexistentes que tratan el cuerpo como un contexto estilístico más amplio, y propongo que los estudios de características coexistentes se centren en los procesos ideológicos mediante los cuales las combinaciones de variables vienen para indexar estilos temáticos.

KEYWORDS

articulatory setting, arts education, class, embodiment, high school, ideology, sociolinguistic style

1 | INTRODUCTION

Much of the work investigating the social meaning of variation explores the indexical value of individual variants (e.g. Calder, 2018; Campbell-Kibler, 2007; D'Onofrio, 2018; Podesva, 2007). Such approaches isolate a particular linguistic feature and identify its indexical value within a situated social context. This work contributes to a theory of sociolinguistic style whereby the social-semiotics of variation emerges through the continual recombination of linguistic features (Coupland, 2007; Eckert, 2008; Moore, 2003), such that an individual feature is one of many composite elements of a style. Crucially, social meaning is theorized to emerge at the stylistic level—the level at which variables cumulatively cluster together (Eckert, 2008). Thus, an important facet of sociolinguistic research is the *co-occurrence* of linguistic variables, and the ways in which their cumulative social meaning is mutually constitutive.

Examinations of stylistic co-occurrence demonstrate that variables often index in concert. British-born Asian speakers (Sharma, 2011), young professional workers in Beijing (Zhang, 2005), and radio personalities in Pittsburgh (Johnstone, 2011) all combine particular consonantal and vocalic features to construct styles relevant to their local political economy. Similarly, high school girls use hyper-articulation and super-standard grammatical features to construct their nerd style (Bucholtz, 2011), and two African-American speakers modify their combinatory use of morphosyntactic features across their lifespans in ways that reflect changing orientations to their life course (Rickford & Price, 2013). This ongoing (re)combination of semiotic resources allows for new, contextualized meanings to emerge through a process of bricolage (Hebdige, 1979). But as Hebdige argues, and as the examples

above demonstrate, the particular elements which are combined are not chosen without reason. That is, the motivation to combine features is ideologically driven, as is the interpretation of their composite, thematic meaning. Stylistic moves are always ideological, in that they reflect the ideas associated with certain speakers or groups positioned as distinctive (Eagleton, 1991; Irvine, 2001); in this sense, they represent the “formations and distributions of energy and interest” of a social actor (Williams, 1976: 11). The Beijing yuppies’ use of both local and non-MSM (Mainland Standard Mandarin) features reflects their orientation to “cosmopolitanness,” just as the nerd girls’ use of hyper-standard features aligns with their intellectual and “counter-cool” ideology. In this way, styles both reflect and reproduce the ideological positioning of the speaker or group.

That ideology is woven into the dailiness of stylistic practice is entailed in the concept of *persona*, a typifiable figure theorized to constitute the semiotic landscape (Agha, 2003, 2007). As abstract, ideological representations of social types, personae are associated with linguistic styles, rendering language one part of how personae come to be recognized in the popular imagination. Because indexical values are never fixed, but rather emergent in interaction (Silverstein, 1993, 2003), personae are involved in a continuous process of enregisterment (Agha, 2003) as speakers draw on conventionalized social meanings of linguistic forms (Coupland, 2001). Through this process, a young woman using uptalk or creaky voice may be enacting the construct of a Valley Girl, which concurrently entails demographic specifications (white, young, female, affluent), qualities (vapid, superficial, exasperated), and linguistic features (uptalk, creak, “like”), all of which are constitutive of each other. Their expected co-occurrence renders them culturally legible through ideological frames. Put another way, personae allow social actors to place one another within the social-semiotic landscape.

In previous work, I have argued for increased attention to the role of affect in persona construction (Pratt, 2018). Affect—or constructions of emotion, attitude and disposition—is a central facet of what we are socialized to convey in interaction, and is likewise woven into personae, hence an exasperated Valley Girl, a smooth-taking Politician, or a laid-back Surfer. In this sense, though sociolinguists have long taken variation to be indexical of macrosocial categories, the social meaning of a given form is contextually emergent by virtue of the speakers’ affective display, often related to a particular stance (Du Bois, 2007; Ochs & Schieffelin, 1989). Social meaning thus resonates between micro- and macro-levels of variation, and affective achievements within interactional moments both constitute and reflect large-scale meanings and categories (i.e. indirect indexicality; Ochs, 1992).

Work in third wave variation emphasizes that these emergent meanings are also dependent on aspects of style which are traditionally considered non-linguistic, such as bodily or sartorial practices (Calder, 2018; Mendoza-Denton, 2008; Pratt, 2018). By virtue of being produced by a body, language is an embodied phenomenon, the implications of which range from articulatory phonetics to the correlated semiosis of language alongside other bodily practices (gesture, facial expression, *hexis*; Bourdieu, 1977). A large body of phonetic literature has examined the effects of articulatory constraints on speech production (e.g. Lindblom & Sundberg, 1971; Ohala, 1983; Ohala, Browman, & Goldstein, 1986), and likewise bodily practice has long been a focus within sociocultural and cognitive approaches to language (e.g. Goffman, 1979; Kendon, 1997; McNeill, 1992), but variationist sociolinguistics has largely been a language-specific endeavour. I suggest here that fine-grained articulatory processes are not disconnected from bodily practice writ large, and that a broader theory of the social-semiotics of variation should explore the interconnectedness of semiotic practice across modalities.

To that end, work in linguistic anthropology highlights that language, the material world, and the body are “an unfolding locus for the display of meaning and action” (C. Goodwin, 2000: 1517; see also Bucholtz & Hall, 2016; Mondada, 2016; Shankar, 2016). Mendoza-Denton and Jannedy (2011) show that the correlation of pitch accents and gestural apices in one speaker’s monologue at a town hall meeting align with the speaker’s interactional goals, and M. H. Goodwin (2017) observes that

creaky voice co-occurs with displays of intimacy in family interactions, notably during hugs—an embodied display of affect. To extend the Valley Girl example, her speech patterns might be interpreted as an expression of an affective state (e.g. exasperation, superficiality), along with bodily practices such as eye-rolling or an open jaw (widely represented in popular media; see Pratt & D'Onofrio, 2017). Linguistic and bodily practices cannot be disentangled, and are jointly implicated in the process of enregisterment, together imbuing the Valley Girl with her affective style, i.e. having an “attitude.”

Bucholtz and Hall (2016) conclude that “the semiotics of style includes all dimensions of language as well as material and embodied resources of self-presentation, which together yield ideologically cohesive semiotic packages,” arguing further that there is “no conceptual difference between stylistic variables based in language and those based in (other forms of) embodiment” (2016: 180). This raises questions about our analytical focus within the study of sociolinguistic style. How does ideology shape the constant interplay of co-occurring linguistic features and non-linguistic social practices? How does this result in a cohesive and recognizable persona in a given community? Here I emphasize that the embodied nature of language is one frame for understanding such cohesion, arguing that the construction of a particular style involves both bodily and linguistic practices, and that the legibility of the linguistic variants is dependent on the broader embodied context. Further, I suggest that it is less crucial to identify individual indexical contributions of each variable than to explore the ideological motivations that render co-occurring semiotic resources cohesive.

2 | ARTICULATORY SETTING AND SOCIAL MEANING

Regarding language, the body, and the material world as interconnected requires an acknowledgement that actions in one modality can be constrained by those in another (Streeck, Goodwin, & LeBaron, 2011). One manifestation of this is the mechanics of articulation, which places notable constraints on the potential range of phonetic realizations of a variable. This is best captured by the notion of *articulatory setting*, defined as the vocal tract configurations that the articulators—including the jaw, larynx, pharynx, tongue, and lips—tend to be deployed from (and return to) in speech production (Honikman, 1964). This notion is a central component of Laver's (1980, 1994) phonetic theory of *voice quality*, a componential, descriptive system of the cumulative tendencies of a speaker's vocal tract. Voice quality, and its associated articulatory settings, outlines “the characteristic auditory colouring of an individual speaker's voice” (Laver, 1980: 1), based on the acoustic and auditory manifestations of variation in articulator position. Laver's work provides us with a basis for interpreting acoustic measures as indicators of articulatory setting: The degree of constriction of the lips, for example, is inversely related to formant frequencies such that lip expansion produces higher frequencies and lip constriction lower frequencies (Laver, 1980: 41).¹ Because articulatory setting mediates the shape of the vocal tract, it interacts predictably with variation in the realization of segmental variables; segments are thus “mutually related parts of the whole utterance” (Laver, 1994: 73). So, while dividing the speech stream into individual segments makes sense for its alignment with phonological units, this approach emphasizes the differences between segments rather than the similarities. Laver advocates instead for an integrated analysis of similarities and differences in speech segments, such that a given articulatory setting could capture a shared property of several sequential segments (Laver, 1980: 2).

Though variationists have primarily centred segmental variation, the role of articulatory setting in large-scale patterns has not been entirely ignored. Trudgill asserts that voice quality is “perhaps the single socially most significant feature of linguistic differentiation in Norwich,” noting that working-class Norwich speech is characterized by nasality, a fronted and lowered tongue, a raised larynx, and a high degree of muscular tension throughout the vocal tract (Trudgill, 1974: 186–187). Labov observes

that up-islanders on Martha's Vineyard produce higher, more constricted variants than down-islanders, concluding that "this 'close-mouthed' articulatory style is the object of social affect" ([1963] 1972: 40). Likewise, Esling (1978) finds that Edinburgh speakers at the "upper end" of the social scale use more creak and more tongue tip articulation, and exhibit a more closed jaw setting than those at the "lower end" of the scale. And Stuart-Smith (1999) details a tendency for working-class Glaswegian speakers to maintain an open jaw, a raised and backed tongue body, and whispery voice. Together, these studies demonstrate that social categories like regional background and class can correlate with articulatory settings.

Recent work in sociophonetics explores the intertwining semiotic potential of segmental variation and articulatory setting, beyond macrosocial observations and into the realm of affect and persona construction. Podesva (2016) shows that facial expressions like smiling correlate with the fronting and lowering of the front lax vowels in California. Though fronting and lowering are both predicted by smiling (because lip spreading shortens the vocal tract and elevates all formant frequencies), lowering of the front vowels is also explained by the vowel movement observed in the California Vowel Shift (Hagiwara, 1997; Kennedy & Grama, 2012). Smiling, then, is both an embodied display of affect as well as an articulatory constraint on the phonetic realization of vowels. Pratt and D'Onofrio (2017) examine the articulatory settings of two actors' performances in the Saturday Night Live skit *The Californians*, demonstrating that each actor uses a particularized jaw setting to parody two stereotypical California personae: the Valley Girl (with an open, retracted jaw) and the Surfer (with lip constriction and protrusion). In comparing each actor's vocalic production across performances of Californian and non-Californian characters, these articulatory settings exhibit both predicted and unpredicted effects on the phonetic realization of phonetic segments. Lip protrusion, for example, should lower all formants—and while the Surfer's F1 values for four vowel classes are lower (producing an overall higher vowel space), the F2 values for five of his vowels are higher. Likewise, though the Valley Girl's open jaw setting predictably corresponds to higher F1 values for three vowel classes (producing an overall lower vowel space), she produces lower F2 values for eight of her vowels.

These findings bring up two points made by Laver (1980) regarding articulatory setting. First, the interdependence of settings and segments is not universal, such that "the performance of a given segment may over-ride the [parameters] of a setting" (1980: 20). That is, if speakers have California-like F2 targets, this may override articulatory settings which predict the opposite. Second, Laver notes that visually observable settings of the jaws and lips may co-occur with less-visible lingual settings, namely tongue-fronting and tongue-backing, which could explain otherwise unpredicted formant shifts (1980: 43). In addition, beyond correlating predictably with acoustic properties, the visual manifestation of articulatory settings can be socially meaningful in and of itself. Because acoustic and visual components of speech are produced simultaneously, their indexical potential is realized cumulatively and through the lens of the ideological landscape, as with the mediatized portrayal of Valley Girls with open jaws.

Building on this perspective, in the present analysis I examine two phonetic features which occur within a locally enregistered style—a raised and rounded variant of the LOT vowel and velarized word-initial /l/—and demonstrate their shared articulatory setting. As I describe in the following section, bodily and technological practices are particularly central to this style, insofar as the speakers engage in collective manual labour in the context of their high school curriculum. I suggest that the cumulative social meaning of the style is co-constructed by the materiality of articulation and the speakers' embodied practices, rendered legible through interpretive frames which construct the students as working-class subjects in the ideological landscape of the high school, and in society more broadly.

3 | SOCIAL REPRODUCTION IN THE HIGH SCHOOL

Given their focus on the transition into adulthood, and social mobility more generally, high schools are a primary site for the reproduction of class (Bourdieu & Passeron, 1977; Oakes, 1982). In US schools, long-standing distinctions between vocational and “college-prep” curricula reinforce a simplistic distinction between students with working-class and middle-class life-courses, respectively. This perspective idealizes preparation for college, prioritizing the socialization of middle-class workers and marginalizing those students who are expected to find work in manual labour or service industries. But class-marginalized students can and do agentively embrace and reproduce their own class position, often by rejecting school authority; as Aronowitz notes, “workers do not like bosses and kids do not like school bosses—the deans, the principals, and often the teachers, whose main job in the urban centers is to keep order” (2004: 60). For instance, the “Lads” in Willis’s (1981) ethnography of a high school in England enact a counter-school stance through embodied style—conspiratorial nods, sidelong glances, even a “foot-dragging walk”—and ritualized practices like “having a laff” (a broad category of subversive activities intended to induce humour and disrupt school formalities). In doing so, the Lads’ position themselves ideologically, against the school’s middle-class values and in alignment with a working-class rowdiness (Rosvall, 2015).

Sociolinguistic ethnographies in high schools have likewise observed that the reproduction of social categories shows up in linguistic practice, and that such practices reflect students’ ideological positioning with respect to the peer-based social order and to school authority (e.g. Eckert, 1989; Moore, 2003; Rampton, 1999). More recent work in US high schools shows how students respond to their positionality as both classed and racialized subjects (e.g. Chun, 2009; Mendoza-Denton, 2008; Reyes, 2007). Through the always-ideological process of bricolage, for example, Desi teens combine forms from Punjabi, Desi-accented English, and California slang into “FOB” styles (Shankar, 2008), Asian-American and White students use linguistic forms associated with African-American speakers (Reyes, 2005; Bucholtz, 2011), and bilingual Latinx students use Spanish with English phonology in the production of “inverted Spanglish” (Rosa, 2019), all stylistic moves which respond to students’ positioning in and by the school. Outside the US, school policies enforcing the global hegemony of colonial languages such as English and French are contested by teachers and students alike, in Canada (Heller, 1994), Hong Kong (Lin, 1999), Botswana (Arthur, 1996), Saudi Arabia, and Sri Lanka (Canagarajah, 2013). In doing so, social actors can exploit the interstices of structure, or “spaces where structures fail to seal hermetically” (Martin-Jones & Heller, 1996: 7), where opposition and subversion are possible. Thus, the process of social selection carried out by schools, which ultimately reflects patterns of power and inequality in society, is often a site for resistance and disruption on the part of students in the day-to-day of stylistic practice.

3.1 | The tech persona at CAPA High School

I focus here on a locally enregistered social group within a broader high school community. The data come from ethnographic fieldwork conducted at a public, arts-focused high school in the San Francisco Bay Area which I call Creative and Performing Arts (CAPA). For the duration of the 2015–2016 academic year, I was a participant observer at CAPA, attending classes and staying after school to hang out with students, primarily high school juniors and seniors ranging in age from 15 to 18 years old. Of the 600-plus students in the school, I knew and interacted with roughly 100 students, and conducted ethnographic interviews with 53 of them. The present analysis is based on interview data with 36 of these students, though my description of the social landscape draws on the entirety of interactions throughout the course of my fieldwork, as recorded in daily fieldnotes.

Students at the high school split their time between academic classes and one of 12 arts disciplines, such as orchestra, dance, theatre, world music, and visual art. One of these disciplines, technical theatre (or “tech”), is distinct in that students engage in manual labour, using professional-grade tools to construct sets, hang lights, and run audio equipment for school productions and events. Many tech students join the local stagehands’ union upon graduation, and current students maintain relationships with alumni who have gone on to work in the union. And “tech” is one of the most crystallized of the disciplinary stereotypes for CAPA students. In the first week of fieldwork, I asked a theatre student about other disciplines, and her first response was about tech students using power tools and playing “crazy” jazz or metal music. Whereas vocal students might walk through the halls harmonizing, she explained, tech kids would more likely be “pummelling” each other. Variants of this description emerged frequently in casual conversation and also in my ethnographic interviews, summarized in Table 1. In 25 of the 36 interviews analysed here, students (from tech and other disciplines) described the social type with remarkable consistency: as builders and assholes who were cool, masculine, handy, and possibly threatening. Further, when enacting “tech” in constructed dialogue, speakers used dramatically low pitch, creaky, and whispery voice qualities, relatively greater fortition in stop releases, and even velarized // (one of the variables examined here) in what could be interpreted as a “mock tech” style.

“Tech” constitutes a locally enregistered persona at the high school, imbued with ideologically intertwined expectations about bodily, affective, and sartorial practices. One theme that emerges is an embodied competence replete with practical skills (see Figure 1). This is in contrast with students in other disciplines, as one tech student explained to me, because “you have to use your body to play the viola, but [in tech] it’s different—your body is the instrument.” This bodily competence or “handiness” is linked to other forms of material power. Tech students carry keys, which grant access to places on campus which are otherwise inaccessible to students; as the same tech student commented, “there’s power in like, being behind the scenes and like, having keys you know, like holding the keys.” Tech’s embodied competence also includes the connotation of physical danger and general affective toughness: one non-tech student jokingly warned me, “they will cut you, you don’t fuck with them.” Relatedly, the most common affective description used for tech students was “asshole,” which aligns with their being suspicious or “cutty,” a local term referring to people or actions that are secretive, sketchy, and deviant. A corresponding affective quality I experienced as a fieldworker was a general reticence of tech students; they were the group that took the longest to warm up to me, and were by far the most hesitant to do interviews.

The class positioning of tech students within the high school and the broader Bay Area emerged less explicitly in conversation. Yet tech students are characterized as workers—their labour has the explicit purpose of maintaining the material and infrastructure that permits other types of artists at the school to display their art at all. In this sense, tech students are the manifestation of the working class at the school. This has all the expected connotations of the high-brow/low-brow distinction in art, and in its most extreme version positions tech students as labourers rather than artists. As a band student explained:

(1) You know, there is an art to building things and craftsmanship, definitely but... They build things for the public. Artists express themselves and then, the public responds. While, tech... [they know] what they're gonna build, w- how they're gonna make it, and what's gonna please the audience, and that's their job.

Against the backdrop of the rapidly changing demographics of the Bay Area, characterized by increasing economic precarity for many of its long-time residents, plenty of students recognized that the skills

TABLE 1 Characteristics used to describe tech students in interviews, with corresponding examples. Bolded terms represent thematic labels, with related labels listed in italics. Mentions represents total mentions, and parenthetical counts refer to number of tech students who used the term, e.g. “8 (3)” indicates 8 mentions, 3 of which were by tech students

Characteristic	Mentions	Example interview excerpts
anti-institutional: <i>independent, don't give a fuck, troublemakers, chill, nonchalant, laidback, lower-achieving, rejects, slackers, stoners</i>	15 (9)	“Like techies are – are very um, I don't know, ant- anti-authorian [sic] that we like to thwart authority” “A lot of techies are like stoners and slackers”
assholes	5 (3)	“Techies are kind of assholes”
builders: <i>worker, industrial, job, productive, tools</i>	14 (6)	“...doing their own thing, you know, like swearing, and building stuff”
black clothing	5 (1)	“They w- dress in all black.”
body: <i>hands, strong, tactical, tough</i>	7 (6)	“You know when we're making it, it's like, it comes from our hands”
close-knit: <i>cliquey, community, crew, culty</i>	12 (6)	“And they only really hang out with each other” “...a stronger bond to their department than other people do”
cool	7 (1)	“They're considered like cool ones” “Cause tech's cool”
cutty: <i>covert, dark, shadows, sketchy, shady, suspicious</i>	9 (2)	“...even if you're not a stoner like, do some sketchy shit” “Tech is known to be kinda cutty.”
handy: <i>competent, craftsmanship, skilled</i>	7 (2)	“They're handy people. They're like – you're like ‘Oh, I'll need something?’ Like they just like fix it.”
masculine: <i>broey, macho, fraternity, boys, guys, dudes, sexist</i>	19 (4)	“Tech is very, like, manly” “...just a lot of like really big loud dudes”
threatening: <i>aggressive, bully, mean, destroying things, hazing, fighting, knife, dangerous, scary, violent</i>	21 (6)	“Like, it was a lot of like hitting each other, like it was like fra- fraternity” “...all the guys who carries knives with them, and all that”
rowdy: <i>boisterous, loud, crazy, ruckus, swearing, testosterone</i>	8 (3)	“...like always running around or skating or like causing a ruckus”

tech students practised made them more viable in the labour market, given their potential to get union jobs after high school. This was nonetheless subject to the working-class/middle-class dichotomy, as perceived by students as well as school administration. In an early conversation with the director of theatre tech, they described their primary responsibility as preparing students for life in an industry. Unlike the other disciplines, they explained, where kids come from families that could afford to put them in music and dance and art lessons, kids in tech come from working-class backgrounds and are interested in going straight to union work after high school. (This was certainly true for some tech students, though not all; many were interested in going to college). And in an ongoing debate about the school's admissions process, one school board member argued specifically that theatre tech is not a programme that students should audition for, framing it instead as a vocational track. This rendering of tech as vocational contributed to the reproduction of classed categories at the high school.



FIGURE 1 Tech students in their workshop (left); using welding tools for a personal project (right)

Like the Lads and the Burnouts (Willis, 1981; Eckert, 1989), tech students at CAPA are both positioned as and position themselves outside the school's mainstream focus. Unlike traditional high schools though, “the arts” (i.e. high-brow artistic pursuits) are central to the institution's system of cultural value. CAPA students are encouraged to orient to either college or professional careers in the arts, though certainly the intersection of these two—an elite music conservatory or art school—is the most prized next step. But as their peers note, tech students are in the unique position of graduating with job prospects which might actually allow them to achieve independence in the Bay Area, an inconceivable prospect for a student attempting to live off the income from music gigs or art shows. Nonetheless, the tech persona ultimately constitutes a working-class subject, serving as a foil to high-brow artistic disciplines and thus reproducing broader societal patterns of difference which separate “real” art from labour.

In brief, though more conventionally high-brow artistic disciplines garner more cultural value in society at large, tech students at the high school are associated with a local persona which carries its own cultural value: They are rowdy, cool, and handy. Tech students are also acutely aware of their classed subjectivity in the school and agentively position themselves outside the institution as “troublemakers” who thwart authority. I take tech students’ ideologically imbued positioning within the school as a starting point for interpreting linguistic practice, emphasizing that a thorough analysis of the relations of power involved in social reproduction is crucial to our theory of style. Such a starting point allows us to examine the function of everyday stylistic practice in the broader reproduction of the political economy, whereby the negotiation of social meaning is central to how individuals are positioned and position themselves in everyday life.

4 | DATA AND METHODS

Data come from audio recordings of ethnographic interviews with 36 students, 19 of whom identified at the time as cisgender young men and 17 as cisgender young women. Seven students are from tech, and the remaining 29 are from band and orchestra (6), architecture and design (1), costuming (2), guitar (1), theatre (4), visual art (1), world music (4), and vocal and musical theatre (10), which roughly reflects the

size of each department. Interviews ranged in length from 42 minutes to 2 hours and 25 minutes, with an average duration of 89 minutes. All interviews were recorded using a Sony PCM M-10 digital recorder, at a 44.1 kHz sampling frequency with a bit rate of 16. Interviewees wore either an Audio-Technica ATR3350 omnidirectional condenser lavalier microphone, or an Audio-Technica AT831b cardioid (i.e. directional) condenser lavalier microphone. Interviews were transcribed in ELAN (Lausberg & Sloetjes, 2009) and then phonemically aligned using FAVE align (Rosenfelder, Fruehwald, Evanini, & Yuan, 2011).

4.1 | LOT methods

The (near-)merger of LOT and THOUGHT² is considered a hallmark of the California Vowel Shift (e.g. Hall-Lew, 2009; Hinton et al., 1987; Labov, Ash, & Boberg, 2006), and more recent work shows that LOT's F1 movement exhibits the most dramatic shift over time (D'Onofrio, Pratt, & Van Hofwegen, 2019). The recruitment of components of a regional vowel shift to construct local social meaning is well-documented, and here I investigate that possibility with the LOT vowel.

For each speaker, up to 25 primary-stress tokens of at least 75 milliseconds in duration were hand-selected for a total of 14 vowel classes: LOT, THOUGHT, TRAP, STRUT, DRESS, FACE, KIT, FLEECE, TOE, GOAT, BOWL, TOO, GOOSE, and POOL³ (N = 8,675). Function words, tokens occurring in constructed discourse or unclear speech, and tokens where the vowel was preceded by a vowel, glide or /r/, or followed by a vowel, glide, /r/ or /l/, were excluded. No more than three tokens per lemma were selected per vowel class. Mean formant measurements of F1, F2, and F3 were taken for the durational interval from 20–80%, via automated script in Praat (Boersma & Weenink, 2012), and hand-corrected where necessary. Vowel measurements were Nearey-normalized (Barreda & Nearey, 2018; Nearey, 1977) using the *vowels* package (Kendall & Thomas, 2012) in R (R Core Team, 2018). The Nearey method was chosen as it maintains inter-speaker differences in the ratio of vowel space width to height, as opposed to Lobanov normalization, which assigns the same standard deviation in F2 to all speakers, thus limiting the ability to account for variation in overall vowel space.⁴

Normalized F1, F2, and F3 measurements of all LOT tokens were fit to three separate mixed-effects linear regression models, using the *lmerTest* package (Kuznetsova, Brockhoff, & Christensen, 2017) in R (R Core Team, 2018). Each model had fixed effects of tech/non-tech, log-transformed duration, place of articulation of the preceding segment (labial, coronal, dorsal, glottal), manner of articulation of the preceding segment (obstruent, nasal), place of the following segment, and manner of the following segment. Vowel duration was included as a fixed effect following phonetic predictions that articulatory targets are more fully reached at longer durations. Each factor group was tested for model fit through a comparison of the residual sum of squares via the *anova* function in R, and only retained if model fit was significantly improved (all $p < .01$ or less). Speaker and lexical item were included as random effects. Gender and department were included in initial regression models but were not found to be significant predictors, nor did they improve model fit (assessed as described above). For all formant measures, interactions of each of the group-based social predictors (tech/non-tech, department, gender) with duration were tested; of all the models tested, only the model predicting F2 was improved by an interaction, in this case of tech status and duration.

4.2 | LOT results

Models testing normalized F1, F2, and F3 means indicate that all three formants are significantly predicted by tech status. Models for each outcome variable are summarized in Tables A1 through A3 in

the Appendix. Here I focus on the significant correlations of the outcome variable of formant measure with tech status and, for F2, vowel duration as well.

In the best-fitting model for LOT F1, tech status is a significant predictor such that tech speakers produce LOT with lower F1 values, or higher in the vowel space, than non-tech students ($\beta = -0.054$, $t = -2.748$, $p = .010$). Duration also correlates with F1, such that longer tokens predict higher F1 values ($\beta = 0.023$, $t = 2.544$, $p = .011$). The same pattern emerged for the model predicting LOT F3, which correlates with lip rounding. Tech speakers produce significantly lower values of F3 for LOT, suggesting a more labialized production than non-tech students ($\beta = -0.019$, $t = -2.348$, $p = .025$). Duration does not correlate with F3. Results for F1 and F3 analyses are visualized in Figure 2.

In the best-fitting model for LOT F2, a marginally significant two-way interaction between tech status and duration emerged: Shorter duration predicted backer tokens for tech students, while duration had the opposite effect on backness for non-tech students ($\beta = 0.018$, $t = 1.932$, $p = .054$). Although marginal, this effect improved model fit as assessed via both a sum squares of the residuals using the *anova* function in R ($p = .05$) as well as the Akaike information criterion (AIC). Figure 3 visualizes these results with respect to duration.

4.3 | /l/-velarization methods

The English lateral approximant /l/ has historically been treated as one phoneme with light (apical or “clear”) and dark (velarized) allophones corresponding to onset and coda positions, respectively (Carter & Local, 2003; Giles & Moll, 1975). Further work in articulatory and acoustic phonetics suggests that the realization of /l/ results from articulatory processes along a continuum of velarization (Recasens, Fontdevila, & Pallarès, 1995; Sproat & Fujimura, 1993). Because the secondary articulation of velarization (i.e. in dark /l/) involves tongue body backing, the degree of velarization can be measured acoustically via the difference between F1 and F2 values (Morris, 2017; Simonet, 2010; Van Hofwegen, 2011). This cline of velarization has been observed in the context of language across varieties of English (DeDecker & Mackenzie, 2017; Morris, 2017; Van Hofwegen, 2011).

Thirty tokens of word-initial singleton /l/ (mean duration 56.5 ms) were hand-selected for each of the 36 speakers included in the LOT analysis above, and labelled for two analytical intervals: the steady state of the lateral, identified by an interval of relative F2 stability (Carter & Local, 2007), and the transition and steady state of the following vowel (Figure 4). For /l/ tokens preceded by a pause or non-sonorant sounds, the lateral onset was cued by the onset of voicing and at the first pitch period where F2 could be observed in the spectrogram. For /l/ tokens preceded by sonorant sounds, the lateral onset was marked where a significant drop in intensity occurred. The offset of the lateral (i.e. the onset of the following vowel) was indicated by an increase in intensity and a transition in F2. No more than three tokens per lemma were selected, and tokens which occurred after word-final liquids or in the context of function words, constructed discourse, or unclear speech were excluded. Tokens of *like* were only included when they occurred as verb forms (see Drager, 2011).

F1 and F2 measurements were taken via script in Praat (Boersma & Weenink, 2012), using a formant range of 0–4000 Hz. The arithmetic difference between Bark-transformed F2 and F1 values (Traunmüller, 1990) was then taken at the temporal midpoint of the steady state of each word-initial /l/ (Morris, 2017; Simonet, 2010; Sproat & Fujimura, 1993; Van Hofwegen, 2011). The Bark Difference Metric, as a by-token measure of two Bark-transformed formant values, normalizes to some extent for inter-speaker differences in vocal tract size. The magnitude of difference between F1 and F2 ($Z_2 - Z_1$) is taken to indicate degree of velarization, such that lighter tokens of /l/ have relatively greater difference between the two formants (higher $Z_2 - Z_1$) and darker tokens have a smaller difference (lower $Z_2 - Z_1$). In order to account for potential coarticulation effects, an F2 transition measurement was

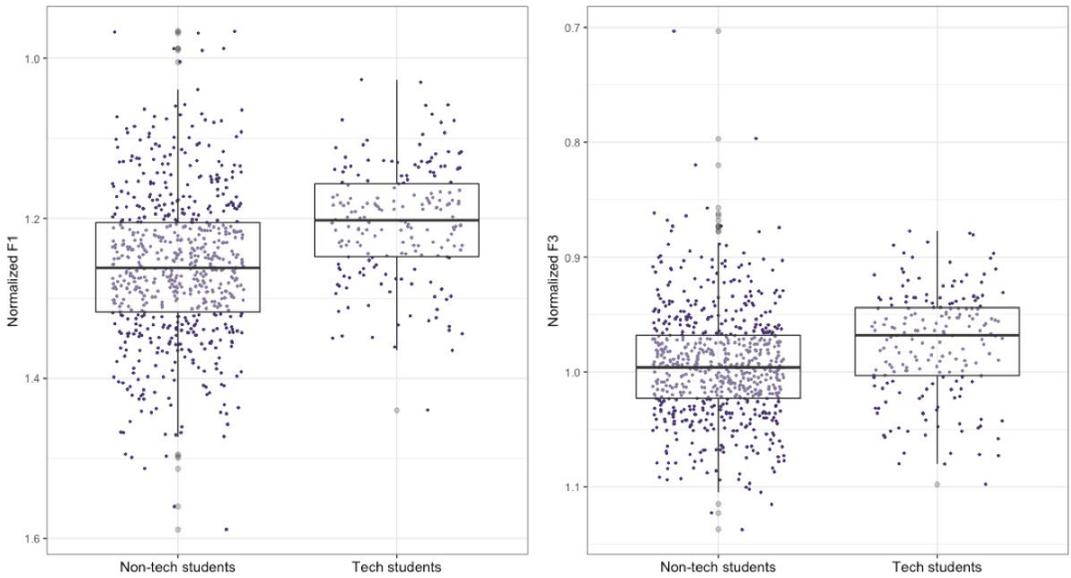


FIGURE 2 F1 (left) and F3 (right) values for tech and non-tech students

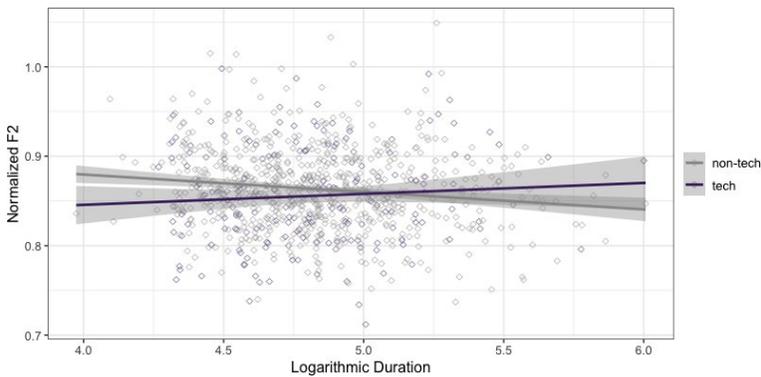


FIGURE 3 Visualization of regression model predicting F2 values of LOT, demonstrating the interaction of duration with tech student status

also taken 30 milliseconds into the following vowel (Morris, 2017; Van Hofwegen, 2011). This value was Bark-transformed, and normalized measures of coarticulation were calculated as the difference between Z_2 of the /l/ midpoint and Z_2 at 30 milliseconds into the vowel ($Z_{2 \text{ vowel}} - Z_{2 /l/}$). A higher value of this measure (henceforth “coarticulation value”) corresponds to a fronter vowel.

Measurements of $Z_2 - Z_1$ for each /l/ token were fit to a series of mixed-effects linear regression models, again with *lmerTest* in R. Each model included the fixed main effect of tech/non-tech as well as continuous fixed effects of logarithmic duration and coarticulation value. Speaker and word were included as random effects. Though all tokens were taken from instances of word-initial /l/, the preceding phonological environment was included as a fixed effect to control for coarticulatory effects in running speech: place of articulation of the preceding segment (labial, coronal, dorsal) and manner of articulation of the preceding segment (vowel, obstruent, glide, nasal, pause). Each factor group was

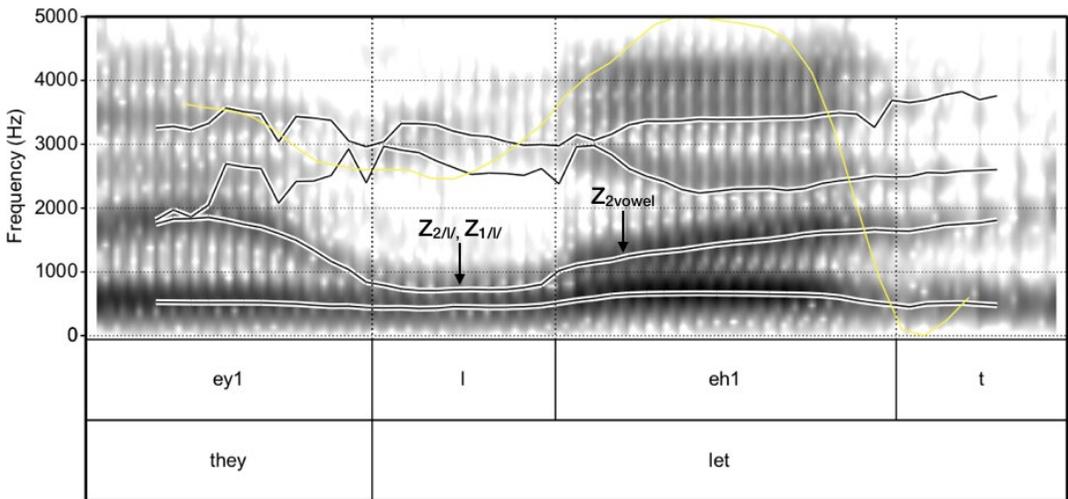


FIGURE 4 Spectrogram of *let* showing onset and offset boundaries for each segment and formant tracks for F1–F4. Arrows indicate measurement points for /l/ ($Z_{1/l/}$ and $Z_{2/l/}$) and following vowel (Z_{2_vowel})

tested for model fit, and improved model fit as assessed through a comparison of the residual sum of squares via the *anova* function in R (all $p < .03$). Gender and department were tested in initial regression models but were not found to be significant predictors of $Z_2 - Z_1$. Likewise, interactions of each of the group-based social predictors (tech/non-tech, department, and gender) were tested with duration and coarticulation value, none of which improved model fit.

4.4 | /l/-velarization results

In the mixed-effects model testing the degree of velarization of word-initial /l/, there is a significant main effect of coarticulation value, such that a higher value (i.e. fronter vowels) correlates with higher $Z_2 - Z_1$ values, or lighter /l/ tokens ($\beta = 0.697$, $t = 34.792$, $p < .001$). This is consistent with previous work (e.g. Morris, 2017; Van Hofwegen, 2011), and possibly related to Recasens and Espinosa's (2005) finding that light /l/ is more sensitive to coarticulation than dark /l/. In addition, tech students produce /l/ tokens with significantly lower $Z_2 - Z_1$ values, indicating more velarized productions than non-tech students ($\beta = -0.564$, $t = -2.859$, $p = .007$). Figure 5 visualizes these results, and Table A4 in the Appendix summarizes the model.

4.5 | Results summary

Tech status is a significant predictor of all but one of the formant measures studied—normalized F1 and F3 of the LOT vowel—as well as $Z_2 - Z_1$ of word-initial /l/. Additionally, in shorter tokens tech students produce lower-F2, or backer, LOT vowels. Taken together, these results demonstrate that tech students exhibit a higher and more rounded LOT vowel, and a backer LOT vowel in shorter-duration tokens than their non-tech peers. They also exhibit a greater degree of /l/-velarization than their non-tech peers. Neither gender nor students' status as members of another department predicts the production of LOT or /l/. These results and corresponding articulatory dimensions are summarized in Table 2.

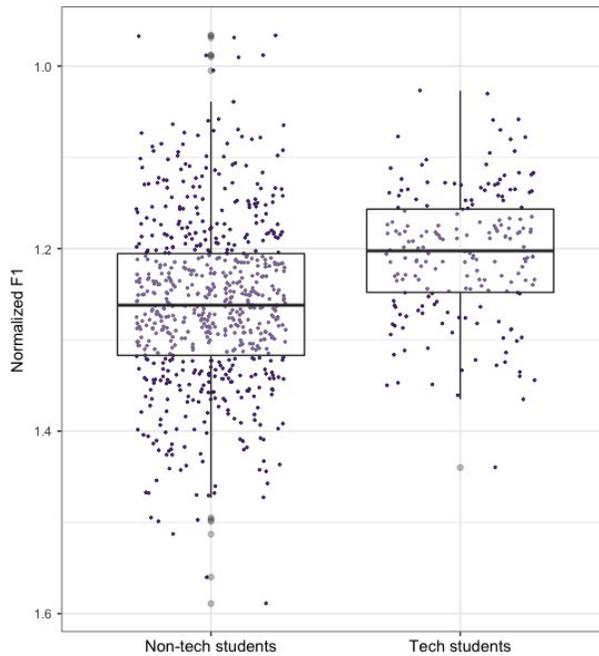


FIGURE 5 Z_2 - Z_1 values for tech and non-tech students

TABLE 2 Summary of tech students' acoustic patterns and corresponding articulatory implications

Variable	Tech students' production (relative to non-tech students)	Articulatory correspondence
LOT	Lower F1	Tongue higher in vowel space
	Lower F2 (in shorter vowels)	Tongue backer in vowel space
	Lower F3	More labialized
Word-initial //	Smaller Z_2 - Z_1 values	More velarized (tongue backer)

5 | DISCUSSION AND CONCLUSIONS

A primary aim of this study is to ask how co-occurring variables come to index a cohesive style. I proposed earlier that it may be less important to try and disentangle what social meaning each variable contributes to a style than to theorize how features index cumulatively within a broader ideological context. Tech students are positioned as workers, and as rowdy, handy assholes whose main purpose at the school is to build things for (other) artists. This semiotic alignment (Babel, 2018) of the affective and material dimensions of their style manifests as the gendered working-class subject, namely the imagining of manual labourers as (white) men, long documented in societal and scholarly discourses alike (e.g. Cockburn, 1988; Glenn, 2002; Ong, 1991; Royster, 2003; Scott, 1997). As one tech student explained when I asked whether she'd considered joining the union, "it's very, male-dominated, old strong s- scruffy men, I don't know. I don't know if I would've felt as in place there."

Thus, the qualities of being strong and scruffy are woven together ideologically, entailing gender, bodily capability, and emotional toughness—not unlike the rendering of tech students at CAPA. That is, the tech persona reproduces the cohesion of bodily and technological practices, and sartorial and affective style, in ways that are legible in society more broadly. An important frame for interpreting tech students' distinctive realizations of both LOT and /l/, then, is one that acknowledges language as an embodied practice, which cannot be disentangled from its affective and material context. It is only cumulatively, within a broader sociohistorical context, that these semiotic resources cohere as ideologically legible. Put another way, the cohesion of tech students' style relies on interpretations of the body—how bodies are gendered and classed and simultaneously imbued with affective meanings related to those categories.

In focusing on articulatory setting, I highlight one path through which such cohesion might arise to link segmental variation to the body. Sociolinguistic work shows that articulatory setting can condition the production of individual segments or the vowel space as a whole. Thus, one way of characterizing tech students' segmental variation is via labialization and tongue body raising—in short, greater overall postdorsal constriction.⁵ Recall that a canonical light /l/ is articulated with a primary gesture of the tongue apex at the alveolar ridge, while velarized /l/ has a secondary articulation involving constriction of the postdorsal region (i.e. back) of the tongue towards the velum. The articulation of a canonical /a/ vowel is produced with a lower and fronter tongue, and a more open jaw, whereas a higher, rounded variant approaches something more like a canonical /ɔ/. That is, a raised and rounded LOT vowel results from more lingual constriction in the back of the vowel space. Though tech students' exhibit backer (i.e. lower F2) LOT vowels only in shorter vowel tokens, as Laver (1980: 55) notes, “back vowels have a necessarily retracted tongue position.” Thus, the already-retracted tongue of the back vowel LOT, which exhibits additional raising as evidenced via lower F1 values, results in greater postdorsal constriction. We can conclude that tech students' exhibit greater lingual constriction for LOT and /l/ in the back of the tongue.

The observed F3 results for tech students' productions of the LOT vowel suggests another element of constriction, that of labialization or lip-rounding. As noted earlier, labialization predicts overall lower formant values by virtue of lengthening the vocal tract, and the general pattern across formant measurements in the present data is one of lowering. Laver (1980) notes that the characteristic lip aperture for rounded vowels is marked by horizontal constriction as well as vertical expansion, emphasizing that such a labialized articulatory setting will “impose differing amounts and types of constraints on... segmental articulations” (1980: 42). Likewise, I do not suggest here that tech students maintain labialization across all segments. Instead, I interpret the evidence of rounding as an indicator of a distinctive setting for the production of LOT which is characterized by more overall vocal tract constriction. Together, rounded and raised LOT vowels and velarized /l/ share the voice qualities of greater postdorsal constriction, with LOT additionally characterized by labial constriction.

I follow Rosa (2019) in advocating that discussions of the body must engage with the historical and institutional conditions under which certain linguistic and bodily practices are rendered legible for certain subjects, in ways that reproduce but possibly contest categories of race, class, and gender, among others (2019: 4). The present analysis is rooted in the understanding that the qualities and practices that constitute the tech persona are a part of the reproduction and reconfiguration of the working-class subject in the political economy of CAPA and the broader Bay Area. The ideological rendering of the tech persona is in step with historical renderings of (white male) labourers and their role in society—to “build things for the public” but perhaps not to produce or consume high culture. Moreover, the stereotypical working-class subject is imbued with expectations about the body (tough, capable, and male) and corresponding affective expectations (tough and reticent). Such ideological discourses are the setting for everyday linguistic and bodily practices, and form the basis for the ideological cohesion

of styles. It is on the basis of the co-occurrence of individual variables that social meaning can emerge at all, in association with broader ideological frames. The current findings suggest that persona construction involves the embedding of articulatory setting within a broader embodied style. Indeed, it is the embodied and affective elements of tech style that students comment on—their handiness, their physical rowdiness, their tactical clothing, and their asshole affect.

As Reyes (2017) demonstrates, assigning qualities like “rough” or “gentle” is often accomplished through the co-naturalization of language and the body. Thus, sensorial descriptors (or *qualia*; see Chumley, 2017; Harkness, 2013) are available frames for meaning-making across seemingly separate modalities of language and the body. This is a key component of the semiotic process of iconization (Irvine & Gal, 2000), whereby a sign takes on meaning through an ideological process of essentialization, thus naturalizing the form-meaning link and rendering it a reflection of some intrinsic property of, for example, a group of speakers. It may be that iconization is what links tech students’ articulatory constriction to their embodied style. This is not unrelated to linguists’ own iconized descriptions of the variants of /l/: apical as “clear” or “light,” and velarized as “dark.” Constriction of the back of the tongue—here co-occurring in tech students’ production of both /l/ and LOT, more so than their peers—may be iconized at CAPA as an index of a bodily solidity or toughness. Here I suggest only that the observed phonetic variation is mediated by a shared articulatory setting of postdorsal constriction, and that the legibility of such an embodied component of language is particularly relevant given the centrality of body in tech’s stylistic practice as well as the rendering of the working-class subject. Through semiotic alignment (Babel, 2018), the ideological interpretation of variation on multiple semiotic levels enables the ongoing enregisterment of the tech persona.

Though we have not yet fully theorized the interplay of ideology, variation, and embodiment in stylistic practice, the argument presented here rests on such an integrated perspective. Tech students at CAPA are associated with bodily, technological, affective, and sartorial practices which together constitute a locally enregistered persona. These same students make greater use of two linguistic variants characterized by constriction of the back of the tongue, and I have argued that articulatory setting is at play in the cohesion of their style. Tech’s embodied persona enables articulatory setting as a plausible stylistic feature, enmeshing these segmental variants within the broader, ideologically rendered context. Further, in examining situated social practice I highlight that affect is central to the emergence and interpretation of social meaning within and across interactions, precisely because of its indexical potential in linguistic and bodily practice. Building on previous work on the social meaning of variation, here I take one step further towards a theory of how ideology, variation, and embodiment are entangled in semiotic practice. The mutually elaborative nature of meaning-making across semiotic channels encourages us to turn towards investigating ideologically driven processes of cohesion rather than the indexical values of individual variables. Only by centring the ideological frames through which styles are constructed and interpreted can we better understand the function of styles and personae in society more broadly.

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ORCID

Teresa Pratt  <https://orcid.org/0000-0002-7790-0774>

ENDNOTES

- ¹See also Nolan (2005) on forensic speaker identification, and Beck (1988) for a perceptual classification model of various settings.
- ²LOT and THOUGHT correspond most canonically to /a/ and /ɔ/ in IPA symbols, though the variation in the present data quite possibly extends beyond the region of the vowel space typically indicated by these phonetic symbols.
- ³Post-coronal GOOSE and GOAT show more advanced fronting than in other environments (Hall-Lew, 2009) and back vowels preceding liquids (here POOL and BOWL) exhibit a backer production than other phonological environments (Cardoso, Hall-Lew, Kementchedjhieva, & Purse, 2016).
- ⁴Barreda and Nearey (2018) argue that Lobanov normalization represents an implausible perceptual model, and present experimental evidence that Lobanov-like algorithms tend to over-normalize and introduce errors in the estimation of speaker parameters. Moreover, they point out that Adank, Smits and van Hout (2004) incorrectly implemented the Nearey (i.e. single-parameter log-mean) normalization by including f0 in the parameter calculations, which should only include formant frequencies.
- ⁵Though acoustic evidence of backing or raising across the majority of segments could confirm a holistic setting, recall Laver's (1980) discussion of the independence of settings and segments, such that not all segments are subject to a setting universally.

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APPENDIX

In Tables A1 - A4, the number of asterisks corresponds to the size of the p value: * = $p < .05$; ** = $p < .01$; *** = $p < .001$. For Tables 1–4A–A, reference levels for categorical factor groups are as follows: preceding manner = nasal, following manner = nasal, preceding place = coronal, following place = coronal.

TABLE A1 Summary of regression model predicting F1 of LOT

Term	Level	β	SE	t	p
(Intercept)		1.138	.047	24.319	< .001***
Logarithmic duration		0.023	.009	2.544	.011*
Tech status	tech	−0.054	.020	−2.748	.010**
Preceding manner	obstruent	−0.016	.010	−1.643	.102
Following manner	obstruent	0.022	.007	2.996	.003**
Preceding place	dorsal	0.011	.009	1.233	.219
	glottal	0.021	.017	1.214	.227
	labial	−0.004	.008	−0.474	.636
Following place	dorsal	0.002	.010	0.218	.828
	glottal	0.102	.077	1.317	.188
	labial	0.012	.007	1.633	.105

TABLE A2 Summary of regression model predicting F2 of LOT

Term	Level	β	SE	t	p
(Intercept)		0.967	.026	36.787	< .001***
Logarithmic duration		−0.019	.005	−3.651	< .001***
Tech status	tech	−0.096	.046	−2.092	.037*
Preceding manner	obstruent	−0.004	.006	−0.743	.458
Following manner	obstruent	0.012	.005	2.548	.011*
Preceding place	dorsal	0.004	.005	0.804	.422
	glottal	−0.026	.011	−2.344	.020*
	labial	−0.030	.005	−6.026	< .001***
Following place	dorsal	−0.015	.006	−2.435	.016*
	glottal	0.069	.042	1.649	.100
	labial	−0.013	.005	−2.655	.009**
Logarithmic duration * tech		0.018	.009	1.932	.054

TABLE A3 Summary of regression model predicting F3 of LOT

Term	Level	β	SE	<i>t</i>	<i>p</i>
(Intercept)		1.001	.026	38.025	< .001***
Logarithmic duration		0.005	.005	1.045	.296
Tech status	tech	-0.019	.008	-2.348	.025*
Preceding manner	obstruent	-0.015	.005	-2.957	.004**
Following manner	obstruent	-0.016	.005	-3.315	.001**
Preceding place	dorsal	0.010	.009	1.046	.296
	glottal	-0.010	.004	-2.319	.022*
	labial	-0.010	.004	-2.642	.009**
Following place	dorsal	-0.019	.005	-3.558	< .001***
	glottal	0.016	.044	0.363	.717
	labial	-0.009	.004	-2.309	.022

TABLE A4 Summary of regression model predicting Z_2-Z_1 of //l/. Reference levels for categorical factor groups are as follows: preceding manner = glide, preceding place = coronal

Term	Level	β	SE	<i>t</i>	<i>p</i>
(Intercept)		5.199	.679	7.652	< .001***
Tech status	Tech	-0.564	.197	-2.861	.007**
Logarithmic duration		0.134	.073	1.851	.064
Coarticulation		0.697	.020	34.793	< .001***
Preceding manner	Obstruent	0.110	.598	0.184	.853
	Vowel	0.121	.600	0.202	.840
	Nasal	0.422	.607	0.696	.487
	Pause	0.331	.600	0.551	.582
Preceding place	Labial	-0.383	.139	-2.747	.006**
	Dorsal	0.082	.097	0.843	.400