Embodying Toughness: LOT-Raising, /l/-Velarization, and Retracted Articulatory Setting

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Abstract
In this paper I examine the realization of two sociophonetic variables to explore the link between articulatory setting (Honikman 1964, Laver 1980) and stylistic practice. I show that raised variants of the LOT vowel and velarized variants of word-initial /l/, both characterized by retraction of the tongue dorsum, are used in tandem by adolescent speakers in the construction of an embodied style characterized by toughness. Data come from a year-long ethnography of a public arts high school in the San Francisco Bay Area, where students split their time between academic classes and one of twelve arts disciplines (e.g., dance, theatre, orchestra). One of these disciplines, technical theater or ‘tech,’ is distinct from the others in that students engage in manual labor, using professional-grade equipment to construct sets for school productions and events. These students self-describe and are described by peers as ‘rowdy’ ‘assholes’ who wear black clothes and work boots, producing a cumulative image of tech students as ‘badass’ and ‘tough.’ Acoustic analyses of interview data from 24 students indicate that tech speakers produce higher LOT tokens and more velarized /l/ variants than their non-tech peers. Because raised LOT and velarized /l/ are both characterized by the backing and raising of the tongue dorsum, I suggest that these students rely more generally on a retracted articulatory setting, and that this articulatory setting is in turn part of indexing toughness.
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1 Introduction

Much of the work investigating the social meaning of variation has explored the indexical value of individual variables (e.g., Campbell-Kibler 2007, Podesva 2007a) as a way of isolating what social meaning a particular feature or variant might contribute to a style. And though studies of the socio-indexical characteristics of vowel shifts are numerous, less work has discussed co-occurring phonetic variables which are not explicitly linked phonologically (cf., Zhang 2005, Podesva 2007b, Johnstone 2011). But because social meaning is theorized to emerge at the stylistic level (Eckert 2000) – that is, the level at which variables cluster together—investigating the co-occurrence of structurally unrelated variables within a style is an important thread of sociolinguistic research. This raises questions about the process by which styles come to be recognizable: does the social meaning of a style emerge as a composite of the indexical values of each variable? How does the interplay of co-occurring variables result in something cohesive and interpretable within a community? How do other semiotic channels (e.g. bodily, sartorial, and consumer practices) participate in the thematic rendering of a style? To that end, in this paper I investigate the co-occurrence of two linguistic features—a raised variant of the LOT vowel and velarized /l/—which co-occur within a coherent style. Notably, both of these features are produced with a retracted tongue dorsum, and I suggest that articulatory setting is part of what connects these variants within the style.

2 Articulatory Setting and Sociolinguistic Style

The embodied nature of language places notable constraints on the potential range of phonetic realizations of a variable, as recent work in sociophonetics has shown. Podesva (2016) demonstrates that facial expressions like smiling correlate with the fronting and lowering of the front lax vowels in California; though fronting is predicted by smiling, lowering is consistent with the California Vowel Shift. This finding parallels previous work showing that back vowel fronting among California speakers correlates with smiling, as phonetically expected, but also with speakers’ self-reported comfort levels in dyad interactions (Podesva et al. 2015). We can think of smiling, then, as both an embodied affective display and a phonetic constraint. Further, durative embodied variation in jaw setting can correlate with holistic shifts of a speaker’s vowel space as Pratt and D’Onofrio (2017) show. In this case, two actors engage in parodic performance of mediatized character types in the Saturday Night Live skit The Californians. The target character types, Valley Girl and Surfer, are stereotypes of affluent, white, coastal Californians, and the actors’ respective performances of these characters is achieved in part by particularized jaw settings. These jaw settings correspond to both mediatized representations of the target character types and also to vowel productions that reflect the advanced variants of the California Vowel Shift: backing of the front vowels and fronting of the back vowels. The semiotic potential of bodily and linguistic variation, then, are mutually elaborative; they signify in tandem. Similarly, Levon and Holmes-Elliott (2017) have recently shown that vowel change in London English is characterized by an open-jaw setting much like the one used by one of the actors in The Californians, and results in a general backing of the front vowels.

The focus on the physiological parameters of the vocal tract is not new to the study of phonetics. In coining the term ‘articulatory setting,’ Honikman contends that “the isolated articulations are mutually related parts of the whole utterance; they are clues, as it were, to the articulatory plan of the whole; the conception of the articulatory setting seeks to incorporate the clues or to see them as incorporated in the whole” (1964:73). She goes on to describe articulatory setting as a framework for “merging and integrating... isolated sounds into that harmonious, cognizable whole which constitutes the established pronunciation of a language.” This sentiment is reflected in Laver’s (1980) justification for the study of phonetic settings, and specifically voice quality. While segmenting the
speech stream into individual phonetic segments makes sense for its alignment with phonological units, this emphasizes the differences between segments rather than the similarities. He advocates for an alternative approach which includes both similarities and differences in speech, where “individual segments are seen as being articulatorily related to other segments in that a particular articulatory feature could be abstracted from the chain of segments as a shared property of all or most of the segments” (1980:2). Laver points out that phonetic setting is central to Trudgill’s (1974) sociolinguistic analysis of Norwich English. Trudgill asserts that voice quality is “perhaps the single socially most significant feature of linguistic differentiation in Norwich” (1974: 190). In addition to creaky phonation, he includes the following settings as characteristic of working-class Norwich speech: high pitch range, loud loudness range, fronted and lowered tongue, raised larynx, nasality, and a high degree of muscular tension throughout the vocal tract (Trudgill 1974:186-7). Some of these durative characteristics are more solidly suprasegmental features not specific to a particular phonetic setting. But others, like the positioning of the tongue and larynx and the general level of muscular tension, are certainly part of a holistic setting of the vocal tract, which suggests that the role of articulatory setting is at issue in the localized manifestation of large-scale patterns of variation, as in the present study.

Building on this perspective, and on more recent work linking durative phonetic settings to socioindexical potential, the present analysis examines the role of a retracted articulatory setting in conditioning the realization of two otherwise unrelated phonetic features: a raised variant of the LOT vowel and velarized /l/. Both of these are characterized by a retraction of the tongue dorsum, though we have no phonological reason to expect such parallel realizations to occur. To that end, I ask what factors – both phonetic and social – influence the co-occurring or tandem realization of two variables, and the social meaning or meanings of those variables within a given style. That is, might a particular articulatory setting be part of what leads to corresponding phonetic attributes of two distinct segments? Further, how might the corresponding phonetic realization of these two variables both reflect and reproduce the social meanings or indexical values associated with the style they’re couched within?

3 Tech and Toughness at the High School

The data come from an ethnographic study of a public, arts-focused high school in the San Francisco Bay Area, which I call Creative and Performing Arts (CAPA). Students at the high school split their time between academic classes and one of twelve arts disciplines, including orchestra, dance, theatre, and visual art. Another of these disciplines is technical theater, more often called ‘tech’. Tech is distinct from the other disciplines in that students engage in manual labor; constructing sets using professional-grade tools, hanging lights in the theater, and running expensive audio equipment for school productions and events. Many tech students join the local stagehands’ union immediately upon graduation, and current students maintain relationships with alumni who have gone on to work in the union. Though more conventionally highbrow artistic disciplines garner more cultural capital in society at large, tech students at the high school are associated with a local stereotype which carries its own cultural value: tech students self-describe and are described by peers as ‘rowdy’ – ‘assholes’ who wear black clothes and work boots, carry utility knives, and are ‘handy’ by virtue of ‘always building stuff’. This produces a cumulative image of tech students as ‘badass’ and ‘tough’.

Although these sartorial specifications were not always born out, Figure 1 demonstrates the general tendency of tech students to wear dark clothing, not to mention the physicality of the work they engage in. In this way, tech students are the manifestation of the working-class at the school; they maintain the materiality and infrastructure that permits the other types of artists to perform in the first place. For the purposes of this analysis, I gloss tech students’ overall style here simply as ‘tough’. While this is certainly a term used by the students themselves, there was not one blanket term used by all of them. Further, though part of the tech stereotype involves being loud and rowdy, it is important to note that another salient affective quality of tech kids was their reticence or aloofness. In my year of fieldwork, they were the group that took the longest time to warm up to me, and they were by far the most hesitant to do interviews with me.
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Figures 1–2: Tech students in their workshop (left); using welding tools for a personal project (right).

Unlike other disciplines, tech students spent their afternoons doing manual labor in the theater, which was a stand-alone building on the high school campus. Perhaps because of their unique technical expertise as well as this spatial separation from the rest of the school, the tech stereotype was one of the most crystallized of all the disciplinary stereotypes. This emerged in casual conversation and also in my ethnographic interviews. The transcribed interview excerpts from students in disciplines other than tech (1, 2, 3) illustrate the way students fit tech into the school’s local ideological and stylistic landscape.

(1) They’re like, they know how to do things really well. They’re like the – they – throw parties… So they’re always at parties setting lights up and stuff and they’re always like… Yeah so they’re very handy guys I guess uh.

(2) They're just known to be like a little dark, kinda suspicious. Yeah, they have knives. They're just like really – They’re handy people. They're like – You're like “Oh, I'll need something?” Like they just like fix it.

(3) The techies, they're like considered like the cool ones […] Yeah, so I dressed like techies for while… That meant like like black boots and like darker clothings [sic] and like t-shirts […] Tech tend to hang out with techies, cuz they like like their type of – person. They all kinda have the same like demeanor.

The student quoted in (3) hints at tech’s shared style with her use of the word ‘demeanor,’ the denotation for which includes both “behavior and bearing” – that is, habitual practices and especially the embodied forms they take.

Both of the students quoted in (4) and (5) are in tech, and both mention the ‘asshole’ label. In (4), I had asked the student whether she thought there was a tech stereotype. And the student in (5) reflects on how tech used to be when he was a freshman or sophomore.

(4) Tech kids are just assholes and they're always in black and they only talk to each other. That's the – it's a big stereotype.

(5) I would stay until eight most days just hanging out in the tech room talking with people, building random stuff, being a troublemaker […] but over the years it got less rowdy […] I don't know, they were just like – assholes all the time […] Yeah, they were just rowdy. They were just always trying to fight and do stuff.

These excerpts reflect a fairly cohesive picture of the ideological rendering of tech students, by themselves as well as their peers. Thus ‘toughness’ is my attempt to capture the complex dimensions
of affect woven into the image and practices of tech students. Though a thorough discussion of affect in sociolinguistics is beyond the scope of the current paper, in other work I have argued that affect should be made a more explicit focus of persona-based studies of sociolinguistic variation (Pratt 2018). I define affect as durative emotional and attitudinal states, and emphasize that such qualities are often central to the construction of styles and personae. In the current paper, tech’s toughness can be thought of as an affective style; that is, a style rooted in the affective qualities of reticence as well as ‘asshole’ rowdiness. The remainder of this paper reports on tech students’ use of two segmental features which I argue are tied up with the construction (by themselves and others) of tech’s ‘tough’ affective style.

4 Data and Methods

Data for these analyses come from audio recordings of my ethnographic interviews. The current sample includes 24 students, 12 of whom identified as cisgender young men and 12 as cisgender young women at the time. 5 of these students are from tech, and the remaining 19 are from world music, vocal, theatre, band, design, and guitar. The proportional distribution of each department roughly reflects the high school community. For the purposes of the present analysis, students are categorized as tech or non-tech.

4.1 LOT-Raising Methods

There is reason to believe that students might make use of the LOT vowel in stylistic practice, given its involvement in ongoing sound change. The movement of LOT and THOUGHT in the context of the low-back merger has been documented throughout the state (e.g. Hinton et al. 1987, Labov, Ash, and Boberg 2006, Hall-Lew 2009) and is considered a hallmark of the California Vowel Shift. More recent work shows that both LOT and THOUGHT are raising and backing over time, but that LOT’s F1 movement exhibits the most dramatic shift over time (Pratt, D’Onofrio, and Van Hofwegen 2017, D’Onofrio, Pratt and Van Hofwegen under review). The recruitment of one or more components of a vowel shift to construct local social meaning is also well-documented in sociolinguistics (e.g. Labov 1963, Eckert 1989), and here I investigate that possibility with LOT-raising.

Data from interviews with the 24 speakers in the current sample was transcribed and force-aligned, and for each speaker I used Praat to generate automated midpoint measurements of the first two formants of LOT tokens for the entirety of the interview. I excluded functions words, and tokens where the LOT vowel was preceded by a vowel, glide or /r/, as well as tokens where the LOT vowel was followed by a vowel, glide, /t/ or /l/. These vowels were Lobanov-normalized along with tokens from the TRAP, STRUT, THOUGHT, BOUT, BITE, DRESS, FACE, KIT, FLEECE, GOAT, FOOT, and BOOT vowel classes, all measured using the same methods. Measurements that extended beyond two standard deviations for the speaker, for either formant, were removed from the dataset. This produced an average of 1,063 vowel tokens per speaker, and an average of 82 LOT tokens per speaker.

F1 measurements for all LOT tokens were fit to mixed-effects regression models, with fixed effects of tech or non-tech and log-transformed duration, and random effects of speaker, word, and preceding and following segment. Gender was also included in initial regression models but was excluded in the final model as it was not found to be a significant predictor of F1 values.

4.2 LOT-Raising Results

Table 1 summarizes the results of the mixed model testing the significance of tech/non-tech and logarithmic duration as predictors of F1 values of the LOT vowel. As expected, vowel duration positively correlates with F1, such that longer tokens are lower in the vowel space. And notably, tech status correlates negatively with F1. This indicates that tech speakers produce LOT with significantly lower values, or higher in the vowel space. Figure 3 visualizes these results (normalized F1 is represented in reverse on the y-axis and to correspond to articulation within the vowel space).
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<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
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<th>DF</th>
<th>T-value</th>
<th>P-value</th>
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Table 1: Summary of mixed-effects model for LOT-raising among tech and non-tech speakers at the high school.

Figure 3: F1 values for tech and non-tech students.

4.3 /l/-Velarization Methods

Though /l/ is treated as one phoneme, the realization of the lateral approximant /l/ in English is generally distinct in onset and coda position. That is, word-initial /l/ has a more apical or ‘lighter’ realization than word-final /l/, which is more velar or ‘darker’. Perhaps unsurprisingly, the patterns of variation found for /l/ in these two environments are also distinct. Word-final /l/ has been shown to exhibit vocalization (e.g., Hall-Lew and Fix 2012, Stuart-Smith, Timmins and Tweedie 2006), whereas word-initial /l/ varies by degree of velarization. Like LOT-raising, /l/-velarization is involved in ongoing sound change (e.g., Macdonald and Stuart-Smith 2014, Morris 2017, Van Hovenegen 2011). Most pertinent to the present analysis is recent work by Podesva et al. (2015) showing that California speakers in Bakersfield exhibit this pattern of darkening of word-initial /l/ over time.

Given the differences in observed variation of /l/ in these two positions, I treat onset and coda /l/ as separate variables, and focus here on the degree of velarization of word-initial /l/ only.

Force-aligned transcripts for the same 24 speakers were used to extract measurements of word-initial /l/. I hand-selected 30 tokens of word-initial /l/ for each speaker in, taking no more than 3 tokens per lemma and excluding tokens which occurred after word-final /l/ or within overlapping or unclear speech. To measure the degree of velarization of each token of /l/, I followed Van Hovenegen’s (2011) method, computing the difference between Bark-transformed F2 and F1 values taken at the midpoint of each token of word-initial /l/. With this measure, the magnitude of difference between the first two formants is an indicator of velarization. That is, lighter tokens of /l/ have relatively greater difference between the two formants and darker tokens have a smaller difference; higher Z2-Z1 values reflect lighter /l/ tokens, and lower Z2-Z1 reflect darker /l/s.

As with the analysis of LOT, measurements of Z2-Z1 of /l/ tokens were fit to mixed-effects regression models. I included fixed effects of tech or non-tech and log-transformed duration of the
segment, and random effects of speaker and word. As with the vocalic analysis, gender was initially included in the regression models but was not found to be a significant predictor of $Z_2-Z_1$ values and thus excluded from the final model.

4.4 /l/-Velarization Results

Table 2 summarizes the results of the mixed-effects model testing the degree of velarization of word-initial /l/. This model tested the significance of tech/non-tech status and logarithmic duration of the /l/ token as predictors of $Z_2-Z_1$, a measure which captures the relative darkness of /l/. I find that the duration of /l/ correlates with lower $Z_2-Z_1$ values, or darker /l/ tokens. I also find that tech students produce /l/ tokens with significantly lower $Z_2-Z_1$ values, indicating more velarized production than their non-tech peers. Figure 5.4 visualizes these results, showing a clear pattern such that tech students (represented by the dotted line) have lower values and thus darker /l/s than non-tech students.

<table>
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<td>0.2463</td>
<td>22.6000</td>
<td>-2.977</td>
<td>0.006822 **</td>
</tr>
</tbody>
</table>

Table 2: Summary of fixed effects model is regression model on /l/-velarization.

![Figure 4: Z_2-Z_1 values for tech and non-tech students.](image)

Taken together, these results indicate that tech students exhibit more LOT-raising and /l/-velarization than their peers. Given the strongly enregistered identity work and social practices that these students engage in, the correlation of these two variants suggests that they may be co-indexical of a salient aspect of the tech persona. Further, the realization of both variants involves retraction of the tongue dorsum. This suggests a few things. First, the use of both of these variables may be related; that is, tech students may have a generally retracted articulatory setting. Second, it may well be that what achieves the indexing is not either variable on its own, but the two variables in tandem and also within the context of a broader articulatory setting. That is, the setting itself may convey social meaning, along and in concert with the observed realizations of raised LOT and velarized /l/ variants.
5 Discussion

A primary aim of this study is to ask what factors might cause the co-occurring realization of two variables within a given style. Because the LOT vowel and the lateral approximant /l/ are distinct segments within a speaker's phonological inventory, there is no reason to believe that a raised variant of LOT is somehow conditioning velarized /l/ for any phonological reasons, or vice versa. And though it is possible that the phonetically-parallel realizations of these two variables are unrelated phenomena, it seems unlikely. Given that recent sociolinguistic work has shown how jaw or articulatory setting can condition the production of individual vowels or the vowel space as a whole, it is reasonable to posit that articulatory setting is in fact at play here. The production of each of the variants used by tech students is characterized by the backing and raising of the tongue dorsum, which suggests that tech students rely more generally on a retracted articulatory setting than their peers.

Tech students are generally stereotyped as tough, in the sense that they are seen (and self-identify) as rowdy, as assholes, and as handy people who can fix things. Another salient dimension of their style is an interactional reticence, a withholding with new people or outsiders, as I experienced in the first several months in the field. Thus, the ideologized characteristics of being a rowdy asshole who wears black clothes and work boots contributes to and aligns with their tendency toward emotional distancing. This is not unrelated to a general, ongoing masculinization of tech as a discipline at the school; most tech students are male, and this of course corresponds with broader expectations about who does manual labor in society. Certainly, the normative manual laborer is a man, and this image entails gendered and classed characteristics as well – he is also physically solid and perhaps emotionally reticent, even in addition to being loud and rowdy. That is, the tempering of emotions does not contradict the rowdiness but instead aligns with the image of a working-class toughness man in the popular imagination. Tech students at CAPA are associated with a particularly embodied toughness and reticence, which this articulatory setting – intertwined both semiotically and mechanically with the retracted phonetic realizations of LOT and /l/ – seems to be indexing.

This could be for acoustic reasons, in that a retracted tongue dorsum creates more space in the vocal cavity and produces lower frequency sounds. The frequency code (Ohala 1994) associates higher frequencies of F0 in both consonants and vowels with smaller size, and lower frequencies with bigger size. Ohala (1994) even goes so far as to suggest that lower-frequency sounds are used by all vocalizing animals in agonistic, or conflict-related, displays. The potential for these two variables characterized by a retracted tongue dorsum, then, may lie in the connections of a backed and thus lower frequency sound with notions of bigness or even simply a physical solidity. I do not suggest that the frequency code points directly to toughness, but rather that toughness here includes a weight or solidity that comes with the embodied stylistic (and explicitly technical) practices shared by these students. They are not simply projecting toughness; they spend their days using their bodies and heavy equipment to accomplish serious tasks. Their style (and their work) is the opposite of delicate; it is solid, durable, and robust. The iconization of lower-frequency sounds as more solid and robust is thus one possible explanation of their retracted articulatory setting and its resulting lower-frequency phonetic products.

A related iconized indexicality might link tongue retraction specifically to the affective quality of reticence or aloofness. Silverstein (1994) and Eckert (2010) have suggested that backed vowels can convey negative affect, and though reticence is not precisely or necessarily a negative quality, certainly the other composite qualities of darkness (in clothing) and the asshole categorization could be linked with a negative affective valence. Taken a step further, it could also be that tongue retraction is iconized as a sort of bodily containment; that is, there is a metaphorical, emotional 'pulling inward' which parallels an articulatory 'pulling inward' of the tongue.

If one reason for the co-occurrence of these variables within the locally-relevant 'tech' style is a shared articulatory setting, what does that tell us about indexicality? We theorize that the social meaning of individual variables emerges at a stylistic level, i.e. the level at which variables cluster or co-occur, rendering those individual variables thematically linked. My findings suggest that the indexical contributions to a style happen in combinatorial and complex ways. That is, the historical focus on the social meaning of individual variables obscures the ways that variables signify in tandem, and the linguistic (e.g. articulatory) reasons that may lead to that tandem-ness. Here, the articulatory setting of a retracted tongue is both a phonetic link between two otherwise phonologically-
unrelated variables, and also a potential sociolinguistic sign in and of itself. As with jaw setting, both the resultant vowel production patterns and the jaw setting itself carry indexical value (Pratt and D’Onofrio 2017). It may be less important to try and disentangle what each variable contributes than to theorize how they come to co-index a particular meaning. Put more broadly, interlocutors experience one another not just as interlocutors delivering linguistic variables, but as human beings producing those variables in bodies. The face is a conventionally salient site of both linguistic and extra-linguistic expression, but these forms of expression co-occur. Unlike jaw setting, I do not claim here that articulatory setting is necessarily a conspicuous visual cue (and certainly the degree to which jaw setting is visually salient is itself variable). Rather, I argue that the holistic, durative acoustic effect of the articulatory setting is capable of indexing some quality within the context of a style, in this case toughness.

It is worth noting again that both of these variants are implicated in ongoing changes in progress in California. LOT-raising is an ongoing change in progress across the state, implicated along with several other vowel classes in the California Vowel Shift. Darkening of /l/ over time has as yet been documented only in Bakersfield, California, but broader patterns in other varieties suggest that velarization of word-initial /l/ is a more likely pattern than apicalization, or lightening over time. Here I show that these variants are used in tandem by virtue of a shared articulatory setting. This has implications for the latest findings on vocalic sound change in California, which indicate that speakers are compressing their vowel space over time (Pratt, D’Onofrio, and Van Hofwegen 2017). This general trend is characterized by a fronting of the back vowels and backing of the front vowels, though the most dramatic compression change happens between the oldest generations of speakers. Millennials are left with a relatively compressed vowel space. This work suggests that the vowel space as a whole should be considered a linguistic variable, and the present findings beg the question of whether these young California speakers are retracting their vowel space as whole. That is, if vocalic distinction can be holistic, perhaps this articulatory setting follows from a retraction of a compressed vowel space, in contrast with peers who may have a similarly compressed but fronted vowel space. Though speculative, a more thorough examination of these students’ holistic vowel space patterns might illuminate this possibility. These findings also raise questions about whether components of vocalic sound changes (such as the backing of the LOT vowel) might have reflexes for other sound changes not implicated in vocal system (such as /l/-darkening).

6 Conclusion

In this paper I have shown that two otherwise unrelated phonological variables exhibit the same articulatory realization by a group of students with a shared stylistic practice. I suggest that this is not coincidental, but instead the result of a more general articulatory setting. This is likely connected to the embodied expression of toughness, which is a salient component of the social meaning of the shared style. Further, I argue that this embodied toughness is central to the projection of affective style; being a rowdy asshole who is also reticent is built into the ongoing display of affect for students who share tech identity.

This provides some insight into the ways that co-occurring variables, in this case deriving from a particular articulatory setting couched in an embodied style, are mutually elaborative. That is, the social meaning of these linguistic and bodily forms are intertwined—the variants themselves as well as the articulatory setting could all be connected to the broader affective style. This mutual elaboration of meaning across linguistic and bodily forms is fundamental to the legibility of a style, along with the other parts of stylistic practice like behavior, clothing and accessories. So we can perhaps imagine all of these semiotic channels interacting, and what I’m suggesting here is that the retracted articulatory setting links the bodily and linguistic channels. And by virtue of their co-occurrence with tech students’ sartorial and social practices, these retracted variants can come to index embodied toughness in this community of practice.
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