Hypercorrect Moun[tʰɨn] in Utah English

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This study analyzes unstressed /tən/ in words like *button, kitten*, and *mountain*. In Utah, there are three variants: North American mainstream [ʔn̩], forticized [tʰɨn], and local [ʔɨn]. While previous work in Utah has focused on [ʔɨn], I use an auditory analysis of wordlist data from 117 Utahns to show that [tʰɨn] is the majority variant in Utah and is twice as common as in other regions. I argue that fortition is a hypercorrection in response to the stigmatized local variant, [ʔɨn]. This aligns with what other studies have reported about the correctness associated with /t/-release in other phonological environments and appears to be just one instance of a broader process of fortition in Utah English.

Keywords: Utah English, released /t/, fortition, hypercorrection, consonantal variation

1. Introduction

The purpose of this paper is to describe a case of hypercorrection in Utah English. The variable is unstressed /tən/, found in words like *mountain, kitten, written, botany*, and *detonate*. The North American mainstream realization uses a glottal stop and syllabic nasal [ʔn̩]. In some varieties, a vowel may surface after the glottal stop [ʔɨn]. The /t/ may also be realized as an aspirated alveolar stop, [tʰɨn]. While not all speakers use [ʔɨn], probably most North Americans use [ʔn̩] most of the time, with [tʰɨn] as an option in careful speech. In this paper, I demonstrate that [tʰɨn] is used more often in Utah English than in other varieties. This appears to be a case of hypercorrection in response to the stigma associated with glottal stops. Previous work on Utah English has focused on [ʔɨn] and how it's perceived by Utahns. However, [ʔɨn] is only a third of the story. This study is the first to focus on [tʰɨn] in Utah and aims to show that, because of hypercorrection, it is the predominant variant in Utah English.

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Hypercorrection is the overapplication of an imperfectly learned linguistic rule to a novel context. A well-known example of hypercorrection is the phrase *between you and I*. Speakers, having been told that *me and you* is wrong in a sentence like *me and you should leave*, overgeneralize into thinking that *me and you* is wrong even when it's the object of a preposition. Sociolinguistically, hypercorrection has been attributed to factors like upward mobility (Labov 1972), education (Hubers et al. 2020), and register (Cheng 2019), and the hypercorrected variant generally has greater prestige than the variant being replaced. In this paper, I use the term *hypercorrection* to specifically mean using a variant more than expected, given comparable data from similar speech communities. This is what Wolfram and Fasold (1974: 87–88) call "statistical hypercorrection". A classic case of this kind of hypercorrection is the crossover effect, wherein lower middle-class New Yorkers used more rhoticity than upper middle-class speakers, but only in careful styles (Labov 1972: 124–128).

The phonological process that is broadly at play here is fortition, which is the realization of a sound with greater constriction or otherwise stronger in some way (Zsiga 2012: 240–241). Arguably,[1] [tʰɨn] is stronger than either [ʔn̩] or [ʔɨn], especially since [ʔ] is weaker than [t] (Hock 1991: 83). Sociolinguists have documented cases of fortition of /t/ in a variety of speech communities. A group of girls at a California high school used superstandard and hypercorrect variants to index their nerd identity (Bucholtz 1999). Word-final [tʰ], among other linguistic variables,[2] is used to index identity as a learned Orthodox Jewish man in a particular community of ultra-orthodox Jews in Northern California (Benor 2001). Podesva, Robers, & Campbell-Kibler (2001) show that [tʰ] is used more by a particular lawyer to index education and precision. These researchers (and many others) have connected the dots between such studies: hypercorrect [tʰ] broadly conveys correctness, but individual speech communities have local interpretations of what that means for them. The current study widens the already-vast indexical field of [tʰ] by examining its use and meaning in Utah.

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1. Admittedly, a more accurate description would be a lack of debuccalization (a type of lenition), since /t/ is the underlying segment. I use the term *fortition* here less from a phonological perspective, where the strength of the phonetic segment is compared to the strength of the underlying segment, and more from the perspective that /tən/ is usually pronounced with a glottal stop. Realizing it with a [tʰ] is a stronger sound than the typical/baseline realization of [ʔ].

2. Benor (2001) also mentions released [t] in words like *cotton*, which is in the same environment as what is analyzed in this paper.

2. *Mountain* in Utah

2.1 Defining the variable

The variable of interest for this study is English unstressed /tən/ in environments where many North American English speakers would typically use [ʔn̩]. Note that this is a more restricted environment than what other studies of /t/-glottalization often study (Byrd 1994; Roberts 2006; Eddington and Savage 2012, and many others), which often include preconsonantal (*football*) or word-final environments (*cat*). Most speakers pronounce this /tən/ with a glottal stop and a syllabic nasal, [ʔn̩], a realization that is so mainstream that textbooks consider it a typical part of American English (Jones 1966: 135; Curzan and Adams 2009: 84; Zsiga 2012: 21; Yavaş 2020: 60). In fact, Ladefoged and Johnson (2015: 66) say specifically that "[p]robably most Americans and many British speakers have a glottal stop followed by a syllabic nasal in words such as *beaten, kitten, fatten*".

A segmental approach to /tən/ may dissect it into multiple phonological processes, including glottalization, tapping, and vowel deletion (or insertion, depending on the phonological perspective). However, I treat /tən/ as a single unit of analysis, with [tʰɨn], [ʔn̩], [ʔɨn], etc. as its variants. This is largely due to the dependence of the segmental variants: vowel deletion is strongly correlated with glottalization (Repetti-Ludlow 2024; Repetti-Ludlow and Blake 2024), and [tʰ] and [ɾ] are mutually exclusive. So, of the logical possibilities ([tʰɨn], [tʰn̩], [ɾɨn], [ɾn̩], [ʔɨn], [ʔn̩]), the three of real consequence in this study require two phonological rules to explain (glottalization and vowel deletion). To me, this suggests that we are dealing with multi-segment units of analysis rather than combinations of independent phonological processes.

However, not all instances of unstressed /tən/ are relevant for this study, so before progressing further, it is important to circumscribe the variable's phonological context (cf. Tagliamonte 2006: 13). The variable can occur word-finally (*bu<u>tton</u>, ti<u>tan</u>, sa<u>tin</u>, ki<u>tten</u>*) or word-internally (*scru<u>tiny</u>, li<u>tany</u>, hoo<u>tenanny</u>, enlighten<u>ment</u>*). It can be preceded by sonorants including /n/ (*moun<u>tain</u>, sen<u>tence</u>, fen<u>tanyl</u>*), laterals (*consul<u>tant</u>, mol<u>ten</u>, sul<u>tan</u>*), and rhotics (syllabic: *cer<u>tain</u>, cur<u>tain</u>, inadver<u>tent</u>*; nonsyllabic: *impor<u>tant</u>, car<u>ton</u>, Mar<u>tin</u>*). It can follow syllables with primary stress (*có<u>tton</u>, ìntermí<u>ttent</u>, pá<u>tent</u>*) or secondary stress (*hándwrì<u>tten</u>, kíndergàr<u>ten</u>,*[3] *fróstbì<u>tten</u>*) or lie between them (*scrú<u>tinì</u>ze, monó<u>ton</u>òus, concá<u>ten</u>àte*). One or more unstressed syllables may follow this /tən/

3. I likely have /d/ underlyingly in *kindergar<u>ten</u>* because I categorically use a tap, and I do not have taps in any other environment listed here. This is likely an eggcorn or simple analogy with *garden*. However, I have heard plenty of people say *kindergar*[ʔn̩] while living in Utah.

(*bótany, glúttony, fríghteningly*), and while it is usually post-tonic, in a few words it can precede primary stress (*dètonátion, mùtinéer, còntinéntal, spòntanéity*). The environment can cross morpheme boundaries (*threat-en, writt-en, straight-en*), including ones where the velar nasal is realized as alveolar (*huntin'*), and orthographic word boundaries so long as they are within the same phonological word (*straight and narrow, foot-and-mouth disease, out and about*). The variable appears in syllables that do not immediately follow a stressed syllable (*búlletin, mètropólitan, hésitant, cómpetent, mílitancy, skéleton*), though anecdotally, glottal stops there may be rarer. Proper nouns in these phonological contexts may be included as well (*Baton Rouge, Clinton, Chattanooga, Gutenberg, Haliburton, Manhattan, Minnesotan, Netenyahu, Putin, Tibetan*).

Not all /tən/ should be considered part of this variable. By definition, it does not appear in syllables with primary stress. It also does not appear with secondary stress (*megaton*), at the start of phonological words (*tonight*, *tenacity*), or in syllables where the /t/ shares an onset with a sibilant fricative (*distance, instant, Ashton*). Impressionistically, /tən/ is likely not glottalized following /ŋ/ (*Arlington*), /m/ (*Binghamton*), or obstruents (stops: *reluctant, expectant*; fricatives: *chieftain*; affricates: *Bridgeton*). It also seems like glottalization is unlikely in certain combinations of environments, like *ìntonátion*, which is both post-sonorant and pre-tonic.

For convenience, I will refer to unstressed /tən/ in the environments where glottalization can occur as MOUNTAIN, and to words that contain the variable as MOUNTAIN words, a convention I borrow from how English dialectologists sometimes refer to vowels (cf. Wells 1982). This word was chosen because *mountain* is a shibboleth for this variable in Utah (Eddington and Savage 2012; Huckvale 2023) and possibly also Vermont (Roberts 2006). Note that individuals may glottalize less following sonorants or not immediately following a stressed syllable, but I see this as phonologically driven variation within MOUNTAIN rather than a need to subdivide this lexical class.

2.2 Phonetic realization of MOUNTAIN

The realization of MOUNTAIN in American English is variable. The /t/ may be a true glottal stop, a glottally reinforced [t], a glottal stop with creak, or creak only (Olive, Greenwood, and Coleman 1993: 332–333; Roberts 2006; Freeman, Riebold, and Skyes 2012; Garellek 2013; Davidson, Orosco, and Wang 2021). Taps are also attested[4] in some speakers (Davidson, Orosco, and Wang 2021;

4. Importantly, these studies do not include /tən/ in post-nasal environments, as in *mountain, Scranton*, and *sentence*.

Shepherd, Sneller, and Howard 2024; Repetti-Ludlow 2024; Repetti-Ludlow and Blake 2024). The vowel may be dropped entirely, turning the nucleus into a syllabic nasal (Trager and Bloch 1941: 232; Shockey 2003: 48).

For this study, I have collapsed these variants into three categories. Reducing the vast amount of variation in MOUNTAIN to a small number of categories admittedly overlooks variation that may be meaningful (see Bellavance 2021), but the purpose of this study is not to describe MOUNTAIN in a detailed phonetic way (see Davidson, Orosco, and Wang 2021). Future phonetic work will need to address the phonetics of MOUNTAIN in the Western United States. Instead, I have chosen these three categories because they appear to be the most common, the most perceptually distinct, and the most important variants to explain the sociolinguistics of MOUNTAIN in Utah.

The first, which I transcribe as [tʰɨn], uses an aspirated alveolar stop and a reduced vowel. Canonically, the stop is aspirated, but it may be unaspirated, and it may be glottally reinforced. This is the citation form of the word and is likely accessible and used by most North American English speakers in formal or careful situations. Because this variant is not lenited in any way, I call it the forticized variant.

The second broad category of realizations canonically uses a glottal stop and a syllabic nasal, [ʔn̩]. This is the typical realization of MOUNTAIN in North American English, so it will be referred to as the mainstream variant. There may be a period of creakiness overlayed on the surrounding vowels rather than a true glottal stop, but the defining characteristic of this variant is glottal activity followed by a nasal, with no intervening vowel.

The final category uses a glottal stop and a reduced vowel, which I transcribe as [ʔɨn]. The primary difference between [ʔɨn] and [ʔn̩] is the presence of a vowel. Like [ʔn̩], what matters is that the /t/ is realized using some sort of glottal activity rather than an alveolar consonant. And like [tʰɨn], the quality of the vowel is not important for this study, though the speakers in this study typically use a vowel higher than a schwa.

2.3 MOUNTAIN in Utah English

Though Utah has been grouped with other western states into the western dialect region (Labov, Ash, and Boberg 2006), research in Utah has uncovered segmental features that have not been documented in other parts of the West. The merger of NORTH and START was common, though it is mostly restricted to older speakers today (Bowie 2003, 2008). Utah English has prelateral approximations in front vowels, yielding near-homophonous pairs like *feel–fill* and *fail–fell* (Di Paolo and Faber 1990). Among the consonants, Utahns are reported to insert [t]

in /ls/ clusters (*sal*[t]*sa, el*[t]*se*; Stanley and Vanderniet 2018), add some sort of stop consonant after velar nasals (*talking*[k]; Di Paolo and Johnson 2018), realize /ɹ/ as a flap in /θɹ/ clusters (*th*[ɾ]*ee, th*[r]*ough*; Stanley 2019), and affricate the fricative in /lθ/ clusters (*fil*[t͡θ̪], *weal*[t͡θ̪]; Stanley and Shepherd 2025). Some of these features may be found in speakers in neighboring states, particularly near the borders of Utah, but since dialectological work in the Mountain West is sparse, it is unknown how widespread they are. However, this combination of features and the local saliency of the variety suggest that what is spoken primarily in Utah is a distinct variety of American English.

Among features of Utah English, MOUNTAIN has received the greatest amount of recent interest. The focus has been on [ʔɨn]. The three studies that have phonetically analyzed MOUNTAIN in Utah have found that 11–17 percent of tokens are realized as [ʔɨn] (see Table 1), particularly among women born after around 1983. It is also perceived as being less friendly, less intelligent, less educated, and more rural (Savage 2014; Eddington and Brown 2021). The [tʰɨn] variant is less consistent. It was not mentioned at all in Eddington and Savage (2012), and while Stanley and Vanderniet (2018) heard it 25.4 percent of the time in their wordlists, Eddington and Brown (2021) only heard it 2.9 percent of the time in their reading passages. Other realizations, such as true deletion of /t/ (Eddington and Savage 2012) or taps (Eddington and Brown 2021) have been reported, though not in more than one study. The [ʔn̩] variant is often treated as the default to which the other variants are compared.

Table 1. Proportion of variants of MOUNTAIN in Utah English research

Study	Speakers	Style	[ʔn̩]	[ʔɨn]	[tʰɨn]	Other
Eddington and Savage (2012)	56	reading	66.9%	16.7%	–	16.4%
Stanley and Vanderniet (2018)	14	wordlists	62.2%	12.4%	25.4%	–
Eddington and Brown (2021)	94	reading	82.0%	11.3%	2.9%	3.8%

2.4 The current study

To summarize, MOUNTAIN is variable in North American English. In Utah, [ʔɨn] is more common among younger women and (perhaps not coincidentally) is perceived negatively. However, the focus for this study is not on [ʔɨn], but rather on an overlooked variant, [tʰɨn]. Repetti-Ludlow (2024), which is based in Long Island, excluded the mere 2.6% of realizations with [t] on the grounds that it is only present in careful speech. The purpose of this paper is to provide evidence

that the forticized variant, [tʰɨn], is the most common variant in Utah. And that Utah may be alone in having this variant as one used most often.[5]

3. Data and methods

3.1 Word selection

Data for this study come from a 208-item wordlist containing words targeting several Utah English features. It included the following 22 MOUNTAIN words: *botany, Britain, bulletin, button, certain, Clinton, cotton, fountain, gluten, kitten, Latin, mitten, mountain, mutiny, potent, satin, Scranton, sentence, threaten, titan, whiten, written*. These words were selected because they are perceived by laypeople to be common: according to the Hoosier mental lexicon (Nusbaum, Pisoni, and Davis 1984), which has subjective familiarity ratings from 600 undergraduates 40 years ago, these words had an average rating of 6.8 out of 7, with the least familiar being *gluten*[6] (5.5). Note that the proper nouns were not included in these ratings since they were not a part of those lists. Familiarity and frequency go hand-in-hand, which means the words are more subject to reduction effects (Zipf 1929; Bybee 2002), so we would expect the glottalized variants to occur.

I limited the scope of this study by excluding words with three syllables (*botany, mutiny, bulletin*) and polymorphemic words (*threaten, whiten, written*). The effect of the intervening unstressed syllable and morphological boundary on the realization of MOUNTAIN is currently not known, and exploring them is outside the scope of this paper. The results presented here should not be interpreted to extend to words in those environments until future work that specifically targets them can offer comparable results.

3.2 Survey questions and coding

People participated in the study by completing a survey using the Qualtrics online platform. First, they provided information about their gender, race, ethnicity,

5. Roberts and Nesbitt (2024) report that older speakers recorded in Vermont in the 1930s use released /t/ much more than glottalized variants. However, that population is so distant geographically and temporally from contemporary Utahns, and while many early Utah settlers came from Vermont, it is not clear whether this was brought over in the 1840s and has been maintained in Utah since then. In fact, as will be shown in this study, a resurgence of released /t/ appears to be an independent, recent development in Utah.

6. This word is likely more common today than it was in 1984 since *gluten-free* is a much more common phrase nowadays.

birth year, affiliation with the Church of Jesus Christ of Latter-day Saints, residential history, and urban-rural orientation, which I explain below. To collect acoustic data, Phonic, a (now-defunct) third-party plugin to Qualtrics, allowed for collecting audio as part of this survey using participants' own devices. Akin to other online dialectology projects (Kim et al. 2019), the audio quality was variable but good enough for basic phonetic analysis. Numerous studies have experimentally documented variability in self-recordings in response to the COVID-19 pandemic (e.g. Freeman and De Decker 2021; Zhang et al. 2021; Calder and Wheeler 2022; Conklin 2023; Sevilla 2024), and work on consonants has shown that some aspects of the speech signal are still clear enough for acoustic analysis, like lenition in Spanish (Broś 2024). Given that the analysis in this study was auditory only, the effect of audio quality on the results should be smaller than in a detailed acoustic analysis.

The survey consisted of three sections. First, after giving their informed consent (IRB number: E2021-242), including acknowledging that they would not be compensated, participants provided basic demographic information, such as their gender and race/ethnicity (optional, open-ended questions), and their birth year. Because of the strong presence of the Church of Jesus Christ of Latter-day Saints in Utah and the surrounding regions, they were also asked to indicate their affiliation with this religion, either as practicing member, non-practicing member, former member, no affiliation, or other.[7] Linguistic differences between Latter-day Saints and non-Latter-day Saints appear phonologically (Meechan 1999; Chatterton 2008; Baker and Bowie 2010), grammatically (Di Paolo 1993), and lexically (Lindsay 1933; Nygaard 2022; Eddington 2023) and linguistic differences within Latter-day Saints vary by religiosity (Baker-Smemoe and Bowie 2015; Stanley and Shepherd 2025), audience (Fogg 1990; Stanley 2016), context (Eckstein and Villarreal 2013), urban-rural orientation (Stanley and Shepherd 2025), and register (Stanley, Stevenson, and Baker-Smemoe 2024; Baker-Smemoe and Stanley 2024). To my knowledge, linguistic variation between or within other religious groups has not been documented in Utah, but it is outside the scope of this study to explore those.

Participants then progressed to the recording portion of the survey to answer the remaining demographic questions and to read the wordlist. First, participants

7. In retrospect, this question should have been open-ended rather than a simple multiple-choice option. Affiliation with the Church of Jesus Christ of Latter-day Saints (or any religion) can be nuanced and complicated in ways that are not easily captured in this survey. In particular, the "other" category could mean a variety of things, including questioning the faith but still actively attending or having a connection through a close family member. Future work should more elicit information about church affiliation and religiosity more thoroughly than what was done here (Yaeger-Dror 2014).

were instructed to make the recordings in a quiet place. Many likely used the microphone built into their smartphone, which is reliable enough for some phonetic research (De Decker and Nycz 2011; Hilton and Leemann 2021). They were then asked to position the microphone about 18 inches from their mouth while recording.

To gather geographic metadata, participants responded orally to the prompt, "Could you describe in a little more detail all the places you've lived?", with instructions to provide city names and ages/years they lived there. This method generated responses detailed enough to allow for specific filters. In this study, only participants who lived in the same city between the ages of 4 to 16 were included,[8] which corresponds to when a person attends school and is most strongly influenced by local speech patterns (Kerswill and Williams 2000; Foulkes and Docherty 2006; Johnson 2010).

Participants were then asked whether they would rather live in an urban area, suburb, small town, or rural area.[9] This was a simple proxy to elicit how oriented they are to a more urban lifestyle compared to a more rural lifestyle, since such orientation is an important predictor of language variation in the western United States (Hall-Lew and Stephens 2012; Podesva et al. 2015; Podesva et al. 2020; Huckvale 2023). Participants who gave unclear responses were excluded in analyses that involved urban-rural orientation.

At this point, participants progressed to the wordlist. The 208 words were pseudo-randomized and displayed in groups of 52, with the MOUNTAIN words

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8. Here are examples of borderline cases and how they were ultimately classified. One person was born in Texas and then moved to Magna when they were four and lived there until going to college. They were coded as being from Magna. In some cases, people moved a short distance as children. One person lived in Spanish Fork until they were ten and then moved 24 miles to Lehi, which is in the same county and valley. I didn't expect that move to affect their language, so I coded them as being from Lehi. However, another person lived in Illinois until they were eleven and then moved to Provo. I excluded them because the move was over 1,300 miles and happened in the middle of their childhood. Another person indicated that they were from Utah, but it turned out they only lived in Utah until they were six and had lived in Las Vegas since then. They were not included in the analysis even though they may identify as a Utahn. Another person was excluded because they mostly grew up in California and had only moved to Utah as an adult.

9. There were issues with this question. Several people expressed the greatest desire to live in a "medium-sized city." This often meant an independent city that was just large enough to have everything they needed but is not part of a larger metropolitan area. Furthermore, what is considered "urban" or "small" depends on the person: Provo, Utah may not seem especially urban to a New Yorker, but it may to a Wyomingite. If this question is used by future researchers, it should be refined by adding medium-sized city as a fifth option, more clearly defining what is meant by each option, and giving examples of local cities for each category.

spaced out somewhat evenly. Their instructions were: "Read the words in a normal voice, not too fast and not too slow, with a brief pause between each word. Try to say each word with the same volume and cadence." Most people followed these instructions.

3.3 Survey distribution

Following Stanley (2022), the survey was distributed primarily through Reddit, a popular forum-based website where communities ("subreddits") are user-created and topic-oriented. A link to the survey was posted to as many Utah-oriented subreddits as possible, including ones specific to regions (r/Utah, r/UtahValley, r/SouthernUtah), universities (r/BYU, r/UtahState, r/UVU, etc.), and cities (r/SaltLakeCity, r/ParkCity, r/Layton, etc.). The survey was not posted to subreddits that were Utah-based, but focused on some other topic like politics, dogs, job hunting, national parks, and other interests, since the post would have been removed for being off-topic. As comparison data, the same survey was sent using the same methods to subreddits related to the neighboring states of Idaho, Montana, and Wyoming. It was also posted to one generic survey subreddit (r/SampleSize) to get participants from elsewhere in English-speaking North America. Comparing speakers from a target region to speakers from diverse regions pooled together as a control group is akin to Davidson, Orosco, and Wang's (2021: 6) analysis of New Yorkers' and non–New Yorkers' realizations of MOUNTAIN-like words.

3.4 Participant demographics

355 people completed the survey, including 150 from Utah. Of the Utahns, 33 responses were excluded either because they did not live in Utah between the ages of 4 and 16 (23), the audio was unusable (5), the survey was mostly incomplete (4), or they did not appear to take the task seriously (1). In the end, 117 Utahns completed the survey and produced 1,682 usable tokens of MOUNTAIN. After similar exclusions, another 60 speakers came from Idaho, 73 from Montana, 28 from Wyoming, and 31 from elsewhere in North America.

The 117 Utahns had the following demographic breakdowns. For self-reported gender, there were 54 female, 58 male, 3 non-binary, 1 agender, and 1 genderfluid. There were 110 White Americans, 1 African American, 1 Asian American, 2 Hispanics, and 3 people with mixed ethnicities. There were 4 Baby Boomers (born 1964 or earlier), 26 Gen Xers (1964–1982), 55 Millennials (1983–1996), and 32 Gen Zers (1997 or later). As for affiliation with the Church of Jesus Christ of Latter-day Saints, there were 45 practicing members, 14 non-practicing members, 36 former members, 17 non–Latter-day Saints, and 5 people with "other" affiliations. 27 peo-

ple wanted to live in an urban area, 41 in a suburb, 25 in a small town, and 13 in a rural area, with an additional 11 showing an unclear or lack of response.

3.5 Acoustic processing

For this study, I conducted an auditory analysis.[10] Foulkes, Docherty, and Jones (2011) point out that there is value to the analyst listening and classifying tokens themselves, including the benefit of filtering complex, multidimensional data through a human's perceptual system. Such auditory coding is common when audio quality is sub-optimal (Pfiffner 2023) or if the variants are perceptually distinct from each other (Alderton 2020; Baranowski and Turton 2020; Sneller 2020; Schleef 2021), which is the case here. Furthermore, impressionistic methods to classify MOUNTAIN have been used in comparable studies (Roberts 2006; Eddington and Taylor 2009; Eddington and Channer 2010; Freeman, Riebold, and Skyes 2012; Eddington and Savage 2012; Eddington and Brown 2021; Roberts and Nesbitt 2024), most of which include Utahns.

I therefore classified each token into one of three categories: [tʰɨn], [ʔn̩], and [ʔɨn]. Most tokens were quickly and easily classified strictly based on auditory analysis. However, for a small proportion of tokens, particularly when discriminating between [ʔn̩] and [ʔɨn], I had to replay the audio and examine the spectrogram for the presence of formant structure after the glottal stop or creak. See Appendix A for details on these borderline case variants and how they were coded.

3.6 Reliability in classifications

To ensure reliability in my classifications, I listened to all tokens using this procedure a second time nine months later. Of the 5,258 tokens (which included speakers from all states and people that were ultimately excluded in this analysis), there were discrepancies among 99 of them (1.9 percent). An unweighted Cohen's κ, a typical measure of inter-rater reliability that ranges from 0 (no agreement) to 1

10. My intent was to do a thorough report of phonetic variation in MOUNTAIN. I planned on finding closure durations, voice onset time (VOT), duration and formants of the following vowel, and duration of the following nasal, where applicable, depending on the realization. However, self-recordings varied in recording quality, both in terms of signal-to-noise ratio and specifications of the audio file (like sampling frequency, bit rate, and file format). For many tokens, fine phonetic detail like F2 drop-off, stop bursts, and the start of quasi-periodicity in the waveform were difficult or impossible to locate. Even if all tokens were coded for these phonetic features, they would likely be unreliable and not comparable to each other because of the greater uncertainty in lower-quality recordings. I therefore settled for an auditory analysis.

(complete agreement) (Cohen 1960), of 0.964 suggests a very high amount of consistency from one listening to the next. I relistened to those 99 discrepancies more carefully a third time to determine their ultimate classification.

Two phoneticians who grew up in Utah were recruited to determine the reliability of my classifications. They listened to the 88 of my discrepancies that were ultimately classified as one of the two variants with a glottal stop in addition to another 250 tokens (5 percent of the unfiltered dataset) randomly selected from the other tokens. These 338 clips were sorted randomly, and the two raters listened to and classified them using the same procedure described above. Cohen's κ can be extended to Light's κ for three raters (Light 1971) by simply taking the average Cohen's κ of all pairwise comparisons. The Light's κ for these three listeners was 0.763, suggesting a moderate-to-strong amount of agreement.[11]

It is noteworthy that there was 100 percent agreement across all three listeners on [tʰɨn] tokens; all disagreements came down to deciding between [ʔn̩] and [ʔɨn], or rather, determining the presence of the vowel. A separate inter-rater reliability score was therefore calculated that only focused on the two variants with glottal stops. The Light's κ dropped to 0.548, suggesting a somewhat low amount of agreement. This is lower than many linguistics reliability scores, but is more common when variants are more difficult to distinguish (Loewen and Plonsky 2015; Perry 2017), which is likely the case here. For this study, I am not too concerned about this lower score because the primary distinction that appears to matter sociolinguistically in Utah is between [tʰɨn] and the glottal stop variants.

4. Results

In this section, I begin by first presenting the distribution of variants in Utah. I then focus on social variation within Utah. I end by comparing the proportion of variants in Utah to that in other regions.

4.1 Overall distribution of variants in Utah

I begin with the distribution of variants across words. Figure 1 shows the proportion of each variant by word, and there is clear heterogeneity within the lexical set.

11. Both Utahn raters had higher pairwise agreements with me (0.761 and 0.826) — a non-Utahn — than with each other (0.701). If they had agreed more with each other, it might suggest their greater exposure to the variable yielded more reliable classifications. However, since such a pattern was not found, I cannot necessarily dismiss my ratings as less reliable because of my outsider status.

Britain was said with [ʔɨn] 19 percent of the time, but for *Scranton* it was only in 4 percent of tokens. Meanwhile, [tʰɨn] was used in *sentence* 89 percent of the time, but only 28 percent of *cotton* tokens. In fact, five of the six words most often realized with [tʰɨn] had /n/ preceding the /tən/ (*sentence, Clinton, Scranton, mountain*, and *fountain*), suggesting some phonological conditioning in this variable. (See the supplemental material in Appendix B for statistical support.) Whether that /n/ is realized as a nasal consonant [maʊ̯nʔn̩] or only as nasalization on the previous vowel [maʊ̯̃ʔn̩] (cf. Shockey 2003: 48) and how those variants interact with the variants of /tən/ will need to be explored in future work with higher quality audio, though impressionistically the lack of a nasal consonant is more stigmatized, particularly when coupled with [ʔɨn]. There appear to be no other apparent phonological trends among these words. They also do not appear to correlate with familiarity ratings (Nusbaum, Pisoni, and Davis 1984).

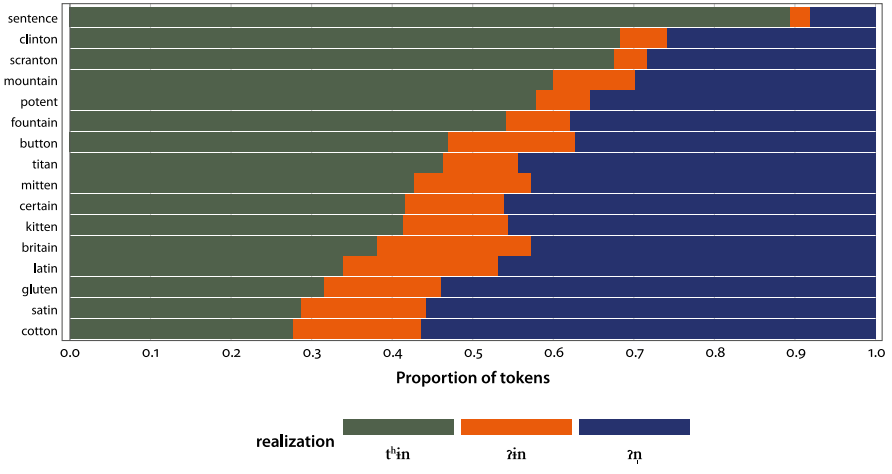

Figure 1. Distribution of MOUNTAIN variants across words

Figure 2 shows the distribution of the three MOUNTAIN variants among the Utahns in this sample. In some ways, these numbers are comparable to what has been found in previous studies in Utah. [ʔɨn] was heard in 11.8 percent of tokens, which is consistent with studies that categorize that variant distinct from [ʔn̩] (see Table 1). This study aligns well with previous work, and we can continue to conclude that [ʔɨn] occurs 11–17 percent of the time in Utah based on reading passages or wordlists. In notable contrast to studies on this variable in other dialect regions, not one Utahn realized any MOUNTAIN word with a tap.

In a departure from previous work though, 47.7 percent of the tokens were classified as [tʰɨn]. Stanley and Vanderniet (2018) heard this variant in 25.4 percent

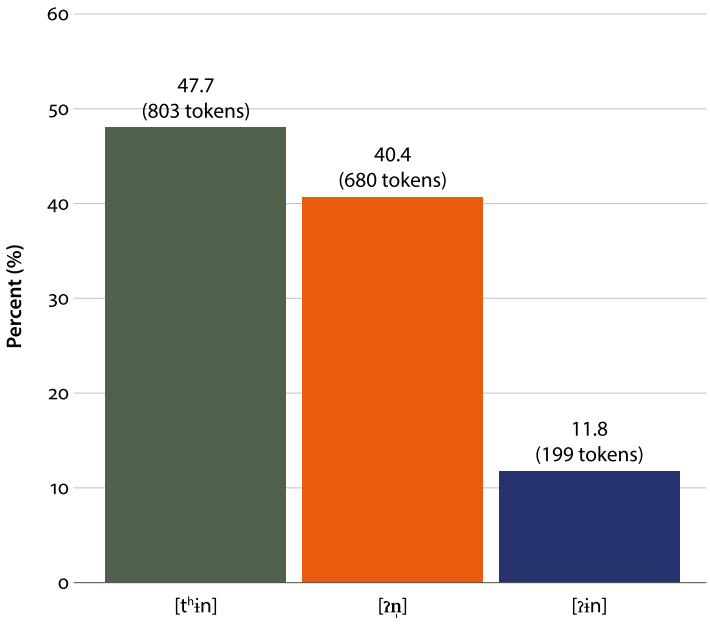

Figure 2. Distribution of MOUNTAIN variants, based on 1,682 words from 117 Utahns

of their tokens while Eddington and Brown (2021) report just 2.9 percent. It is not immediately clear where this discrepancy comes from, though it is worth noting that the latter study is based on a reading passage rather than wordlists.[12] Another important methodological note is that previous studies on MOUNTAIN include at most two post-nasal /tən/ tokens in their elicitations (Eddington and Savage 2012; Davidson, Orosco, and Wang 2021; Eddington and Brown 2021; Repetti-Ludlow 2024), which, as shown in Figure 1, are more likely to be realized with [tʰɨn]. Those studies also have a large number of words with past participle *-en* (e.g. *written, frighten*), which this study excludes. Future work will need to reconcile these methodological differences. Nevertheless, in the current dataset, MOUNTAIN in post-oral environments (like *kitten* and *button*) was realized as [tʰɨn] 43 percent of the time, which is still a marked increase compared to what was found in other work.

12. Anecdotally, I hear a large proportion of [tʰɨn] in Utahns even in casual speech, so I am hesitant to immediately conclude that these differences are purely stylistic.

4.2 Demographic predictors in Utah

To test the effect of all the demographic factors, a set of three mixed-effects binary logistic regression models were fit to the data, one for each variant. The model for [tʰɨn], for example, compared [tʰɨn] to both [ʔn̩] and [ʔɨn] collapsed together. Predictors included GENDER (with nonbinary, genderfluid, and agender grouped[13] together into a gender minority category), CHURCH AFFILIATION (with "other" responses excluded), GENERATIONAL COHORT[14] (Gen X: 1964–1982; Millennial: 1983–1996; Gen Z: 1997–2005), URBAN-RURAL ORIENTATION, REGION WITHIN UTAH (see below), and PREVIOUS SEGMENT (/n/ vs other). To foreshadow this section, all predictors except GENDER had some significant influence on the realization of MOUNTAIN. SPEAKER and WORD were included as random intercepts. A summary of each model is provided in the supplemental material in Appendix B. All models had low multicollinearity among the predictor variables. To interpret these plots, I present plots showing the distribution of the raw data, but note that the model incorporates all other predictors, including random effects, and may predict different estimates than what the plots suggest.

First, it should be mentioned that while the models accounted for a good amount of the variance in the data, the contribution by the random effects substantially overshadow that of the fixed effects. Table 2 shows that marginal R^2 values, which indicate the proportion of variance explained by the fixed effects alone, are small relative to the conditional R^2 values, which indicate the proportion explained by both fixed and random effects. Model summaries (see the supplemental material in Appendix B) suggest that this is largely due to the effect of SPEAKER rather than WORD, meaning there is quite a bit of idiosyncratic variation in these speakers. These differences suggest that there is much more that conditions the realization of MOUNTAIN in Utah beyond the demographic variables examined in this study. In the paragraphs that follow, effects that are significant over and above these by-speaker random effects are reported, though noteworthy nonsignificant trends apparent in the plots are mentioned.

Figure 3 shows the distribution of variants by GENDER. In the raw distribution like this, it appears that women use the most [ʔɨn] and the least [ʔn̩], and that

13. Because there was just one person in each of the agender and genderfluid categories, and especially because neither used the [ʔɨn] variant making the dependent variable in one of the models is invariant for those levels, results from their estimates are unreliable with very high standard errors (Menard 2010: 125–144).

14. There were just four Baby Boomers (born 1945–1963), and it didn't seem right to generalize an entire generation based on four speakers, so they were excluded from these statistical models.

Table 2. Conditional and Marginal R^2 values for the three models

	[ʔn̩]	[ʔɨn]	[tʰɨn]
Conditional R^2	0.793	0.857	0.797
Marginal R^2	0.248	0.327	0.271

agender, nonbinary, and especially genderfluid people use the most [ʔn̩]. Recall, though, that it was not possible to statistically analyze differences between agender, nonbinary, and genderfluid groups since they were collapsed into a single gender minority category. However, once other demographic factors and especially speaker random effects were incorporated in the models, these differences did not come to be statistically significant.

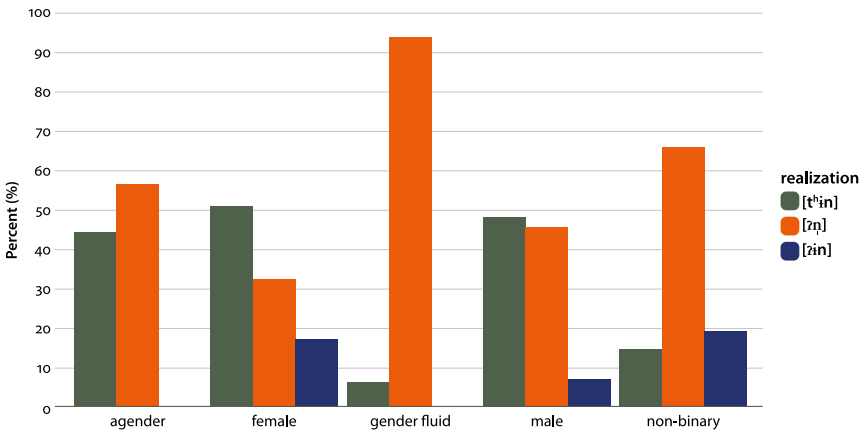

Figure 3. Distribution of MOUNTAIN variants by GENDER

Figure 4 shows the distribution of variants across generational cohorts. Modeling suggests that [ʔn̩] has been consistent across generations, that Millennials and Gen Z use more [ʔɨn], and that Gen Z uses significantly less [tʰɨn]. The trend that Millennials use the most [tʰɨn] that is suggested in the plot did not reach significance.

Figure 5 shows the distribution of variants by affiliation with the Church of Jesus Christ of Latter-day Saints. Compared to the reference level of practicing members, former members used significantly more [ʔn̩] and less [tʰɨn]. In the [ʔɨn] model, CHURCH AFFILIATION was not a significant predictor. The plot suggests that nonpracticing and former Latter-day Saints are approximately equal, but after accounting for other factors and SPEAKER random effects, it is only the former members who were statistically different from the practicing members. It

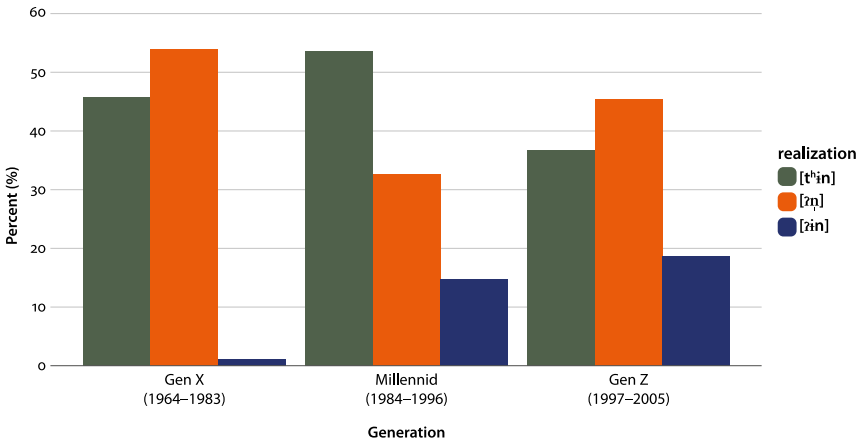

Figure 4. Distribution of MOUNTAIN variants by GENERATIONAL COHORT

is noteworthy that those not affiliated with this religious group were also statistically the same as practicing members, suggesting that former members are a distinct group from outsiders.

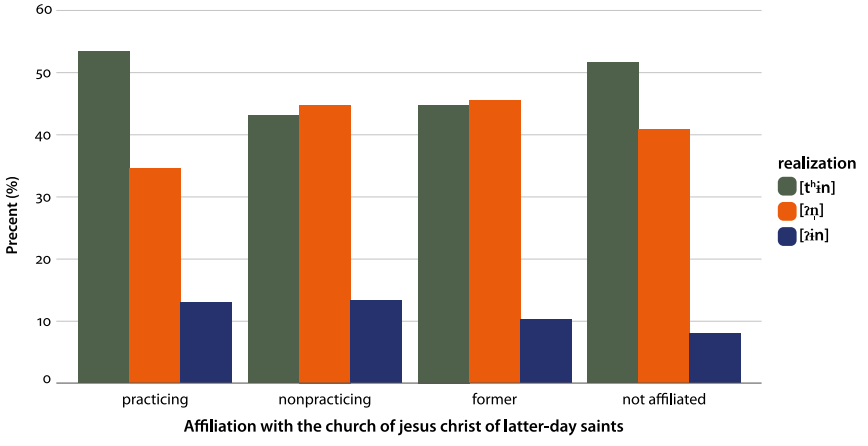

Figure 5. Distribution of MOUNTAIN variants by affiliation with the Church of Jesus Christ of Latter-day Saints

Figure 6 shows the distribution of variants based on what region in Utah someone grew up in. Keep in mind that these are subjective categories and should not be taken to be definitive regional categories in Utah. Compared to the reference level of Salt Lake City, the Tooele Area used significantly less [ʔn̩], but otherwise there were not significant trends. The raw data suggests more variation, such

as the Wasatch Back (Heber, Park City, etc) using far less [ʔn̩] and far more [tʰɨn] and rural northern Utah (mostly the Logan area) using more [tʰɨn], but those too did not come out as significant in the model, likely due to the lack of enough data to show trends beyond speaker-level effects. It is, of course, possible to subdivide Utah into different regions, but to avoid the chance of false positives, I leave such probing into regional variation for more systematic future work.

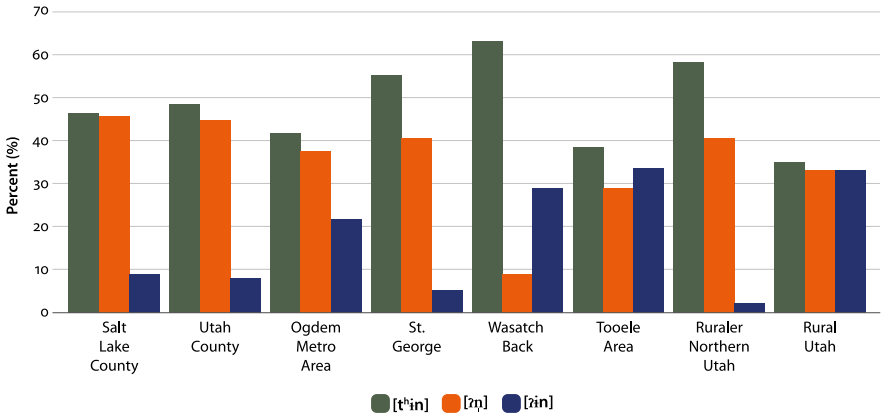

Figure 6. Distribution of MOUNTAIN variants by region. Regions are ordered roughly from most to least densely populated

Figure 7 shows the distribution of variants based on urban-rural orientation, which was determined by what size of community someone wanted to live in. The model suggests that, compared to the reference level of urban-oriented people, people who wanted to live in a small town used significantly more [ʔn̩]. The raw data suggests that rural people use even more [ʔn̩] and that small town–oriented people use more [ʔɨn], but the model did not support these observations. However, it did suggest that people who wanted to live in a small town or a rural place used significantly less [tʰɨn] than urban-oriented people.

To summarize this quantitative analysis, there are relatively few demographic factors that predict usage of MOUNTAIN in this dataset. However, the models do suggest somewhat opposite patterns for [ʔn̩] and [tʰɨn]: [ʔn̩] is used more among former Latter-day Saints and people who want to live in small towns while [tʰɨn] is used less among former Latter-day Saints, people who want to live in small towns or rural areas, and Gen Z. Additionally, [ʔɨn] was used more among Millennials and Gen Z. Again however, at least within these Utahns, speaker-level variation appears to be the driving force rather than the macro-level categories presented here.

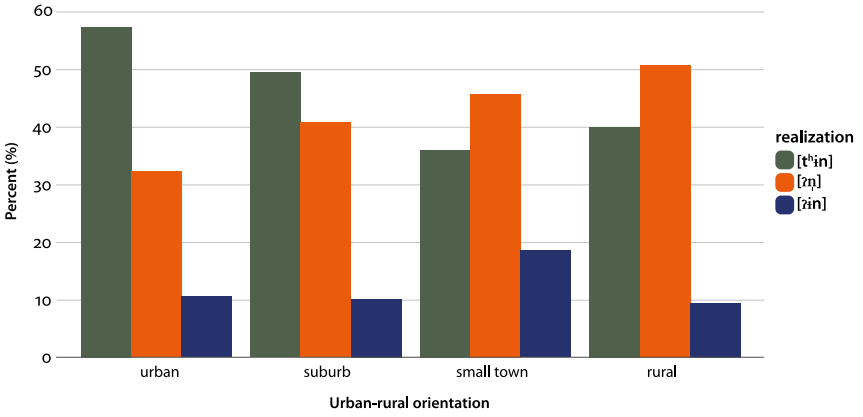

Figure 7. Distribution of MOUNTAIN variants by URBAN-RURAL ORIENTATION

4.3 Comparison to non-Utahns

Data from non-Utahns can be used to see whether [tʰɨn] as a majority variant is indeed unique to Utah. This section incorporates the data collected from Idahoans, Montanans, Wyomingites, and elsewhere in English-speaking North America, as mentioned in Section 3.3, and compares it to the Utahns' data.

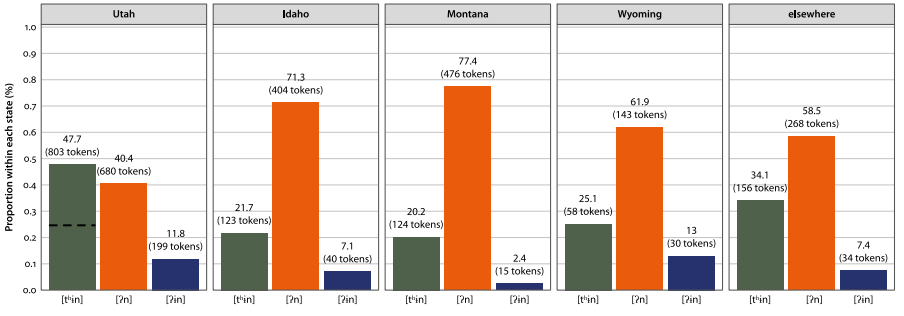

Figure 8. Distribution of MOUNTAIN variants in Utah, Idaho, Montana, Wyoming, and elsewhere in North America, based on 3,553 words from 297 people. The line in the Utah panel shows the average number of tokens of [tʰɨn] from the other panels

Figure 8 augments Figure 1 with these additional states and the elsewhere control group. First, we see that [ʔɨn], represented by the shorter right column in each panel, is indeed attested in other regions, but is less common than it is in Utah (cf. Eddington and Brown 2021). Mixed-effects regression models similar in structure to the above models were fit to this expanded dataset, but with STATE as an additional predictor, summaries of which are provided in the supplemental

material in Appendix B. In the model for [ʔɨn], STATE was not a significant predictor, suggesting that the difference in [ʔɨn] between states is negligible. This goes against Eddington and Savage's (2012: 345) finding that [ʔɨn] is "virtually nonexistent among non-Utahns",[15] though it agrees with Eddington and Brown's (2021) report of insignificant differences across states (New Mexico, Utah, Indiana, Mississippi).

Returning to Figure 8, when comparing the height of the left column within each panel, which represents [tʰɨn], we see a large difference between the Utahns on the left panel and the other regions. We see that while [tʰɨn] undoubtedly is attested in the other regions,[16] it is more frequent in Utah. The model for [tʰɨn] that includes STATE suggests that this difference is statistically significant. The odds ratios from these model coefficients suggest that Utahns are predicted to use [tʰɨn] 1.79–1.62 times more than the other groups. Additionally, [ʔn̩] is the majority variant by a large margin in all other states, and the difference between each state and Utah is significant, with each state being 1.6–5.9 times more likely to use [ʔn̩] than Utah is.

We can use these patterns from other regions to explain the Utah data. On average, the non-Utah regions used [tʰɨn] 24.6 percent of the time. This is likely the result of the more formal register common in wordlist styles. We might therefore expect approximately a quarter of tokens in Utah to be [tʰɨn], assuming Utahns do the same register shifts that other North Americans do. That amount is represented by the black dashed line in the Utah panel of Figure 8. If [tʰɨn] were produced approximately 25 percent of the time in Utah, we would conclude that there is nothing out of the ordinary since that is within the range of the other regions. However, Figure 8 shows that nearly half of MOUNTAIN tokens in Utah were [tʰɨn] — almost double the expected amount. It is prudent to assume that half of those tokens, or about 25 percent of all tokens, are simply the result of stylis-

15. Davidson, Orosco, and Wang (2021: 8, 12, 14, esp. Figures 2, 4, 5) show that New Yorkers use [ʔən] 37 percent of the time and people from other regions use it 9 percent of the time in elicited sentences. Based on other datasets reported therein, the Northern Cities region uses it 15 percent of the time and the Pacific Northwest uses it 29 percent of the time in conversation. They also find it in five percent of tokens in another dataset that samples across multiple dialect regions. It also occurs in about 13 percent of tokens in Repetti-Ludlow's (2024: 8, esp. table. 2) Long Island–based sample in a semantic differential task. Thus, [ʔən] shows up more than a "virtually non-existent" amount, and there does seem to be differences across regions.

16. Repetti-Ludlow (2024: n. 2) found released [t] in 105 of 3,943 (2.7 percent) tokens, but excluded them under the assumption that they represent formal speech. Davidson, Orosco, and Wang (2021) do not mention released [t].

tic effects. However, that doesn't explain the additional 22.2 percent of tokens that were realized as [tʰɨn] in Utah. I return to this in Section 5.1.

5. Discussion

The previous section describes a case of hypercorrection in Utah English. In a sample of wordlist data, the most common realization of the unstressed syllable in MOUNTAIN words like *mountain, button*, and *kitten* is [tʰɨn], especially if the /tən/ follows a nasal. [ʔn̩] was used more among former Latter-day Saints and people who want to live in small towns. [tʰɨn] was used less among former Latter-day Saints, people who want to live in small towns or rural areas, and Gen Z. [ʔɨn] was used more among Millennials and Gen Z. But there are still considerable speaker-level idiosyncrasies unaccounted in the models. [tʰɨn] was the majority variant in Utah, and it was the only state that showed that pattern.

5.1 Hypercorrection in response to stigma

Why does Utah English have such a higher amount of [tʰɨn] than other varieties? Again, all areas sampled in this study use [tʰɨn] to some degree. Presumably, most speakers have access to [tʰɨn] and use it in formal tasks like reading wordlists. While data from multiple styles was not elicited in this study, I believe it is a safe assumption that most Utahns use [ʔn̩] or [ʔɨn] in more casual styles and that [tʰɨn] here is a shift in response to careful speech. More Utahns make the shift than people from other regions.

While social evaluations of [ʔn̩] compared to [tʰɨn], have not been directly analyzed in Utah, what is known is that [ʔɨn] is stigmatized. Savage (2014) finds [ʔɨn] is evaluated as the least friendly and the least intelligent out of six Utah English features. Eddington and Brown (2021) show that [ʔɨn] is perceived as less educated and more rural than [ʔn̩]. The latter finding suggests that [ʔn̩] is more positively evaluated than [ʔɨn]. Presumably [tʰɨn] is even more positively evaluated, though this remains to be tested explicitly. A possible explanation for why [tʰɨn] occurs so much in Utah is that even [ʔn̩] is still somewhat stigmatized. Perhaps the stigma associated with [ʔɨn] has spread to [ʔn̩] due to the glottal stop they share (Stanley submitted). The use of [tʰɨn] is then a response against the stigma associated with either glottal stop variant.

This appears to be a case of hypercorrection akin to the "crossover effect" first observed by Labov (1972: 124–128) in New York City. Recall that lower middle-class speakers recognized that they used a stigmatized variant more than upper

middle-class speakers, so in careful speech styles they adjusted their speech in order to match the perceived linguistic patterns of the more prestigious group. However, they overshot their target and ended up producing more of the prestigious variant than even the upper middle-class group did. I believe what is happening in Utah is a similar phenomenon. Utahns recognize that they use variants (that is, [ʔɨn] or [ʔn̩]), which they feel are stigmatized, more often than people from other regions use those variants, so they adjust their speech to match what they perceive in others (Stanley submitted).

But if presumably all dialect areas use [ʔɨn], [ʔn̩] and [tʰɨn], why is this hypercorrection so much stronger in Utah than in other regions? Why would Utahns respond differently to the same set of initial linguistic parameters shared with other reasons? Perhaps those parameters are not the same. For example, [ʔɨn] could be somehow a little more extreme in Utah, such as being realized with a longer closure duration in [ʔ]. This, potentially combined with other small factors, may be what allowed MOUNTAIN to reach social awareness in Utah. Orthographic *t*, awareness of the underlying /t/ (evidenced in morphological pairs like *bit* and *bitten*), and a dose of prescriptivism potentially reinforce [tʰ] over [ʔ]. And since the difference between [ʔn̩] and [ʔɨn] is perceptually small (see Section 3.6) the layperson may conflate the two, leading the [ʔn̩] to be stigmatized by association with [ʔɨn]. So, while most dialect areas have variation in MOUNTAIN, Utahns' awareness of that variation seems to have led to statistical hypercorrection. It is beyond the scope of this paper to explicate the development of the hyperawareness of MOUNTAIN in Utah and the resulting hypercorrection, but future analysis of the qualitative data collected as a part of this survey will shed additional light on these phenomena (see Stanley submitted).

5.2 Fortition in Utah

This study focused on MOUNTAIN, but other consonantal variables in Utah English can all be described as undergoing fortition compared to mainstream variants. Stops are inserted after word-final velar nasals (*sing* [sɪŋg] ~ [sɪŋk]) (Di Paolo and Johnson 2018), [t] is inserted between /ls/ clusters (*else* [ɛɫt͡s]) (Stanley and Vanderniet 2018), and /θ/ is affricated after /l/ (*health* [hɛɫt̪͡θ]) (Stanley and Shepherd 2025). Social meaning associated with these other variables and the social distribution of their occurrence have not yet been explored, but it may be the case that [tʰɨn] in MOUNTAIN is part of a broader pattern of fortition in Utah English. The question is: why fortition and why now?

At this point, an explanation for this fortition is speculative, but as mentioned above, /t/-release generally conveys ideas of correctness. Does fortition generally carry that same idea of correctness? Further experimental work in Utah or other

varieties (if fortition is present) may help address whether /t/-release (or [tʰɨn] in MOUNTAIN) is just one manifestation of a broader phenomenon and whether these fortition processes are sociolinguistically linked. However, it does not yet explain why correctness is a socially meaningful ideology among these participants, though qualitative analysis of speakers' comments from this survey to answer this very question is currently underway (Stanley submitted).

Discovering why fortition is being employed in this community will go hand-in-hand with why it is now variable. To be clear, evidence of variation in the present is not evidence of a lack of variation in the past because variation can be stable for generations (Labov 2001: 74–120). And since detailed attitudinal data on some of these processes has been collected only recently, it may not ever be possible to get the longitudinal data required to answer this question. However, differences in language attitudes across contemporary age cohorts may be a fruitful avenue for determining why fortition has appeared in Utah English.

6. Conclusion

In this study, I have provided evidence that a forticized variant of MOUNTAIN is the most common variant in Utah. The proportion of [tʰɨn] is the highest that has been reported in any study of Utah English. On the surface, this seems like a simple case of hypercorrection, but a closer inspection reveals some of the social underpinnings that drive this change. In this paper, I have highlighted numerous avenues for future work, some of which are currently being explored Stanley (submitted). But given that variation in /tən/ in other regions has recently been described, often involving taps (Davidson, Orosco, and Wang 2021; Repetti-Ludlow and Blake 2024; Shepherd, Sneller, and Howard 2024), which are virtually unattested in this Utah-based sample, we may be on the cusp of nationwide volatility in MOUNTAIN.

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Appendix A

Treating [tʰɨn], [ʔn̩], and [ʔɨn] as the only three variants of MOUNTAIN is an oversimplification. This appendix shows some of alternative variants and how they were classified in this study. I have chosen to illustrate these variants with data from higher voices to make the contrast between model voice and creaky voice more apparent, but this is not to imply that only some variants were found in some kinds of people.

The [tʰɨn] variant was straightforward since [tʰ] is quite salient compared to [ʔ] or creak. Figure 9 shows a canonical realization of this variant in *certain* as uttered by Deborah (White, female, b. 1989, Highland, Utah).

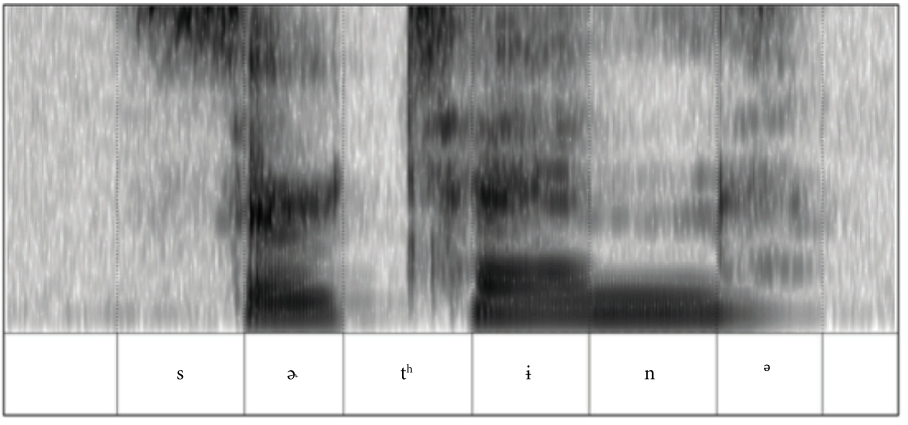

Figure 9. Realization of *certain*

Figure 10 shows a canonical realization of [ʔn̩] in *titan*, as uttered by Mayra (White, female, b. 1990, Orem, Utah).

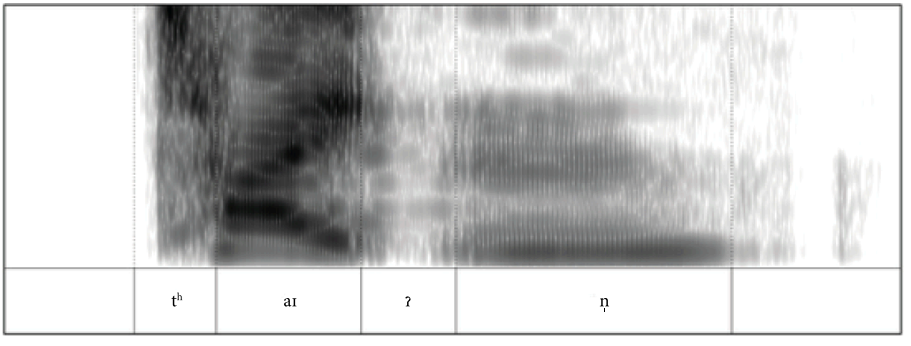

Figure 10. Realization of *titan*

However, glottal stops are often realized as creak, either surrounding the glottal closure or instead of it. So, such cases had to be considered. If the creakiness was immediately followed by a nasal, I classified it as [ʔn̩] following Davidson, Orosco, and Wang (2021). Figure 11 shows one such instance in *cotton* by Roxanne (White, female, b. 1985, Provo, Utah).

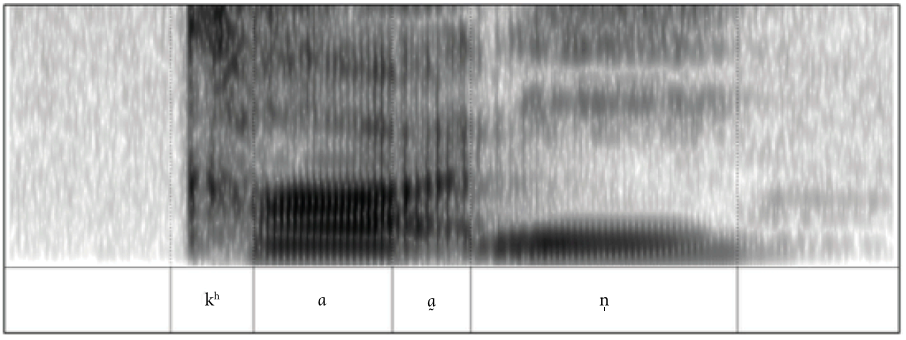

Figure 11. Realization of *cotton*

If there was a period of glottal closure and the nasal was creaky, it was also classified as [ʔn̩]. This is illustrated in Figure 12 in *written* by Naomi (White, female, b. 1982, Libby, Montana). Note that tokens of *written* were excluded in this study, but this particular token serves as an illustrative example.

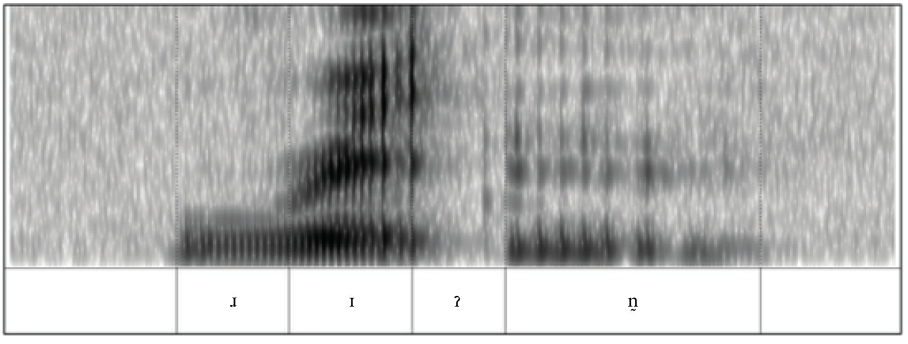

Figure 12. Realization of *written*

Canonically, [ʔɨn] is realized with glottal closure and a modal vowel. This is illustrated in Figure 13 in Ariana's (White, female, b. 2001, Idaho Falls, Idaho) realization of *mitten*.

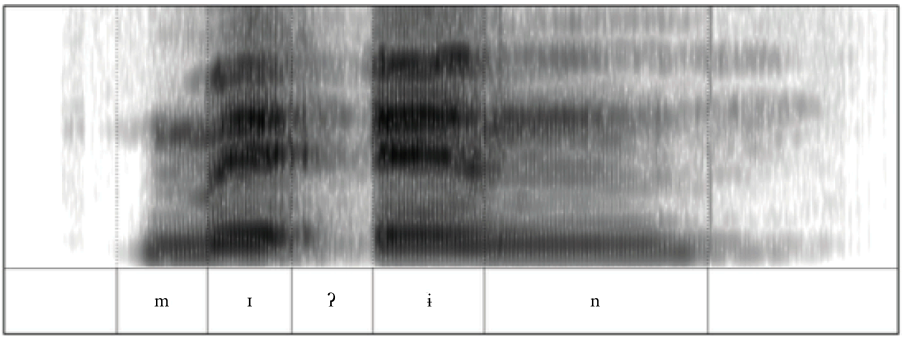

Figure 13. Realization of *mitten*

It is the presence of that reduced vowel and the lack of alveolar closure that is the primary determinant for classifying a token as [ʔɨn]. For example, Figure 14 shows a case where there was glottal closure but a period of modal voice with vowel-like formant structure following creakiness in *Britain* by Claudia (White female, b. 1995, Spanish Fork, Utah).

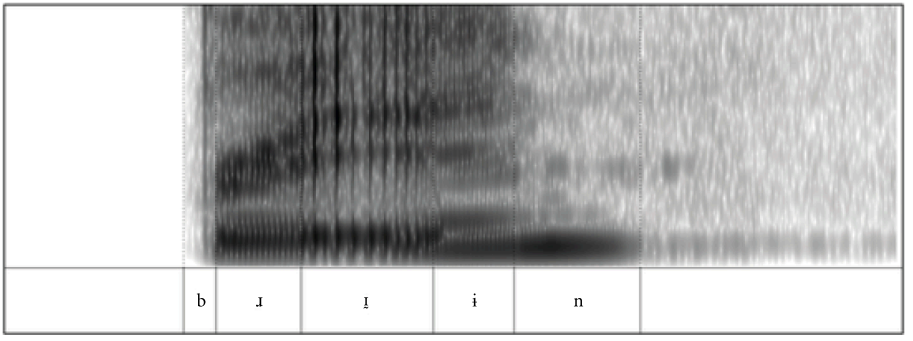

Figure 14. Realization of *Britain*

Figure 15 shows another realization by Claudia that was classified as [ʔɨn]. This token of *cotton* has glottal closure and a creaky vowel following.

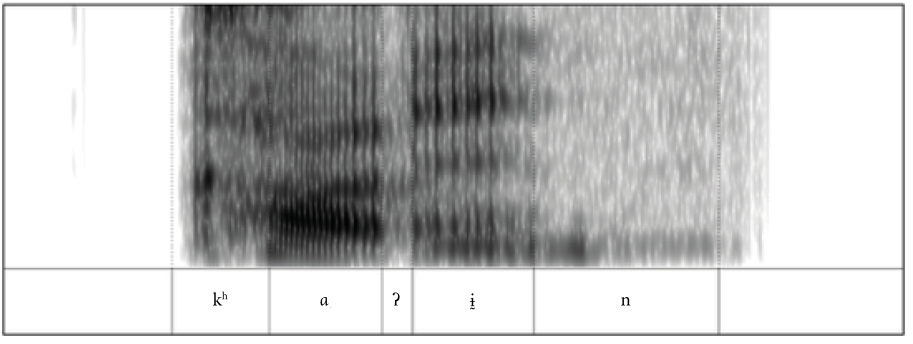

Figure 15. Alternative realization of *cotton*

Figure 16 shows Kiana's (White, female, b. 1995, Billings, Montana) realization of *Latin*, which exhibited partial creak in the preceding vowel and full creak in the following vowel. This, too, was classified as [ʔɨn].

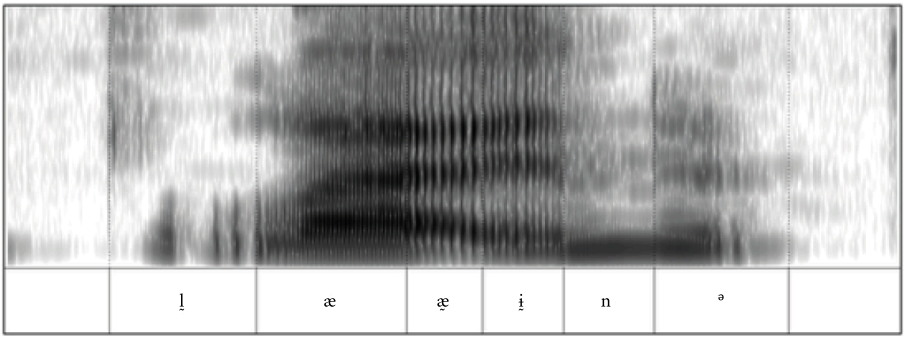

Figure 16. Realization of *Latin*

In a few cases, there was complete deletion of /t/ but two distinct vowel qualities remain. Figure 17 shows one case in Trista's (White, female, b. 1984, Cheyenne, Wyoming) realization in *rotten*. Such cases were classified as [ʔɨn] since they perceptually are closer to other tokens classified with this variant than to [tʰɨn].

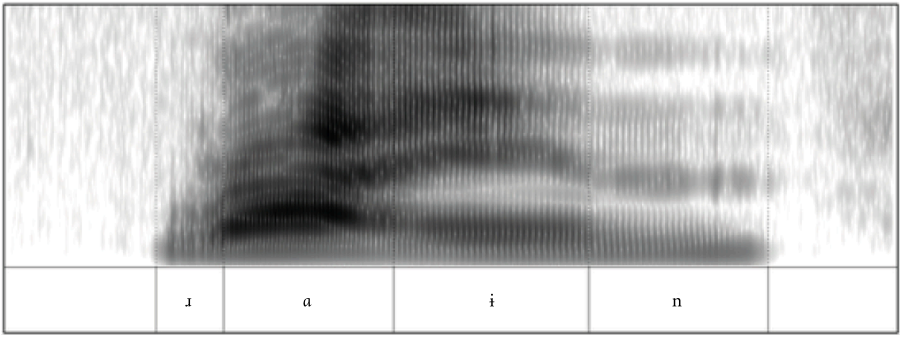

Figure 17. Realization of *rotten*

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Appendix B

```
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation)
['glmerMod']
 Family: binomial  ( logit )
Formula: is_tin ~ gender + church + generation + urban_or_rural + region + prev_seg
                  (1 | word) + (1 | speaker_id)
   Data: utah_data
Control: glmerControl(optimizer = "bobyqa")

      AIC       BIC    logLik -2*log(L)  df.resid
   1139.6    1249.0    -548.8    1097.6      1325

Scaled residuals:
    Min      1Q  Median      3Q     Max
-6.4558 -0.3731 -0.0801  0.2694  3.4740

Random effects:
 Groups     Name        Variance Std.Dev.
 speaker_id (Intercept) 7.449    2.729
 word       (Intercept) 1.052    1.026
Number of obs: 1346, groups:  speaker_id, 93; word, 18

Fixed effects:
                            Estimate Std. Error z value Pr(>|z|)
(Intercept)                  2.24425    1.39530   1.608 0.107740
gendermale                  -0.42845    0.70210  -0.610 0.541704
genderminority               0.04407    1.81736   0.024 0.980655
churchnon-practicing        -1.38810    1.03824  -1.337 0.181230
churchformer                -2.09895    0.85488  -2.455 0.014079 *
churchno affiliation        -0.71860    1.22309  -0.588 0.556849
generationMillennial        -0.57207    0.89069  -0.642 0.520690
generationGen Z             -2.57424    1.02235  -2.518 0.011804 *
urban_or_ruralsuburb        -0.94521    0.91168  -1.037 0.299839
urban_or_ruralsmall town    -3.74373    1.07251  -3.491 0.000482 ***
urban_or_ruralrural         -2.87458    1.39603  -2.059 0.039484 *
regionUtah County            1.15052    0.93249   1.234 0.217273
regionOgden Metro Area       0.33502    1.04800   0.320 0.749218
regionSt. George             0.05270    2.23489   0.024 0.981185
regionWasatch Back           2.88439    2.08142   1.386 0.165814
regionTooele Area            2.10835    1.90387   1.107 0.268121
regionRuraler Northern Utah  2.47946    1.40270   1.768 0.077122 .
regionRural Utah            -0.37974    1.71702  -0.221 0.824967
prev_segnasal                2.50492    0.59370   4.219 2.45e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 18. Statistical summary of the model fit to [tʰɨn] verses [ʔɨn~ʔn̩] in Utah only

```
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation)
['glmerMod']
 Family: binomial  ( logit )
Formula: is_in ~ gender + church + generation + urban_or_rural + region + prev_seg +
                 (1 | word) + (1 | speaker_id)
   Data: utah_data
Control: glmerControl(optimizer = "bobyqa")

      AIC       BIC    logLik -2*log(L)  df.resid
    552.9     662.2    -255.5     510.9      1325

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.6680 -0.1155 -0.0445 -0.0131 15.8568

Random effects:
 Groups     Name        Variance Std.Dev.
 speaker_id (Intercept) 11.7265  3.424
 word       (Intercept)  0.4489  0.670
Number of obs: 1346, groups:  speaker_id, 93; word, 18

Fixed effects:
                            Estimate Std. Error z value Pr(>|z|)
(Intercept)                  -7.3200     2.2029  -3.323 0.000891 ***
gendermale                   -1.1737     1.0484  -1.120 0.262894
genderminority               -0.6135     2.6077  -0.235 0.813998
churchnon-practicing         -0.7821     1.6337  -0.479 0.632154
churchformer                 -0.5614     1.2461  -0.451 0.652338
churchno affiliation         -1.3802     1.8213  -0.758 0.448577
generationMillennial          3.6974     1.6122   2.293 0.021825 *
generationGen Z               4.2763     1.6957   2.522 0.011673 *
urban_or_ruralsuburb          0.2154     1.3112   0.164 0.869528
urban_or_ruralsmall town      1.7273     1.5326   1.127 0.259719
urban_or_ruralrural          -0.4301     2.3444  -0.183 0.854450
regionUtah County            -1.2944     1.4258  -0.908 0.363968
regionOgden Metro Area        0.5665     1.5324   0.370 0.711632
regionSt. George              3.3888     2.9449   1.151 0.249832
regionWasatch Back            1.5664     2.7296   0.574 0.566066
regionTooele Area             2.7458     2.5762   1.066 0.286501
regionRuraler Northern Utah  -2.5592     2.2047  -1.161 0.245720
regionRural Utah              4.0991     2.3913   1.714 0.086492 .
prev_segnasal                -2.0861     0.5151  -4.050 5.13e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 19. Statistical summary of the model fit to [ʔin] verses [tʰin~ʔn̩] in Utah only

```
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation)
['glmerMod']
 Family: binomial  ( logit )
Formula: is_n ~ gender + church + generation + urban_or_rural + region + prev_seg +
                (1 | word) + (1 | speaker_id)
   Data: utah_data
Control: glmerControl(optimizer = "bobyqa")

      AIC       BIC    logLik -2*log(L)  df.resid
   1162.1    1271.4    -560.1    1120.1      1325

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.6392 -0.3122 -0.0844  0.3848  5.3910

Random effects:
 Groups     Name        Variance Std.Dev.
 speaker_id (Intercept) 7.9850   2.8258
 word       (Intercept) 0.6632   0.8144
Number of obs: 1346, groups:  speaker_id, 93; word, 18

Fixed effects:
                           Estimate Std. Error z value Pr(>|z|)
(Intercept)                 -2.6500     1.4469  -1.832 0.067025 .
gendermale                   1.4729     0.7480   1.969 0.048926 *
genderminority               1.5896     1.8835   0.844 0.398690
churchnon-practicing         1.8743     1.0878   1.723 0.084888 .
churchformer                 2.0184     0.8881   2.273 0.023037 *
churchno affiliation         1.0450     1.2878   0.811 0.417082
generationMillennial        -0.8888     0.9313  -0.954 0.339895
generationGen Z              0.9656     1.0562   0.914 0.360597
urban_or_ruralsuburb         0.5635     0.9486   0.594 0.552528
urban_or_ruralsmall town     2.3009     1.1004   2.091 0.036528 *
urban_or_ruralrural          1.9582     1.4545   1.346 0.178210
regionUtah County           -0.1687     0.9698  -0.174 0.861937
regionOgden Metro Area      -0.4795     1.1013  -0.435 0.663243
regionSt. George            -1.3701     2.5491  -0.538 0.590922
regionWasatch Back          -4.2583     2.3431  -1.817 0.069162 .
regionTooele Area           -4.3240     2.0030  -2.159 0.030872 *
regionRuraler Northern Utah -1.3506     1.4498  -0.932 0.351562
regionRural Utah            -1.7077     1.8362  -0.930 0.352340
prev_segnasal               -1.8225     0.4863  -3.748 0.000178 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 20. Statistical summary of the model fit to [ʔn̩] verses [tʰɨn~ʔɪn] in Utah only

```
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation)
['glmerMod']
 Family: binomial  ( logit )
Formula: is_tin ~ gender + church + urban_or_rural + generation + state + prev_seg +
                  (1 | word) + (1 | speaker_id)
   Data: all_data
Control: glmerControl(optimizer = "bobyqa")

      AIC       BIC    logLik -2*log(L)  df.resid
   1876.1    1975.2    -921.0    1842.1      2495

Scaled residuals:
    Min      1Q  Median      3Q     Max
-7.7222 -0.3101 -0.1160  0.1853  3.9370

Random effects:
 Groups     Name        Variance Std.Dev.
 speaker_id (Intercept) 7.8653   2.8045
 word       (Intercept) 0.7047   0.8394
Number of obs: 2512, groups:  speaker_id, 215; word, 18

Fixed effects:
                         Estimate Std. Error z value Pr(>|z|)
(Intercept)                1.3594     0.8631   1.575  0.11524
gendermale                -0.7271     0.4557  -1.596  0.11060
genderminority              -1.1216   1.6016  -0.700  0.48375
churchnon-practicing      -0.5344     0.8221  -0.650  0.51564
churchformer              -1.0589     0.6827  -1.551  0.12086
churchno affiliation      -0.4424     0.7016  -0.631  0.52827
urban_or_ruralsuburb      -0.2780     0.6450  -0.431  0.66651
urban_or_ruralsmall town  -1.8689     0.6580  -2.840  0.00451 **
urban_or_ruralrural       -1.9040     0.7518  -2.533  0.01132 *
generationMillennial      -0.3427     0.5636  -0.608  0.54312
generationGen Z           -1.5884     0.6261  -2.537  0.01118 *
stateID                   -1.5872     0.6704  -2.368  0.01791 *
stateMT                   -1.8854     0.7805  -2.416  0.01571 *
stateWY                   -1.3953     0.9477  -1.472  0.14092
prev_segnasal              3.1494     0.4895   6.434 1.24e-10 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 21. Statistical summary of the model fit to [tʰɨn] verses [ʔɨn~ʔn̩] in all states

```
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation)
['glmerMod']
 Family: binomial  ( logit )
Formula: is_in ~ gender + church + urban_or_rural + generation + state + prev_seg +
                 (1 | word) + (1 | speaker_id)
   Data: all_data
Control: glmerControl(optimizer = "bobyqa")

      AIC       BIC    logLik -2*log(L)  df.resid
    740.8     839.9    -353.4     706.8      2495

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.6990 -0.0240 -0.0081 -0.0030 20.8853

Random effects:
 Groups     Name        Variance Std.Dev.
 speaker_id (Intercept) 50.232   7.0874
 word       (Intercept)  0.671   0.8191
Number of obs: 2512, groups:  speaker_id, 215; word, 18

Fixed effects:
                         Estimate Std. Error z value Pr(>|z|)
(Intercept)               -9.1508     2.4482  -3.738 0.000186 ***
gendermale                -0.7852     1.0712  -0.733 0.463535
genderminority             0.5879     3.2624   0.180 0.857006
churchnon-practicing      -0.8394     1.9214  -0.437 0.662183
churchformer              -1.4585     1.4568  -1.001 0.316752
churchno affiliation      -2.4197     1.6367  -1.478 0.139307
urban_or_ruralsuburb      -0.3795     1.4267  -0.266 0.790245
urban_or_ruralsmall town  -0.3004     1.5242  -0.197 0.843733
urban_or_ruralrural       -0.2918     1.7327  -0.168 0.866261
generationMillennial       2.7826     1.9755   1.409 0.158975
generationGen Z            3.7257     2.1275   1.751 0.079911 .
stateID                   -0.6197     1.5264  -0.406 0.684751
stateMT                   -1.7004     2.2463  -0.757 0.449075
stateWY                    0.8466     1.8959   0.447 0.655196
prev_segnasal             -2.6222     0.5777  -4.539 5.66e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 22. Statistical summary of the model fit to [ʔɨn] verses [tʰɨn~ʔn̩] in all states

```
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation)
['glmerMod']
 Family: binomial  ( logit )
Formula: is_n ~ gender + church + urban_or_rural + generation + state + prev_seg +
                (1 | word) + (1 | speaker_id)
   Data: all_data
Control: glmerControl(optimizer = "bobyqa")

      AIC       BIC    logLik -2*log(L)  df.resid
   1963.8    2062.9    -964.9    1929.8      2495

Scaled residuals:
    Min      1Q  Median      3Q     Max
-4.0745 -0.2237  0.0906  0.3239  8.3883

Random effects:
 Groups     Name        Variance Std.Dev.
 speaker_id (Intercept) 8.5297   2.9206
 word       (Intercept) 0.3655   0.6046
Number of obs: 2512, groups:  speaker_id, 215; word, 18

Fixed effects:
                        Estimate Std. Error z value Pr(>|z|)
(Intercept)              -2.7708     0.8904  -3.112  0.00186 **
gendermale                1.4848     0.4777   3.108  0.00188 **
genderminority            1.4330     1.6467   0.870  0.38420
churchnon-practicing      1.0959     0.8499   1.289  0.19728
churchformer              1.7762     0.7233   2.456  0.01407 *
churchno affiliation      1.7784     0.7352   2.419  0.01557 *
urban_or_ruralsuburb      0.5023     0.6774   0.742  0.45837
urban_or_ruralsmall town  1.7773     0.6836   2.600  0.00932 **
urban_or_ruralrural       1.8615     0.7764   2.398  0.01650 *
generationMillennial     -0.6320     0.5851  -1.080  0.28006
generationGen Z           0.1969     0.6440   0.306  0.75975
stateID                   1.8522     0.6964   2.660  0.00782 **
stateMT                   2.1503     0.8069   2.665  0.00771 **
stateWY                   0.5109     0.9758   0.524  0.60058
prev_segnasal            -2.4629     0.3756  -6.557  5.5e-11 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 23. Statistical summary of the model fit to [ʔn̩] verses [tʰɨn~ʔɪn] in all states

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