



# Are our brains more prescriptive than our mouths? Experience with dialectal variation in syntax differentially impacts ERPs and behavior

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## ABSTRACT

We investigated online auditory comprehension of dialectal variation in English syntax with event-related potential (ERP) analysis of electroencephalographic data. The syntactic variant under investigation was the double modal, comprising two consecutive auxiliary verbs (e.g., *might could*). This construction appears across sub-regional dialects of Southern United States English and expresses indirectness or uncertainty. We compared processing of sentences with attested double modals and single modals in two groups of young adult participants: listeners who were either familiar (Southern) or unfamiliar (Unmarked) with double modal constructions. Both Southern and Unmarked listeners engaged rapid error detection (early anterior negativity) and sentence-level reanalysis (P600) in response to attested double modals, relative to single modals. Offline acceptability and intelligibility judgments reflected dialect familiarity, contrary to the ERP data. We interpret these findings in relation to usage-based and socially weighted theories of language processing, which together capture the effects of frequency and standard language ideology.

## 1. Introduction

Variation is inherent to language. Across a diverse set of lects, speakers distinguish themselves and their communities acoustically, lexically, and syntactically. However, models of language processing have primarily drawn upon neurocognitive and behavioral evidence from standard language varieties without incorporating variationist perspectives. To what extent does this work apply to non-standard varieties? To advance the explanatory power of language processing theories, the present study combined event-related potential (ERP) analysis of electroencephalographic (EEG) data and sociolinguistic measures to investigate dialectal variation in English syntax.

### 1.1. Double modals

Many speakers of Southern United States English (SUSE) use a verb construction called a double modal, which comprises two consecutive auxiliary verbs. For example, the sentence “She said we *might could* go on Tuesday” combines the modals *might* and *could*, which is not permitted in other varieties of United States (US) English. Pragmatically, these constructions signal indirectness, hedging, or politeness by speakers in

one-on-one conversation (Mishoe & Montgomery, 1994). As a result, double modals are generally restricted to spoken discourse, but can appear in informal written communication (e.g., Grieve, 2015). While the specificity of these situational contexts limits the overall frequency of double modals—in both sociolinguistic interviews and spontaneous speech (Hasty et al., 2012)—double modals appear across a wide range of US English dialects. Double modals appear in SUSE dialects extending east from Texas to Georgia (e.g., Di Paolo, 1989; Mishoe & Montgomery, 1994) and north into the Carolinas, eastern Tennessee, and Virginia (e.g., Hasty, 2015; Williamson & Han, 2018), as well as in dialects in Utah, West Virginia, and New York (e.g., Sykes, 2010). The first modal tends to be *may*, *might*, or *must*, which expresses epistemic (subject impressions of truth or likelihood) modality, and the second tends to be *can*, *could*, *should*, *will*, or *would*, which expresses root (possibility, permission, necessity, or obligation) modality (Coates, 1995; Nagle, 2003). We refer to these as attested double modals, as opposed to unattested double modals that do not appear in the literature.

Double modal dialects are an overlapping subset of SUSE, Appalachian English, and African American Vernacular English (AAVE) varieties (Montgomery, 1989; Mufwene, 2003). Double modal SUSE dialects, as the most well-defined in the linguistic literature, are the

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focus of the present study. The geographic distribution of double modal SUSE dialects generally maps onto formulations of “the South” (Cramer & Preston, 2018). The double modal *might could* in particular is considered a “socially diagnostic” feature that identifies speakers as “Southern,” in addition to *y’all* and *fixin’ to* (as cited in Bernstein, 2003). While double modal constructions themselves may not be stigmatized, particularly among SUSE speakers (Hasty, 2015), US English speakers overall perceive Southern dialects as distinctly incorrect and non-standard (Hasty, 2018; Preston, 1996). It is in this context that we define standard or unmarked US English as a set of vernacular features that are neither stigmatized nor perceived as non-standard relative to SUSE (Lippi-Green, 2011; Wolfram & Schilling, 2015).

The conflict between the auxiliary verb rules of standard and double modal dialects has driven decades of research in sociolinguistics and theoretical syntax (Hasty, 2012). While the syntax, semantics, and pragmatics of double modals are well-documented from these perspectives, the online comprehension of double modal constructions remains unexplored. At the same time, a rich body of psycholinguistic work, both neurocognitive and behavioral, supports theoretical perspectives on syntactic processing in standard language varieties. This set of factors represents a unique opportunity to make a novel and timely contribution to the study of dialectal variation in syntax. To our knowledge, the present study is the first to use EEG to examine systematically the patterns of neural activity associated with processing double modal constructions.

### 1.2. Syntactic processing and ERPs

Previous research with standard language varieties and native speakers has established two sets of ERP components related to syntactic processing. The first includes early (i.e., within 500 ms) negative shifts over anterior channels that are commonly, but not exclusively, left-lateralized. These are the left anterior negativity (LAN) and its early counterpart (ELAN), which generally reflect difficulty in syntactic processing (Swaab et al., 2012). The second set includes later positive shifts, typically with posterior distributions. In particular, the syntactic P600 component reflects restructuring processes (Leckey & Federmeier, 2019).

Friederici et al. (2002), Hagoort (2003), and Bornkessel and Schlesewsky (2006) provide different accounts for these neurocognitive correlates of online sentence comprehension (see also Bornkessel-Schlesewsky & Schlesewsky, 2016; Friederici, 2011; Hagoort, 2017). According to Friederici et al. (2002), processing unfolds in three incremental stages that elicit functionally distinct ERP components. The ELAN indexes word category identification during Phase 1 (100–300 ms), the LAN indexes morphosyntactic processes related to thematic role assignment during Phase 2 (300–500 ms), and the P600 indexes integration processes during Phase 3 (+500 ms). Similarly, the extended Argument Dependency Model (eADM) details a three-phase hierarchy, beginning with phrase structure template selection in Phase 1, moving to argument role encoding and processing in Phase 2, and ending with general interpretation in Phase 3 (Bornkessel & Schlesewsky, 2006). ELAN effects arise during Phase 1, as in Friederici et al. (2002), if template selection fails. During Phase 2, agreement violations can elicit LAN or P600 effects depending on the specific item (predicating vs. non-predicating) and the language’s morphosyntactic structure, while integration failures give rise to semantic P600 or other late positive effects in Phase 3. By contrast, the Unification Model posits that parsing involves the formation of dynamic links between syntactic frames containing both phrase structure and relational information (Hagoort, 2003). (E) LAN effects reflect failures to bind syntactic frames into a cohesive structural representation for an entire utterance, while P600 effects result from weak links between these frames.

Despite their theoretical differences, all three models predict early negative-going responses in (left) anterior regions in response to violations of verb inflection or agreement, case or gender agreement, or word

category. However, the validity of ELAN effects under the Friederici et al. (2002) model have been challenged due to the prevalence of spillover and offset effects in previous studies (Steinhauer & Drury, 2012). Reflecting the unstable status of the ELAN, the Unification Model collapses ELAN and LAN effects in its conceptualization of syntactic unification failures. Regarding P600 effects, while the eADM separates syntactic P600 effects in Phase 2 from other late positivities reflecting general repair processes in Phase 3, Friederici et al. (2002) and Hagoort (2003) ascribe reanalysis, revision, and integration processes to the P600. Overall, P600 effects are commonly observed in response to overt syntactic violations (e.g., Osterhout & Holcomb, 1992) and dispreferred or ambiguous constructions (e.g., Kaan et al., 2000; Kaan & Swaab, 2003).

### 1.3. ERP measures of dialectal variation

Neurocognitive research on dialectal variation has focused on phonetic and semantic rather than syntactic variation. In Goslin et al. (2012), unfamiliar regional accents, compared to the listener’s own regional accent, increased the amplitude of the phonological mapping negativity (PMN), which indexes pre-lexical processing of competing phonological candidates. By contrast, foreign-accented speech, relative to the listener’s own accent or unfamiliar regional accents, reduced the PMN effect. These results suggest that listeners accommodate native variation more readily than non-native, and that dialect familiarity—defined as experience with dialect-specific variation through sufficient community exposure, as well as one’s own language production—impacts processing difficulty. An ERP study with kindergarten-aged speakers of two German dialects supports this finding (Bühler et al., 2017). Regardless of the congruence between image-word pairs, unfamiliar lexical items elicited a biphasic N400-late positive complex (LPC) effect, indexing difficulties with lexico-semantic access and integration, while unfamiliar pronunciations elicited an LPC effect alone. If language processing were not dialect-specific, only incongruent image-word pairs would yield processing costs. In both studies, familiarity modulated online processing.

Interactions between phonetic and lexical variation further demonstrate the impact of dialect familiarity on comprehension. Martin et al. (2016) tested native British English participants with sentences in which the sentence-final word was either congruent or incongruent with the dialectal context. Incongruent accent-word pairs elicited a (delayed) N400 effect relative to congruent pairs, reflecting difficulties with lexico-semantic integration; however, there was no main effect of speaker accent, suggesting that within-dialect consistency was more important than dialect proximity. Importantly, the study design assumed a high level of familiarity with US English dialects: participants needed experience with both dialects to know which lexical item was congruent with which accent. Otherwise, the congruency effect would not have held in the US English accent condition.

When phonetic variation produces ambiguities or conflicts in the lexicon, listeners’ neural activity reflects difficulty in integrating these lexical items. Specifically, Conrey et al. (2005) investigated online comprehension of the “pin-pen merger” found in several US English dialects, where *pin* and *pen* are both pronounced like *pin*. They found that speakers of unmerged varieties exhibited LPC effects for all incongruent stimuli. By contrast, speakers of merged varieties only showed LPC effects for control stimuli without this contrast. Ambiguous pronunciations increased processing difficulties in the unmerged listener group that were mitigated by experience in the merged listener group. Another ERP investigation of contrastive phonemes demonstrated an asymmetric sensitivity to dialectal variation—with ambiguous pronunciations eliciting N200-LPC effects and unambiguous semantic violations eliciting N400-LPC effects—that facilitated comprehension in contact situations (Lanwermeijer et al., 2016). Both studies show that processing is sensitive to the familiarity of a dialectal variant.

Very few ERP studies have investigated dialectal differences beyond

lexical and phonological variation. Garcia (2017) used auditory EEG to explore differential processing of morphosyntactic variation in US English. A morphosyntactic feature of AAVE is the omission of the third person singular -s verb agreement marker (e.g., “The black cat *lap* the milk.”). Monodialectal “Mainstream American English” (MAE) listeners and bidialectal AAVE-MAE listeners judged the grammaticality of sentences with (-s) and without (-s-drop) the standard -s suffix on the verb while their neural activity was recorded. The -s-drop sentences, compared to the -s sentences, elicited a P600 effect in MAE listeners but not in AAVE-MAE listeners. In addition, the bidialectal listeners showed significantly greater acceptability of -s-drop sentences than monodialectal listeners in their behavioral data. Experience with a particular syntactic variant not only affected grammatical judgments, but also modulated patterns of neural activity.

ERP research on dialectal variation has illustrated the critical role of familiarity in online language processing. Experience with particular phonetic, lexical, and syntactic variants modulated neural responses across a variety of dialects, languages, and paradigms. Goslin et al. (2012) observed differential processing of one’s own regional accent compared to an unfamiliar regional accent. Sensitivity to the congruence between the accents and lexical items of particular dialects drove the ERP effects in Lanwermyer et al. (2016) and Martin et al. (2016), which provides further evidence for the role of familiarity in comprehension. Conrey et al. (2005), Bühler et al. (2017), and Garcia (2017) similarly demonstrated how familiarity enabled listeners to adapt their comprehension systems to accommodate specific variants. These findings align with usage-based accounts of language production and comprehension (e.g., Bybee, 2006; Goldberg, 2006; MacDonald, 2013), which centralize experience in characterizing linguistic behavior.

#### 1.4. Familiarity in language processing

Usage-based theories provide mechanistic explanations for the relation between familiarity and language processing. The Production-Distribution-Comprehension (PDC) model grounds cross-disciplinary findings on language comprehension and typology in the language production system (MacDonald, 2013). This model connects the computational demands of speech production not only to the distributional frequencies of particular features within individual utterances, but also to the general forces of variation and change that operate across dialects and languages. The PDC account of language use aligns with usage-based accounts in linguistics, which specify functional relationships between frequency and linguistic behavior. For example, Goldberg (2006) posits that speakers learn to generalize individual constructions based on language input and develop item-specific knowledge about these constructions to constrain this generalization. Token and type frequency—the number of times a construction appears overall and the number of times particular manifestations of that construction appear, respectively—play key roles in these processes. Similarly, Bybee (2006) articulates an exemplar model of grammaticalization based on construction frequency that extends from individual speakers to speech communities. From these usage-based perspectives, familiarity with a particular construction, operationalized in terms of frequency, will lead to concomitant changes in language comprehension. We apply this usage-based framework to the neurocognitive correlates of dialectal variation in the present study.

The dual-route theory of lexical access provides an alternative theoretical perspective, according to which listeners assign variable acoustic signals to separate but interactive social and linguistic representations (Sumner et al., 2014). This model distinguishes typicality, measured in terms of frequency, from subjective perceptions of prestige. It posits that prestigious forms have higher social weights, improving

immediate perception and strengthening representations in memory. Robust identification and encoding facilitate processing for infrequent, idealized variants relative to frequent, default variants and other infrequent variants. Here, default forms are both unmarked and informal, while idealized variants are both marked and prestigious. This conceptual framework complements research on cross-dialect comprehension demonstrating an advantage for processing standard over regionally-marked forms, regardless of the regional dialect of the listener (e.g., Sumner & Samuel, 2009; Walker, 2018).

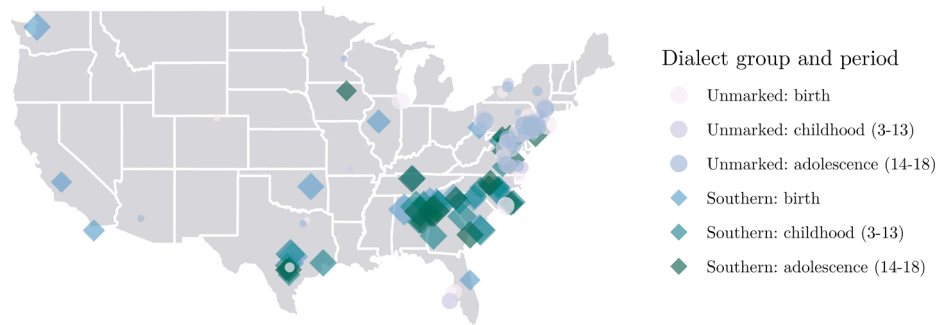
#### 1.5. Present study

To investigate the neurocognitive correlates of syntactic variation, we used a naturalistic auditory EEG paradigm with two groups of listeners: *Southern* and *Unmarked*. Participants familiar with double modals comprised the Southern dialect group, while those with little to no experience comprised the Unmarked dialect group. By contrast, both groups were highly familiar with single modal constructions, as they appear frequently across US English varieties. We analyzed ERP responses as participants listened to pairs of sentences with single or attested double modal constructions. We complemented these neural data with behavioral judgments of acceptability and intelligibility for single, attested double, and unattested double modals.

The usage-based perspective predicts a large difference in processing between single modal and attested double modal constructions for Unmarked listeners, based on the large difference in familiarity with these constructions. Following Garcia (2017), a P600 effect is expected for the double modals; in addition, given the extensive literature on grammatical processing in standard language varieties, we also anticipated early anterior negativities. However, double modals represent neither strict word category violations nor morphosyntactic violations, which would correspond to ELAN or LAN effects, respectively (Bornkessel & Schlesewsky, 2006; Friederici et al., 2002). In addition, our design relied on a context manipulation, which falls under the empirical concerns surrounding ELAN effects (Steinhauer & Drury, 2012). As a result, we did not make strong predictions regarding ELAN or LAN effects; rather, we considered early anterior negativities (hereafter: EAN effects) more broadly.

By contrast, the usage-based perspective does not predict a difference in ERP responses in Southern listeners, as they are familiar with both double and single modals. Offline, the usage-based perspective predicts that acceptability and intelligibility judgments for attested double modals should be higher among Southern listeners than Unmarked listeners. The Southern group, but not the Unmarked group, is also expected to differentiate between attested and unattested double modals. As a result, Southern listeners should rate attested double modals higher than unattested, while Unmarked listeners should rate them similarly. Overall, linguistic judgments and experience measures should correlate negatively with ERP response amplitudes across groups.

Alternatively, the dual-route theory predicts that the processing benefit for frequent, idealized forms outweighs familiarity with a non-standard dialect. Following this standard-language advantage, unmarked modal forms should dominate regionally-marked ones in both groups. Specifically, single modals are expected to be overall easier to process than attested double modals. If so, Southern listeners should demonstrate P600 effects, potentially preceded by early anterior negativities, in line with Unmarked listeners. Both groups are expected to show a preference for unmarked forms by rating single modals higher than both attested and unattested double modals. In addition, neither Southern nor Unmarked participants should distinguish between attested and unattested double modals in their acceptability and intelligibility ratings.



**Fig. 1.** Regional dialect exposure from birth through adolescence. Point size represents the sum of the two quantitative metrics (double modal experience and familiarity) used to assign participants to dialect groups.

**Table 1**  
Auditory stimuli.

Type	Context sentence	Condition	Task	Target sentence	Comprehension question
Critical	"Kaitlyn is having a hard time with her essay."	Standard single modal	EEG and judgment	"She thinks she <i>should</i> ask the professor for an extension."	Does Anna always forget her coffee?
		Attested double modal	EEG and judgment	"She thinks she <i>might should</i> ask the professor for an extension."	
		Unattested double modal	Judgment only	"She thinks she <i>could should</i> ask the professor for an extension."	
Filler	"Anna always forgets when she makes hot tea."		EEG only	"She said <i>the that</i> tea is usually too cold when she remembers it."	

## 2. Methods

### 2.1. Participants

Fifty-three Pennsylvania State University community members participated: 29 were Unmarked speakers and 24 were Southern speakers (see Section 2.3 for dialect group criteria). We recruited participants via the undergraduate participant pool, word-of-mouth, and flyers. They received either course credit (1/hour) or a monetary reward (\$10/hour) for their participation. All provided written informed consent before participating in the EEG session. Data from eight participants was excluded: three for not meeting the criteria for native, monolingual US English speakers (Section 2.2.2), three for excessive blink artifact (Section 2.4.3), and two for not completing all EEG and behavioral tasks.

Twenty-three Unmarked participants (Age:  $M = 19.70$  years,  $SD = 2.72$  years; Gender: Man = 8, Non-binary/Other = 0, Woman = 15) and 22 Southern participants (Age:  $M = 19.86$  years,  $SD = 3.24$  years; Gender: Man = 6, Non-binary/Other = 0, Woman = 16) remained. Southern and Unmarked participants did not differ in age ( $t(41.05) = 0.19$ ,  $p = .852$ ) or handedness scores ( $t(42.94) = 0.37$ ,  $p = .712$ ), based on a 10-item version of the Edinburgh Handedness Inventory (Oldfield, 1971). All participants had normal or corrected-to-normal vision and no history of hearing disabilities, traumatic brain injury, or learning or attention issues.

We collected several measures of experience with SUSE features and Southern culture more broadly. Southern participants spent significantly more time in Southern states than Unmarked participants ( $t(34.95) = 6.01$ ,  $p < .001$ ; Section 2.2.2). As shown in Fig. 1, the plurality of Unmarked participants reported spending their childhoods in Pennsylvania (43.48%), while Southern participants primarily grew up in North Carolina (27.27%) or Georgia (22.73%). Southern participants had more experience than Unmarked participants with *might could* ( $t(24.91) = 7.57$ ,  $p < .001$ ) and other syntactic constructions in SUSE ( $t(39.36) =$

4.62,  $p < .001$ ; Section 2.2.3). Within Southern participants, perception and production experience with *might could* did not differ ( $t(21) = 1.07$ ,  $p = .296$ ).

Southern participants also reported higher familiarity with attested double modals than Unmarked participants ( $t(38.14) = 8.12$ ,  $p < .001$ ; Section 2.2.4). Experience with *might could* in particular and familiarity with double modals overall did not differ for Southern participants ( $t(21) = 1.78$ ,  $p = .089$ ). Additionally, Southern participants reported stronger affiliations with Southern culture than Unmarked participants ( $t(42.99) = 3.76$ ,  $p < .001$ ; Section 2.2.5).

### 2.2. Materials

#### 2.2.1. Experimental stimuli

The auditory stimuli comprised 240 sentences divided into 120 sentence pairs with one context and one target sentence (Appendix A, Tables A.1 and A.2). Because pragmatic context is a critical component of double modal usage, we designed the context sentences to license the potential use of double modals in the target sentences. The context sentences all began with one of 10 names appearing in an even distribution across conditions and described a particular action taken by the subject (Table 1). Target sentences began with a pronoun referring to the subject of the context sentence and described their thoughts or feelings about the context.

The 60 critical sentence pairs appeared in two different conditions during EEG recording: single modal, with *should* or *could*, and attested double modal, with *might should* or *might could*. The Judgment Survey, described in Section 2.2.4, also included a third condition, unattested double modal, with *could should* and *should could*. Ten additional sentence pairs, which were all grammatical and did not include any modals, and four comprehension questions were used for practice in the EEG session (Appendix A, Table A.3).

Half of the sentence pairs (60) were fillers. To ensure that



participants did not associate the presence of double modals with the research question, the filler sentences had both grammatical (10) and ungrammatical (50) items, including the unattested double modals *could might* and *should might*. Following half of the filler sentence pairs (30), participants responded to a visually presented yes-no comprehension question. Comprehension questions were not presented after critical sentence pairs to avoid calling attention to the experimental manipulation and did not include any modals.

For the EEG session, we created two stimulus lists with 120 sentence pairs across four experimental blocks. Each list contained either the single or attested double modal version of each critical target sentence, such that each participant heard a context sentence paired with its target sentence only once. In total, each participant heard 40 grammatically correct target sentences (fillers and single modals), 50 grammatically incorrect target sentences (fillers), and 30 target sentences with unclear grammaticality (double modals). All 120 context sentences were grammatically correct. As a result, the proportion of ungrammatical sentences could range from around a fifth (50) to a third (80) of all experimental materials (240), depending on the listener (see [Molinaro et al., 2011](#), for a discussion of how the proportion of violations can affect the P3b component). Stimulus lists were pseudorandomized to ensure that each block contained a balanced number of critical and filler sentence types and comprehension questions. Within each block, no more than three critical or filler sentence pairs appeared in succession, and no more than two target sentence types appeared consecutively.

In the post-EEG Judgment Survey, participants listened to a subset of the critical target sentences from the counterbalanced stimulus list. For example, if a participant listened to List A during EEG recording, she listened to sentences drawn from List B during the Judgment Survey. This stimulus list was randomized for each participant and comprised two-thirds (20) of the single modal sentences from the counterbalanced list, two-thirds (20) of the attested double modal sentences from the counterbalanced list, and 20 of the unattested double modal versions of the remaining sentences in the counterbalanced list (Appendix A, [Table A.4](#)). Participants listened to and provided judgments only for target sentences.

A fluent female speaker of a double modal SUSE dialect made the recordings. The speaker recorded the sentences at 44.1 kHz in a sound-attenuated booth, and we edited the recordings to include 50 ms of silence at both ends and standardize the volume to 70 dB. A separate group of 33 Pennsylvania State University community members listened to the sentences from the Judgment Survey and completed a survey with demographic questions about the speaker. When asked “Do you think the speaker in the previous section had an accent?” all participants responded “no.” Thus, the recordings allowed for a targeted assessment of syntactic processing that minimized the influence of phonetic and prosodic characteristics.

### 2.2.2. Background questionnaire

A Background Questionnaire collected information on participants' demographic characteristics, handedness, health history, language history, and geographic background (Appendix B, Questionnaire B.1). Participants rated their proficiency levels in their native and any other languages on a 5-point scale from “beginner” to “native-like.” For geographic data, participants provided the city or town; state, territory, or province; and country where they spent the majority of their time during three developmental stages—birth, childhood (ages 3–13), and adolescence (ages 14–18)—and where their two primary caregivers grew up. We created a locality metric for each participant by scoring their residency during each time period on a binary scale, where one represented a Southern state, and summing these values. We also created a caregiver locality metric by summing the binary scores for their primary caregivers. We defined Southern states as those in which double modals have been reported in SUSE dialects in the literature: Alabama, Arkansas, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia.

Participants who reported native languages other than English, proficiency levels greater than the scale mean (3) in any languages other than English, or childhood residency outside the US were not considered native, monolingual US English speakers.<sup>1</sup> Participants who reported proficiency levels of three or lower in any languages other than English were evaluated based on their reported experience with the language (e.g., significant study abroad experience was exclusionary).

### 2.2.3. Dialect survey

Participants responded to a series of questions about their experience with SUSE dialect features (Appendix B, Questionnaire B.2). The instructions emphasized that researchers were interested in spontaneous speech with friends and family to encourage naturalistic responses. The first five items were fillers that asked about phonological or lexical variation. The next 24 items asked participants to indicate the likelihood of saying and hearing sentences with six syntactic constructions, each presented in the context of two short scenarios. Each scenario had a production (saying) and comprehension (hearing) version to assess participants' experience with these constructions. Five of these constructions, including *might could*, were drawn from SUSE dialects. One informal US English construction, *try and*, served as a filler. One of the scenarios for this filler construction always appeared first, but the scenarios were otherwise randomized by participant. Participants responded on a 5-point scale from “extremely unlikely” to “extremely likely.” Responses to the four *might could* items were averaged across production and comprehension to create a composite double modal exposure score, while responses to the other SUSE constructions—*fixin' to*, *liketa*, *a-prefixing*, and double negatives—were averaged to create a composite SUSE exposure score that did not include double modals.

### 2.2.4. Judgment survey

After EEG recording, participants listened to the counterbalanced set of 60 target sentences ([Section 2.2.1](#)). Participants were asked about the intelligibility, acceptability, and familiarity of each sentence (Appendix B, Questionnaire B.3). Intelligibility and acceptability ratings were on a 5-point scale from “very easy to understand” to “very difficult to understand” and “completely acceptable” to “completely unacceptable,” respectively. Familiarity ratings were on a 4-point scale from “I use it a lot” to “I’ve never heard it before today,” which purposely created a continuum from high rates of production, entailing high rates of comprehension, to low rates of comprehension, entailing low rates of production, to capture a different perspective from the Dialect Survey. Participants also provided paraphrases of each sentence, but analyses of these data were not included here. Intelligibility, acceptability, and familiarity ratings were averaged for each modal condition to create composite scores. For the comparison between double modal familiarity and *might could* experience, composite familiarity scores were transformed into 5-point measures.

### 2.2.5. Attitude survey

We combined the 32 language attitude questions from [Grey and Van Hell \(2017\)](#) with six new questions to probe attitudes toward Southern and British accents (Appendix B, Questionnaire B.4). Participants responded to these questions on a 5-point scale from “strongly disagree” to “strongly agree,” and their responses were averaged to create a general language attitude score (32 items) and accent-specific scores (3 items each). Participants were also asked how strongly they identified with “American” culture and five regional cultures—Appalachian, Midwestern, Northeastern, Southern, and West Coast—on a 5-point scale from “not at all” to “completely.” We computed a weighted affiliation score by dividing each cultural affiliation by the sum of the affiliations with all six identities.

<sup>1</sup> One Unmarked participant did not provide location data, so their childhood residency in the US was confirmed verbally by the first author.

## 2.3. Dialect group assignment

We assigned participants to Unmarked and Southern dialect groups based on their double modal exposure, double modal familiarity, and geographic backgrounds. Participants with double modal exposure scores greater than or equal to three (out of five) or double modal familiarity scores greater than or equal to two (out of four) were considered Southern if they also reported having spent childhood or adolescence in a Southern state. All other participants, who had little or no exposure to double modals, were included in the Unmarked group.

## 2.4. Procedure

### 2.4.1. Behavioral data

Participants completed all surveys via Google Forms or Qualtrics. They completed the Background Questionnaire first, then the EEG session, followed by the Dialect, Judgment, and Attitude Surveys. After completing data collection for Unmarked participants, we combined the Background Questionnaire and Dialect Survey into an online Screening Questionnaire and invited only eligible Southern participants into the lab. We performed Welch Two Sample t-tests for between-group comparisons and Paired t-tests for within-group comparisons using the stats R package (R Core Team, 2019).

### 2.4.2. EEG acquisition

Participants were instructed to attend to the sentences and answer the comprehension questions as quickly and accurately as possible. They completed a practice session with 10 sentence pairs and four comprehension questions before beginning the experimental session. During the experimental session, participants listened to 120 sentence pairs and answered 30 comprehension questions while EEG was recorded. The stimuli were presented in four blocks, with a self-paced break between each block.

Participants sat approximately three feet from a computer monitor in a sound-attenuated chamber. The EEG session was programmed with E-Prime 2.0 software, and comprehension question responses were recorded using a serial response box (Psychology Software Tools, Pittsburgh, PA). Auditory stimuli were presented over Etymotic micro-Pro ER-4P headphones at a comfortable volume (Etymotic Research Inc., Elk Grove Village, IL). All text appeared in white, Arial, 100-point font on a black screen. On each trial, participants first saw “Ready?” on the screen. Once they pressed any button, they heard a context sentence. A fixation cross remained on the screen for the total duration of the sentence. They saw “Ready?” on the screen again before pressing any button to hear a target sentence, which was also paired with a fixation cross. Following a quarter of the sentence pairs, participants had an unlimited amount of time to respond to a comprehension question that appeared on the screen before beginning the next trial. The correspondence between a “yes” or “no” response and a right- or left-hand button press was counterbalanced across participants.

Scalp EEG was recorded at a continuous sampling rate of 500 Hz with an elastic cap containing 31 active Ag/AgCl electrodes and additional bipolar recordings (Brain Products ActiCap, Germany), following Fernandez et al. (2019). Electrode locations included five midline (Fz, FCz, Cz, Pz, Oz), 13 left lateral (FP1, F7, F3, FC5, FC1, T7, C3, CP5, CP1, P7, P3, O1, PO9), and 13 right lateral (FP2, F7, F4, FC6, FC2, T8, C4, CP6, CP2, P8, P4, O2, PO10) sites. Bipolar recordings above and below the left eye (VEOG) monitored for vertical eye movements, including blinks, and bipolar recordings at the outer canthus of the left and right eyes (HEOG) monitored for horizontal eye movements. The EEG signal was amplified with a NeuroScan SynAmps RT amplifier (Compumedics Neuroscan USA, Ltd., Charlotte, NC), and impedances were kept below 10 k $\Omega$ . Online, the signal was referenced to a vertex reference (FCz) and filtered with a 0.05–100 Hz bandpass filter.

### 2.4.3. ERP analysis

Offline data processing was completed with the EEGLAB and ERPLAB MATLAB toolboxes (Brunner et al., 2013; Lopez-Calderon & Luck, 2014). EEG data were filtered with a 30 Hz low-pass filter (24 dB/octave roll-off) and re-referenced to the average of the two mastoids. The EEG signal was time-locked to the onset of the second modal in the attested double modal target sentences and the only modal in the single modal target sentences. Epochs were baseline-corrected relative to a 200 ms pre-stimulus interval. We automatically excluded epochs with peak to peak activity in VEOG or HEOG greater than 55, 65, or 75  $\mu$ V, determined by participant to balance data quality and quantity, from analysis. If more than one third of the epochs in either condition (10/30) were excluded at the highest threshold after manual review, the data for that participant was considered to have excessive blink artifact and excluded from all analyses.

We computed mean amplitudes separately at each electrode for each condition. We also computed mean amplitudes for each condition in four regions of interest (ROIs): right frontal (“RF”: F4, F8, FC2, FC6), left frontal (“LF”: F3, F7, FC1, FC5), right posterior (“RP”: CP2, CP6, P4, P8), and left posterior (“LP”: CP1, CP5, P3, P7). We computed ERPs in two time windows based on previous research to capture EAN effects spanning the purported ELAN and LAN windows (200–400 ms) and P600 effects (500–900 ms).

Two sets of repeated-measures analyses of variance (ANOVAs) using the afex R package (Singmann et al., 2019) characterized the ERPs in each time window for each dialect group. Significant interactions were followed by simple effect tests. The first set used specific electrodes along the midline in a Distribution (Fz, Cz, Pz) by Condition (single modal, attested double modal) analysis. The second set used the four ROIs as factors in a Distribution (RF, LF, RP, LP) by Condition (single modal, attested double modal) analysis to investigate the laterality of the neural responses. Greenhouse-Geisser corrections were applied to all analyses with more than one degree of freedom in the numerator. Significant effects at  $p < .05$  are reported in the text. In all figures, asterisks indicate the level of significance: \* $<0.05$ , \*\* $<0.01$ , \*\*\* $<0.001$ .

## 3. Results

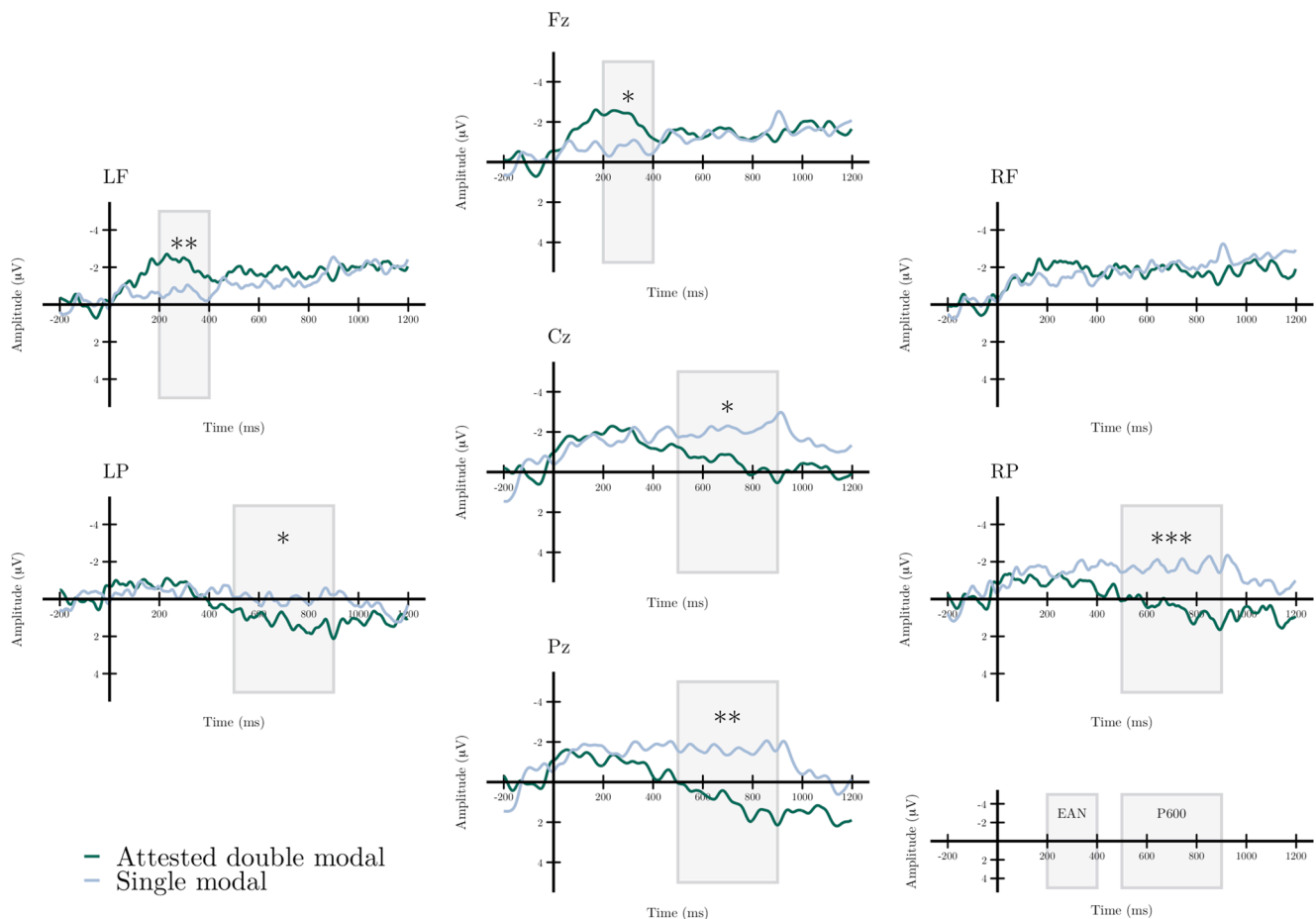
### 3.1. Comprehension questions

Trials with reaction times (RTs) more than one standard deviation below or two standard deviations above the overall mean ( $M = 2956$  ms,  $SD = 1770$  ms) were considered outliers and excluded from the comprehension question analyses (6.79% of responses). Sentence comprehension accuracy did not differ between Unmarked ( $M = 96.62\%$ ,  $SD = 4.62\%$ ) and Southern ( $M = 95.04\%$ ,  $SD = 4.72\%$ ) participants ( $t(42.81) = 1.13$ ,  $p = .264$ ). Likewise, RTs for Unmarked ( $M = 2873$  ms,  $SD = 535$  ms) and Southern ( $M = 2646$  ms,  $SD = 538$  ms) participants did not differ ( $t(42.89) = 1.42$ ,  $p = .163$ ). The high accuracy rates demonstrate that participants attended to the sentences, and the consistency in RTs and accuracy rates also shows that attention to the sentences did not differ across groups.

### 3.2. ERP results

#### 3.2.1. Unmarked participants

**3.2.1.1. 200–400 ms.** The midline ANOVA showed a Distribution  $\times$  Condition interaction ( $F(1.20, 26.49) = 10.55$ ,  $p = .002$ ). Simple effects tests revealed negative-going waveforms for attested double modals, compared to single modals, in Fz ( $F(1, 22) = 7.01$ ,  $p = .015$ ). The ROI ANOVA also yielded a Distribution  $\times$  Condition interaction ( $F(1.84, 40.55) = 7.79$ ,  $p = .002$ ). Simple effects tests in each ROI showed strong negative deflections in LF ( $F(1, 22) = 11.57$ ,  $p = .003$ ) in response to attested double modals relative to single modals.



**Fig. 2.** Unmarked participants: Grand mean waveforms for attested double modals (dark green) compared to single modals (light blue). Waveforms were filtered with a 15 Hz low-pass filter for presentation purposes.

**3.2.1.2. 500–900 ms.** The midline ANOVA showed a Distribution  $\times$  Condition interaction ( $F(1.25, 27.59) = 13.35, p < .001$ ) and main effect of Condition ( $F(1, 22) = 5.04, p = .035$ ). Simple effects tests revealed a difference in Pz ( $F(1, 22) = 12.97, p = .002$ ) and Cz ( $F(1, 22) = 5.55, p = .028$ ), such that attested double modals elicited more positive deflections than single modals. In the ROI ANOVA, there was a Distribution  $\times$  Condition interaction ( $F(2.20, 48.48) = 15.79, p < .001$ ). Probing this interaction, we observed positive-going waveforms in LP ( $F(1, 22) = 5.44, p = .029$ ) and RP ( $F(1, 22) = 18.61, p < .001$ ) for attested double modals compared to single modals.

**3.2.1.3. Summary.** Unmarked participants exhibited biphasic EAN-P600 responses to attested double modal constructions, relative to single modal constructions (see Fig. 2). Early responses between 200 and 400 ms in frontal regions indexed rapid detection of syntactic violations. Later responses across centroparietal channels in the 500–900 ms time window indexed reanalysis and restructuring processes as listeners attempted to integrate the second modal.

### 3.2.2. Southern participants

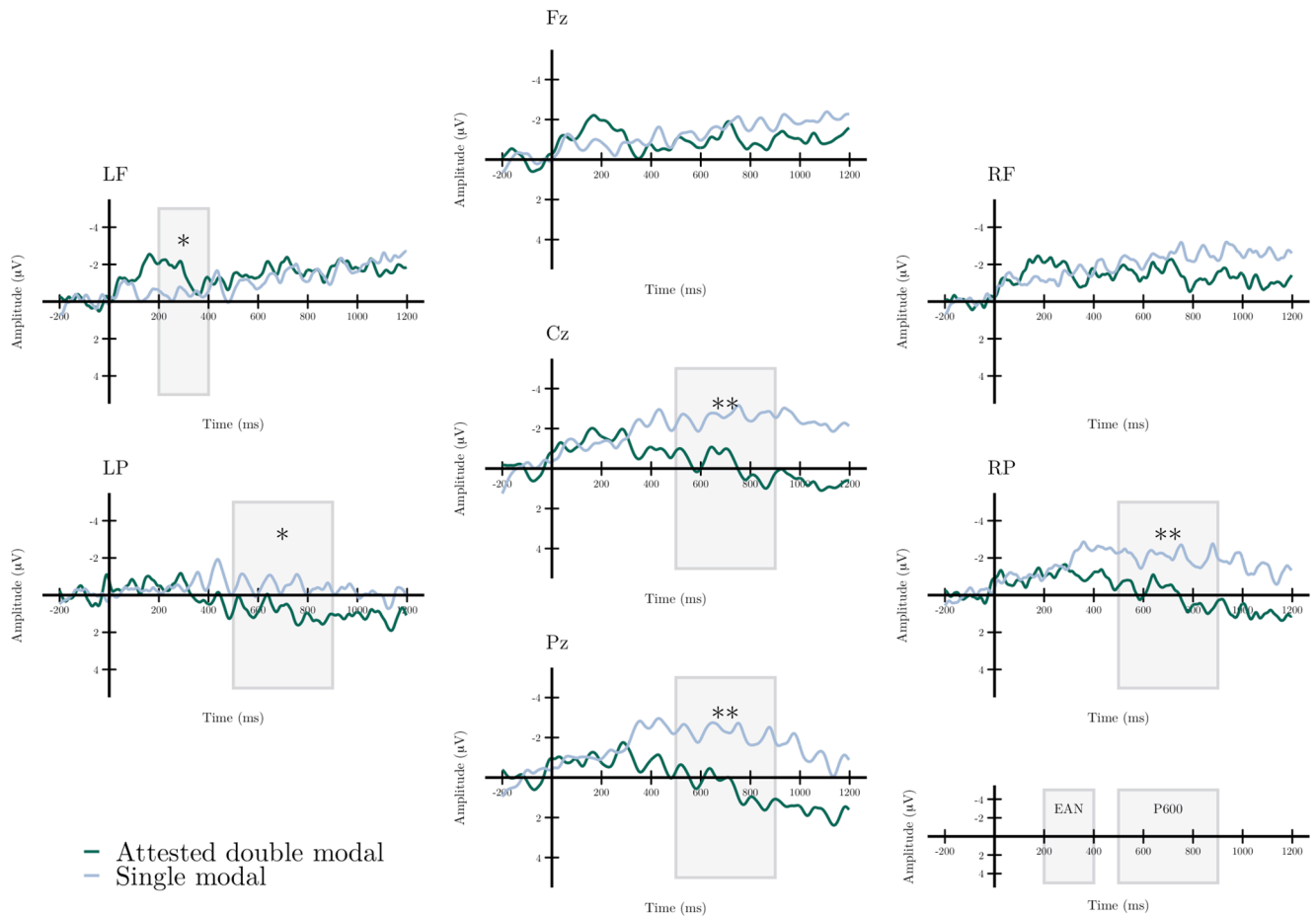
**3.2.2.1. 200–400 ms.** Analyses along the midline were not significant. The ROI ANOVA yielded a Distribution  $\times$  Condition interaction ( $F(1.83, 38.33) = 5.23, p = .012$ ). Comparing attested double modals to standard single modals, simple effects tests showed negative deflections in LF ( $F(1, 21) = 5.21, p = .033$ ).

**3.2.2.2. 500–900 ms.** Along the midline, the Distribution  $\times$  Condition interaction ( $F(1.13, 23.67) = 6.56, p = .015$ ) and main effect of Condition ( $F(1, 21) = 8.64, p = .008$ ) were significant. In Pz ( $F(1, 21) = 9.46, p = .006$ ) and Cz ( $F(1, 21) = 13.34, p = .001$ ), attested double modals elicited a positive effect compared to single modals. The ROI ANOVA revealed a Distribution  $\times$  Condition interaction ( $F(1.60, 33.69) = 8.91, p = .002$ ), with positive deflections in LP ( $F(1, 21) = 5.58, p = .028$ ) and RP ( $F(1, 21) = 10.19, p = .004$ ) for attested double modals relative to single modals.

**3.2.2.3. Summary.** The ERP responses of Southern participants reflected significant processing differences between double and single modal constructions. Similar to the Unmarked group, Southern participants displayed an EAN followed by a P600 in response to attested double modal constructions, relative to single modal constructions (see Fig. 3).

### 3.2.3. Between-group analysis

Both Unmarked and Southern participants showed a biphasic EAN-P600 response to attested double modal constructions, relative to single modal constructions. To characterize the extent of the similarity between Unmarked and Southern participants, we performed a set of repeated-measures ANOVAs with dialect group as a between-subjects factor. The three-way Group  $\times$  Distribution  $\times$  Condition interaction was not significant in the 200–400 ms time window along the midline ( $F(1.15, 49.50) = 0.58, p = .471$ ) or laterally ( $F(1.89, 81.27) = 0.10, p = .896$ ). This interaction was also not significant in the 500–900 ms time



**Fig. 3.** Southern participants: Grand mean waveforms for attested double modals (dark green) compared to single modals (light blue). Waveforms were filtered with a 15 Hz low-pass filter for presentation purposes.

window along the midline ( $F(1.19, 51.17) = 0.40, p = .567$ ) or laterally ( $F(1.92, 82.45) = 0.57, p = .558$ ).

To test the strength of the evidence against including Group as a factor in our analyses, we computed Bayes factors following the approach of Rouder et al. (2017). We ran Bayes ANOVAs corresponding to each of the four conventional ANOVAs, adding Participant as a random factor, using the BayesFactor R package (Morey & Rouder, 2018). The model with the Distribution  $\times$  Condition interaction and its corresponding main effects (DC model) was the best-performing model in the 200–400 ms time window in lateral ROIs ( $BF_{10} = 1.67 \times 10^6$ ) and in the 500–900 ms time window, both along the midline ( $BF_{10} = 1.64 \times 10^6$ ) and laterally ( $BF_{10} = 1.93 \times 10^{16}$ ). Thus, the model we used for our conventional within-group ANOVAs performed the strongest against the null model. None of the models along the midline in the 200–400 ms time window performed better than the null model, including the DC model ( $BF_{10} = 0.13$ ).

We also tested the best-performing (DC) model against a model including Group as a factor. We compared the Bayes factors for the DC model and the model with the Group  $\times$  Distribution  $\times$  Condition interaction and its corresponding two-way interactions and main effects (GDC model) within each Bayes ANOVA. The DC model outperformed the GDC model in all cases: 200–400 ms, central ( $BF_{10} = 297.12$ ) and lateral ( $BF_{10} = 1720.41$ ); 500–900 ms, central ( $BF_{10} = 771.65$ ) and lateral ( $BF_{10} = 5457.34$ ). Overall, these results lend strong support to

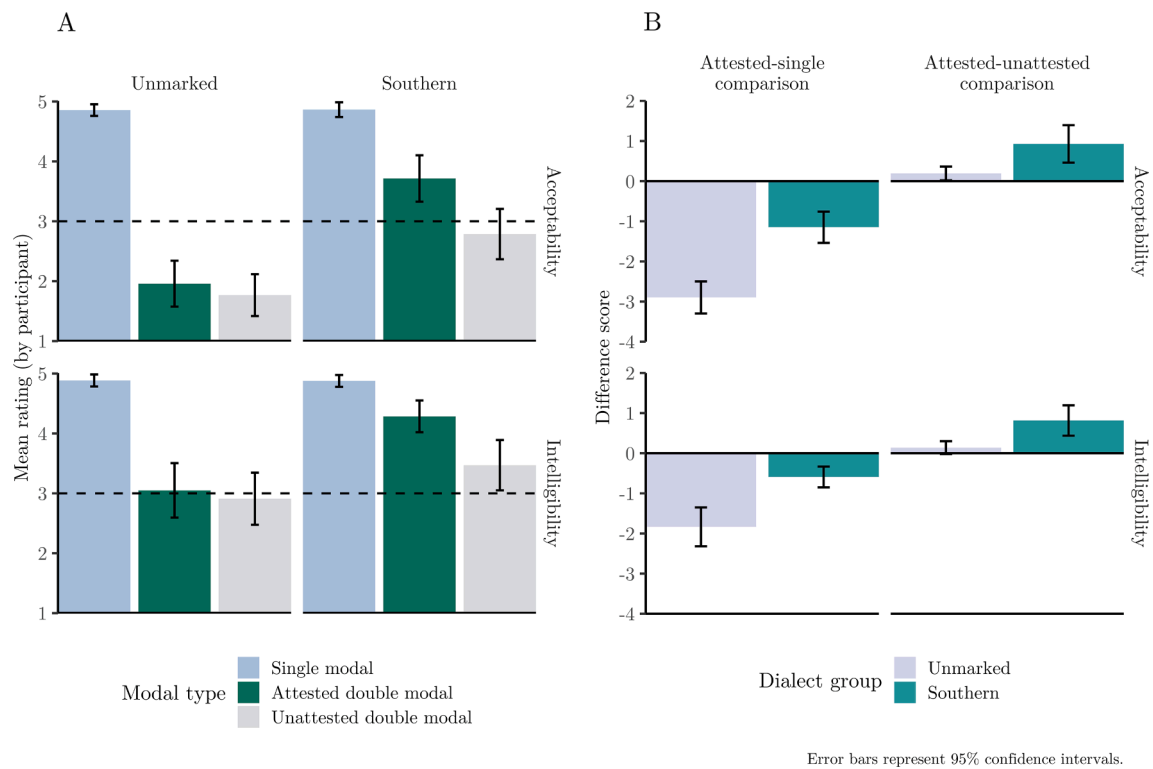
the invariance of Group (see Wagenmakers et al., 2018).

### 3.3. Linguistic judgments

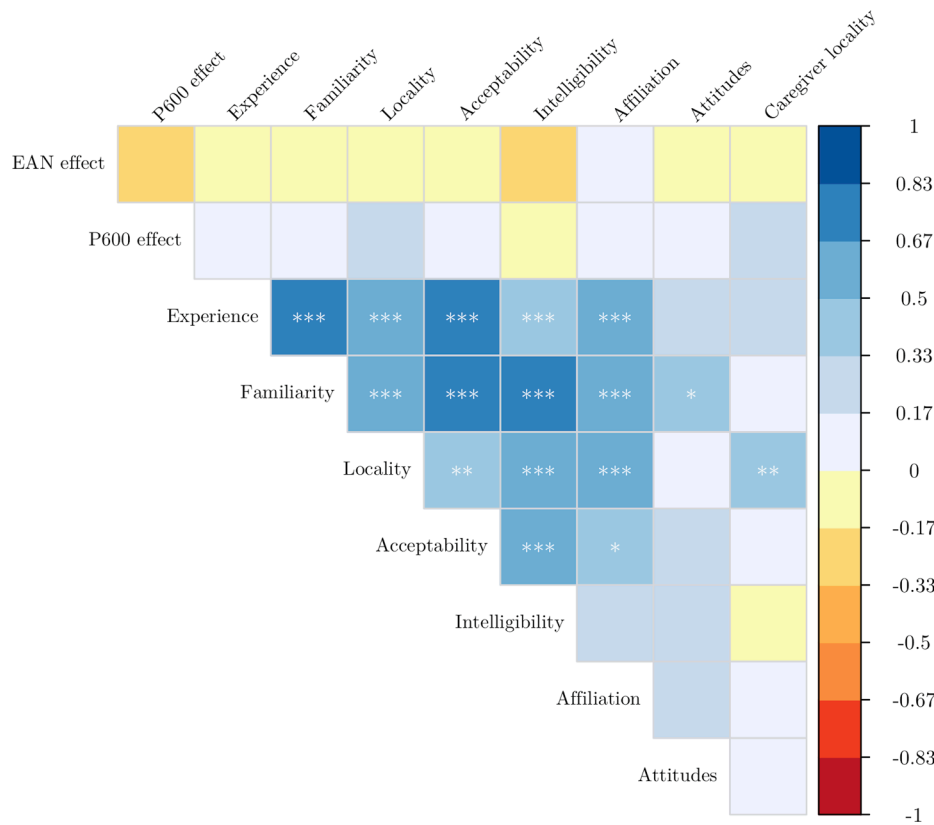
We analyzed participants' judgments of sentences with attested double modals, unattested double modals, and single modals. Fig. 4: Panel A depicts the mean ratings for each dialect group. Southern participants found attested double modals to be more acceptable ( $t(42.96) = 6.69, p < .001$ ) and intelligible ( $t(35.17) = 4.87, p < .001$ ) than Unmarked participants. Fig. 4: Panel B transforms these data into difference scores relative to attested double modals. Difference scores closer to zero indicate that the ratings were more similar.

Overall, Southern participants were more sensitive to the different functions of the three modal constructions than Unmarked participants. Comparing single and attested double modal constructions, Southern group ratings were closer to zero than Unmarked group ratings in both acceptability ( $t(43.00) = 6.51, p < .001$ ) and intelligibility ( $t(33.43) = 4.70, p < .001$ ). Conversely, the difference scores between attested and unattested double modal constructions were closer to zero in the Unmarked group than in the Southern group for acceptability ( $t(26.62) = 3.08, p = .005$ ) and intelligibility ( $t(28.41) = 3.42, p = .002$ ). These results reflect Southern participants' experience with the semantic, syntactic, and pragmatic features of attested double modal constructions relative to other modal combinations.





**Fig. 4.** Linguistic judgments. Panel A: Mean acceptability and intelligibility ratings. Panel B: Difference scores comparing mean ratings for attested double modals to mean ratings for single and unattested double modals.



**Fig. 5.** Correlation matrix with neural and behavioral measures. Colors represent the direction (hue) and strength (saturation) of the correlation coefficients. Asterisks represent the significance of the p value associated with each coefficient after applying a Bonferroni correction for multiple comparisons: \* < 0.05, \*\* < 0.01, \*\*\* < 0.001.

### 3.4. Language attitudes

We did not observe between-group differences in general language ( $t(37.46) = 0.95, p = .347$ ) or Southern accent-specific ( $t(42.70) = 0.45, p = .654$ ) attitudes. British accent-specific ratings were higher among Unmarked than Southern participants ( $t(38.55) = 2.07, p = .045$ ). Both Southern ( $t(41.10) = 2.24, p = .031$ ) and Unmarked ( $t(38.09) = 4.02, p < .001$ ) participants viewed Southern accents more negatively than British.

### 3.5. Correlation results

We computed pairwise correlations, using the stats R package (R Core Team, 2019), between two ERP amplitude measures—EAN effect and P600 effect—and a set of behavioral measures (Fig. 5): judgments of attested double modals (Acceptability, Intelligibility, and Familiarity), experience with *might could* (Experience), weighted affiliation with Southern culture (Affiliation), non-standard language attitudes (Attitudes), and Southern locality scores for participants (Locality) and their caregivers (Caregiver locality). To create each amplitude measure, we subtracted mean responses to single modals from mean responses to attested double modals and calculated the absolute value. For the EAN effect, we used the LF ROI in the 200–400 ms time window. For the P600 effect, we used a centroparietal ROI (Cz, CP1, CP2, Pz, P3, P4) in the 500–900 ms time window. Correlations between the EAN and P600 effects and all behavioral measures were not significant. Among the behavioral measures, familiarity with and exposure to double modals were strongly positively correlated ( $r(43) = 0.82, p < .001$ ), demonstrating the consistency between these experience measures.

## 4. Discussion

This study investigated the relation between familiarity and online comprehension of dialectal variation in syntax. Challenging the usage-based hypothesis, both Unmarked and Southern dialect groups exhibited biphasic EAN-P600 responses to the regionally-marked double modal constructions *might could* and *might should*, compared to the unmarked single modal constructions *could* and *should*. This neural pattern reflects early syntactic violation detection and sentence-level reanalysis in response to the second modal in double modal constructions. Encountering the auxiliary *might*, listeners began to construct a purely epistemic interpretation and expected the main verb to follow. To incorporate the second modal, they needed to restructure the sentence. The lack of group-level differences aligns with sociophonetic research demonstrating a standard-language advantage in recognition and encoding, regardless of a listener's own dialect.

We observed a different pattern in the behavioral data. Among Unmarked participants, low offline acceptability and intelligibility ratings of attested double modals were consistent with difficulty in online processing. By contrast, Southern participants displayed a dissociation between their neural and behavioral responses. Southern listeners not only rated attested double modals significantly higher in acceptability and intelligibility than Unmarked listeners, but also were more sensitive to the distinction between attested and unattested constructions than Unmarked listeners. These results align with the usage-based hypothesis. We first discuss our findings in relation to neurocognitive models and previous research before framing the relation between our neural and behavioral data.

On the surface, double modals appear to contradict the limitation of one modal per tense phrase. In this sense, the second modal in a double modal construction produces a subcategorization violation, in that listeners expect a nonfinite verb, rather than another modal verb, to follow *might*. Subcategorization violations have been found to elicit either N400 or LAN effects, depending on the language, due to the specifics of theta role assignment (Bornkessel & Schlesewsky, 2006); however, this analysis is based on verb-argument mismatches in thematic relations (e.

g., Frisch et al., 2004), which does not strictly apply to double modals. Word category errors, which classically elicit ELAN effects (Friederici et al., 2002), also fail to apply in the case of double modals, since a verb is both expected and encountered. The Unification Model generally predicts an anterior negativity, as opposed to an ELAN or LAN per se, in response to word category and morphosyntactic violations (Hagoort, 2003). While the predicted component aligns with our results, the violations do not. Overall, the distinctive EAN response to double modals reflects their unique status among previously investigated syntactic violations.

Across all three neurocognitive models, P600 effects are expected in response to several types of syntactic violations and dispreferred constructions. Thus, the late positive-going waveform we observed aligns with previous ERP research. We can also integrate the modal phrase head account of double modals (Hasty, 2012), in which the first modal takes a tense phrase, containing the second modal and a verb phrase with the main (nonfinite) verb, as its complement. Single modal constructions do not have this modal phrase above the tense phrase. During incremental processing, the listener initially analyzes the first modal *might* as the head of a tense phrase and expects a verb phrase to follow. Upon encountering the second modal *could* or *should*, the listener needs to reanalyze the first modal as the head of a modal phrase instead. The extent to which listeners approach double modals as outright violations rather than as dispreferred structures remains an open question. It is possible that Unmarked and Southern listeners, while exhibiting the same ERP patterns during online sentence processing, still process these constructions differently, as the offline behavioral judgment data show clear differences between the two groups. We will elaborate on possible explanations later in the discussion, and future research may seek to unravel this issue further.

Our ERP results align in part with those of Garcia (2017), which investigated variation in the present tense verb marker for third person singular subjects. Monodialectal MAE listeners exhibited a P600 effect in response to the marked *-s-drop* construction, similar to the EAN-P600 effect in our Unmarked group, but bidialectal AAVE-MAE listeners did not. Another recent study on AAVE inverted this experimental paradigm with a single participant group and bidialectal stimuli (Weissler & Brennan, 2020). The authors were interested in the auxiliary *be*, which AAVE dialects can omit in present progressive verb constructions. Participants with varied dialect backgrounds listened to sentences produced with unmarked or AAVE phonetic features across three syntactic conditions: unmarked *is* (e.g., “he is/he’s working”), attested *is-drop* (e.g., “he working”), and unattested *will* (e.g., “he will/he’ll working”). Only unattested *will* constructions elicited P600 effects, indicating that listeners did not form dialect-specific expectations about the *is-drop* construction. While Weissler and Brennan (2020) did not control for exposure to AAVE, Garcia (2017) accounted for dialect experience by design. Thus, dialect familiarity plays a critical role in attuning listeners’ language systems to syntactic variation.

These two studies diverge from the current investigation in two important ways. The first is the type of dialect and the properties that follow from this categorization. SUSE is geographically bounded as a regional dialect in a way that AAVE is not. Our Southern participants may have been sensitive to the incongruity between attested double modals and the geographic context of Central Pennsylvania. The AAVE-MAE participants in Garcia (2017) did not experience this conflict between variety and region. The second difference lies in the nature of the syntactic variants under investigation. All three studies chose syntactic constructions related to verb use; however, Garcia (2017) investigated a morphosyntactic variant affecting subject-verb agreement, while the present study and Weissler and Brennan (2020) chose syntactic variants with auxiliary verbs. Interestingly, both Garcia (2017) and Weissler and Brennan (2020), for the contracted items, manipulated word-final /s/. By contrast, our conditions differed by an entire word, with the critical condition defined by its inclusion rather than its omission. Syntactic reanalysis may have been differentially affected by this manipulation.

Possibly, the additional acoustic, semantic, and syntactic information highlighted the non-standard status of double modals, such that Southern participants' ERPs exhibited the standard-language advantage.

We derived the usage-based hypothesis from linguistic theories centering type and token frequency in language representation (e.g., Bybee, 2006; Goldberg, 2006; MacDonald, 2013). We used the likelihoods of hearing and producing *might could* and familiarity with double modals generally, in conjunction with geographic data, to estimate the frequency of double modals in participants' individual language environments. Our dialect measures were effective in categorizing our participants, such that the Southern and Unmarked groups were significantly different on all SUSE and Southern cultural features, and in accounting for the offline judgment data. However, dialect experience did not affect online processing. The group-level and between-group ANOVAs, using binary Southern-Unmarked categories, showed consistent EAN-P600 effects in response to double modals, relative to single modals, in both speaker groups. Similarly, the correlation analyses, capturing the continuous and multifaceted nature of language experience, did not reveal any relations between individual response amplitudes and dialect measures.

Several factors may have contributed to the differential pattern of results in the offline and online data. First, our dialect measures may more readily explain the offline data due to their similarity in measurement via Likert scale responses to survey questions. Second, online data may be more sensitive to the immediate linguistic environment than offline data. Testing Southern participants in Central Pennsylvania outside the SUSE dialect region potentially increased processing difficulty for SUSE syntactic constructions while leaving acceptability and intelligibility judgments unaffected. Future research in Southern language contexts should illuminate the effects of testing location—inside or outside the linguistic community—on online processing of dialectal variation.

To what extent can frequency differences between attested double and single modal constructions affect our results? In an analysis of modern written US English corpora—comprising press, general prose, academic, and fiction texts—the modals *would*, *will*, *can*, and *could* appeared at a rate of ~10 thousand occurrences per million words (opmw), accounting for ~80% of all “core” modal tokens (Leech, 2013). *Could* in particular had ~1.5 thousand opmw, while *should* had ~75 opmw. By comparison, in a US Twitter corpus, the frequency of *might could* ranged from 0 to ~1.16 opmw, depending on the location (Grieve, 2015). A corpus of recorded medical consultations showed a similar rate, with a group of 10 double modal constructions having ~1.19 opmw overall (Hasty et al., 2012). If we assume that Southern participants encounter the double modals *might could* and *might should* at ~1.19 opmw and the single modals *could* and *should* at ~1.6 thousand opmw, this stark frequency difference may explain the EAN-P600 effect in this group. Moreover, if we compare ~1.19 opmw for Southern participants to ~0 opmw for Unmarked participants, this small frequency difference may explain the absence of group-level differences in the ERPs. Our results suggest that there may be a frequency threshold for usage-based effects to emerge in online processing as measured by ERPs.

By contrast, we derived the standard-language advantage hypothesis from the dual-route model, in which lexical recognition and encoding rely on combined linguistic and social representations (Sumner et al., 2014). The model posits that social salience improves recognition and encoding, such that infrequent, prestigious pronunciations have robust representations equaling frequent pronunciations. In this sense, the dual-route model builds on usage-based theories. The standard-language advantage readily explains the ERP results in the present study: double modals do not enjoy any prestige benefits that would outweigh their infrequent occurrence, and single modals, while being unmarked, are frequently occurring across US English varieties. This advantage for standard forms also holds in the behavioral results, with single modals being more acceptable and intelligible for both groups than attested double modals. However, the dual-route theory does not motivate a

strong distinction between the salience advantage for prestigious variants and the salience disadvantage (or lack of advantage) for regionally-marked ones.

Double modals, particularly *might could*, index Southern social identity (Bernstein, 2003). They are used to navigate situations that involve a threat to “face” (Mishoe & Montgomery, 1994), including patient-doctor interactions (Hasty et al., 2012; Hasty, 2015). As a result, the high level of meta-linguistic awareness attached to double modals defines them as socially salient linguistic features for Southern listeners (Trudgill, 1986). Double modals are also salient for Unmarked listeners: they are novel features that violate their expectations about modal usage given their previous language experience (Jaeger & Weatherholtz, 2016). How does the salience of double modals differ from that of prestigious variants? It is possible that standardness, rather than prestige or social salience per se, modulates online comprehension. If so, what seems to be a contradiction in our online and offline measures may actually be perceptions of non-standard language operating over different timescales. Indeed, behavioral research investigating the regional *needs* + past participle construction (e.g., “the car *needs washed*”) has demonstrated a tension between positive adaptation effects, such that unfamiliar readers become faster with exposure and align their performance with familiar readers, and negative standardness effects, with slower reading times significantly correlated with perceptions of abnormality (e.g., Fraundorf & Jaeger, 2016; Kaschak, 2006).

In conclusion, the present study demonstrates the complexity and constraints of usage-based theories of language processing. We found that familiarity with dialect-specific syntactic variants did not differentially impact online comprehension. Both Unmarked and Southern listeners exhibited biphasic EAN-P600 responses, supporting the standard-language advantage. However, the two groups displayed distinct behavioral patterns for double vs. single modals. Usage-based theories did not capture the dissociation we observed between experience and online processing, but the dual-route model also did not fully explain the disadvantage we found for socially salient but non-prestigious forms. The present study demonstrates the need for an enhanced usage-based account of language processing that incorporates notions of standard language ideology.

#### CRedit authorship contribution statement

**Holly A. Zaharchuk:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing, Visualization.  
**Adrianna Shevlin:** Conceptualization, Methodology, Resources.  
**Janet G. van Hell:** Conceptualization, Methodology, Validation, Writing - review & editing, Supervision, Project administration, Funding acquisition.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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#### Appendix A. Experimental stimuli

See Tables A1–A4.

**Table A1**  
EEG session: Critical stimulus type (counterbalanced across two stimulus lists).

Sentence number	Context sentence	Attested double modal target sentence	Standard single modal target sentence
1	Adam feels like the sink is getting too full.	He thinks he might should wash the dishes soon.	He thinks he should wash the dishes soon.
2	Adam hasn't been feeling very energetic lately.	He thinks he might should drink more water.	He thinks he should drink more water.
3	Adam knows I wish we went on more dates.	He said we might could go to dinner this weekend.	He said we could go to dinner this weekend.
4	Adam noticed your shirtsleeves are too long.	He said he might could shorten them for you.	He said he could shorten them for you.
5	Adam thinks the mall will be busy in the afternoon.	He said you might could go early to beat the crowd.	He said you could go early to beat the crowd.
6	Adam's cat keeps attacking his yarn.	He thinks he might should put it out of her reach.	He thinks he should put it out of her reach.
7	Anna believes the parking meter needs more money.	She thinks we might should check before we leave.	She thinks we should check before we leave.
8	Anna did poorly on her exam.	She said she might could have done better.	She said she could have done better.
9	Anna is starting to fall behind on her bills.	She thinks she might should ask her mom for help.	She thinks she should ask her mom for help.
10	Anna noticed you're unhappy with your job.	She said you might could do something to fix it.	She said you could do something to fix it.
11	Anna thinks you're really good at basketball.	She said you might could get a scholarship for it.	She said you could get a scholarship for it.
12	Anna's students have been very well-behaved this year.	She thinks she might should do something to reward them.	She thinks she should do something to reward them.
13	Ashley has been driving for a while now.	She thinks she might should find a hotel to stay at.	She thinks she should find a hotel to stay at.
14	Ashley knows her dad wants a new pair of slippers.	She said she might could buy him a pair for Christmas.	She said she could buy him a pair for Christmas.
15	Ashley noticed your dad has seemed lonely.	She thinks you might should go visit him this week.	She thinks you should go visit him this week.
16	Ashley said she misses having fresh tomatoes.	She said she might could plant some in the spring.	She said she could plant some in the spring.
17	Ashley volunteered to bring dessert to Thanksgiving dinner.	She said she might could bring the cake her dad likes.	She said she could bring the cake her mom likes.
18	Ashley's boyfriend hurt her feelings last night.	She thinks she might should talk to him about it.	She thinks she should talk to him about it.
19	Ethan needs to save up money for his spring trip.	He said he might could pick up more shifts at work.	He said he could pick up more shifts at work.
20	Ethan really likes that computer.	He thinks we might should ask how much it costs.	He thinks we should ask how much it costs.
21	Ethan saw the casserole recipe we saved.	He said we might could make it for dinner tomorrow night.	He said we could make it for dinner tomorrow night.
22	Ethan thinks you're a skilled guitar player.	He said you might could teach classes for extra money.	He said you could teach classes for extra money.
23	Ethan's flowers have been looking droopy lately.	He thinks he might should water them more often.	He thinks he should water them more often.
24	Ethan's kids have been quiet for a while.	He thinks he might should check on them.	He thinks he should check on them.
25	Jacob and his wife are having a baby soon.	He thinks they might should finish decorating the nursery.	He thinks they should finish decorating the nursery.
26	Jacob believes the decorations for the reception will be expensive.	He said we might could use his employee discount at the craft store.	He said we could use his employee discount at the craft store.
27	Jacob has a lot of leaves to rake up.	He said he might could hire someone to do it for him.	He said he could hire someone to do it for him.
28	Jacob has been losing some weight.	He said he might could wear a smaller size of pants now.	He said he could wear a smaller size of pants now.
29	Jacob's computer broke last week.	He thinks he might should send it out to be fixed soon.	He thinks he should send it to be fixed soon.
30	Jacob's daughter is sleeping too late.	He thinks he might should wake her up.	He thinks he should wake her up.
31	Kaitlyn has been sick a lot this year.	She thinks she might should start taking vitamins.	She thinks she should start taking vitamins.
32	Kaitlyn has very little time for her holiday visit home.	She said she might could visit again in the spring.	She said she could visit again in the spring.
33	Kaitlyn is having a hard time with her essay.	She thinks she might should ask the professor for an extension.	She thinks she should ask the professor for an extension.
34	Kaitlyn knows we want to go to the park.	She said we might could go Tuesday.	She said we could go Tuesday.
35	Kaitlyn noticed that boy is struggling with his books.	She thinks she might should help him.	She thinks she should help him.
36	Kaitlyn thinks the soup is missing something.	She said it might could use more pepper.	She said it could use more pepper.
37	Maggie has an extra table.	She said she might could give it to her brother.	She said she could give it to her brother.
38	Maggie said the firework show at the lake is starting soon.	She thinks we might should leave now so we can be sure to see it.	She thinks we should leave now so we can be sure to see it.
39	Maggie thinks the weather is supposed to be nice on your birthday.	She said we might could go to the beach if it is.	She said we could go to the beach if it is.
40	Maggie wants to start exercising again.	She thinks she might should get a gym membership.	She thinks she should get a gym membership.
41	Maggie's grandparents have a pond in their backyard.	She said we might could go fishing over there sometime.	She said we could go fishing over there sometime.
42	Maggie's husband has been working nonstop all weekend.	She thinks he might should take a break.	She thinks he should take a break.
43	Michael forgot to bring paper to class.	He said he might could borrow some from his friend.	He said he could borrow some from his friend.
44	Michael found a few mistakes in our group paper.	He thinks we might should correct them now before we forget.	He thinks we should correct them now before we forget.
45	Michael noticed the temperature has been dropping.	He thinks he might should start wearing his winter coat.	He thinks he should start wearing his winter coat.
46	Michael really likes your art.	He said you might could sell it at the next fair in town.	He said you could sell it at the next fair in town.
47	Michael said it's raining pretty hard.	He thinks we might should wait to leave until it stops.	He thinks we should wait to leave until it stops.
48	Michael sees you're making good progress on your project.	He said you might could have it done before the end of the month.	He said you could have it done before the end of the month.
49	Robert found out there's a meteor shower tonight.	He said we might could see it if we go out of the city.	He said we could see it if we go out of the city.
50	Robert has been sick for a while now.	He thinks he might should go see a doctor.	He thinks he should go see a doctor.
51	Robert has had bad luck with his plants.	He thinks he might should ask his grandfather for advice.	He thinks he should ask his grandfather for advice.

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Table A1 (continued)

Sentence number	Context sentence	Attested double modal target sentence	Standard single modal target sentence
52	Robert needs something to do in the evenings.	He said he might could start taking a yoga class.	He said he could start taking a yoga class.
53	Robert's daughter's hair is getting long and messy.	He thinks she might should get it trimmed before picture day.	He thinks she should get it trimmed before picture day.
54	Robert's niece needs new bath towels.	He said she might could get her some for her birthday.	He said he could get her some for her birthday.
55	Tammy has a lot of homework but prefers to do something else right now.	She said she might could finish the homework tomorrow.	She said she could finish the homework tomorrow.
56	Tammy has been having to talk to you a lot louder lately.	She thinks you might should get your hearing checked.	She thinks you should get your hearing checked.
57	Tammy knows you like taking care of animals.	She said you might could volunteer at a local animal shelter.	She said you could volunteer at a local animal shelter.
58	Tammy noticed the faucet has been dripping for a while.	She thinks you might should call the plumber.	She thinks you should call the plumber.
59	Tammy only has two months left until her trip.	She thinks she might should buy her tickets soon.	She thinks she should buy her tickets soon.
60	Tammy thinks these exercises will be hard on her knee.	She said she might could modify them so they are easier.	She said she could modify them so they are easier.

Table A2

EEG session: Filler stimulus type (same across both stimulus lists).

Sentence number	Condition	Context sentence	Target sentence	Comprehension question	Correct response
61	Double determiner	Adam enjoys organizing things.	He wants to implement a an new filing system at his job.	Does Adam want to implement a new filing system?	yes
62	Double determiner	Anna always forgets when she makes hot tea.	She said the that tea is usually too cold when she remembers it.	Does Anna always forget her coffee?	no
63	Double determiner	Ashley has been trying to buy a very popular new lipstick.	She said the that makeup store is always out of stock.	Does Ashley think that the makeup store will have the blush?	no
64	Double determiner	Ethan is serious about studying.	He goes to the that library four nights a week.	Does Ethan go to the library four nights a week?	yes
65	Double determiner	Jacob wants to plan something special for his wife's birthday.	He wants to take her to her our favorite beach.		
66	Double determiner	Kaitlyn waits for the bus every morning to go to work.	She said the that bus is usually late.		
67	Double determiner	Maggie's brother loves pickles.	She said he is always eating them those out of the jar.		
68	Double determiner	Michael drives a truck that uses a lot of gas.	He is planning to swap it that for a more fuel-efficient car soon.		
69	Double determiner	Robert likes to paint in his spare time.	He is considering buying a an bigger variety of paintbrushes.		
70	Double determiner	Tammy's bosses post a scheduled on the bulletin board each week.	She said the that schedule is unreliable.	Does Tammy think that the schedule is unreliable?	yes
71	Negation	Adam has been in a lot of pain recently.	He doesn't want to see a doctor.	Does Adam want to see a doctor?	no
72	Negation	Anna has a long commute to work.	She said she doesn't like it.		
73	Negation	Ashley's baby has been getting up more often during the night.	She said she hasn't slept much in the last few days.		
74	Negation	Ethan misses riding roller coasters.	He hasn't been on one in seven years.	Does Ethan often ride roller coasters?	no
75	Negation	Jacob has started working the morning shift.	He can't handle waking up early.	Does Jacob have trouble waking up early?	yes
76	Negation	Kaitlyn's cousin said he saw her riding her bike yesterday evening.	She said she didn't ride her bike yesterday.	Does Kaitlyn deny that she rode her bike yesterday?	yes
77	Negation	Maggie has to wait until pay day to buy her concert tickets.	She hopes the venue doesn't run out.		
78	Negation	Michael is a picky eater.	He doesn't like eating vegetables.	Does Michael dislike eating vegetables?	yes
79	Negation	Robert's dad bought him a motorcycle for his birthday.	He doesn't know how to ride it.		
80	Negation	Tammy used to play piano when she was younger.	She said she probably can't play anymore.		
81	Relative clause	Adam has a new pet snake.	He worries that everyone who visits his house will be afraid of it.	Does Adam worry that everyone will be afraid of his pet turtle?	no
82	Relative clause	Anna organized this year's Christmas party at her company.	She thinks everyone that came had a good day.		
83	Relative clause	Ashley is annoyed with the trash in her yard from the block party.	She thinks everyone who participates needs to be more considerate of the neighborhood.		
84	Relative clause	Ethan is considering going to a new tattoo shop downtown.	He said everybody that has been there really likes it.		
85	Relative clause	Jacob is organizing a banquet.	He needs everyone who is attending to sign up in advance.		

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Table A2 (continued)

Sentence number	Condition	Context sentence	Target sentence	Comprehension question	Correct response
86	Relative clause	Kaitlyn was worried the school would cancel her favorite class.	She said everyone that registered was planning to drop it.	Does Kaitlyn think that everyone will drop the class?	yes
87	Relative clause	Maggie is worried about the eclipse.	She said everyone who looks at it needs special glasses.	Does Maggie think everyone needs special glasses for the eclipse?	yes
88	Relative clause	Michael enjoys painting with oil paints.	He thinks everyone that likes painting should try them sometime.	Does Michael think that people should try watercolor painting?	no
89	Relative clause	Robert likes his job.	He said everyone that he works with is nice.		
90	Relative clause	Tammy is trying to plan ahead for her wedding meal.	She thinks everyone that is coming will eat chicken.	Does Tammy think that everyone will eat fish?	no
91	Word order	Adam has to follow a new diet for his health.	He pasta misses eating.		
92	Word order	Anna is always changing her dinner routine.	She said she a new recipe wants to make this week.	Does Anna want to make a new recipe this week?	yes
93	Word order	Ashley goes to the gym every day.	She said she the weight machine wants to try.	Does Ashley want to try the weight machine?	yes
94	Word order	Ethan really enjoys exercising.	He the stairs uses more than the elevator.	Does Ethan use the elevator more than he uses the stairs?	no
95	Word order	Jacob loves all types of food.	He Chinese food likes the best.	Does Jacob like Italian food the best?	no
96	Word order	Kaitlyn's husband asked if there was any cake left from the party.	She said she the rest ate yesterday.		
97	Word order	Maggie is training for the Olympics.	She a strict diet is following.		
98	Word order	Michael hosts a radio show most nights.	He more listeners wishes he had.		
99	Word order	Robert wants a small pet to have in his apartment.	He a hedgehog wants to buy.	Does Robert want to buy a hamster?	no
100	Word order	Tammy bakes cookies every weekend.	She said she almond flour uses because she has an allergy.		
101	Reversed double modal	Adam has never cooked a steak before.	He said he could might search the internet to learn.		
102	Reversed double modal	Adam's car is really dirty from winter.	He thinks he should might clean it now since the weather is getting nicer.		
103	Reversed double modal	Anna finished filling out her applications.	She thinks she should might double-check the requirements before she submits them.		
104	Reversed double modal	Anna has to pick up her puppy from daycare at an inconvenient time.	She said she could might leave work early to get him.	Does Anna want to leave work early?	yes
105	Reversed double modal	Ashley doesn't have time to get lunch with us today.	She said she could might do it tomorrow.		
106	Reversed double modal	Ashley got a lot of nice presents for her birthday this year.	She thinks she should might write thank-you cards.	Does Ashley think about writing thank-you cards?	yes
107	Reversed double modal	Ethan hasn't played this game in a long time.	He thinks he should might double-check the rules before he starts.		
108	Reversed double modal	Ethan needs a few more ingredients for his cookies tonight.	He said he could might make it to the store before it closes.		
109	Reversed double modal	Jacob wants to learn to cook better.	He said he could might take a cooking class.	Does Jacob want to take a dancing class?	no
110	Reversed double modal	Jacob's house lease is going to be up soon.	He thinks he should might start looking for somewhere else to live.		
111	Reversed double modal	Kaitlyn and her husband like a house they are looking at.	She said they could might afford to buy it.	Does Kaitlyn worry that they won't be able to afford the house?	no
112	Reversed double modal	Kaitlyn is going to be a senior soon.	She thinks she should mght start working harder in school.		
113	Reversed double modal	Maggie needs vegetables for a stew she is making but doesn't have any money.	She said she could might pick some from her stepdad's garden.	Does Maggie want to get some vegetables from her mom's garden?	no
114	Reversed double modal	Maggie's laundry basket is pretty full.	She thinks she should might wash laundry soon.	Does Maggie want to do laundry soon?	yes
115	Reversed double modal	Michael had to pay a late fee on his water bill.	He thinks he should might check his mail more often so he sees his bills on time.	Does Michael think about checking his mail more often?	yes
116	Reversed double modal	Michael heard a big accident is blocking our way to the concert.	He said we could might leave earlier and still make it there on time.		
117	Reversed double modal	Robert found out it's supposed to snow overnight.	He thinks he should might treat the driveway with salt before bed.	Does Robert want to sand the driveway?	no
118	Reversed double modal	Robert's brother's band is playing at the bar tonight.	He said we could might see the show.	Does Robert want to see his brother's show?	yes
119	Reversed double modal	Tammy has some packages to mail.	She thinks she should might drop them off before she goes out tonight.	Does Tammy want to drop the packages off tomorrow?	no
120	Reversed double modal	Tammy needs another reference for a job application.	She said she could might ask her professor.		

**Table A3**

EEG session: Practice items (same across both stimulus lists).

Sentence number	Context sentence	Target sentence	Comprehension question	Correct response
P1	Kaitlyn wishes she were more in shape.	She wants to try running soon.		
P2	Adam has been creating music in his spare time.	He is nervous to share it with his friends.		
P3	Tammy loves dogs.	She fosters them in her spare time.	Does Tammy foster cats?	no
P4	Ashlee read all of her library books.	She wants to go back and check more out.		
P5	Anna travelled to see her family last weekend.	She wishes she could go home more often.	Does Anna want to go home more often?	yes
P6	Maggie is going to study abroad next semester.	She needs to apply for her passport soon.		
P7	Michael watches a lot of movies.	He wants to put a theater room in his house.	Does Michael want a theater room?	yes
P8	Jacob's mother's birthday is soon.	He is planning to surprise her with flowers at work.		
P9	Ethan is graduating college soon.	He is hoping to get a job somewhere close to home.	Does Ethan want to get a job far from home?	no
P10	Robert is renovating his bathroom.	He wants to make it bigger and add a second sink.		

**Table A4**

Judgment survey.

Survey version	Sentence number	Condition	Sentence
A	1	Standard single modal	He thinks he should wash the dishes soon.
A	2	Standard single modal	He thinks he should drink more water.
A	3	Attested double modal	He said we might could go to dinner this weekend.
A	4	Attested double modal	He said he might could shorten them for you.
A	5	Attested double modal	He said you might could go early to beat the crowd.
A	6	Standard single modal	He thinks he should put it out of her reach.
A	7	Standard single modal	She thinks we should check before we leave.
A	8	Standard single modal	She said she could have done better.
A	9	Unattested double modal	She thinks she could should ask her mom for help.
A	10	Standard single modal	She said you could do something to fix it.
A	11	Attested double modal	She said you might could get a scholarship for it.
A	12	Attested double modal	She thinks she might should do something to reward them.
A	13	Unattested double modal	She thinks she could should find a hotel to stay at.
A	14	Attested double modal	She said she might could buy him a pair for Christmas.
A	15	Attested double modal	She thinks you might should go visit him this week.
A	16	Unattested double modal	She said she should could plant some in the spring.
A	17	Standard single modal	She said she could bring the cake her mom likes.
A	18	Unattested double modal	She thinks she could should talk to him about it.
A	19	Unattested double modal	He said he should could pick up more shifts at work.
A	20	Attested double modal	He thinks we might should ask how much it costs.
A	21	Unattested double modal	He said we should could make it for dinner tomorrow night.
A	22	Unattested double modal	He said you should could teach classes for extra money.
A	23	Standard single modal	He thinks he should water them more often.
A	24	Standard single modal	He thinks he should check on them.
A	25	Unattested double modal	He thinks they could should finish decorating the nursery.
A	26	Unattested double modal	He said we should could use his employee discount at the craft store.
A	27	Standard single modal	He said he could hire someone to do it for him.
A	28	Unattested double modal	He said he should could wear a smaller size of pants now.
A	29	Attested double modal	He thinks he might should send it out to be fixed soon.
A	30	Attested double modal	He thinks he might should wake her up.
A	31	Unattested double modal	She thinks she could should start taking vitamins.
A	32	Unattested double modal	She said she should could visit again in the spring.
A	33	Standard single modal	She thinks she should ask the professor for an extension.
A	34	Attested double modal	She said we might could go Tuesday.
A	35	Standard single modal	She thinks she should help him.
A	36	Unattested double modal	She said it should could use more pepper.
A	37	Attested double modal	She said she might could give it to her brother.
A	38	Attested double modal	She thinks we might should leave now so we can be sure to see it.
A	39	Attested double modal	She said we might could go to the beach if it is.
A	40	Unattested double modal	She thinks she could should get a gym membership.
A	41	Standard single modal	She said we could go fishing over there sometime.
A	42	Unattested double modal	She thinks he could should take a break.
A	43	Standard single modal	He said he could borrow some from his friend.
A	44	Standard single modal	He thinks we should correct them now before we forget.
A	45	Attested double modal	He thinks he might should start wearing his winter coat.
A	46	Attested double modal	He said you might could sell it at the next fair in town.
A	47	Standard single modal	He thinks we should wait to leave until it stops.
A	48	Attested double modal	He said you might could have it done before the end of the month.
A	49	Unattested double modal	He said we should could see it if we go out of the city.
A	50	Attested double modal	He thinks he might should go see a doctor.

(continued on next page)

Table A4 (continued)

Survey version	Sentence number	Condition	Sentence
A	51	Attested double modal	He thinks he might should ask his grandfather for advice.
A	52	Standard single modal	He said he could start taking a yoga class.
A	53	Unattested double modal	He thinks she could should ask how much it costs.
A	54	Standard single modal	He said he could get her some for her birthday.
A	55	Standard single modal	She said she could finish the homework tomorrow.
A	56	Attested double modal	She thinks you might should get your hearing checked.
A	57	Standard single modal	She said you could volunteer at a local animal shelter.
A	58	Unattested double modal	She thinks you could should call the plumber.
A	59	Unattested double modal	She thinks she could should buy her tickets soon.
A	60	Unattested double modal	She said she should could modify them so they are easier.
B	1	Unattested double modal	He thinks he could should wash the dishes soon.
B	2	Attested double modal	He thinks he might should drink more water.
B	3	Unattested double modal	He said we should could go to dinner this weekend.
B	4	Unattested double modal	He said he should could shorten them for you.
B	5	Standard single modal	He said you could go early to beat the crowd.
B	6	Attested double modal	He thinks he might should put it out of her reach.
B	7	Attested double modal	She thinks we might should check before we leave.
B	8	Unattested double modal	She said she should could have done better.
B	9	Standard single modal	She thinks she should ask her mom for help.
B	10	Unattested double modal	She said you should could do something to fix it.
B	11	Standard single modal	She said you could get a scholarship for it.
B	12	Standard single modal	She thinks she should do something to reward them.
B	13	Standard single modal	She thinks she should find a hotel to stay at.
B	14	Unattested double modal	She said she should could buy him a pair for Christmas.
B	15	Standard single modal	She thinks you should go visit him this week.
B	16	Attested double modal	She said she might could plant some in the spring.
B	17	Attested double modal	She said she might could bring the cake her dad likes.
B	18	Attested double modal	She thinks she might should talk to him about it.
B	19	Standard single modal	He said he could pick up more shifts at work.
B	20	Unattested double modal	He thinks we could should ask how much it costs.
B	21	Standard single modal	He said we could make it for dinner tomorrow night.
B	22	Attested double modal	He said you might could teach classes for extra money.
B	23	Unattested double modal	He thinks he could should water them more often.
B	24	Attested double modal	He thinks he might should check on them.
B	25	Attested double modal	He thinks they might should finish decorating the nursery.
B	26	Standard single modal	He said we could use his employee discount at the craft store.
B	27	Unattested double modal	He said he should could hire someone to do it for him.
B	28	Attested double modal	He said he might could wear a smaller size of pants now.
B	29	Standard single modal	He thinks he should send it to be fixed soon.
B	30	Standard single modal	He thinks he should wake her up.
B	31	Attested double modal	She thinks she might should start taking vitamins.
B	32	Standard single modal	She said she could visit again in the spring.
B	33	Attested double modal	She thinks she might should ask the professor for an extension.
B	34	Standard single modal	She said we could go Tuesday.
B	35	Unattested double modal	She thinks she could should help him.
B	36	Standard single modal	She said it could use more pepper.
B	37	Unattested double modal	She said she should could give it to her brother.
B	38	Unattested double modal	She thinks we could should leave now so we can be sure to see it.
B	39	Unattested double modal	She said we should could go to the beach if it is.
B	40	Attested double modal	She thinks she might should get a gym membership.
B	41	Unattested double modal	She said we should could go fishing over there sometime.
B	42	Attested double modal	She thinks he might should take a break.
B	43	Attested double modal	He said he might could borrow some from his friend.
B	44	Unattested double modal	He thinks we could should correct them now before we forget.
B	45	Unattested double modal	He thinks he could should start wearing his winter coat.
B	46	Standard single modal	He said you could sell it at the next fair in town.
B	47	Unattested double modal	He thinks we could should wait to leave until it stops.
B	48	Standard single modal	He said you could have it done before the end of the month.
B	49	Attested double modal	He said we might could see it if we go out of the city.
B	50	Standard single modal	He thinks he should go see a doctor.
B	51	Unattested double modal	He thinks he could should ask his grandfather for advice.
B	52	Attested double modal	He said he might could start taking a yoga class.
B	53	Standard single modal	He thinks she should get it trimmed before picture day.
B	54	Unattested double modal	He said he should could get her some for her birthday.
B	55	Attested double modal	She said she might could finish the homework tomorrow.
B	56	Unattested double modal	She thinks you could should get your hearing checked.
B	57	Attested double modal	She said you might could volunteer at a local animal shelter.
B	58	Standard single modal	She thinks you should call the plumber.
B	59	Standard single modal	She thinks she should buy her tickets soon.
B	60	Attested double modal	She said she might could modify them so they are easier.



## Appendix B. Questionnaires

### Questionnaire B.1: Background Questionnaire

*This questionnaire is designed to give us a good understanding of your general background. We ask questions about your health, handedness, and personal history. The information you provide is confidential.*

A. Please indicate which hand (left or right) you prefer to use for each of the following activities. When the preference is so strong that you would never try to use the other hand unless absolutely forced to, please select “always left” or “always right.” Some of the activities listed below require the use of both hands. In these cases, the desired part of the object or task is indicated in parentheses.

Response options: Always left, Left, No preference, Right, Always right

Activities: Writing, Drawing, Throwing, Using scissors, Brushing teeth, Using a knife without a fork, Using a spoon, Using a broom (upper hand), Striking a match, Opening a box (lid)

B. Please indicate whether each of the following people is left-handed.

Response options: Yes, No, I don't know

People: Biological mother, Biological father, Biological siblings, Biological grandparents

C. This section asks general questions about your health. Please be as accurate and thorough as possible in responding to these questions.

Response options: Yes, No

Questions:

- Do you have normal or corrected-to-normal vision (i.e., do you wear glasses or contacts)?
- Do you have any hearing disabilities?
- Have you ever suffered a traumatic brain injury?
- Do you have any learning or attention issues (e.g., ADHD or Autism Spectrum Disorder)?

If “yes” response for any of the last three items: Please provide additional information regarding which learning or attention issue(s) you have, when you were diagnosed, and whether you are currently taking medication. Please list all medications.

D. Were you born in the United States?

Response options: Yes, No

E. Please provide the location of the following events or periods of time. Please do not use abbreviations. If you are not sure of the city or town, you may provide a region or area instead.

Response prompts: City/town, State/territory/province, Country

Questions:

- Where were you born?
- Where did you spend most of your childhood (ages 3-13)?
- Where did you spend most of high school (ages 14-18)?

F. Who were your two main caregivers? A caregiver is a parent, guardian, or other adult individual who is directly responsible for taking care of you when you're growing up.

Response options: Mother, Father, Aunt, Uncle, Grandmother, Grandfather, Other

If “other” response for any item: Please describe that caregiver here.

G. Where did your caregivers grow up? Please do not use abbreviations. If you are not sure of the city or town, you may provide a region or area instead.

Response prompts: City/town, State/territory/province, Country

H. What is the highest level of education for each of your caregivers?

Response options: Some high school, High school or equivalent, Some college, Associate’s degree, Bachelor’s degree, Master’s degree, Ph.D. or other advanced degree (M.D., J.D., etc.), I don’t know

I. What language did you grow up speaking at home? If you grew up speaking more than one language at home, please specify the language that you learned first. If you learned more than one language simultaneously, please specify the language in which you are currently the most proficient. There will be an opportunity for you to describe your experience with the other language(s) below.

J. How would you rate your current proficiency in this language?

Response options: Beginner – 1, 2, 3, 4, Native-like – 5

K. Do you speak any other languages?

Response options: Yes, No

L. What other language(s) do you speak? Please list up to three languages and describe your experience with each language (e.g., taking high school/college courses, studying abroad, or speaking with family members).

Response prompts: Language, Experience, Years of experience

M. How would you rate your current proficiency in each language?

Response options: Beginner – 1, 2, 3, 4, Native-like – 5

N. Gender

Response options: Man, Non-binary, Woman, Other

O. Age

P. Date of birth

Q. Ethnicity

Response options: Hispanic or Latinx, Not Hispanic or Latinx

R. Race

Response options (check all that apply): American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, Other (specify)

S. This section contains a number of statements with which some people agree and others disagree. Please rate how much you agree or disagree with these statements. When responding, consider how much they reflect how you personally feel or think.

Response options: Strongly disagree – 1, 2, 3, 4, Strongly agree – 5

Statements:

- I was in a good mood before starting this experiment.
- I was in a bad mood before starting this experiment.
- I'm in a good mood right now.
- Today is going well.
- I'm in a bad mood right now.
- Today is going poorly.

### Questionnaire B.2: Dialect Survey

*This questionnaire looks at how you speak in everyday conversation. We're interested in natural, spontaneous speech, not what is considered "correct" or "proper" speech in school. Please do your best to think about how you speak when you're at home with your friends and family. The information you provide is confidential.*

*I. This section asks questions about specific words you use and how you pronounce them. When responding, please think about how you speak in everyday conversation with your friends and family.*

A. How do you usually address a group of two or more people? If you use more than one form, please select the one you use most frequently.

Response options: y'all, yinz, you, all, you guys, you lot, you 'uns, yous/youse, other

B. What is your general word for a sweet, carbonated beverage? If you use more than one form, please select the one you use most frequently.

Response options: coke, pop, soda, soft drink, tonic, other

C. How do you pronounce the word *aunt* when you're referring to a specific person?

Response options:

- to sound like *ah*
- with the vowel in *caught*
- I have the same vowel in *ah*, *caught*, and *aunt*
- with the vowel in *ant*
- with the vowel in *ain't*
- other

D. What is the difference between *dinner* and *supper*?

Response options:

- *supper* is an evening meal, while *dinner* is eaten earlier
- *supper* is a lighter meal, while *dinner* is the main meal
- *dinner* is more formal than supper
- they're not different; they mean the same thing
- I don't use the word *supper*
- I don't use the word *dinner*
- other

E. How do you pronounce the word *like*?

Response options:

- with the vowel in *bah*

- with the vowel in *bye*
- I have the same vowel in *bah*, *bye*, and *like*
- other

II. This section presents several scenarios and asks what you are likely to **say** or **hear** in each one. Please do your best to imagine each scenario and think of how you, your friends, and your family speak in everyday conversation when you respond.

Response options: Extremely likely, Likely, Neither likely nor unlikely, Unlikely, Extremely unlikely

Statements:

1. Imagine that you want a family member to go to the store. How likely are you to **say** something like: *"You might could go to the store."*
2. Imagine that a family member wants you to go to the store. How likely are you to **hear** something like: *"You might could go to the store."*
3. Imagine that you're at home with your family, and your mom can't find her wallet. She's in a rush, and you think she's forgetting an obvious spot. In this context, how likely are you to **say** something like: *"You might could check your bag."*
4. Imagine that you're at home with your family, and you can't find your wallet. You're in a rush, and you think you're forgetting an obvious spot. In this context, how likely are you to **hear** something like: *"You might could check your bag."*
5. Imagine that a family member asks you what your mom was doing earlier. How likely are you to **say** something like: *"She was a-goin' to the store."*
6. Imagine that you ask a family member what your mom was doing earlier. How likely are you to **hear** something like: *"She was a-goin' to the store."*
7. Imagine that you're at home. Earlier today, your dog got through a hole in the fence and ran away. Your family is out looking for her. Your friend comes by to tell you that he recently saw your dog. In this context, how likely are you to **hear** something like: *"She was a-runnin' all over the neighborhood."*
8. Imagine that you're at home. Earlier today, your dog got through a hole in the fence and ran away. Your family is out looking for her. When they come back, you tell them that you recently saw your dog. In this context, how likely are you to **say** something like: *"She was a-runnin' all over the neighborhood."*
9. Imagine that a family member asks you if your parents went to the store. How likely are you to **say** something like: *"They didn't go nowhere."*
10. Imagine that you ask a family member if your parents went to the store. How likely are you to **hear** something like: *"They didn't go nowhere."*
11. Imagine that you're at home with your family, and your mom has just come back from the grocery store. Before she left, you asked her to pick up some bananas. You see that she only has milk and cereal, and ask if she got the bananas. In this context, how likely are you to **hear** something like: *"They didn't have none."*
12. Imagine that you're at home with your family, and you have just come back from the grocery store. Before you left, your mom asked you to pick up some bananas. She sees that you only have milk and cereal, and



asks if you got the bananas. In this context, how likely are you to **say** something like: *"They didn't have none."*

13. Imagine that a family member asks you why you got your car keys out, but didn't leave. How likely are you to **say** something like: *"I liketa went to the store."*
14. Imagine that you ask a family member why they got their car keys out, but didn't leave. How likely are you to **hear** something like: *"I liketa went to the store."*
15. Imagine that you're at home with your family. Your mom is telling a story. When she was biking today, she started to go through a busy intersection, but noticed a car about to run a red light. In this context, how likely are you to **hear** something like: *"I liketa got hit by that car."*
16. Imagine that you're at home with your family. You're telling a story. When you were biking today, you started to go through a busy intersection, but noticed a car about to run a red light. In this context, how likely are you to **say** something like: *"I liketa got hit by that car."*
17. Imagine that a family member asks you what you're planning to do later. How likely are you to **say** something like: *"I'll try and go to the store."*
18. Imagine that you ask a family member what she's planning to do later. How likely are you to **hear** something like: *"I'll try and go to the store."*
19. Imagine that you're at home with your family. A light bulb in the kitchen goes out. Your mom asks you to get a new one from the closet, but you tell her that there aren't any left. In this context, how likely are you to **say** something like: *"I'll try and buy one tomorrow."*
20. Imagine that you're at home with your family. A light bulb in the kitchen goes out. Your mom asks you to get a new one from the closet, but you tell her that there aren't any left. In this context, how likely are you to **hear** something like: *"I'll try and buy one tomorrow."*
21. Imagine that a family member asks you if you and your friends are leaving soon. How likely are you to **say** something like: *"We're fixin' to go to the store."*
22. Imagine that you ask a family member if she and her friends are leaving soon. How likely are you to **hear** something like: *"We're fixin' to go to the store."*
23. Imagine that you're at home with your friends. You've just finished baking a cake, and the kitchen is a mess. Your mom says that you and your friends need to clean up before you leave. In this context, how likely are you to **say** something like: *"We're fixin' to do the dishes."*
24. Imagine that you're at home with your friends. You've just finished baking a cake, and the kitchen is a mess. Your mom says that you and your friends need to clean up before you leave. In this context, how likely are you to **hear** something like: *"We're fixin' to do the dishes."*

### Questionnaire B.3: Judgment Survey

*In this survey, you will listen to recorded sentences and answer some questions about them. Please listen to each sentence carefully before you respond.*

A. Please listen to this sentence before answering the questions below.

B. How easy is this sentence to understand?

Response options:

- Very easy to understand

- Easy to understand
- Neither easy nor difficult to understand
- Difficult to understand
- Very difficult to understand

C. How acceptable is this sentence?

Response options:

- Completely acceptable
- Acceptable
- Neither acceptable nor unacceptable
- Unacceptable
- Completely unacceptable

D. How familiar are you with a sentence like this?

Response options:

- I use it a lot
- I use it occasionally
- I've heard it before but I don't use it
- I've never heard it before today

E. Please paraphrase this sentence. Do your best to express the same meaning using different words.

#### **Questionnaire B.4: Attitude Survey**

*In this survey you will encounter questions regarding your cultural identity, language attitudes, and language background. The information you provide is confidential. Please let the researcher know if you have any questions about the items, and thank you again for participating in this study!*

*I. This section asks questions about your affiliation with American cultural identities.*

Response options: Not at all – 1, 2, 3, 4, Completely – 5

Questions:

- How strongly do you identify with American culture?
- How strongly do you identify with Northeastern culture?
- How strongly do you identify with Midwestern culture?
- How strongly do you identify with West Coast culture?
- How strongly do you identify with Southern culture?
- How strongly do you identify with Appalachian culture?

*II. This section contains a number of statements with which some people agree and others disagree. Please rate how much you agree or disagree with these statements. When responding, consider how much they reflect how you personally feel or think.*

Response options: Strongly disagree – 1, 2, 3, 4, Strongly agree – 5

Statements:

1. It is important to me that native English speakers use grammatically correct English.
2. It is important to me that native English speakers achieve standard English pronunciation.

3. I have an accent.
4. People always comment on my accent.
5. People tell me they like the way I speak.
6. People tease me about my accent.
7. People often misunderstand me.
8. Other Americans sometimes have trouble understanding me.
9. I often have to ask people to repeat themselves.
10. I have trouble understanding people with unfamiliar accents.
11. I have no trouble understanding people with accents.
12. People often ask me to repeat myself.
13. I've consciously changed my accent since starting college.
14. I make a conscious effort to make my speech intelligible.
15. I have a Southern accent.
16. I try to make sure that people don't make fun of me for my accent.
17. I switch how I speak depending on the person I'm talking to.
18. I switch how I speak depending on the context.
19. I grew up speaking standard American English.
20. People in my hometown have strong accents.
21. People in my family have strong accents.
22. I don't like the accent I grew up speaking.
23. I like my accent.
24. I have close American friends with strong accents.
25. I have close friends who are not native-speakers of English.
26. People can tell what my race or ethnicity is based on how I talk.
27. Schools should do a better job of teaching people proper English.
28. I like Southern accents.
29. I like British accents.
30. People with Southern accents sound stupid.
31. People with British accents sound stupid.
32. People with British accents sound friendly.
33. People with Southern accents sound friendly.
34. People with Southern accents sound intelligent.
35. People with British accents sound intelligent.
36. There are right and wrong ways to speak.
37. I hate it when people make grammatical errors.
38. I correct people when they make grammatical errors.

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