



Tim Beyer<sup>1</sup>, Tess Renirie<sup>2</sup>, and David Andresen<sup>3</sup>  
<sup>1</sup>Psychology, University of Puget Sound, United States

## Race-relevant cues influence the processing of linguistic variation: Evidence from African American English and Mainstream American English

Race-relevant cues, whether vocal or visual, shape how listeners process the incoming speech signal. In order to better understand how these cues inform sentence-level processing, we asked listeners to rate the plausibility of three different sentence types: (a) plausible in both Mainstream American English (MAE) and African American English (AAE), (b) implausible in both, or (c) plausible in AAE, but not MAE. Across three experiments, we manipulated the type of race-relevant cues provided to listeners, who all identified as MAE-speakers. Experiment 1 ( $n = 72$ ) used written sentences and therefore did not provide vocal or visual cues, Experiment 2 ( $n = 72$ ) provided vocal cues to speaker background, and Experiment 3 ( $n = 72$ ) provided vocal and visual cues to speaker background. Results show that MAE-speaking listeners readily incorporated race-relevant cues when processing these sentences. In particular, findings indicate that expectations associating African Americans with utterances implausible from an MAE-perspective inform sentence-level processing.

*Key words:* dual-route approach to speech perception, socially meaningful linguistic variation, race-relevant cues, speech processing, African American English

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Address for correspondence: Tim Beyer

Psychology, University of Puget Sound, Department of Psychology c/o Tim Beyer 1500 N. Warner Street  
Tacoma, WA 98416-1046

E-mail: [tbeyer@pugetsound.edu](mailto:tbeyer@pugetsound.edu)

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Speech indexes our demographic backgrounds and social identities. One reason for this is that variability in speech is not random, but rather is conditioned by a number of social and stylistic factors, including age, gender, social class, race, and ethnicity of a speaker, as well as the perceived formality of the interaction and social characteristics of the interlocutor (Eckert & Rickford, 2001; Labov, 1972). For example, African American speakers tend to have higher rates of consonant cluster reduction (e.g., t/d deletion in which the final coronal stop in a consonant cluster may be absent as in *desk*, *child*) when speaking English than European American<sup>1</sup> speakers do (Rickford, 1999; see also Box 1).

Because linguistic variation, such as t/d deletion, is highly predictive of linguistic behavior, this variation can aid the listener in processing the speech signal (Kushins, 2014; Staum Casasanto, 2008; Sumner et al., 2014; Sumner, 2015). Moreover, when linguistic variation is socially meaningful, knowledge of a speaker's social characteristics, as well as what that speaker is therefore likely to say, enables listeners to rapidly and accurately process the unfolding speech signal and predict upcoming variation in speech and style (Levy, 2008).

The idea that socially meaningful linguistic variation influences how listeners' process speech is at the center of Sumner et al.'s (2014) dual-route approach to speech perception. The dual-route approach posits that listeners use phonetically cued information to simultaneously extract linguistic and social information from words, and that these two processes interact to determine comprehension (Sumner et al., 2014). In particular, vocal cues appear to activate social representations related to speaker identity early during processing (Purnell et al., 1999; Sumner et al., 2014; Sumner, 2015; Thomas & Reaser, 2004), as well as influence the listener's expectations of the speaker (Baese-Berk et al., 2020; McGowan & Babel, 2020). This socially-informed structure incorporates socially meaningful linguistic variation and social expectations (Baese-Berk et al., 2020; Drager, 2010; McGowan, 2015; Squires, 2014; Sumner et al., 2014). In this way, activated social representations add social weighting to dynamically alter the processing of the speech signal (Pierrehumbert, 2003; Sumner et al., 2014; Sumner, 2015; Weissler & Brennan, 2020). For example, when listeners are given information about a speaker's social group affiliation, they will not only expect the speaker to conform to that social group's linguistic characteristics, but also be more likely to perceive the speaker as producing those linguistic characteristics (Hay & Drager, 2010; Lev-Ari et al., 2019; McGowan & Babel, 2020).

Listeners are adept at using minimal cues, such as a speaker's voice, to categorize them as belonging to a member of a particular social group (Dragojevic, 2018; Sumner et al., 2014; Sumner, 2015). This categorization can activate stereotypes about the social group(s) that a speaker is perceived to be a member of (Acheme & Cionea, 2022; Dragojevic, 2018; Fasoli et al., 2020).

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<sup>1</sup> Creating meaningful labels for racial and ethnic groups in the United States is not always clear. Throughout this article, we use the term "European American" to refer to White Americans in order to retain the parallel to "African American" as the group's identifier.

In this way, speakers become socially linked to their inferred social group(s). Language processing is therefore not value free. While we certainly use linguistic information (e.g., what nouns and verbs make up the utterance), we also use the social cues embedded in that linguistic information to (a) infer a speaker's group membership and (b) link the stereotypes associated with the inferred group to the speaker (Acheme & Cionea, 2022; Dragojevic & Giles, 2016; Dragojevic, 2018). These mechanisms influence how we process speech (Baese-Berk et al., 2020; Fasoli et al., 2020; McGowan & Babel, 2020; Sumner et al., 2014; Sumner, 2015; Weissler & Brennan, 2020). This integration has been called sociolinguistic perception (Campbell-Kibler, 2009; Squires, 2014).

The current line of research builds on the predictions of the dual-route approach to extend our understanding of how listeners utilize race-relevant cues when processing socially meaningful linguistic variation. To do so, we focused on the linguistic differences between two varieties of English spoken in the United States: African American English (AAE) and Mainstream American English (MAE). Because AAE is a stigmatized language variety in the United States (Green, 2002; Labov, 1972; Lippi-Green, 2012; Weissler & Brennan, 2020), it is crucial to understand how race-relevant cues can influence sociolinguistic perception by activating stereotypes and biases surrounding AAE, and by extension AAE-speakers. In this way, we can more fully understand how such stereotypes contribute to linguistic profiling experienced by many AAE-speakers (Baugh, 2003; Rickford & King, 2016).

### **African American English (AAE) and Mainstream American English (MAE)**

African American English is a rule-governed, systematic variety of English spoken by many, but not all, African Americans in the United States (Lippi-Green, 2012). Although one cannot equate race and language variety, considerable research has shown that in the United States, African Americans are strongly associated with speaking AAE (see e.g., Green, 2002; Lippi-Green, 2012; Mengesha & Zellou, 2018; Pullum, 1999; Rickford, 1999; Staum Casasanto, 2008). Moreover, AAE is a nonstandard, stigmatized language variety in the United States, in part because its surface form is more variable than the surface form of MAE (Lippi-Green, 2012; see also Box 1). Since vocal cues can lead to racial categorization, they can also elicit stereotype-based inferences about the speaker. Thus, non-AAE-speakers may perceive AAE-speakers as inconsistent and prone to utter incorrect speech.

These negative perceptions may lead to stigma resulting in linguistic discrimination. For example, non-AAE-speakers tend to associate the use of AAE with language deficits, mistakes, and poor performance on language-based tasks (Green, 2002; Pearson et al., 2013; Pullum, 1999). In particular, the status (e.g., intelligence, competence) of non-MAE-speakers is evaluated more negatively than that of MAE-speakers (Dragojevic & Giles, 2016; Giles &

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Watson, 2013; Kushins, 2014; Lippi-Green, 2012). These negative stereotypes can lead to linguistic profiling (Baugh, 2003; Rickford & King, 2016) which has been linked to a host of discriminatory behaviors, including lower hiring rates (Kushins, 2014), lower income (Grogger, 2011), real estate inequities (Massey & Lundy, 2001), and differential evaluation in courtroom settings (Rickford & King, 2016). The current study capitalized on these realities to investigate how such expectations affect how listeners perceive AAE, and by extension AAE-speakers, during speech processing.

**Box 1**

African American English (AAE) and Mainstream American English (MAE) can differ in their linguistic structure. In order to maximally differentiate the two language varieties and activate stereotyped knowledge and expectations about vernacular versions of AAE in our MAE-speaking listeners, we selected four features which (a) are unique to AAE, both qualitatively and quantitatively, when compared to MAE (Fasold, 1981), (b) show robust variation and differences between AAE and MAE (Green, 2002; Labov, 1972), (c) are stereotypically associated with AAE (Staum Casasanto, 2008; King & Sumner, 2014), and (d) are easily manipulated in a systematic way. Following is a summary of how these features – t/d deletion (both when part of the root and past tense –ed), copula/auxiliary absence, and possessive –s absence – pattern in AAE and MAE:

1. While final consonant cluster reduction is common across varieties of English, including AAE and MAE, the two differ systematically in their patterns of final consonant cluster reduction. In AAE, the final t/d sound in a consonant cluster can be absent when it occurs as part of the root (e.g., *child*, *mast*), including when the final consonant cluster is followed by a word beginning with a vowel (Fasold, 1981; Green, 2002; Labov, 1972; Rickford, 1999). While MAE does allow for t/d deletion when it occurs as part of the root, it does so at lower rates than AAE (Labov, 1972) and does not allow for t/d deletion when the consonant cluster is followed by a vowel (Fasold, 1981).
2. In AAE, the final t/d sound in a consonant cluster may also be absent when it corresponds to past tense –ed (e.g., *walked*, *missed*; Green, 2002; Labov, 1972; Rickford, 1999). In MAE, when the final t/d sound corresponds to past tense –ed, it is rarely deleted (Labov, 1972).
3. There is much greater copula and auxiliary absence of *is* forms in AAE (e.g., *He tired*) than in MAE (e.g., *He is tired*; Fasold 1981; Labov, 1972).
4. Because word order can indicate possession in AAE, the use of genitive –s is variable in possessive contexts (e.g., *He at my mama house*; Green 2002) while it is required in MAE (e.g., *He's at my mama's house*; Fasold, 1981).

Whether these features appear in the surface form of AAE is variable and conditioned by a number of social (e.g., setting, class, interlocutor, age of speaker) and linguistic (e.g., surrounding phonological environment) factors (Fasold, 1981; Green, 2002; Labov, 1972; Rickford, 1999). Thus, while the surface form of MAE is typically less variable when compared to AAE, the degree to which the AAE surface form differs from MAE is contextually dependent.

As a variety of English, AAE shares many linguistic features with MAE, such as lexical items (Green, 2002) and basic sentence structure (Martin & Wolfram, 1998). Because of these similarities, AAE and MAE are often assumed to be mutually intelligible, suggesting that speakers of one variety should have few processing difficulties when they encounter the other variety. This is not always the case: AAE-speakers can differ from MAE-speakers when processing certain

MAE forms (e.g., Beyer & Hudson Kam, 2012; Green, 2011; Johnson, 2005) and MAE-speakers can differ from AAE-speakers when processing certain AAE forms (e.g., Beyer et al., 2015). Crucially, these processing differences have been linked to systematic linguistic differences between AAE and MAE.

Further, listeners are sensitive to the linguistic differences between AAE and MAE and associate the use of AAE features with African Americans (Mengesha & Zellou, 2018; Staum Casasanto, 2008; Weissler & Brennan, 2020). For example, Staum Casasanto (2008) investigated whether listeners associated t/d deletion (see Box 1) more with African American than European American faces. Listeners not only showed a stronger association between t/d absence and African American faces, but also used this expectation to resolve temporary ambiguities and responded faster to a continuation compatible with a t/d absence when they saw an African American face than a European American face (Staum Casasanto, 2008). These results demonstrate that listeners link t/d deletion and perceived race and use race-relevant visual information to form expectations of the speaker as they process and interpret what they hear.

### **The Current Line of Research**

Our main aim was to further show that race-relevant vocal and visual cues alter the way listeners process AAE and MAE utterances. We predicted that listeners would rely on race-relevant cues to process these utterances in line with the social category conveyed by a speaker's voice and/or face to match their (stereotyped) expectations of the speaker. In order to test this general prediction, we recruited participants who self-identified as native MAE-speakers who have relatively little self-reported exposure to and knowledge of AAE. Focusing on speakers with this specific language background allowed us to investigate how race-relevant vocal and visual cues are used by listeners who do not themselves speak AAE, and therefore are more likely to rely on stereotyped knowledge and expectations of AAE during processing.

Prior research on sociolinguistic perception has generally focused on phonological variation and phonetic variables (Perry et al., 2017; Squires, 2016), finding strong support for the dual-route approach. However, in their description of the dual-route approach, Sumner et al. (2014) also predicted that social weighting may be most robust in longer utterances, and recent research has shown that social weighting does indeed extend to the sentence level as well (see e.g., Fasoli et al., 2020; Staum Casasanto, 2008; Weissler & Brennan, 2020). Extending the predictions of the dual-route approach to the sentence level is important because it allows us to examine not only words and word forms, but also how grammatical variation is impacted by socially-weighted information (see also Squires, 2016). That is, the dual-route approach makes predictions about standard and nonstandard lexical items, and the current study sought to extend these predictions to how listeners process socially meaningful linguistic

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variation at the sentence level as they encounter race-relevant cues. Because our participants reported little knowledge of AAE, this provided insight into their passive knowledge of nonstandard linguistic structure at the sentence level.

The common bias against AAE and its speakers can also influence what measures are used in assessing linguistic function. In order to assess the effects of race-relevant cues on the processing of socially meaningful linguistic variation, we used a “plausibility” judgment rather than a more typical “correct/incorrect” grammaticality judgment. We operationalized “plausibility” as being both easy to understand and grammatically correct. Our reasoning for using this measure was twofold. First, prior research has shown that outgroup members may be perceived as harder to understand despite being grammatically correct (e.g., Dragojevic & Giles, 2016). Thus, judgments of grammaticality already concurrently reflect the effects of both ease-of-understanding and grammaticality; plausibility combines both of these explicitly. Second, whether social information impacts speech processing explicitly, implicitly, or both, remains unclear. For example, Squires (2016) showed that perceiving (an implicit process) and noticing (an explicit process) are different cognitive mechanisms supporting different components of sociolinguistic perception. This suggests that not all grammatical anomalies are perceived equally by the listener because perception is related to a listener’s linguistic knowledge (Squires, 2016). Importantly, in this line of study, we asked participants to process both AAE and MAE utterances, yet it is unclear to what degree our MAE-speaking participants have access to AAE linguistic knowledge. Thus, by combining an implicit measure (ease of understanding) with an explicit measure of sentence processing (grammaticality), we allowed both implicit and explicit effects to be expressed.

Because AAE and MAE are not monolithic systems, speakers of these varieties can differ in the quality and quantity of how they use features typically associated with them in their speech (see e.g., Eckert & Rickford, 2001; Labov, 1972). For this reason, we selected four features which maximally differentiate AAE and MAE while activating stereotyped knowledge and expectations about vernacular versions of AAE in our MAE-speaking listeners. These features are: t/d deletion (both when part of the root and past tense –ed), copula/auxiliary absence, and possessive –s absence (see Box 1 for a description of these features). In addition, previous research comparing AAE and MAE typically assumes that MAE is the standard or “correct,” implicitly associating AAE with nonstandard or “incorrect” language use. However, AAE is a systematic language variety, and from a linguistic perspective, is qualitatively different from “incorrect” language. Whether listeners also share this distinction needs to be assessed.

### Experiment Overview and Predictions

In this study, we presented listeners with sentences that were plausible in both AAE and MAE (plausible sentences; e.g., “He is over there”), plausible in AAE but not MAE (plausible AAE sentences; e.g., “He over there”), or implausible

in both AAE and MAE (implausible sentences; e.g., “He over is there”). To our knowledge, this is one of the few lines of research that presents listeners with plausible AAE sentences alongside plausible and implausible sentences (see also Weissler & Brennan, 2020). In this way, we assessed whether MAE-speaking listeners perceive plausible AAE sentences as implausible (since they are implausible in MAE) or as plausible (since they are plausible in AAE). To investigate how MAE-speaking listeners use race-relevant cues during sentence-level processing, we manipulated what social information was provided to the listeners about the speaker across three experiments: Experiment 1 served as a baseline and presented stimuli in written form, removing vocal cues to speaker background, Experiment 2 provided vocal cues to speaker background, and Experiment 3 provided vocal and visual cues to speaker background.

Across these experiments, we hypothesized that our MAE-speaking listeners’ plausibility judgments would be highest for plausible sentences when compared to plausible AAE and implausible sentences. This is because plausible sentences match the language variety our listeners use, unlike the plausible AAE and implausible sentences. Thus, plausible sentences should result in little processing difficulties. The dual-route approach predicts that listeners should differentiate plausible AAE and implausible sentences if indeed they incorporate socially meaningful linguistic variation and expectations during sentence-level processing. In line with the predictions of the dual-route approach, we hypothesized that our MAE-speaking listeners would differentiate plausible AAE and implausible sentences if (a) they have some awareness of AAE features, and (b) use race-relevant cues during sentence-level processing.

## Experiment 1

The dual-route approach relies on vocal cues to activate social information about the speaker (Sumner et al., 2014). Without these vocal cues, related social information cannot be activated, and therefore, listeners cannot integrate this information during processing. This allowed us to examine how participants process sentences devoid of the social information activated by vocal cues and provides a baseline against which we can compare processing patterns as we add cues to social background.

Squires (2014) suggests that speech processing should (a) vary based on the listener’s language background, (b) depend on the listener’s expectations, and (c) be affected by both linguistic and nonlinguistic (e.g., social) information. In line with Squires (2014), we predicted that even with the absence of social information, MAE-speaking listeners will still have significantly higher plausibility judgements for plausible sentences when compared to plausible AAE and implausible sentences. We expected this outcome because unlike plausible AAE and implausible sentences, plausible sentences are typical of the main linguistic system our MAE-speaking listeners use. In contrast, in the absence of

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vocal cues, we predicted that MAE-speaking listeners' processing should differ as a function of their knowledge of AAE. That is, while listeners modulate their expectations based on how a speaker sounds, it remains unclear whether listeners have explicit knowledge of a language variety that is not their own (Squires, 2016; Weissler & Brennan, 2020). Thus, if MAE-speaking listeners are familiar with the linguistic structure of AAE, then they should judge plausible AAE sentences as significantly more plausible than implausible sentences. In contrast, if MAE-speaking listeners are not familiar with the linguistic structure of AAE, or it is not activated in the absence of vocal cues, then they should judge plausible AAE sentences and implausible sentences as similarly implausible since both are implausible from an MAE-perspective.

## Method

### *Participants*

Seventy-two participants (18 male, 54 female,  $M_{\text{age}} = 19.97$  years) completed this experiment; 55 identified as European American, nine as Asian, six as Mixed/Multi-racial, one as Hispanic/Latino, and one as Native Hawaiian/Pacific Islander. Participants were recruited from the Psychology Department subject pool at a small college in the Pacific Northwest and received course credit for their participation.

### *Stimuli*

Sixty-four sentences (48 test, 16 filler) were created. Test sentences were constructed in triads such that one version was plausible in both AAE and MAE (plausible sentences, as in 1a), one was plausible in AAE, but not in MAE (plausible AAE sentences, as in 1b), and one was implausible in both AAE and MAE (implausible sentences, as in 1c):

- 1a) She is the tallest in the class.
- 1b) She the tallest in the class.
- 1c) She am the tallest in the class.

The 48 test sentences were therefore identical except for one feature that made them plausible (or not) in MAE and/or AAE. As outlined in Box 1, four features, the absence of which is more common in AAE than MAE, were selected: t/d root (e.g., "That chil'/child almost dropped the new vase"), past tense -ed (t/d morpheme: e.g., "My mother talk'/talked crossly to the salesclerk"), copula/auxiliary absence involving is forms (e.g., "He carrying/is carrying that book"), and possessive marking (e.g., "I know Emma/Emma's book is overdue"). Each feature appeared in 12 test sentences.

In order to create implausible sentences, features that would make a sentence

ungrammatical in both varieties were added to the plausible version of each sentence. These included using the incorrect form of the copula (e.g., *am* instead of *is* as in 1c,  $n = 6$ ), inappropriate use of progressive *-ing*, (e.g., “His car starting immediately after he changed the oil,”  $n = 12$ ), misplaced possessive *-s* (e.g., “Everyone saw his friend snowboard’s break,”  $n = 6$ ), using an inappropriate verb tense/aspect (e.g., “The card almost slide across the table,”  $n = 6$ ), inappropriate use of *have* (e.g., “The bird have flying south for the winter,”  $n = 12$ ), and inappropriate possessive pronouns (e.g., “The swimmer’s her goggles filled with water,”  $n = 6$ ). The 16 filler sentences were plausible in both AAE and MAE (e.g., “My grades were very good last semester,” “Sammy lost his car keys again”) so that from an MAE perspective, half of all sentences were plausible (plausible sentences, fillers) and half were implausible (plausible AAE, implausible). All sentences were initially created using published norms (e.g., Fasold, 1981; Green, 2002; Labov, 1972; Rickford, 1999). Two self-identified native AAE-speakers then revised these initial sentences; any disagreement was resolved by discussion. See the Appendix for sample sentences.

### *Procedure*

After providing consent, participants were asked to complete a computerized sentence plausibility task. In this task, participants were presented with 64 sentences (48 test, 16 filler). Sentences were placed into one of three orders using systematic rotation. To do so, we placed one version of each test sentence triad into one unique order. For example, Test Sentence 1a appeared in Order 1, 1b appeared in Order 2, and 1c appeared in Order 3. We then systematically rotated versions such that test sentence 2c was placed in Order 1, 2a in Order 2, and 2b in Order 3. We followed this sequence to place the 48 test sentences into their respective orders. All orders contained the same 16 filler sentences. Each participant was exposed to only one order of 64 sentences (16 plausible, 16 plausible AAE, 16 implausible, and 16 filler). Within each order, the sequence of the 64 sentences was randomized for each participant by Inquisit (2006), the computer program used for this study.

Participants were asked to read one sentence at a time on the screen and then decide as quickly and accurately as possible whether the sentence was plausible or implausible. Participants were instructed that a sentence is plausible if it is easy to understand and grammatically correct or implausible if it is not easy to understand and ungrammatical. In order to make their choice, participants pressed the appropriate key on the keyboard (“a” for plausible, and “k” for implausible). In order to enable quick, accurate decisions, participants were asked to place their index fingers on each key.

The entire written sentence was presented at one time. After participants made their plausibility judgment they had a 500 ms break. The start of a new trial was signaled by a bell and a crosshairs symbol which appeared in the center of the

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computer screen. Participants were asked to fixate on the crosshairs symbol at the start of each trial. The participants first read three practice sentences and provided judgments for each before starting the actual experiment. Participants read the sentences associated with their order in a single 10-minute testing session.

Following the written sentence judgment task, participants completed a questionnaire assessing basic demographics (age, gender, ethnicity) and language background, including self-reported ability to comprehend and produce AAE and MAE on a seven-point scale (1 = *poor*, 7 = *excellent*). In addition, participants were asked to indicate how many African Americans and European Americans they knew, were friends with, and went to high school with on a seven-point scale (1 = *none*, 7 = *many*).

## Results

### *Language Background and Familiarity with Social Groups*

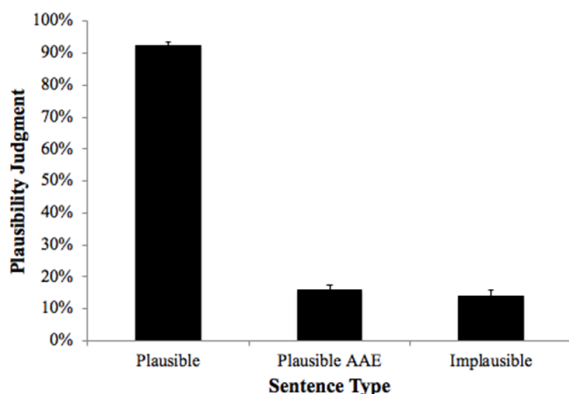
Participants' self-reported language background, language abilities, and social group exposure are presented in Table 1. All participants identified as native MAE-speakers; none identified as an AAE-speaker. Participants rated their abilities with MAE significantly higher than AAE for both production,  $t(71) = 19.62, p < .001, \eta^2 = .84$ , and comprehension,  $t(71) = 14.21, p < .001, \eta^2 = .74$ . In addition, participants reported significantly greater exposure to European Americans than African Americans,  $t(71) = 11.99, p < .001, \eta^2 = .67$ . Thus, our sample was quite homogeneous and mainly self-identified as monolingual MAE-speakers with little exposure to African Americans, and reported limited abilities in AAE.

Table 1. *Demographics and Self-reported Language Background and Social Group Exposure (Experiments 1-3).*

| Measure            | Experiment 1 | Experiment 2 | Experiment 3 |
|--------------------|--------------|--------------|--------------|
| Sample size        | 72           | 72           | 72           |
| Female             | 54           | 43           | 52           |
| Male               | 17           | 29           | 20           |
| Age (mean)         | 19.97        | 19.75        | 19.42        |
| AAE                |              |              |              |
| Comprehension      | 3.63 (.17)   | 4.26 (.19)   | 4.72 (.16)   |
| Production         | 2.19 (.14)   | 2.69 (.19)   | 2.07 (.17)   |
| MAE                |              |              |              |
| Comprehension      | 6.39 (.13)   | 6.54 (.07)   | 6.60 (.09)   |
| Production         | 6.18 (.15)   | 6.38 (.10)   | 6.24 (.12)   |
| Exposure to        |              |              |              |
| African Americans  | 2.83 (.15)   | 3.17 (.14)   | 3.23 (.15)   |
| European Americans | 5.57 (.18)   | 5.01 (.22)   | 4.88 (.23)   |

*Note.* Values in parentheses indicate standard error. Comprehension and production are measured on a seven-point scale (1 = *poor*, 7 = *excellent*), and exposure is also measured on a seven-point scale (1 = *none*, 7 = *many*).

Figure 1. Mean plausibility judgment by sentence type (Experiment 1).



### *Plausibility Judgments*

As shown in Figure 1, a one-way repeated measures analysis of variance (ANOVA) revealed a significant difference for sentence type,  $F(1, 71) = 975.07$ ,  $p < .001$ ,  $\eta^2 = .93$ , observed power = 1.00. Follow up  $t$  tests showed that plausible sentences were judged as significantly more plausible than plausible AAE sentences,  $t(71) = 36.40$ ,  $p < .001$ ,  $\eta^2 = .95$ , and implausible sentences,  $t(71) = 33.01$ ,  $p < .001$ ,  $\eta^2 = .94$ . Plausible AAE and implausible sentences did not differ significantly,  $t(71) = 1.39$ ,  $p = .169$ ,  $\eta^2 = .03$ .

### **Discussion**

In Experiment 1, our written stimuli were devoid of vocal cues which could be used to index social information. Thus no social weighting, as predicted by the dual-route approach, could occur as participants read our sentences. As hypothesized, and in line with Squires (2014), our MAE-speaking participants had statistically significantly higher plausibility ratings for plausible sentences than plausible AAE and implausible sentences. This likely reflects the fact that plausible sentences matched the linguistic system our participants used and should therefore have been easier to process.

In the absence of vocal cues, our MAE-speaking participants did not differentiate between plausible AAE and implausible sentences, judging both types to be implausible. This could suggest that our MAE-speaking participants did not have knowledge of AAE, and therefore could not differentiate plausible AAE and implausible sentences. Alternatively, it is unclear whether participants reduced their expectations more generally when encountering a variety they themselves do not speak (Weissler & Brennan, 2020). Thus, it could be that

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our MAE-speaking listeners did have some knowledge of AAE, but failed to use it systematically when vocally-cued social information about the speaker is absent. Moreover, because we presented our stimuli in written form, MAE, which has a standardized written system, may have been primed. This could have caused our MAE-speaking participants to filter AAE (which does not have a standardized written system; Green, 2002) and implausible sentences through the MAE linguistic system. Doing so could also explain why plausible AAE and implausible sentences were both judged implausible.<sup>2</sup>

In order to further tease apart how MAE-speakers process plausible, plausible AAE, and implausible sentences, we provided race-relevant social information about a speaker in Experiment 2 (vocal cues) and Experiment 3 (vocal and visual cues).

## Experiment 2

Experiment 1 found that in the absence of vocally-cued social information, MAE-speaking participants did not differentiate between plausible AAE and implausible sentences. The dual-route approach predicts that vocal cues will activate social expectations about a speaker, and therefore influence processing. In this way, adding race-relevant vocal cues would allow us to better understand how MAE-speaking listeners process socially meaningful linguistic variation. If indeed MAE-speaking listeners have no knowledge of AAE or expectations of AAE-speakers, then we should replicate the findings of Experiment 1 and show that even with the addition of race-relevant vocal cues, plausible AAE and implausible sentences are not differentiated. In contrast, if race-relevant cues are used during processing, the dual-route approach predicts that these utterances should be processed differently.

MAE-speaking listeners are quite adept at identifying race using vocal cues (Kushins, 2014; Thomas & Reaser, 2004). Since vocal cues can lead to racial categorization, they can also elicit stereotype-based inferences about the speaker. Because AAE is considered a stigmatized language variety in the United States, listeners may perceive AAE-speakers to utter incorrect speech. This perception can lead to expectations that AAE-speakers are more likely to have language deficits, make more frequent linguistic mistakes, and perform poorly on language-based tasks (Green, 2002; Pearson et al., 2013; Pullum, 1999). This stigma could therefore lead to a general negative evaluation of AAE-speakers. If race-relevant vocal cues activate a general negative stigma in MAE-speaking listeners, then any sentence (plausible, plausible AAE, implausible) uttered by a voice perceived to be African American should be judged as less plausible than when that sentence is uttered by a voice perceived to be European American.

Alternatively, if familiarity with socially meaningful linguistic variation and voice-derived social information interact, then sentences may be judged as more

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2 We would like to thank the anonymous reviewers for bringing this possibility to our attention.

plausible when the sentence structure matches the perceived race of the voice compared to when it does not match. In this case, plausible AAE sentences uttered by a voice perceived to be African American would be judged as more plausible than when uttered by a voice perceived to be European American, and plausible sentences uttered by a voice perceived to be European American would be judged as more plausible than when uttered by a voice perceived to be African American.

In line with the dual-route approach, we hypothesized that adding race-relevant vocal cues would alter the processing patterns in our MAE-speaking listeners. Specifically, we did not expect to replicate the findings in Experiment 1. Rather, we predicted that our MAE-speaking listeners would differentiate plausible AAE and implausible sentences. Moreover, we hypothesized that our MAE-speaking listeners would not rely on general negative stereotypes during processing. Rather, we predicted that MAE-speakers will use race-relevant vocal cues when processing socially meaningful linguistic variation, such that plausible AAE sentences would be judged more plausible when uttered by a voice perceived to be African American, and that the plausible sentences would be judged more plausible when uttered by a voice perceived to be European American.

## Participants

Seventy-two participants (29 male, 43 female,  $M_{\text{age}} = 19.75$  years) completed this experiment. Of these, 56 identified as European American, seven as Asian, five as Mixed/Multi-racial, two as Hispanic/Latino, one as African American/Black, and one as Native Hawaiian/Pacific Islander. Participants were recruited from the Psychology Department subject pool at a small college in the Pacific Northwest and received course credit for participation. Participants who completed Experiment 1 were excluded from Experiment 2.

## Stimuli and Procedure

In order to examine how race-relevant vocal cues influence the processing patterns found in Experiment 1, we asked two female speakers of a similar age to record the sentences used in Experiment 1. One speaker identified as African American and as a native AAE-speaker, while the other identified as European American and as a native MAE-speaker. Doing so enabled us to disentangle processing effects due to race-relevant cues from the speaker (African American voice vs. European American voice), from those due to language variety (AAE vs. MAE). Each speaker was asked to read the sentences using her self-identified native variety. Prior to recording, both speakers were asked to familiarize themselves with the sentences so that they would be spoken as naturally as possible. Both speakers were employed at the university where the research took place. The speakers and the first author were familiar with each other and the AAE-speaker felt comfortable using AAE, and the MAE-speaker felt comfortable using MAE, with the first author during recording. After recording, the sentences were spliced from the larger sound

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file and filtered to eliminate any background noise. The final sound files did not differ in volume. Neither speaker was aware of the study's purpose.

After providing consent, participants were asked to complete the identical computerized sentence plausibility task as in Experiment 1, except that now participants listened to the sentences instead of reading them. The participants first heard three practice sentences and provided judgments for each before starting the actual experiment. For the experiment, a  $2 \times 3$  [speaker (AAE, MAE)  $\times$  test sentence type (plausible, plausible AAE, implausible)] design was employed. Following the same procedure as for Experiment 1, sentences were placed into one of six unique orders using systematic rotation. To do so, we placed one version of each test sentence uttered by either the AAE-speaker or MAE-speaker into one unique order. This resulted in six unique orders in which half the test sentences were uttered by the AAE-speaker and the other half by the MAE-speaker. All orders contained the same 16 filler sentences; half were uttered by the AAE-speaker, half were uttered by the MAE-speaker. Each participant was exposed to only one order, and therefore, heard 64 sentences (16 plausible; half uttered by the AAE-speaker, half by the MAE-speaker, 16 plausible AAE; half uttered by the AAE-speaker, half by the MAE-speaker, 16 implausible; half uttered by the AAE-speaker, half by the MAE-speaker, and 16 filler; half uttered by the AAE-speaker, half by the MAE-speaker). Within each order, the sequence of the 64 sentences (test, filler) were randomized by Inquisit (2006). Participants heard the 64 sentences one at a time over headphones in a single 10-minute testing session. Following the sentence judgment task, participants completed the same background questionnaire as in Experiment 1.

## Results

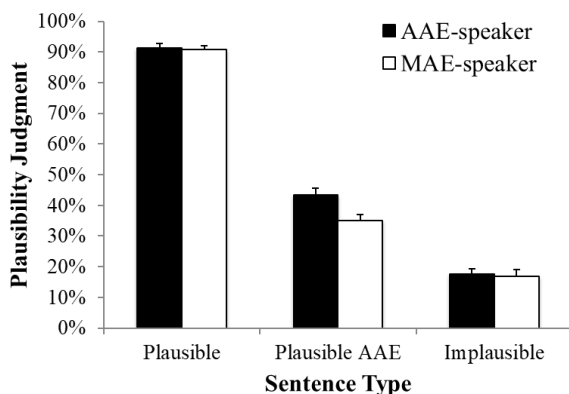
### *Language Background and Familiarity with Social Groups*

As in Experiment 1, all participants identified as MAE-speakers, and none as an AAE-speaker (see Table 1). Participants again reported significantly greater abilities in MAE than AAE for production,  $t(71) = 17.70$ ,  $p < .001$ ,  $\eta^2 = .82$ , and comprehension,  $t(71) = 12.26$ ,  $p < .001$ ,  $\eta^2 = .68$ , as well as significantly greater exposure to European Americans than African Americans,  $t(71) = 7.01$ ,  $p < .001$ ,  $\eta^2 = .41$ . Thus, this sample has the same characteristics as the sample from Experiment 1.

### *Plausibility Judgments*

A  $2$  (speaker)  $\times 3$  (sentence type) repeated-measures analysis of variance (ANOVA) revealed significant main effects for speaker,  $F(1, 71) = 8.21$ ,  $p = .005$ ,  $\eta^2 = .10$ , observed power = .81, and sentence type,  $F(2, 142) = 718.80$ ,  $p < .001$ ,  $\eta^2 = .95$ , observed power = 1.00, as well as a statistically significant interaction,

Figure 2. Mean plausibility judgment by sentence type (Experiment 2).



$F(2, 142) = 5.13, p = .007, \eta^2 = .11$ , observed power = .75. As shown in Figure 2, regardless of the speaker, participants provided similar judgments for both plausible,  $t(71) = .31, p = .756, \eta^2 = .00$ , and implausible sentences,  $t(71) = .33, p = .743, \eta^2 = .00$ . This result indicates that participants readily distinguished between these sentences and therefore understood the task, judging plausible sentences as plausible and implausible sentences as implausible. However, plausible AAE sentences were rated significantly more plausible when uttered by the AAE-speaker than the MAE-speaker,  $t(71) = 3.90, p < .001, \eta^2 = .18$ .

## Discussion

The results from Experiment 2 supported the predictions of the dual-route approach and showed that the speaker matters: MAE-speaking listeners integrated both speaker information (i.e., race-relevant vocal cues) and sentence content to arrive at a different pattern of sentence-level judgments. Crucially, speaker information only altered judgments when it was associated with socially meaningful linguistic variation. That is, only the plausible AAE sentences were judged as more plausible when uttered by an AAE-speaker while there was no effect of speaker on the other sentence types. This is in contrast to the results of Experiment 1, where in the absence of race-relevant cues, MAE-speaking listeners did not differentiate between plausible AAE and implausible sentences.

As pointed out during anonymous review, MAE is both a standardized written and spoken variety while AAE is a spoken variety with no standardized written system (Green, 2002). Thus, it is possible that the differences between Experiment 1 and 2 could be due to a shift in modality, not the addition of social cues. While the predictions of the dual-route approach explain the findings of both Experiment 1 (no vocal cues to social group resulting in no social weighting) and Experiment

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2 (vocal cues to social group resulting in social weighting) quite well, the possible influence of a modality shift cannot be ruled out in the design of Experiments 1 and 2. Future research should test this possibility by comparing standard and non-standard varieties that both have a standardized spoken and written system.

The addition of race-relevant vocal cues allowed MAE-speaking listeners to dynamically integrate their expectations about the AAE-speaker as they processed socially meaningful linguistic variation (see also Mengesha & Zellou, 2018; Staum Casasanto, 2008, 2010; Weissler & Brennan, 2020). These expectations do not appear to activate a general negative evaluation of the AAE-speaker since our MAE-speaking listeners did not judge all utterances by the AAE-speaker as less plausible than the utterances by the MAE-speaker. Rather, our hypothesis that utterances in which perceived race and socially meaningful linguistic variation match are judged as more plausible was partially supported. As hypothesized, we found that plausible AAE sentences were judged as more plausible when uttered by a voice perceived to be African American than when uttered by a voice perceived to be European American. Contrary to our hypothesis, this did not extend to plausible sentences, which were judged similarly plausible regardless of whether they were uttered by a voice perceived to be European American or African American. Taken together, this suggests that our MAE-speaking listeners have a more nuanced understanding of standard and non-standard linguistic structure, and that this nuanced understanding is employed in the presence of race-relevant vocal cues (see also Weissler & Brennan, 2020). Moreover, these results showed that the predictions of the dual-route approach can be extended to processing standard and non-standard linguistic structure at the sentence level.

These patterns were driven by vocal cues to a speaker's social characteristics. While vocal cues are readily and accurately employed to identify African American voices (Babel & Munson, 2014; Kushins, 2014; Thomas & Reaser, 2004), other cues to a speaker's social background may interact with this process. In particular, visual cues indicate many social characteristics, including perceived race, which may serve to further activate a listener's expectations of socially meaningful linguistic variation. In Experiment 3, we investigated how visual cues to speaker characteristics interact with vocal cues.

### Experiment 3

Both implicit and explicit processes guide social judgments. In particular, implicit, automatic activation of social information and controlled perceptual processing combine to arrive at explicit judgments (e.g., Posner & Snyder, 1975). In Experiment 2, vocal cues were not explicitly labeled as belonging to a particular group. While we cannot rule out that participants did not have an explicit awareness of social information as they listened to the stimuli in Experiment 2, the more likely explanation is that the race-relevant vocal cues implicitly activated race-relevant speaker characteristics and associated social

and linguistic expectations.

However, explicit visual cues to perceived race do activate expectations about a speaker (Staum Casasanto, 2008). Thus, in Experiment 3, we tested how MAE-speaking listeners integrate explicit visual and vocal cues during speech processing. To test this, we presented MAE-speaking listeners with faces of two potential speakers, one African American and one European American. Participants then heard the same sentences uttered by the AAE- and MAE-speaker as in Experiment 2 and were asked to select the most likely speaker of the utterance. This allowed us to further test how MAE-speaking listeners integrate race-relevant visual and vocal cues, which each carry information about a speaker's characteristics, as they encounter socially meaningful linguistic variation. We hypothesized that MAE-speaking listeners would readily match vocal and visual cues and select the speaker whose voice best matches both cues (e.g., sentences perceived to be uttered by an African American voice would be linked to the African American face; sentences perceived to be uttered by a European American voice would be linked to the European American face). Because the dual-route approach predicts social weighting, we further hypothesized that the African American face would be linked most frequently to the plausible AAE sentences when uttered by the AAE-speaker, as compared to plausible and implausible sentences. Further, we hypothesized that the European American face would be linked most frequently to the plausible sentences when uttered by the MAE-speaker, as compared to plausible AAE and implausible sentences.

## Method

### *Participants*

Seventy-two participants (20 male, 52 female,  $M_{\text{age}} = 19.42$  years) completed this experiment. Of these, 55 identified as European American, six as Mixed/Multi-racial, seven as Asian, two as American Indian/Alaska Native, one as Hispanic/Latino, and one as Native Hawaiian/Pacific Islander. Participants were again recruited from the Psychology Department subject pool at a small college in the Pacific Northwest and received course credit for their participation. Participants who completed Experiments 1 or 2 were excluded from Experiment 3.

### *Stimuli and Procedure*

In order to assess whether explicit race-relevant visual cues influence the processing of socially meaningful linguistic variation, participants heard the same sentences as in Experiment 2 while seeing the faces of two potential speakers – one African American and one European American – on a computer screen. Thirty-two faces (16 African American, 16 European American) were selected from the Center for Vital Longevity Face Database - Neutral Expressions (Minear

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Figure 3. *Sample faces used in experiment 3.*



& Park, 2004). These faces were matched across ethnicity. We also matched the faces to control for differences in age, hairstyle, perceived attractiveness, and type of jewelry. The 32 faces were then converted to grayscale; a subset of these faces are shown in Figure 3 as an example. Two faces (one African American, one European American) were randomly paired with each sentence for each participant by Inquisit (2006). The African American face appeared on the left side of the screen on half of the trials; the exact pairing between sentence and face location was randomized for each participant by Inquisit (2006).

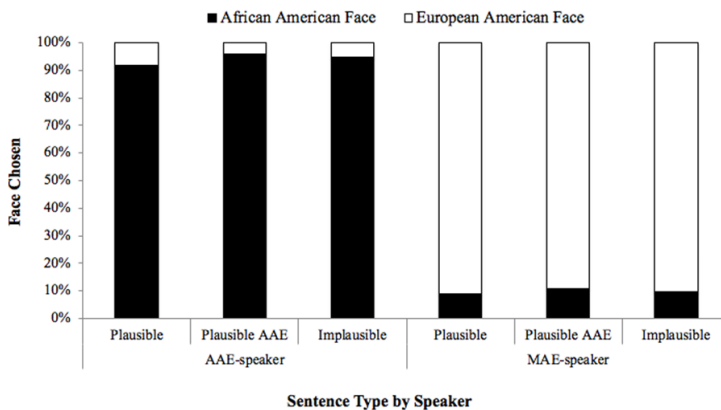
After providing consent, participants were instructed that they would listen to a series of sentences and should identify which of the two potential speakers was the most likely to have uttered the sentence they just heard. Participants were asked to make their decision as quickly and accurately as possible by pressing the same keys as in the previous experiments, however, now “a” corresponded to the face displayed on the left, and “k” corresponded to the face displayed on the right. After each response, there was a 500 ms break before the next sentence played. As before, a tone and a central presented crosshairs symbol signaled that the next trial was about to begin. Participants heard the sentences over headphones in a single 10 minute testing session. Following the speaker identification task, participants completed the same background questionnaire as in the previous experiments.

## Results

### *Language Background and Familiarity with Social Groups*

As before, all participants identified as MAE-speakers, and none as an AAE-speaker (see Table 1). Participants again reported significantly greater abilities with MAE than AAE for production,  $t(69) = 17.48$ ,  $p < .001$ ,  $\eta^2 = .82$ , and

Figure 4. Mean percentage of face chosen by sentence type and speaker (Experiment 3).



comprehension,  $t(70) = 11.24$ ,  $p < .001$ ,  $\eta^2 = .64$ , as well as significantly greater exposure to European Americans than African Americans,  $t(71) = 6.17$ ,  $p < .001$ ,  $\eta^2 = .35$ .<sup>3</sup> Thus, this sample has the same major characteristics as the samples from the previous experiments.

### Speaker Identification

A 2 (speaker)  $\times$  3 (sentence type) repeated measures analysis of variance (ANOVA) revealed significant main effects for the speaker,  $F(1, 71) = 9.19$ ,  $p = .003$ ,  $\eta^2 = .12$ , observed power = .85, but not sentence type,  $F(2, 142) = 0.69$ ,  $p = .50$ ,  $\eta^2 = .01$ , observed power = .16, and a significant interaction between speaker and sentence type,  $F(2, 142) = 3.19$ ,  $p = .044$ ,  $\eta^2 = .04$ , observed power = .60. As shown in Figure 4, the significant interaction indicates that when uttered by the AAE-speaker, both plausible AAE and implausible sentences were associated with an African American face significantly more often than for plausible sentences (plausible AAE vs. plausible:  $t(71) = -2.61$ ,  $p = .011$ ,  $\eta^2 = .09$ ; implausible vs. plausible:  $t(71) = -2.50$ ,  $p = .015$ ,  $\eta^2 = .08$ ). When uttered by an AAE-speaker, plausible AAE and implausible sentences were associated with the African American face at similar rates,  $t(71) = 0.77$ ,  $p = .446$ ,  $\eta^2 = .01$ . These patterns are not true of the MAE-speaker. All sentences uttered by the MAE-speaker were associated with the European American face at similar rates (plausible vs. implausible,  $t(71) = 0.81$ ,  $p = .419$ ,  $\eta^2 = .01$ ; plausible vs. plausible AAE,  $t(71) = 0.26$ ,  $p = .793$ ,  $\eta^2 = .00$ ; plausible AAE vs. implausible,  $t(71) = -0.78$ ,  $p = .437$ ,  $\eta^2 = .01$ ).

3 Due to some incomplete questionnaires, the df are different for these comparisons.

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**Discussion**

In contrast to Experiments 1 and 2, here, we did not ask participants to provide sentence plausibility judgments, but rather to associate each sentence with an African American or European American face. Because a face that explicitly matched the race-relevant vocal cues of each utterance was always present, we hypothesized that participants would match voice to face regardless of sentence type. This hypothesis was generally borne out as the face matching the perceived voice was selected about 90% across all sentence types for both speakers. Because of the social weighting predicted by the dual-route approach, we also hypothesized that the African American face would be associated more often with the plausible AAE sentences when uttered by the AAE-speaker. We found partial support for this hypothesis. As hypothesized, when uttered by the AAE-speaker, MAE-speaking listeners did associate the African American face significantly more with plausible AAE than plausible sentences. This significant boost in face selection is likely due to the social weighting afforded by the race-relevant vocal cues and their integration with matching visual cues. Contrary to our hypothesis, however, MAE-speaking listeners also associated the African American face significantly more with implausible than plausible sentences when they were uttered by the AAE-speaker. Moreover, when uttered by an AAE-speaker, the African American face was associated with plausible AAE and implausible sentences at similar rates. While Experiment 2 showed that our participants did differentiate between plausible AAE and implausible sentences, Experiment 3 showed that MAE-speaking listeners associated the African American face significantly more with plausible AAE and implausible utterances. This suggests that MAE-speaking listeners may hold negative expectations about what utterances African Americans are likely to say and therefore select the African American face significantly more for sentences which are implausible from an MAE perspective. The MAE-speaker did not appear to activate these same expectations; contrary to our hypothesis, the European American face was selected at similar rates across sentence types.

In sum, the MAE-speaking listeners did appear to differentiate the AAE- and MAE-speakers and appeared to have different expectations for them. Taken together, these results suggest that in combination with explicit visual cues, race-relevant vocal cues activate expectations which associate African Americans with incorrect utterances in our MAE-speaking listeners. These expectations provided a boost such that the African American face was selected significantly more for both plausible AAE and implausible sentences (which are both implausible in MAE) than the plausible sentences, even though all were uttered by the same AAE-speaker.

## General Discussion

The dual-route approach (Sumner et al., 2014) predicts that phonetically cued information allows listeners to simultaneously extract linguistic and social information from what they hear. This social weighting influences how listeners process socially meaningful linguistic variation. The current line of research extended these predictions and investigated how MAE-speaking listeners integrate different race-relevant cues as they process AAE and MAE utterances. Because AAE carries stigma relative to MAE in the United States, these differences allowed us to assess how MAE-speaking listeners judged the plausibility of sentences and identified potential speakers as we manipulated (a) socially meaningful linguistic variation and (b) provided different race-relevant cues to accentuate MAE-speaking listeners' stereotypical knowledge and expectations regarding the speaker. Moreover, while the bulk of previous research has focused on the interaction of socially meaningful linguistic variation and social expectations at the word level (Perry et al., 2017; Squires, 2016), the current line of research examined this interaction at the sentence level. This extends our understanding of how the processing of grammatical variation is impacted by socially-weighted information. In line with the dual-route approach and the predictions of Squires (2014), we hypothesized that processing should depend on the listener's expectations, be affected by both linguistic and nonlinguistic information, and also vary based on a listener's language background. Converging evidence from the experiments reported here supports the predictions of the dual-route approach and Squires (2014) and shows that MAE-speaking listeners integrate race-relevant cues to dynamically alter their processing of socially meaningful linguistic variation.

In the absence of race-relevant vocal cues (Experiment 1), MAE-speaking listeners judged both the plausible AAE and the implausible sentences as implausible. As predicted by the dual-route approach, in the absence of race-relevant vocal cues, social weighting did not occur and participants did not appear to demonstrate familiarity with socially meaningful linguistic variation. Rather, sentences deemed implausible from an MAE perspective (i.e., plausible AAE and implausible sentences) were not differentiated (but see the Discussion section in Experiments 1 and 2 regarding standardized writing systems).

In line with the dual-route approach, we hypothesized that the addition of race-relevant cues would lead to significant differences in how MAE-speaking listeners process socially meaningful linguistic variation. As hypothesized, when provided with race-relevant vocal cues (Experiment 2), MAE-speaking listeners were sensitive to socially meaningful linguistic variation and, regardless of speaker, judged plausible AAE sentences (which are not plausible in MAE) as significantly more plausible than implausible sentences (which are neither plausible in AAE nor MAE). In addition, participants judged plausible AAE sentences as significantly more plausible when uttered by an AAE-speaker than when uttered by an MAE-speaker. Moreover, plausible sentences were judged as

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plausible, and implausible sentences were judged as implausible, regardless of whether the sentence was uttered by an AAE- or MAE-speaker. This indicates that our participants did not appear to have a default strategy which associated AAE-speakers with implausible sentences. These findings align with previous research and show that listeners create a socially informed structure of the speech signal which incorporates socially meaningful linguistic variation and social expectations (Baese-Berk et al., 2020; Drager, 2010; McGowan, 2015; McGowan & Babel, 2020; Mengesha & Zellou, 2018; Squires, 2014; Sumner et al., 2014; Sumner, 2015). Importantly, the current line of research shows that this integration occurs not just at the word, but also at the sentence level.

We predicted the same pattern of socially-weighted processing when listeners were presented with race-relevant visual and vocal cues (Experiment 3). While the participants matched face with perceived voice about 90% of the time regardless of sentence type, MAE-speaking listeners utilized these cues differently for the AAE- and MAE-speaker. That is, MAE-speaking listeners associated the AAE-speaker with the African American face for sentences considered implausible from an MAE perspective (i.e., plausible AAE and implausible sentences) significantly more than for plausible sentences. While we hypothesized that the African American face would be selected significantly more for plausible AAE sentences uttered by the AAE-speaker, we did not hypothesize that this pattern would extend to implausible sentences. Taken together, this suggests that when made explicit, MAE-speaking listeners associate African American faces with incorrect utterances (plausible AAE and implausible sentences) more so than plausible utterances (see also King & Sumner, 2014). This bias could contribute to a potential implicit mechanism which leads to linguistic profiling and linguistic discrimination experienced by many AAE-speakers (Baugh, 2003). These patterns are in contrast to the MAE-speaker who was consistently paired with the European American face, regardless of sentence type, at similar rates.

Taken together, these findings contribute to the literature in several respects. Importantly, the dual-route approach predicts the general pattern found in this line of research. Vocal cues appear to activate expectations about the speaker and these expectations are integrated with socially meaningful linguistic variation during processing. As further predicted by Sumner et al. (2014), this social weighting is also robust in longer utterances, not just in words and word forms. While prior research has shown that semantic content and vocal cues interact in how stereotypes are applied during sentence comprehension (e.g., Fasoli et al., 2020), this line of research extends this to the processing of grammatical variation. Like Weissler and Brennan (2020), our findings suggest that MAE-speaking listeners appear to have some passive knowledge of non-standard linguistic structure and integrate this knowledge with race-relevant cues during sentence-level processing.

Yet, participants across all experiments reported little familiarity with AAE on their explicit self-report measures, so it remains unclear where our listeners'

knowledge of AAE comes from. Moreover, it remains unclear whether participants are perceiving these differences (an implicit process) or noticing these differences (an explicit process; see Squires, 2016). It is likely that implicit ideologies about correct and incorrect pronunciation and grammar, rather than explicit linguistic knowledge about AAE, are at work for MAE-speaking listeners. These ideologies may be informed by education, media, interactions (both indirect and direct), as well as some combination of these factors (Acheme & Cionea, 2022). Moreover, these ideologies may support a linguistic hierarchy which elevates MAE and perpetuates negative evaluations of nonstandard varieties (Weissler & Brennan, 2020). Likely, these ideologies are implicit and activate stereotyped associations when listeners are presented with race-relevant vocal and visual cues. In line with the dual-route approach, our findings show that the processing of socially meaningful linguistic variation is qualitatively different when integrated with race-relevant vocal cues. If MAE-speaking listeners associate race-relevant cues with the speaker's perceived social group, then stereotypes about that social group are likely to persist. In this way, the current line of research provides a feasible avenue to test how ideologies and stereotypes based on linguistic hierarchies inform the evaluation and processing of nonstandard language varieties.

### **Limitations and Future Directions**

The sentences employed in these experiments presented plausible AAE sentences alongside sentences that were either plausible or implausible in both varieties. This allowed us to assess whether plausible AAE sentences are considered to be (a) more similar to plausible sentences (which are plausible in both AAE and MAE), (b) more similar to implausible sentences (which are implausible in both AAE and MAE), or (c) different from both plausible and implausible sentences. We found that with the addition of race-relevant cues, plausible AAE sentences were considered significantly less plausible than plausible sentences, but significantly more plausible than implausible sentences. Thus, while MAE-speaking listeners do not equate plausible AAE sentences and implausible sentences, plausible AAE sentences are also not equivalent to plausible sentences.

One explanation for these patterns is that MAE-speaking listeners have some knowledge of AAE which they use during processing. This explanation aligns with recent empirical findings from Weissler and Brennan (2020) who show that listeners do process AAE and MAE differently, but that these differences do not appear to reflect specific grammatical knowledge. Future research must investigate how type of knowledge of socially meaningful linguistic variation (implicit, explicit), explicit measures of speaker expectations and attitudes, as well as their interactions, influence the processing of nonstandard grammatical variation.

An alternative explanation for these results deals with how plausible AAE and implausible sentences were constructed in the present set of experiments.

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That is, plausible AAE sentences were created by removing a feature (see Box 1), while implausible sentences were created by adding a feature that made the sentence ungrammatical. This qualitative difference may influence how noticeable these changes were and therefore could have influenced processing. In particular, because MAE also uses reductions, the removal of features, which characterizes the plausible AAE sentences, may not have been as noticeable to the listeners. Further, omissions and commissions are treated differently during processing (see e.g., Dube et al., 2016). Thus, the differences in how plausible AAE and implausible sentences were judged may reflect this qualitative difference in stimulus construction.<sup>4</sup> While we do not believe that the pattern of results found in these experiments is best explained by these qualitative differences in how stimuli were constructed, future research must more cleanly control the construction of plausible AAE and implausible sentences to empirically rule out this alternative explanation.

In addition, processing fluency, or the ease with which speech information is processed, interacts directly with sociolinguistic perception (Dragojevic & Giles, 2016). For example, a listener may have difficulties processing speech when they encounter unfamiliar linguistic variation (e.g., t/d deletion). The difficulties encountered can activate negative attitudes towards that speaker and serve to further influence the expectations the listener has about the speech they are likely to encounter from that speaker (Acheme & Cionea, 2022; Dragojevic & Giles, 2016; Dragojevic, 2018; Dovidio & Gluszek 2012; Lev-Ari et al., 2019). To what degree linguistic features disrupt processing fluency likely depends on how familiar or unfamiliar specific features are to a listener (see also Squires, 2014). For example, some features which differ between AAE and MAE, such as t/d deletion, may be more familiar to the average MAE-speaking listener than other features. Because our stimuli only used four features which differ between AAE and MAE, future research must employ a broader range of features to address how feature type may interact with processing fluency and expectations of the speaker.

Moreover, a potential concern is that the differences in Experiments 2 and 3 could be driven by the idiosyncrasies of the speakers themselves. Both the AAE- and the MAE-speaker were asked to record plausible AAE sentences, a task that was likely easier for the AAE-speaker than the MAE-speaker. It may be that the plausible AAE sentences uttered by the AAE-speaker sounded more fluent and natural to our listeners, which may be reflected in the overall plausibility ratings in Experiment 2. However, the results from Experiment 3 do not neatly align with possible differences in speaker fluency as the African American face was associated at similar rates for plausible AAE and implausible sentences when uttered by the AAE-speaker, and the European face was associated at similar rates for all sentence types when uttered by the MAE-speakers. In order to address potential issues of speaker fluency, future research may benefit from using a

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4 We thank an anonymous reviewer for bringing this alternative explanation to our attention.

matched-guise technique, in which the same speaker utters the same stimuli in the language varieties tested (Acheme & Cioni, 2022; Dragojevic & Giles, 2016). If the speaker can produce both language varieties fluently, then this control could help rule out idiosyncratic differences in a speaker's voice or fluency.

Finally, although our findings are in line with the dual-route approach, it remains unclear how different types of social information contribute to sociolinguistic perception. In particular, implicit and explicit knowledge supports different cognitive components involved in sociolinguistic perception (Squires, 2016). Therefore, it is likely that implicit and explicit knowledge interacts differently, and at different stages, in the dual-route approach model. It is also unclear whether phonetically cued information leads to the unidirectional activation of social categories (as indicated in Sumner et al., 2014), or, once activated, the stereotypes associated with specific social categories can also influence what social features a listener perceives. This is especially important when investigating socially meaningful linguistic variation that not only carries stigma, but also tends to be associated with a social group that experiences bias and discrimination. While the current findings contribute to the existing knowledge of how race-relevant social cues influence the processing of socially meaningful linguistic variation at the sentence level, future research must specify aspects of this integration more fully.

In sum, it matters who we are listening to, and providing race-relevant cues can accentuate the integration of socially meaningful linguistic variation with expectations about the speaker during speech processing. Our findings strongly suggest that negative expectations about AAE, and therefore AAE-speakers, are implicated during speech processing. These expectations may inform a nuanced, implicit mechanism which could further explain persistent discriminatory practices due to what Baugh (2003) has termed linguistic profiling. For example, individuals who are perceived to be AAE-speakers experience lower hiring rates (Kushins, 2014), reduced income (Grogger, 2011), racial profiling leading to real estate inequities (Massey & Lundy, 2001), and differential evaluation in courtroom settings (Rickford & King, 2016) when compared to individuals who are not perceived to be AAE-speakers. While listeners' stereotyped knowledge and expectations are an important feature in how socially meaningful linguistic variation is processed, this may also lead to discriminatory practices as meaningful linguistic variation and expectations about a speaker are integrated. the more ironic an item is, the more positive the speaker feels. This might be an issue of ambiguity, where the more easily an item is recognized as ironic, the more clearly a bystander perceives the speaker as feeling positive. However, more research into self-irony is needed to solidify this finding.

Second, when listeners are addressed by statements ("How clumsy/careful of you"), regardless of whether they are ironic or not, they are rated to feel more negative and more aroused than when statements are not directed at them ("How clumsy/careful of me") or, when compared to speakers of these statements.

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Thus, our results empirically demonstrate, as intuition suggests, that being the addressee of a statement matters for a perceived emotional state.

In conclusion, our study demonstrates that both, whether we say or hear a comment in a communicative exchange, and whether we are addressed by a comment or not, matter for the emotional impact of the comment. Self-irony presents a special case deserving of further empirical inquiry.

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### **Conflict of Interest Disclosure**

The Authors report no conflicts of interest.

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### **Research Ethics Statement**

The current study was approved by the University of Puget Sound Institutional Review Board Approval number: 1415-023. All standard ethical guidelines required for scientific research were followed in designing, conducting, and reporting of this study. Written informed consent was collected prior to each study. Only participants who provided written consent continued on to the study.

### **Authorship Details**

Tim Beyer: research concept and design, collection and/or assembly of data, data analysis and interpretation, writing the article, critical revision of the article, and final approval of the article.

Tess Renirie: collection and/or assembly of data, data analysis and interpretation, and writing the article.

David Andresen: data analysis and interpretation and writing the article.

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## Appendix

| Nr. | Base         | Plausible                               | Ending type                            |                                          |
|-----|--------------|-----------------------------------------|----------------------------------------|------------------------------------------|
|     |              |                                         | Plausible AAE                          | Implausible                              |
| 1   | The...       | ...raft almost fell over in the rapids  | ...raf' almost fell over in the rapids | ...raft almost fall over in the rapids   |
| 2   | That...      | ...child almost dropped the new vase    | ...chil' almost dropped the new vase   | ...child almost dropping the new vase    |
| 3   | My mother... | ...talked crossly to the salesclerk     | ...talk crossly to the salesclerk      | ...have talked crossly to the salesclerk |
| 4   | The cake...  | ...baked briefly in the hot oven        | ...bak briefly in the hot oven         | ...baking briefly in the hot oven        |
| 5   | He...        | ...is carrying that book                | ...carrying that book                  | ...have carrying that book               |
| 6   | George...    | ...is finally taking a bath             | ...finally taking a bath               | ...am finally taking a bath              |
| 7   | I know...    | ...Emma's book is overdue               | ...Emma book is overdue                | ...Emma hers book is overdue             |
| 8   | Her...       | ...sister's piggy bank broke last night | ...sister piggy bank broke last night  | ...sister piggy bank's broke last night  |

*Note.* These sample test sentences illustrate the four features which differentiate African American English (AAE) and Mainstream American English (MAE) utilized in this study to create sentence triads: t/d absence when part of the root (1 and 2), t/d absence when indicating past tense (3 and 4), copula and auxiliary absence involving is forms (5 and 6), and possessive –s absence (7 and 8). Filler sentences were plausible in both AAE and MAE and included sentences such as “*No one will go to the basketball game with me,*” and “*She took her dog for a walk around the neighborhood.*”