Broken Telephone: Children's Judgments of Messages Delivered by Non-Native Speakers are Influenced by Processing Fluency

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Abstract

Children and adults show preferences for native speakers and judge them to be more credible sources of information than non-native speakers. Previous research with children has attributed this bias to a preference for in-group members. The present study investigated the role of processing fluency on children's social judgements. Children were shown two speakers (one with a native accent and the other with a non-native accent) relaying a message from another individual. They were then asked to make credibility and social judgements about the speakers and their messages. Children were also asked a processing fluency question, and a question about the speakers' comprehension of the original message. Responses to the processing fluency question and question about the speakers' comprehension predicted credibility judgements, but did not predict preference. These findings suggest that processing fluency may play a role in developing biases towards non-native accented speakers. Implications are discussed.

Keywords: processing fluency, intelligibility, accents, credibility judgements, social preferences

Introduction

We make social decisions every day. For example, we make decisions about who we trust and who we want to befriend. To come to these decisions, we might use various pieces of information about the individuals in question. One of these is the way they speak.

Language guides social decisions early in development. For example, infants and children prefer individuals who speak their native language over those who do not (Kinzler, Dupoux & Spelke, 2007). Even variability within a native language influences social decisions: children make social decisions based on accent. Children are more likely to choose children who speak with a native accent of their language as friends, compared to children who speak in a non-native accent (Kinzler, Dupoux & Spelke, 2007). Even monolingual children who are frequently exposed to different English accents demonstrate a preference for native accented English speakers in a friendship task (Paquette-Smith et al., 2019). Accent also influences children's judgements of informants. Preschool children are more likely to endorse labels and functions for novel objects from native accented speakers compared to non-native accented speakers (Corriveau, Kinzler & Harris, 2013; Kinzler, Corriveau & Harris, 2011). In some cases, children seem to rely more on accent than on other cues. For example, while bilingual children show no preference between their two languages in general, they do show preferences for native accented varieties of their languages (DeJesus, Hwang, Dautel & Kinzler, 2017). Additionally, when making friendship decisions, accent biases override racial biases in 5-year-olds (Kinzler, Shutts, DeJesus & Spelke, 2009).

Adults also make social judgements based on accent: they often show preferences for speakers of their own accent and for information from these speakers (though not always; see Stocker, 2017; Frances, Costa & Baus, 2018; Foucart, Costa, Moris-Fernandez & Hartsuiker, 2020). Adults attribute more negative stereotypes and lower social status to non-native accented speakers (Gluszek & Dovidio, 2010) and give native accented speakers more tokens than non-native accented speakers, in a resource allocation task (Cabellero & Pell, 2020). In an Implicit Association Task, adults are more likely to associate statements spoken in a non-native accent with "bad," compared to "good" (Pantos & Perkins, 2012). Adults also rate doctors who speak English in a Canadian (native) accent as more competent compared to doctors who speak in a Chinese (non-native) accent (Baquiran & Nicoladis, 2020).

Accent-based biases are pervasive and have a negative impact on individuals (including professionals) who speak with a non-native accent. Given our increasingly multi-cultural and international society, where we regularly encounter individuals with different accents, it is important to investigate what contributes to accent-based biases across development, and if these biases can be mitigated.

Why do children and adults prefer native speakers and judge them to be better sources of information? The prevailing explanation for this native-speaker bias is that children and adults prefer and trust individuals who are part of their in-group more than those of an out-group. Indeed, accents are an important cue to group membership (Cohen, 2012; DeJesus, Hwang, Dautel & Kinzler, 2018), and in some cases may be a stronger cue than race (Kinzler, Shutts, DeJesus & Spelke, 2009; Spence & Imuta, 2020). Relatedly, listeners may expect more relevant information from native speakers because they are in-group members (Begus, Gliga & Southgate, 2016).

However, there may also be more basic cognitive factors contributing to these language-based biases – in particular, the degree to which the linguistic material is understood (intelligibility) and the ease with which it is processed (speech processing fluency). Stimuli that are more difficult to process are given more negative evaluations. For example, "Woes unite enemies" is judged as less accurate than "Woes unite foes" (McGlone & Tofighbakhsh, 2000), presumably because the latter rhymes and is easier to process. Additionally, participants judge the statement "Osorno is in Chile" as less true when the font is harder to read (Reber & Schwarz, 1999). These negative associations persist when participants make social evaluations (for a review see, Lick & Johnson, 2015). For example, participants rate individuals with names that are difficult to pronounce as less likeable (Laham, Koval, & Alter, 2012). Thus, processing costs incurred by accented speech may similarly lead to negative social biases.

Adults experience slower processing speed and lower accuracy when listening to unfamiliarly accented speech (reviewed in Cristia et al., 2012). These processing costs are more severe earlier in development: children appear to be worse than adults at identifying words in unfamiliarly accented speech (Bent & Atagi, 2017; Nathan et al., 1998), and infants under 19 months may be unable to recognize familiar words in unfamiliarly accented speech (Best et al., 2009; van Heugten & Johnson, 2014) and map them onto their referents (Mulak et al., 2013; van Heugten, Krieger & Johnson, 2015; White & Aslin, 2011). Thus, it is possible that listeners exhibit biases against speakers with non-native accents in part because more resources are required to process their speech. This processing difficulty may result in negative affect that is ultimately directed toward the speaker or their information.

Processing fluency does appear to influence judgements of credibility in adults. In Baquiran and Nicoladis (2020), doctors' competency ratings were positively correlated with perceived fluency: doctors perceived as more fluent in English were also more likely to be perceived as competent. Lev-Ari and Keysar (2010) directly investigated the role of processing fluency in credibility judgements. Participants were asked to rate the truthfulness of statements read by native accented speakers and non-native accented speakers. Importantly, participants were told that the speakers were only reading statements that the experimenter had provided them – thus, statements were not a reflection of each speaker's knowledge. Since participants were aware that speakers were only a vessel for relaying statements, then any difference in truth judgements should be due to processing fluency, and not pre-conceived biases about speakers' knowledge. Participants rated statements from non-native accented speakers as less true compared to those from native accented speakers, and statements rated as more difficult to understand were also rated as less truthful.

Dragojevic and Giles (2016) investigated the relationship between processing fluency, affective state, and social judgements. Participants listened to statements in a native accent or non-native accent, with either low levels or high levels of background noise. They then rated their own affective state and processing fluency, and made status and solidarity judgements about the speaker. Participants were more likely to report negative affective states after listening to statements by non-native accented speakers, and to rate these speakers lower on status and solidarity; this effect increased when there was high background noise. Further mediation analyses indicated that increased noise reduced processing fluency, which in turn increased negative affect; negative affect then influenced judgements. These findings suggest that processing fluency plays a unique role when it comes to language attitudes, by first influencing a listener's affective state.

While there is evidence that processing fluency influences adults' judgements of credibility for non-native accented speakers, to our knowledge there are no studies to date that test this hypothesis in children. Investigating if processing fluency contributes to accent-based biases in children will provide insight into both the development of these biases, and strategies to mitigate them in childhood. If processing costs contribute to accent-based biases in children, then it may be possible to mitigate such biases early in development with interventions that increase processing fluency.

In the present study, we tested 6-year-old children in an experimental paradigm based on Lev-Ari & Keysar (2010), whereby native accented speakers and non-native accented speakers were repeating statements told to them by someone else. After hearing these statements, children were then asked to make a truth judgement and a social preference in a forced-choice task. We also measured children's self-reported processing by asking them who they understood better. We predicted that children would indicate the non-native accented speaker was harder to understand, and that this would be related to truth decisions and social preference.

Methods

Participants

Sixty-four 6-year-old English-speaking children (M_{age} = 6.49; 58% female) participated. Children were either only exposed to English or English was their dominant language.

All children were recruited in the Kitchener-Waterloo Region of Ontario, Canada.

Stimuli

Statements were recorded by 2 native accented English speakers (from the local Kitchener-Waterloo region) and 2 non-native accented speakers (Chinese accented English). A total of 8 statements (4 pairs of statements differing in the final word) were recorded by each speaker. The statements were neither true nor false; statements contained novel words and thus conveyed novel information (e.g., *"A big bird is called a toma").* Each trial showed a picture of a girl, Emily, to the left of two other girls, one native speaker and one non-native speaker. All three held a telephone. Speakers were matched on race and other physical features, such as hair color. See Figure 1.

Figure 1. Example of a test trial. A red box appeared over each speaker when they said their statement.

Procedure

Participants viewed the study on an iPad using Microsoft PowerPoint in a quiet room, either in-lab or in community locations (e.g., schools or the museum). Once participants were comfortable, they were introduced to a girl named Emily, whose picture appeared on the screen. They were told that Emily wanted to call her friends to tell them about some things she learned that day. Two new girls then appeared on the upper right and lower right sides of the screen (while Emily remained in the center-left of the screen) and they were introduced as Emily's friends. Participants were told that Emily was going to call both friends and tell them the same thing. For the first girl, participants heard ringing and then white noise, at which point the researcher said, "*Uh-oh we can't hear what she said! Now she will call her other friend.*" The same white noise was heard when Emily called her other friend. Note that children only heard white noise (there was no actual underlying linguistic stimulus). The researcher then said, *"Oh no! We still can't hear what she said! Let's ask her friends for help."* Each speaker then produced a variant of a novel sentence, differing only in the final novel word (e.g., "*This is what she told me: A bird is called a toma*" vs. "*This is what she told me: A big bird is called a modi*"). A red box appeared over each speaker as her sentences were playing. Participants were then asked four questions (order counterbalanced across children, with the exception that the 1st question was always about the truth of the statement): 1) Which one of those things is true? (truth judgement) 2) Which girl do you like? (social preference) 3) Who did you understand better? (self-understand) 4) Who understood Emily better? (other-understand). Participants completed 4 trials, each with different statement pairs. Assignments of statements and pictures of speakers were counterbalanced across children. Speaker order was also counterbalanced.

Results

We first assessed truth judgements, liking, and understanding questions individually to determine whether there was a preference for the native speaker for each. Participants' responses were coded as follows: 1 = native accented speaker, 0 = non-native accented speaker. For this analysis, data were averaged across trials for each participant for each question; a score closer to 1 indicates a native accented speaker preference, while a score closer to 0 indicates a preference for the non-native accented speaker. Each question type was then subjected to a one-sample t-test with the test value set to 0.5 (chance). Participants chose the native speaker at above chance levels for the truth judgement, $t(63) = 3.46$, $M = 0.63$, $SD = 0.04$, $p < .001$, self-understand question $t(63) = 3.49$, $M = 0.67$, $SD = 0.31$, $p < .001$, and other-understand question, $t(63) = 3.38$, $M = 0.62$, $SD = 0.29$, $p = .001$. Responses to the liking question were not different from chance $t(61) = 0.58$, $M = 0.52$, $SD = 0.30$, $p = .567$. See Figure 2.

We then investigated the relationship between responses for the different question types. Pearson correlations were computed using the averaged data (i.e., across trials for each participant). Truth judgements were related to the self-understand question, $r = .70$, $p < .001$, and other-understand question, $r = .40$, $p = .001$, and responses to the two understanding questions were related to each other, $r = .34$, $p = .007$. Responses to the liking question were not related to any of the other questions. See Table 1.

Our primary question was whether responses to the two understanding questions would predict truth judgements and social preferences. To investigate this, we computed separate linear multi-level models (MLMs) for truth judgements and social preference, with the understanding questions as predictors and participant and trial number entered as random effects. These analyses allowed us to ask whether children's responses to the truth and social preference questions on any

Table 1. Correlation matrix.

	Truth judgement	Self-understand	Other-understand	Social preference
Truth judgement	-	-	-	-
Self-understand	.70**	-	-	-
Other-understand	.40**	.34**	-	-
Social preference	.15	.12	.23	-

Table 2. Summary of Linear MLM models.

Model	Predictor	*B*	*SE*	*t*	*p*
Model 1 (Truth)	Intercept	0.26	0.05	4.96	< .001
	Self-understand	0.44	0.06	7.49	< .001
	Other-understand	0.14	0.06	2.40	.017
Model 2 (Preference)	Intercept	0.52	0.07	7.23	< .001
	Self-understand	-0.06	0.07	-0.88	.381
	Other-understand	0.09	0.07	1.25	.211

given trial were predicted by their responses to the understanding questions on that trial. Although our outcome is binary, linear MLMs were computed rather than logistic MLMs as logistic MLMs are often difficult to interpret, and there is recent evidence that linear MLMs do not produce biased estimates with binary data (Gomila, 2020).

Model 1 tested whether, within a given trial, responses to the self-understand and other-understand questions predicted truth judgements. Self-understand and other-understand responses were entered as fixed effects with truth judgement entered as the outcome. Children's response to the self-understand question was the stronger predictor of truth judgements, $B = 0.44$, $SE = 0.06$, $t(215.68) = 7.49$, $p < .001$, but their response to the other-understand question also significantly predicted truth judgements, $B = 0.14$, $SE = 0.06$, $t(225.70) = 2.40$, $p = .017$. See Table 2.

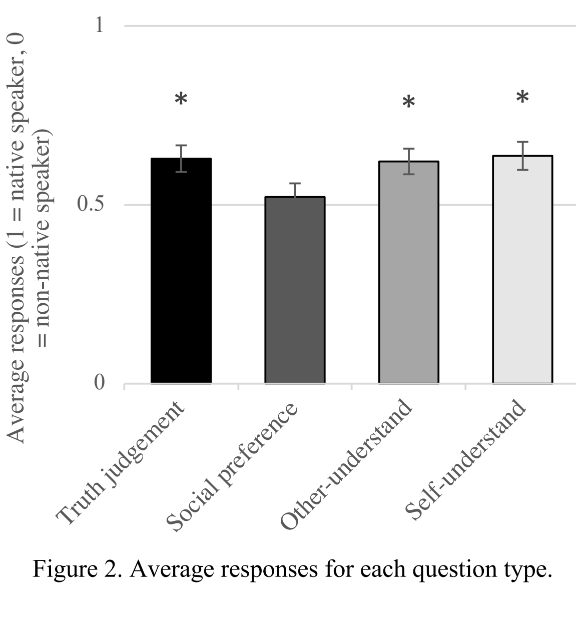

Figure 2. Average responses for each question type.

Model 2 tested whether, within a given trial, responses to the self-understand and other-understand questions predicted social preference. Neither the self-understand question, $B = -0.06$, $SE = 0.07$, $t(205.38) = -0.88$, $p = .381$, nor the other-understand question, $B = 0.09$, $SE = 0.07$, $t(211.67) = 1.25$, $p = .211$, predicted social preference.

Discussion

The current study is the first to demonstrate the role of intelligibility and processing fluency on children's social biases towards non-native accented speakers. Six-year-old children were more likely to endorse a native accented speaker's statement as true, even when they were portrayed simply as the messenger of another's information (and not the source of the information). Children were also more likely to say that they understood the native accented speaker better, and that the native accented speaker understood the informant better. Furthermore, truth judgements were significantly related to children's responses to both understanding questions: children were more likely to trust the speaker who they understood better and who they believed understood the informant better.

Children in our study did not demonstrate a social preference for native accented speakers, and their liking responses were not predicted by their responses to the understanding questions. The absence of a social preference here differs from previous research. There are some potential explanations for this divergence. First, children were told that both speakers were friends with the informant. From this information, children may have assumed both speakers to be equally likable. Second, children were not asked who they themselves would want to be friends with (as is typically done in studies of children's social preferences), but rather who they liked more. Finally, our stimuli were adult faces and voices, while previous research has used child faces and voices. These methodological differences could be addressed in future research.

While previous research with children has attributed native accented speaker biases to group membership (with accent acting as a cue to group membership) and to an expectation of relevant information (e.g., Kinzler, Dupoux & Spelke, 2009; Begus, Gliga & Southgate, 2016), our findings suggest that children's social decisions are affected by their ability to process speech delivered by native and non-native speakers. In our study, a strong predictor of children's credibility judgements was who they understood better.

The fact that children's endorsement was related to the self-understanding question suggests that children in our study trusted the speaker whose speech elicited lower processing costs (i.e., the speaker they understood better). Additionally, children in our study appeared to have made an inference about how easy it would have been for the two speakers to understand the informant's original statement: they trusted the individual who they believed understood the informant better. One possibility is that children used accent as a proxy for the speakers' comprehension competence, believing that non-native accented speakers are less likely to understand others. Another possibility is that children made an inference about each speaker's processing fluency, perhaps based on their own processing fluency. Importantly, however, children's credibility judgements were more strongly predicted by their own processing ease/difficulty.

Our findings suggest that accounts of children's social biases should consider lower-level factors like processing fluency, in addition to notions of group membership. In fact, it is possible that difficulty processing accented speech works in conjunction with more socially driven biases (e.g., preferences for in-group members) resulting in even stronger preferences for native accented speakers. Indirect support for this conclusion comes from the fact that accent-based speaker biases are typically larger than language-based biases (Spence, Hornsey, & Imuta 2021). While biases against both kinds of speakers could be driven by perceived group membership, only unfamiliarly accented speakers of the child's language would result in additional processing costs (as we do not process languages we do not know). Accent-based processing difficulty may also serve more directly as a signal to group status – that is, we may use processing difficulty to establish an individual's group membership. In the visual domain, individuals whose faces are processed more fluently (i.e., have repeated exposure) are more likely to be categorized as in-group members, regardless of race (Claypool et al., 2012).

These findings have broader societal implications: interventions that reduce processing costs may reduce children's social biases against non-native accented speakers. Previous research with adults suggests that short-term exposure to new accents lowers processing costs, although it may not completely mitigate them (Smith, Holmes-Elliot, Pettinato & Knight, 2014). Additionally, long-term exposure to regional accents (e.g., Standard British English) may mitigate processing costs (Smith, Holmes-Elliot, Pettinato & Knight, 2014; Adank, Evans, Stuart-Smith & Scott, 2009), though this may be more apparent in terms of intelligibility and not online measures of processing, such as reaction time (Floccia, Butler, Goslin & Ellis, 2009). Future research should investigate if lower processing costs resulting from familiarity reduce social biases in both children and adults.

The current study has limitations. Most importantly, we did not use a direct measure of processing fluency. Instead, we relied on children's self-report of their understanding after the statements were heard. Future work could more directly probe children's processing of the speech either offline (using content-related comprehension questions) or online, using eye-tracking or modifications to other experimental paradigms used to investigate online processing in adults. For example, Perry, Mech, MacDonald and Seidenberg (2018) investigated the role of speech familiarity on adults' processing through a shadowing task. Second, we did not have a direct measure of children's affective states. If processing fluency influences social judgements by first acting on affect (see Dragojevic & Giles, 2016), then future research should have a measure of children's affective states to investigate the relationship between affect, processing fluency, and social judgements in children. Finally, although we controlled for race by using Caucasian faces (as is typical in such studies), it is possible that children identified an incongruency between the non-native accented speaker's accent (Chinese) and their race (Caucasian; see Weatherhead & White, 2018 for evidence that children have expectations about the link between race and language behaviour). If children were sensitive to this information, then this could influence their processing fluency by introducing a higher cognitive load. Future work could use the present paradigm with silhouettes to investigate this issue. Importantly, however, if this incongruency did result in processing difficulty and, subsequently, less trust in the non-native speakers, this would also provide support for the role of processing fluency in children's credibility judgements.

Despite these limitations, the present work demonstrates that in children, as in adults, processing difficulty may contribute to negative social biases towards non-native accented speakers. These findings further open new directions for research and intervention.

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