



Cognitive Science 45 (2021) e13064

© 2021 Cognitive Science Society LLC

ISSN: 1551-6709 online

DOI: 10.1111/cogs.13064

# Exposing Individuals to Foreign Accent Increases their Trust in What Nonnative Speakers Say

Katarzyna Boduch-Grabka, Shiri Lev-Ari

*Royal Holloway, University of London*

Received 11 February 2021; received in revised form 6 October 2021; accepted 12 October 2021

---

## Abstract

People are more likely to believe things that are easier to process. Foreign-accented speech is relatively difficult to process, and prior research shows that, correspondingly, people believe information less when it is delivered in a foreign accent rather than a native accent. Here we show that a short exposure to foreign accent can reduce this bias, and that the reduction in bias is due to improvement in the processing of the accent. These results demonstrate how cognitive aspects of language processing can influence attitudes. The results also suggest that ensuring exposure to foreign accent can reduce discrimination against nonnative speakers.

*Keywords:* Accent; Fluency; Credibility; Communication

---

## 1. Introduction

Today's society is highly global in nature and interactions between native and nonnative speakers are commonplace. Cities are diverse, business might have clients or suppliers in other countries, and call centers are increasingly located in foreign locations. Despite the ubiquity of interactions between native and nonnative speakers, prior research indicates that individuals have biases that can lead them to treat the speech of nonnative speakers less favorably. Individuals rate foreign-accented speakers as less competent and suitable for a job (Hosoda, Nguyen, & Stone-Romero, 2012; Livingston, Schilpzand, & Erez, 2017), they are less likely to frequent their business (Livingston et al., 2017), and they rate them as less intelligent, knowledgeable, and honest (Tsalikis, DeShields, & LaTour, 1991). Biases against outgroup members abound, but recent research suggests that some of the bias against nonnative speakers might stem from basic perceptual difficulty that could be independent

---

Correspondence should be sent to Shiri Lev-Ari, Department of Psychology, Royal Holloway, University of London, Egham Hill, Egham TW20 0EX, UK. E-mail: Shiri.lev-ari@rhul.ac.uk

of prejudice. Foreign-accented speech is harder to process (e.g., Munro & Derwing, 1995), and difficulty of processing is often misattributed to other negative attributes, such as lower credibility (e.g., McGlone & Tofghbakhsh, 2000; Reber & Schwarz, 1999). Consequently, people believe information less if it is reported in a nonnative accent (Lev-Ari & Keysar, 2010). In this paper, we replicate the latter finding as well as explore more the underlying mechanism by providing more direct evidence that the reason that foreign-accented speech is believed less is at least partially due to reduced processing fluency. We do so by demonstrating that we can reduce the bias against nonnative speaker with an intervention that makes it easier for listeners to understand foreign-accented speech.

### 1.1. Fluency of processing

Whenever we process information we evaluate it by relying not only on its content but also on how easy it is to process. For example, when we judge whether a name is famous, we are more likely to decide that it is if it is easy to process (Jacoby, Kelley, Brown, & Jasechko, 1989). Our reliance on relative ease of processing, also termed processing fluency, for making judgments is a useful shortcut as processing fluency naturally correlates with many aspects of the stimulus, such as its frequency, recency, clarity etc.

While reliance on processing fluency is often a useful shortcut, it can also distort our judgment, because while we have access to the relative difficulty of processing, we do not have direct access to the source of this difficulty. Consequently, we sometimes misattribute the source of (dis)fluency, leading to erroneous judgments. Indeed, experiments on processing fluency rely on this error-prone inferential process. Such experiments manipulate ease of processing without participants' awareness, for example, by priming, and participants erroneously infer from the relative fluency of processing about other aspects of the stimuli. Thus participants judge more fluent stimuli to be presented more clearly (Whittlesea, Jacoby, & Girard, 1990), for a longer duration (Masson & Caldwell, 1998) and more loudly (Jacoby, Allan, Collins, & Larwill, 1988).

Fluently processed stimuli, however, are not only judged to be perceptually clearer, but also tend to be judged more positively. Thus, stimuli that are processed more fluently are judged to be prettier (Reber, Winkielman, & Schwarz, 1998), safer (Song & Schwarz, 2009), more morally acceptable (Laham, Alter, & Goodwin, 2009), and more credible (Reber & Schwarz, 1999). For example, Reber and Schwarz (1999) presented participants with little known trivia statements and asked them to judge their veracity. They manipulated the font color in which the statements were written and the background color of the screen, such that some statements were easier to read than others. Participants rated the statements as more true when they were presented in easier-to-read color contrasts. McGlone and Tofghbakhsh (2000) manipulated processing fluency by manipulating whether aphorisms rhymed. Participants read either the original aphorisms (e.g., *Woes unite foes, A fault confessed is half redressed*) or alternative versions of them in which one of the words was replaced with a synonym to prevent it from rhyming (e.g., *Woes unite enemies, A fault admitted is half redressed*). Participants agreed more with the aphorisms when they were presented in their original rhyming version, presumably because rhyming facilitates processing.

## 1.2. *Processing fluency and accent*

As described above, there is ample evidence that stimuli that are easier to process are perceived more favorably. This finding could have grave implications for interactions between native and non-native speakers. Languages differ in their sound inventories. This can lead non-native speakers to find it difficult to produce certain sounds in their second language because these sounds do not exist in their first language, or because the sounds are not contrastive in their first language. For example, Japanese speakers often produce English 'l' in a nonstandard manner that can be confused with 'r' because Japanese does not distinguish between these sounds (Bradlow, Pisoni, Akahane-Yamada, & Tohkura, 1997). Nonnative speakers might also use nonstandard stress or prosodic patterns because these differ from those in their native language (e.g., Magen, 1998). These deviations from standard production render foreign-accented speech harder to process even when it is fully understood (e.g., Munro & Derwing, 1995).

The greater difficulty of processing foreign-accented speech could lead individuals to treat it less favorably. Indeed, when Lev-Ari and Keysar (2010) presented participants with trivia statements recorded by native versus foreign-accented speakers of a variety of foreign accents (e.g., Korean, Italian, Turkish), participants judged the statements as more likely to be true when they were produced by native speakers. This effect was obtained even though it was highlighted to participants that speakers were merely reading aloud sentences provided by the experimenter, without knowing whether these were true or not. In other words, all speakers were merely messengers without any control over the content of their speech, thus reducing the relevance of any prejudice as it is not the speaker's honesty and knowledge that are evaluated. The lower belief in foreign-accented statement was hypothesized to be due to the greater difficulty in processing them.

In a follow up study, Lev-Ari and Keysar (2010) tested whether raising participants' awareness to the source of their difficulty reduces the tendency to believe nonnative speakers less. Their prediction rested on literature that shows that raising individuals' awareness to the source of an affective experience can prevent individuals from misattributing the affective experience to other sources (Schwarz & Clore, 1983). To test whether raising awareness to the source of the difficulty would eliminate its misattribution to lower credibility, Lev-Ari and Keysar (2010, exp. 2) asked participants to rate the relative ease of understanding each of the speakers, in addition to rating the veracity of the statements. This manipulation succeeded in reducing the bias against mildly accented speakers, but not against heavily accented speakers. It seems, then, that participants corrected for the difficulty of processing, but not sufficiently so for the heavily accented speakers. The reduction of the bias against mildly accented speakers once awareness to the difficulty was raised also provides some support for the hypothesis that the lower belief in foreign-accented speech is at least partly due to misattribution of the lower processing fluency.

Since the publication of those studies, several studies examined whether people believe information delivered by nonnative speakers less. Several of these found supportive evidence. One of these studies demonstrated that it is not only native speakers, but also nonnative speakers, who believe information more when it is provided in a native rather than a foreign accent

(Hanzlíková & Skarnitzl, 2017). Other studies examined people's ability to detect when native and nonnative speakers tell the truth and when they lie. All these studies found that people have a truth-bias when evaluating native speakers, that is, they are more likely to assume that the speakers are telling the truth than lying (Castillo, Tyson, & Mallard, 2014; Elliott & Leach, 2016; Evans & Michael, 2014; De Silva & Leach, 2013; Leach & De Silva, 2013). In contrast, participants never have a truth bias when evaluating nonnative speakers, and they sometimes have a lie bias, that is, they are more likely to assume that the speakers are lying rather than telling the truth (Castillo et al., 2014; De Silva et al., 2013; Evans & Michael, 2014). These latter studies, however, were not concerned with processing fluency, and their results might be driven by prejudice. In contrast, a couple of studies failed to find an effect of foreign accent on truth judgment (Souza & Markman, 2013; Stocker, 2017; Wetzel et al., 2021). While the conflicting results might be due to methodological differences (e.g., use of a highly familiar foreign accent without testing whether it is harder to process, use of a single speaker per condition), the inconsistent results of the follow up studies suggest it is important to try to replicate the results of Lev-Ari and Keysar (2010).

Furthermore, while past research suggests that people believe information less when it is delivered in a foreign accent, there is no direct evidence to indicate that this difference is due to lower processing fluency. Confirming the underlying mechanism is important for both theoretical and applied reasons. First, it will help us understand how the experience of language processing can influence decision making. Understanding the source of bias can also enable us to understand where else it might surface and how to counteract it. The main goal of this study is therefore to test the underlying mechanism that leads listeners to believe information delivered in a foreign accent less. The manner by which the study tests it, using an intervention paradigm, also proposes one approach that could be taken to reduce the bias against nonnative speakers.

One way to further test whether the tendency to believe information less when it is delivered in foreign-accented speech is at least partly due to processing fluency is to test whether facilitating the processing of foreign accent can reduce the bias. It is well established that the difficulty of processing foreign-accented speech is reduced with more exposure to the accent (Clarke & Garrett, 2004). Furthermore, the benefit of exposure can generalize to new speakers, especially if individuals are exposed to multiple speakers (Bradlow & Bent, 2008). The benefit is due to the fact that individuals speak with a foreign accent because the sounds of their native language differ from those of their second language. For example, the "th" sound in "think" does not exist in German. Therefore, many German speakers produce "s" instead (e.g., Hanzlíková & Weber, 2012). Exposure to several German speakers who substitute "s" for "th" allows the listener to adapt to the accent and correctly interpret words with this nonnormative pronunciation of "th" also when encountering unfamiliar German speakers. Furthermore, German is not the only language to not have the sound "th." Therefore, exposure to foreign-accented speakers who produce "th" in a nonnormative way could also help the listener to later understand speakers of other languages, such as Hebrew, who also does not have this sound and produce it in a similar nonnormative way. Indeed, it has been found that exposure to several foreign accents can alleviate processing of other foreign accents (Baese-Berk, Bradlow, & Wright, 2013).

If at least one of the reasons that listeners distrust information delivered in a foreign accent is because it is harder to process it, and if exposure to foreign accent facilitates its processing, it might be possible to reduce individuals' bias against foreign-accented speech by exposing them to foreign accent. This is the goal of the current study.

It should be noted that one prior study attempted to examine a highly related question, whether familiarity can moderate the effect of foreignness on credibility by facilitating processing (Wetzel et al., 2021). It did so by comparing familiar native accent, unfamiliar native accent, familiar foreign accent, and unfamiliar foreign accent. That study did not find an effect of either foreignness or familiarity. Unfortunately, because that study only utilized one speaker for each accent condition, it is hard to draw conclusions from it. There are many idiosyncratic features that influence how credible one sounds (e.g., pitch, speech rate). These need to be controlled, either by using the same speaker for all conditions (difficult when testing accents), or by using several speakers per accent to reduce the effect of idiosyncratic differences. As the study used one speaker per accent, it is impossible to know whether the speakers of the different accent did not differ on other features that cue trustworthiness. Second, group effects are not present in a comparison of every two individuals from the two groups. For example, men are taller than women, but when selecting at random only one man and one woman, the height difference might not be present or reversed. In other words, even if speakers of an unfamiliar foreign accent are harder on average to understand than speakers of a familiar foreign accent, not all speakers of an unfamiliar foreign accent would be harder to understand than all speakers of a familiar foreign accent, and similarly, not all of them would be rated as less truthful. Furthermore, as the authors themselves acknowledged, it was not even clear whether the unfamiliar foreign accent in the study (Finnish accent) was any harder to process than the familiar foreign accent (German accent), as the two accents are quite similar. Therefore, we do not know at the moment whether the tendency to believe foreign-accented speech less can be attenuated by exposure.

### 1.3. *Current study*

The current study has three goals: (1) to replicate Lev-Ari and Keysar's (2010) finding that individuals believe information less when it is delivered in a foreign accent, (2) to test whether this effect is at least partly due to the greater difficulty of processing foreign accents, and (3) to test whether the bias can be reduced by exposure to foreign accent. If listeners find foreign-accented speech less credible and this effect is at least partly due to difficulty of processing the speech, then improving listeners' ability to understand the speech should reduce their tendency to find the speech less credible. As reviewed earlier, individuals become better at understanding foreign accent the more they are exposed to it (e.g., Clarke & Garrett, 2004). We therefore exposed half of our participants to Polish accent by presenting them with stories told by Polish speakers while the other half listened to native speakers of British English tell the same stories. We then presented everyone with trivia statements produced by Polish and British speakers. We predicted that those in the control condition (exposure to British speakers) would provide higher truth ratings to statements produced by native speakers than to those produced by Polish speakers, replicating prior findings. Crucially, we also predicted

that this effect would be smaller in participants who were exposed to Polish accented speakers during the exposure phase. Finally, we tested participants' comprehension of Polish-accented speech and conducted a mediation test to test whether the effect of exposure on the reduction in the bias against Polish-accented speech is driven by better comprehension of the accent.

## 2. Experiment

### 2.1. Method

#### 2.1.1. Participants

The study was conducted online. Participants were recruited via contacts, mailing lists, and social media. They were often holders of public sector roles (e.g., police personnel). Participants were first screened for native language and having no Polish friends or family members. Two-hundred and twenty participants met the screening criteria and were therefore directed to the study ( $F = 124$ ; Age range: 18–74,  $M = 38.15$ ,  $SD = 14.36$ ). We initially planned on recruiting 200 participants. We opted for a large sample size because the effect size in Lev-Ari and Keysar (2010) was small and we were looking for an interaction that would reduce it even further. Additionally, our manipulation was relatively short (~10 min), so we wanted to ensure that we had the ability to detect even small differences. We ended up recruiting a few more participants than we had planned (220 rather than 200) because more responses were provided over the last few days than we had anticipated.

#### 2.1.2. Stimuli

To ensure that participants did not suspect the study to be about accent, participants were told that the study compared police personnel and the general public on their ability to understand and evaluate statements made by victims and witnesses, and that they would thus listen to both police-related and neutral content<sup>1</sup>. To justify the inclusion of Polish-accented speech, participants were told that “According to most recent statistics, Poles are the biggest non-UK-born population in the UK... To prepare police personnel best for their role, recent training courses include recordings of Polish immigrants to the UK. We will compare performance of police personnel and the general public using real training stimuli. The recordings you will listen to might therefore include several Polish speakers.”

*2.1.2.1. Exposure stimuli.* Eight short stories were constructed. The stories were written as police testimonies and were 164–217 words long ( $M = 178.6$ ,  $SD = 17$ ). Each statement had two versions, one recorded by a native Polish speaker and one by a native speaker of British English, such that participants in the Polish Exposure condition listened to eight different Polish speakers, and those in the British Exposure condition listened to eight speakers of British English. The Polish speakers had spent between 4 months and 11.5 years in the United Kingdom ( $M = 6.5$  years) and were 24–34 years old ( $M = 29.9$ ). To ensure engagement and confirm that participants are paying attention, each statement was followed by a

simple multiple-choice comprehension question. To be included, participants had to respond correctly to at least six of the eight questions. All participants met this criterion.

*2.1.2.2. Trivia stimuli.* Fifty trivia statements about little known facts were recorded by Polish and British English speakers. Most of the trivia statements were taken from Lev-Ari and Keysar (2010). A few statements were replaced to remove facts related to the United Kingdom or Poland or to make sentences more similar in length to each other. Half of the statements were true (e.g., *An ostrich's eye is bigger than its brain*) and half were false (e.g., *Falcons are the only birds who can see the color blue*). The full list of trivia statements is provided in the Appendix. Eight Polish speakers and six British English speakers recorded the trivia statements. Seven of the eight Polish speakers and all British speakers were those who recorded statements for the Exposure phase<sup>2</sup>. Two lists were created, each containing 25 trivia statements recorded by Polish speakers and 25 trivia statements recorded by British English speakers. The statements that appeared in Polish accent in one list appeared in British English accent in the other list and vice versa. Participants evaluated the veracity of each statement on a continuous 100-point scale ranging from false to true.

*2.1.2.3. Comprehension task.* Eight recorded sentences, one from each of the Polish-accented witness statements, were selected. These statements were selected such that words would not be predictable from the context. Participants were asked to transcribe them verbatim. Participants received one point for each content word (nouns, verbs, adjectives, adverbs) that they transcribed correctly. The maximal score was 60. Scores ranged from 2 to 60 ( $M = 44$ ,  $SD = 14$ ).

### *2.1.3. Procedure*

Participants were randomly assigned to either the Polish or British exposure condition. They then listened to the eight testimonies in their condition in a random order and answered a comprehension question after each testimony. Participants could not replay a testimony and did not receive feedback on their accuracy. Next, participants were randomly assigned to one of the two lists of trivia statements. Trivia statements were presented in a random order one at a time, and participants could not replay them. Participants did not receive feedback regarding the accuracy of the statements. Finally, participants were tested on their comprehension of Polish-accented speech. They listened to the eight comprehension task sentences one by one in a random order and transcribed them word for word. Participants could not replay the recordings.

## *2.2. Results*

To test whether exposure to Polish accent reduces the tendency to believe Polish-accented speech less, we ran a mixed effects model using the lme4 package (Bates, Maechler, Bolker, & Walker, 2015) with Exposure (British, Polish), Trivia Speaker Accent (British, Polish), and the interaction of Exposure and Trivia Speaker Accent as fixed effects and ratings of the trivia statements as the dependent measure. The random structure included intercepts

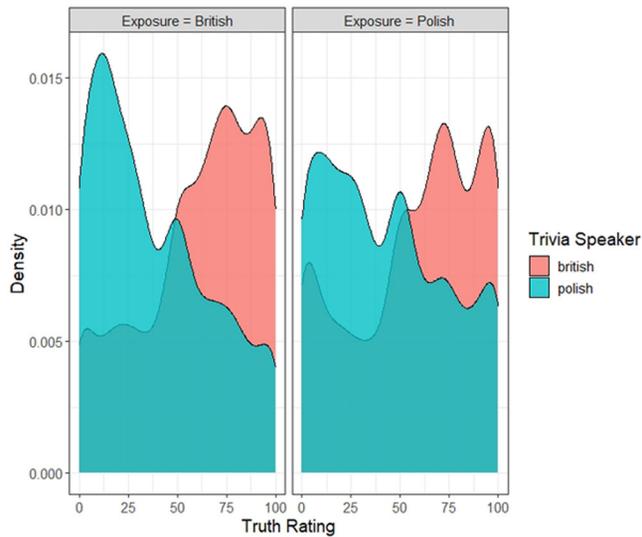


Fig 1. Density plot of the truth ratings for participants in the control British exposure condition (left panel) and those exposed to Polish accent (right panel). Truth ratings of trivia statements produced by native speakers of Polish are in teal, and ratings of trivia statements produced by native speakers of British English are in pink. As can be seen, in both exposure conditions the distribution of truth ratings differ for British and Polish speakers, but when participants were exposed to Polish accent, the distribution of truth ratings for Polish speakers includes fewer low scores and more high scores.

for participants and items and a by-participant slope for Trivia Speaker Accent. A by-items slope for Exposure was not included as this led to singular fit. Results revealed that at the reference level (Exposure to British accent), participants believed trivia statements more when they were produced by British speakers than by Polish speakers ( $\beta = 22.26$ ,  $SE = 2.40$ ,  $t = 9.29^3$ ). This replicates Lev-Ari and Keysar (2010) and shows that people believe information less when it is provided in a foreign accent. Crucially, results also revealed an interaction between Exposure and Trivia Speaker Accent ( $\beta = -7.71$ ,  $SE = 3.21$ ,  $t = -2.40$ ; see Fig. 1) reflecting the fact that the effect of Trivia Speaker Accent was smaller for those who were exposed to Polish accent. Furthermore, there was an effect of Exposure ( $\beta = 4.94$ ,  $SE = 1.65$ ,  $t = 3.00$ ) at the reference level (Polish Trivia Speaker) indicating that participants who were exposed to Polish accent believed trivia statements produced by Polish speakers more than participants who were exposed to British accent. The results thus indicate that exposing individuals to foreign accent can reduce the bias that these individuals have against foreign-accented speech.

The goal of exposure was to reduce bias by facilitating accent processing. The main results indicate that exposure worked. To further examine whether its effect can be attributed directly to improvement in accent processing, we carried out two additional analyses. First, we tested whether exposure to Polish accent improved the comprehension of Polish-accented speech. To do so, we ran a linear regression with Exposure (British, Polish) as a predictor and comprehension score on the Accent Comprehension task as the dependent measure. Results indicated

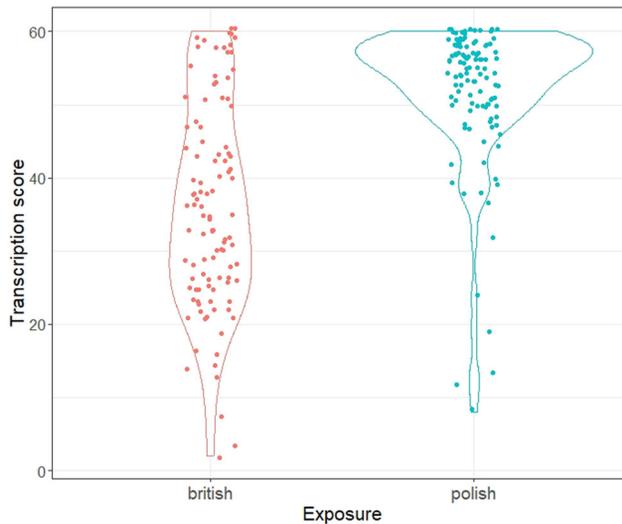


Fig 2. Participants' transcription score of Polish-accented sentences (max = 60) as a function of the accent they were exposed to in the Exposure phase. Each dot represents the total score of one participant.

that those who were exposed to Polish accent were better at transcribing the Polish-accented sentences than those who were exposed to British accent ( $\beta = 15.72$ ,  $SE = 1.63$ ,  $t = 9.66$ ,  $p < .001$ ; See Fig. 2).

Next, we formally tested whether the improvement in comprehension mediated the effect of exposure on truth rating of trivia statements produced by Polish speakers. First, we tested the preconditions for a mediation: Using linear regressions, we confirmed that Exposure condition (British, Polish) influenced the truth ratings of trivia statements produced by Polish speakers ( $\beta = 5.54$ ,  $SE = 1.70$ ,  $t = 3.27$ ,  $p < .01$ ). We also confirmed that Exposure condition influenced comprehension score ( $\beta = 15.72$ ,  $SE = 1.63$ ,  $t = 9.66$ ,  $p < .001$ ), and importantly, that the Comprehension score positively predicted truth ratings of trivia statements produced by Polish speakers ( $\beta = 0.26$ ,  $SE = 0.06$ ,  $t = 4.5$ ,  $p < .001$ ). Next, a mediation test using the Mediation package (Tingley, Yamamoto, Hirose, Keele, & Imai, 2014) revealed that 63% of the effect of Exposure on truth ratings of the Polish speakers was due to Comprehension, and in fact, that once the indirect effect was taken into account, the direct effect from Exposure to truth rating was no longer significant ( $p = .43$ ). This confirms that the reason that the exposure to Polish accent increased belief in statements delivered in Polish-accented speech is because it improved participants' comprehension of the accent rather than because exposure to accent had another positive effect such as increased liking of Polish speakers.

### 3. General Discussion

This study shows that a cognitive factor, processing fluency, can lead individuals to distrust information when it is delivered in a foreign accent. At the same time, the study also shows

that this bias against nonnative speakers can be reduced by exposure to foreign accent. These findings have important implications for social, work, and consumer environments.

### 3.1. *Limitations*

One limitation of the study is that, for the most part, the same speakers appeared in the exposure and test phases. People regularly encounter new speakers and cannot be a priori exposed to the speech of every speaker that they might encounter. Therefore, one may wonder whether exposure to foreign-accented speakers would confer a benefit in real world circumstances. Fortunately, research on accent comprehension shows that exposure to several speakers improves comprehension not only of those speakers but also of novel ones (Bradlow & Bent, 2008), and exposure to speakers with several different accents can facilitate processing of similar unencountered foreign accents (Baese-Berk et al., 2013), suggesting that providing exposure to accent could play a positive role in the real world as well.

The study also focused on a single foreign accent, Polish. One may therefore wonder to what extent the findings in this study generalize to other foreign accents. Prior research, however, found a beneficial effect of accent exposure on its comprehension across quite different foreign accents including Mandarin (Bradlow & Bent, 2008; Clarke & Garrett, 2004) and Spanish (Clarke & Garrett, 2004). Furthermore, exposure to several accents (Thai, Korean, Hindi, Romanian, and Mandarin) was found to facilitate comprehension of a different accent (Slovakian; Baese-Berk et al., 2013). Therefore, it seems likely that we would have found the same results had we exposed and tested our participants with an accent other than Polish. That said, none of the prior studies examined whether the facilitation in accent comprehension translates into smaller bias in believing the speaker, so we cannot rule out the possibility that the link between processing fluency and belief is stronger with Polish accent than with other accents, though we do not have an a priori reason to expect that.

Another potential limitation of the study is that accent comprehension was tested with sentences from the exposure phase. This might have influenced the size of the effect that exposure had on comprehension although it is not clear in which direction. On the one hand, participants in the Polish exposure condition were tested on their comprehension of recordings that they had already heard while those in the British exposure condition were tested on their comprehension of recordings that they had heard for the first time, which might have exaggerated the effect of exposure on comprehension. On the other hand, participants in the British exposure condition had already heard the same sentences as well, and their prior exposure was to a clearer version, a native-accented one. It is therefore possible that their clearer prior exposure to the content gave them an opportunity to fully and easily decode all words in the sentence, thus giving them an advantage during the comprehension test and reducing the effect of exposure on comprehension. Crucially, any advantage that the prior exposure might have given one of the conditions over the other one cannot account for the fact that accent comprehension mediated the effect of exposure on truth judgment. Similarly, any such advantage in the comprehension task cannot account for the fact that exposure to Polish accent increased truth rating of Polish-accented statements.

### 3.2. *Processing fluency and prejudice*

The study showed that exposure to accent can reduce participants' tendency to believe foreign-accented speech less than native speech, but it did not eliminate the effect. In fact, the reduction was numerically small. The exposure phase in this study, however, was quite short. It is likely that longer exposure would have greater benefits. Furthermore, while the study shows that the greater difficulty of processing foreign-accented speech can lead to trusting foreign-accented speech less, processing difficulty is not the only factor that can lead to such a bias. It is quite possible that participants' lower belief in the Polish-accented statements was due to both prejudice and processing difficulty, and exposure only reduced the latter. Importantly, while fluency and prejudice are two distinct mechanisms underlying the bias against nonnative speakers and can be tapped and moderated individually (but see Lick & Johnson, 2015), in the real world, it might be possible to tackle fluency and prejudice jointly. In particular, if exposure to foreign accent is achieved in the real world by means such as ensuring the diversity of the work force, this prolonged exposure should not only lead to greater gains in accent comprehension, but reduce prejudice, as intergroup contact has been shown to reduce prejudice, at least under certain conditions (Pettigrew & Tropp, 2000).

Relatedly, foreign accent is associated with many negative perceptions, such as lower intelligence and competence (e.g., Tsalikis et al., 1991) and heavier accent is interpreted as indication of greater prototypicality of being an outgroup member (Dragojevic, Giles, Beck, & Tatum, 2017). While these effects are often interpreted as being driven by prejudice, it is worth investigating whether they are also partly driven by prejudice, and therefore can be reduced with manipulations that facilitate accent processing. It is worth noting that some have even suggested that prejudice is partly driven by processing fluency (Lick & Johnson, 2015).

### 3.3. *Wider implications*

In addition to bias reduction, exposure to foreign-accented speech might influence the way in which it is processed. Foreign accent influences processing not only by adding an additional cognitive load (e.g., Munro & Derwing, 1995) but also by influencing how information is processed. When participants process foreign-accented speech, they do not rely on linguistic cues that they do rely on when processing native speech. For example, listeners are able to use cues to differentiate between truth-telling and lying speakers or confident and doubtful speakers when listening to native speakers, but not when listening to nonnative speakers (De Silva et al., 2013; Jiang, Gossack-Keenan, & Pell, 2020). Future research should examine whether the facilitation of accent processing can allow listeners to make use of other linguistic cues and thus lead them to process foreign-accented speech in a manner more similar to their processing of native speech.

This study examined how ease of processing influences truth judgment, but ease of processing influences evaluation on many additional aspects including liking, risk, and moral acceptability. This study showed that people believe information less when it is delivered in a foreign accent, but it is possible that people might also find information delivered in a foreign accent as less morally acceptable, more risky and so forth. It is important to further investigate biases that people have toward foreign-accented speech and test ways to overcome them.

Foreign accent is not the only aspect of communication that influences processing fluency. Information might be easier or harder to process for many reasons varying from sentence structure and lexical choice to quality of the Internet connection (in virtual meetings). One may therefore wonder whether, to the degree that language processing is harder in online meetings because of reduced visual cues, and even more so over poor connections, do people trust less the information that is delivered in such meetings versus face-to-face meetings? Similarly, we know people repeat each other's vocabulary and grammatical structure (e.g., Giles, Coupland, & Coupland, 1991), and that this repetition eases both production and comprehension (e.g., Pickering & Garrod, 2004). Does it also increase the listener's likelihood of believing the information? Future research should further explore this potential link between processing fluency and credibility beyond foreign accent as well as between such other sources of processing fluency and other consequences of processing fluency, such as liking.

To conclude, the results of this study show that people might discriminate against non-native speakers independently of any prejudice they have, simply because they find the accent difficult to process. The study also suggests that exposure to foreign accent can be the first step to combatting such bias. That said, it is important to keep in mind that processing fluency is not the sole cause of the bias that people show against foreign-accented speakers and any attempt to reduce such bias should tackle other factors such as prejudice as well.

## Notes

- 1 The study was originally planned to be conducted with police personnel but plans were changed due to COVID-19. Some of the stimuli were therefore police-related.
- 2 Two of the British speakers and one Polish speaker were unavailable for the second recording session.
- 3 There is no uncontroversial method to calculate  $p$ -values in mixed effects models. A common rule of thumb is that  $t$  values that are  $>|2|$  are significant.

## References

- Baese-Berk, M. M., Bradlow, A. R., & Wright, B. A. (2013). Accent-independent adaptation to foreign accented speech. *Journal of the Acoustical Society of America*, *133*(3), EL174–EL180.
- Bates, D. M., Maechler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1), 1–48.
- Bradlow, A. R., & Bent, T. (2008). Perceptual adaptation to non-native speech. *Cognition*, *106*(2), 707–729.
- Bradlow, A. R., Pisoni, D. B., Akahane-Yamada, R., & Tohkura, Y. (1997). Training Japanese listeners to identify English /r/ and /l/: IV. Some effects of perceptual learning on speech production. *Journal of the Acoustical Society of America*, *101*, 2299–2310.
- Castillo, P. A., Tyson, G., & Mallard, D. (2014). An investigation of accuracy and bias in cross-cultural lie detection. *Applied Psychology in Criminal Justice*, *10*(1), 66–82.
- Clarke, C. M., & Garrett, M. F. (2004). Rapid adaptation to foreign-accented English. *The Journal of the Acoustical Society of America*, *116*, 3647–3658.
- Da Silva, S. C., & Leach, A. M. (2013). Detecting deception in second-language speakers. *Legal and Criminological Psychology*, *18*(1), 115–127.

- Dragojevic, M., Giles, H., Beck, A. C., & Tatum, N. T. (2017). The fluency principle: Why foreign accent strength negatively biases language attitudes. *Communication monographs*, 84(3), 385–405.
- Elliott, E., & Leach, A. M. (2016). You must be lying because I don't understand you: Language proficiency and lie detection. *Journal of Experimental Psychology: Applied*, 22(4), 488.
- Evans, J. R., & Michael, S. W. (2014). Detecting deception in non-native English speakers. *Applied Cognitive Psychology*, 28(2), 226–237.
- Giles, H., Coupland, N., & Coupland, J. (1991). Accommodation theory: Communication, context, and consequence. In H. Giles, N. Coupland, & J. Coupland (Eds.), *Contexts of accommodation: Developments in applied sociolinguistics* (pp. 1–68). Cambridge, UK: Cambridge University Press.
- Hanulíková, A., & Weber, A. (2012). Sink positive: Linguistic experience with th substitutions influences nonnative word recognition. *Attention, Perception, & Psychophysics*, 74(3), 613–629.
- Hanzlíková, D., & Skarnitzl, R. (2017). Credibility of native and nonnative speakers of English revisited: Do non-native listeners feel the same? *Research in Language*, 15, 285–298
- Hosoda, M., Nguyen, L. T., & Stone-Romero, E. F. (2012). The effect of Hispanic accents on employment decisions. *Journal of Managerial Psychology*, 27(4), 347–364.
- Jacoby, L. L., Allan, L. G., Collins, J. C., & Larwill, L. K. (1988). Memory influences subjective experience: Noise judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 14(2), 240.
- Jacoby, L. L., Kelley, C. M., Brown, J., & Jasechko, J. (1989). Becoming famous overnight: Limits on the ability to avoid unconscious influences of the past. *Journal of Personality and Social Psychology*, 56, 326–338.
- Jiang, X., Gossack-Keenan, K., & Pell, M. D. (2020). To believe or not to believe? How voice and accent information in speech alter listener impressions of trust. *Quarterly Journal of Experimental Psychology*, 73(1), 55–79.
- Laham, S. M., Alter, A. L., & Goodwin, G. P. (2009). Easy on the mind, easy on the wrongdoer: Discrepantly fluent violations are deemed less morally wrong. *Cognition*, 112(3), 462–466.
- Leach, A. M., & Da Silva, C. S. (2013). Language proficiency and police officers' lie detection performance. *Journal of Police and Criminal Psychology*, 28(1), 48–53.
- Lev-Ari, S., & Keysar, B. (2010). Why don't we believe non-native speakers? The influence of accent on credibility. *Journal of Experimental Social Psychology*, 46(6), 1093–1096
- Lick, D. J., & Johnson, K. L. (2015). The interpersonal consequences of processing ease: Fluency as a metacognitive foundation for prejudice. *Current Directions in Psychological Science*, 24(2), 143–148.
- Livingston, B. A., Schilpzand, P., & Erez, A. (2017). Not what you expected to hear: Accented messages and their effect on choice. *Journal of Management*, 43(3), 804–833.
- Magen, H. S. (1998). The perception of foreign-accented speech. *Journal of phonetics*, 26(4), 381–400.
- Masson, M. E., & Caldwell, J. I. (1998). Conceptually driven encoding episodes create perceptual misattributions. *Acta Psychologica*, 98(2–3), 183–210.
- McGlone, M. S., & Tofiqbakhsh, J. (2000). Birds of a feather flock conjointly(?): RHyme as reason in aphorisms. *Psychological Science*, 11(5), 424–428
- Munro, M. J., & Derwing, T. G. (1995). Processing time, accent and comprehensibility in the perception of native and foreign-accented speech. *Language and Speech*, 38, 289–306.
- Pettigrew, T. F., & Tropp, L. R. (2000). Does intergroup contact reduce prejudice: Recent meta-analytic findings. In S. Oskamp (Ed.), *The Claremont symposium on applied social psychology reducing prejudice and discrimination* (pp. 93–114). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Pickering, M. J., & Garrod, S. C. (2004). Towards a mechanistic Psychology of dialog. *Behavioral and Brain Sciences*, 27(2), 169–190.
- Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition*, 8, 338–342
- Reber, R., Winkielman, P., & Schwarz, N. (1998). Effects of perceptual fluency on affective judgments. *Psychological Science*, 9, 45–48
- Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology*, 45, 513–523.

- Song, H., & Schwarz, N. (2009). If it's difficult-to-pronounce, it must be risky: Fluency, familiarity, and risk perception. *Psychological Science*, 20, 135–138
- Souza, A. L., & Markman, A. B. (2013). Foreign accent does not influence cognitive judgments. *Proceedings of the 35th Annual Meeting of the Cognitive Science Society*, 1360–1365. Austin, TX: Cognitive Science Society.
- Stocker, L. (2017). The impact of foreign accent on credibility: An analysis of cognitive statement ratings in a swiss context. *Journal of Psycholinguistic Research*, 46, 617–628.
- Tingley, D., Yamamoto, T., Hirose, K., Keele, L., & Imai, K. (2014). Mediation: R package for causal mediation analysis. *Journal of Statistical Software*, 59(5), 1–38.
- Tsalikis, J., DeShields, O. W. Jr, & LaTour, M. S. (1991). The role of accent on the credibility and effectiveness of the salesperson. *Journal of Personal Selling & Sales Management*, 11(1), 31–41.
- Wetzel, M., Zufferey, S., & Gyax, P. (2021). Do non-native and unfamiliar accents sound less credible? An examination of the processing fluency hypothesis. *Journal of Articles in Support of the Null Hypothesis*, 17, 2.
- Whittlesea, B. W., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language*, 29(6), 716–732.

## Appendix

### *Trivia statements (true and false)*

1. The cigarette lighter was invented before matches.
2. A sneeze travels out of the mouth at over 100 miles per hour.
3. The most expensive coin in the world was sold for more than 7 million dollars.
4. Crocodiles can't stick out their tongues to prevent them from biting off their tongue.
5. A kangaroo can't jump unless its tail is touching the ground.
6. Polar bears can swim more than 60 miles without a rest.
7. Owls swallow their prey whole because they have no teeth.
8. The flea can jump 350 times its body length.
9. Tigers have striped skin not just striped fur.
10. An ostrich's eye is bigger than its brain.
11. Camels have three eyelids to protect themselves from blowing sand.
12. The planet Venus has no seasons because it does not tilt as it goes around the Sun.
13. A giraffe can go without water longer than a camel can.
14. A giraffe's heart can pump 16 gallons of blood in one minute.
15. Even though a polar bears fur looks white it is actually colorless.
16. Polar bear fur is oily and water repellent.
17. The Sun contains 99.8 percent of the total mass of the solar system.
18. The Sun shrinks five feet every hour.
19. The only animals born with horns are giraffes.
20. The global adult literacy rate is around 86 percent.
21. The two hemispheres of a dolphin's brain work independently in alternating "shifts" of 8 hours.
22. The Can opener wasn't invented until 48 years after the can.
23. The longest wedding veil was longer than 63 football fields.
24. The oceans contain almost 200,000 different kinds of viruses.

25. There are more than 200 different breeds of dogs.
26. The Sea of Tranquility on the moon is shallower than any lake on earth.
27. The first public library in the world was in Vienna, Austria in 1745.
28. Every second, eight babies are born on Earth.
29. Jerusalem in Israel is the oldest city in the world.
30. Sharks attack women ten times more often than they attack men.
31. The koala is the only known animal that never gets sick.
32. The only places on the body of a cow that have sweat glands are the ears.
33. Luxemburg is the European country with the highest population density.
34. Women blink nearly four times as much as men.
35. The planet Jupiter spins opposite to the other planets in the solar system.
36. The first fire brigades in the modern sense were created in Germany in the early 18th century.
37. About 300 grapes go into one bottle of wine.
38. One strawberry has around 100 seeds.
39. 15 percent of the water covering the earth is drinkable.
40. If Facebook was a country, it would have 3 billion more people than China.
41. The original designer behind the game "Tetris" is from Norway.
42. There are approximately 20,000 feathers on an eagle.
43. Falcons are the only birds who can see the color blue.
44. When a polar bear cub is born it cannot see or hear for approximately a year.
45. The hides of mature male blue sharks are more than twice as thick as those of females.
46. Large crocodilians cannot survive for more than a few days without food.
47. Carrots were the first vegetable to be grown in space.
48. The average human body contains around 20 pints of blood.
49. The lowest place on earth is Death Valley in North America.
50. A cat can jump as much as 15 times its height.