



Pragmatics and social meaning: Understanding under-informativeness in native and non-native speakers

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ABSTRACT

Foreign-accented non-native speakers sometimes face negative biases compared to native speakers. Here we report an *advantage* in how comprehenders process the speech of non-native compared to native speakers. In a series of four experiments, we find that under-informative sentences are interpreted differently when attributed to non-native compared to native speakers. Specifically, under-informativeness is more likely to be attributed to inability (rather than unwillingness) to say more in non-native as compared to native speakers. This asymmetry has implications for learning: under-informative teachers are more likely to be given a second chance in case they are non-native speakers of the language (presumably because their prior under-informativeness is less likely to be intentional). Our results suggest strong effects of non-native speech on social-pragmatic inferences. Because these effects emerge for written stimuli, they support theories that stress the role of expectations on non-native comprehension, even in the absence of experience with foreign accents. Finally, our data bear on pragmatic theories of how speaker identity affects language comprehension and show how such theories offer an integrated framework for explaining how non-native language can lead to (sometimes unexpected) social meanings.

1. Introduction

Being a non-native speaker of a language presents some disadvantages. Most obviously, people are slower to process foreign-accented sentences, and rate such sentences as less intelligible than native speech (Munro & Derwing, 1995; although native listeners adapt quickly to a foreign accent; Clarke & Garrett, 2004). Furthermore, native comprehenders process non-native speech differently from native speech. Syntactic errors like “She *mow the lawn” typically elicit a P600 component in event-related potential studies, but this neural response is attenuated when ungrammatical sentences are spoken by a non-native speaker, suggesting that listeners expect non-native speakers to make syntactic errors (Hanulíková, van Alphen, van Goch, & Weber, 2012; cf. Grey & Van Hell, 2017). Being a non-native speaker may also carry negative social consequences: adults judge non-native speakers as being less trustworthy (Lev-Ari & Keysar, 2010) and more vague (Lev-Ari & Keysar, 2012), and non-native speakers face social and workplace discrimination (Gluszek & Dovidio, 2010; Hosoda & Stone-Romero, 2010; Kalin & Rayko, 1978). Distinct attitudes and behaviors towards non-native speakers emerge early in life: young children prefer to learn from, be friends with, and share resources with native over non-native speakers (Kinzler, Dupoux, & Spelke, 2007).

Here we hypothesize and experimentally probe a systematic difference in the way comprehenders interpret what native vs. non-native speakers say (and leave unsaid). Unlike some of the evidence above (Kinzler et al., 2007; Lev-Ari & Keysar, 2010, 2012), however, the difference is expected to create a bias *in favor* of non-native speakers. We focus on (under)informativeness, a pragmatic aspect of meaning that is driven by expectations about how rational communication works.

According to pragmatic theory, when speakers fail to be as informative as required, hearers are justified in engaging in further inferences to understand the reasons behind the failure. Within the traditional Gricean framework, a first broad class of such inferences involves the speaker's *inability* to offer the required information. For instance, a sentence such as “Some of Jane's friends are vegetarian” may give rise to the inference that the speaker does not know whether the stronger statement (“All of Jane's friends...”) is true; alternatively, if the speaker is assumed to be well-informed about Jane's friends, the statement may lead to the assumption that the speaker knows for a fact that not all of Jane's friends are vegetarian (Grice, 1975; Horn, 1972; Sauerland, 2012; Carston, 1998; cf. Goodman & Stuhlmüller, 2013). In a second broad class of cases, under-informativeness is attributed to the speaker's *unwillingness* to communicate additional information. Some of

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these cases involve politeness (“Some people hated your poem”), where the speaker avoids mentioning information that would be face-threatening to the listener (Grice, 1975; Brown et al., 1987). Frequently, unwillingness to communicate relevant information is linked to the desire to mislead the listener by deceptively leaving things out (“A few of my projects have failed”). In other cases, unwillingness to say more may be made obvious to the listener (“No comment”). Inability or unwillingness inferences may be computed on the basis of what the speaker said but whether they are taken as part of what the speaker intended to convey depends on how much the listener trusts the speaker, and what they know about the speaker’s preferences (Sperber & Wilson, 1995).

Depending on its perceived cause, a communicative partner’s failure to be informative is likely to affect social cognition and future behavior in different ways. Within the Gricean framework, instances where the speaker is unwilling to offer relevant information (in the absence of mitigating factors such as the desire to be polite) are seen as a breach of the co-operativeness assumption that leads to communication breakdowns (but see also Geurts, 2010; Sperber & Wilson, 1995). As a result, other things being equal, unwillingness to be informative is likely to be penalized more heavily than inability to offer required information. This asymmetry is confirmed in studies that have examined how considerations of inability vs. unwillingness contribute to intentional action understanding more broadly in both human infants and other species. In one study, infants as young as 9 months reacted with more impatience (e.g., reaching, looking away) when interacting with an adult who failed to give them a toy if the adult was unwilling to give them the toy than when the adult was simply unable to give it (Behne, Carpenter, Call, & Tomasello, 2005). In another study, chimpanzees produced more frustration behaviors and left the testing station earlier when interacting with an unwilling compared to an unable (but willing) experimenter (Call, Hare, Carpenter, & Tomasello, 2004). Similar patterns have been observed in other species such as capuchins (Phillips, Barnes, Mahajan, Yamaguchi, & Santos, 2009) and Tonkean macaques (Canteloup & Meunier, 2017).

Existing experimental investigations of under-informativeness have generally focused on a relatively narrow set of possible circumstances motivating information omissions (for exceptions, see Bonnefon, Feeney, & Villejoubert, 2009; Mazzarella, 2015). In what follows we build on pragmatic theory to explore a fuller range of explanations of under-informativeness in speakers from different language backgrounds. As we show, the specific case of under-informativeness can shed light on broader theories of speaker meaning at the intersection of non-native speech processing, pragmatic interpretation and social cognition.

1.1. Understanding under-informativeness in native and non-native speakers

Our main thesis, inspired by the pragmatic framework sketched earlier, is that listeners reason about an under-informative speaker’s intentions differently depending on the speaker’s native language. Because the speech of non-native speakers is expected to be more error-prone and less controlled by the speaker’s intent as compared to native speakers’ production, we hypothesize that under-informativeness is more likely to be attributed to inability (rather than unwillingness) to produce an appropriate conversational contribution in non-native as compared to native speakers. Suggestive evidence for this hypothesis comes from the observation that under-informative statements such as “Some dogs are mammals” are more likely to be judged as “making sense” when emanating from non-native as compared to native speakers (Fairchild & Papafragou, 2018). However, the origins of this asymmetry have not yet been put to the test. In Experiments 1 and 2, we directly assess perceived reasons for under-informativeness in native and non-native speakers.

Most strikingly, expanding on pragmatic theory, we derive novel

predictions about the social costs and benefits of being under-informative. Specifically, we hypothesize that the higher likelihood of considering under-informativeness voluntary in native compared to non-native speakers should affect further social inferences and learning. For instance, despite the tendency to avoid learning from individuals with a history of under-informativeness (Gweon, Pelton, Konopka, & Schulz, 2014; cf. Koenig & Harris, 2005), people may be more willing to give the benefit of the doubt to – and continue learning from – an under-informative non-native speaker as compared to an under-informative native speaker because of the different underlying assumptions about what led each of them to be under-informative (and the lower social penalties associated with being an unable – but willing – as opposed to an unwilling social partner; cf. Behne et al., 2005, a.o.). If so, being a non-native speaker should have an unexpected social advantage. In Experiments 3 and 4, we test this second hypothesis.

Taken together, these experiments on under-informativeness have broader implications for accounts of how speaker identity affects non-native speech processing and language comprehension more generally. First, if the present hypotheses are confirmed by experimental data, these results will broaden the empirical basis for positing differences in how native and non-native speech is comprehended by adding evidence from pragmatics to a list of mostly syntactic phenomena (Gibson et al., 2017; Grey & Van Hell, 2017; Hanulíková et al., 2012). More critically, these data would begin to suggest that the presence of a foreign accent does not simply characterize a linguistic stimulus but offers the impetus for inferences about the identity and properties of the speaker. As we argue, pragmatic theory offers a nuanced and principled explanation of such inferences, and can lead to further, sometimes counterintuitive, predictions about downstream implications of such inferences for social cognition and action. Within this pragmatically-informed framework, it is possible to explain how what begins as a disadvantage (diminished linguistic ability) for non-native speakers can in other contexts be treated as a benefit (especially when it reduces the likelihood of occurrence of other, unambiguously undesirable properties such as unwillingness to offer relevant information). Furthermore, a pragmatic account can resolve the apparent tension between existing evidence that non-native speakers face negative biases (e.g., Kinzler et al., 2007; Lev-Ari & Keysar, 2010, 2012) and the possibility that non-native communicators may also enjoy positive social treatment in some contexts (see also Gibson et al., 2017; Hanulíková et al., 2012).

Second, the present data can shed light on the origin of the processing differences for native vs. non-native utterances. According to some theoretical accounts, non-native speech is processed differently to the extent that a foreign accent taxes intelligibility and introduces additional processing load (Davis, Johnsrude, Hervais-Adelman, Taylor, & McGettigan, 2005; cf. Floccia, Goslin, Girard, & Konopczynski, 2006). Other accounts propose that listeners have different expectations about the speech of non-native speakers (Niedzielski, 1999; Lev-Ari, 2015): because non-native speech tends to contain errors, comprehenders rely more on top-down extra-linguistic information such as visual context and background knowledge of the situation when interpreting non-native language. Most prior studies have included spoken sentences with foreign accents in their materials, making the effects of intelligibility hard to disentangle from effects of higher-order expectations about non-native speech. One exception is a recent study (Fairchild & Papafragou, 2018), in which participants read sentences attributed to either native or non-native speakers and were asked to rate their meaning. Even though there was no physical accent to process, people showed selective lenience towards non-native speakers. In our current paradigm, we adapt this method to continue probing the potency of expectations in the comprehension of non-native utterances. We manipulate the identity of the speaker (native vs. non-native) in written text, so as to keep all other properties of the linguistic stimulus identical between conditions. Critically, we go beyond metalinguistic judgment tasks, and ask how a pragmatic aspect of meaning (under-informativeness) is interpreted in a simple, everyday context (Experiments 1

Table 1
Breakdown of justifications given in Experiment 1 by Speaker and Type.

Justification type	Native	Non-native	Example
Inability	39.68%	76.20%	
Linguistic difficulty	7.94%	41.27%	She didn't know the word for pears.
Perceptual or cognitive difficulty	31.74%	34.93%	She didn't see the pears./She forgot about the pears./She thought the pears were apples.
Unwillingness	60.32%	23.80%	
Deception	26.98%	12.70%	She wanted to keep the pears.
Politeness	19.05%	3.17%	She knew her friend didn't like pears, so she only offered her fruit she liked.
Saving face	6.35%	3.17%	She is embarrassed of her accent.
Other	7.94%	4.76%	It was her choice.

and 2) and has downstream consequences for future learning choices (Experiments 3 and 4). To the extent that our data confirm that speaker background affects pragmatic and social inferences from under-informative utterances, they would strongly support the role of higher-level expectations in non-native language comprehension even in the absence of actual intelligibility costs.

Finally, the present perspective on informativeness bears on theories of pragmatics and social meaning. As mentioned already, pragmatic theory assumes that listeners consider both the speaker's abilities and preferences when making conversational inferences, especially when listeners try to process utterances that apparently fail to observe fundamental communicative principles such as informativeness (e.g., Grice, 1975; Sperber & Wilson, 1995; Geurts, 2010, among many others). Nevertheless, these assumptions from pragmatic theory have not yet been fully examined experimentally. For instance, even though there is now a vast literature on how adults and children process under-informative sentences, many of these studies introduce such sentences in isolation and without much motivation (e.g., Barner, Brooks, & Bale, 2011; Bott & Noveck, 2004; Guasti et al., 2005; Noveck, 2001). A limited amount of studies has linked under-informativeness to the speaker's epistemic state (mostly ignorance: Breheny, Ferguson, & Katsos, 2013; Bergen & Grodner, 2012; Papafragou, Friedberg, & Cohen, 2018; Barner, Hochstein, Rubenson, & Bale, 2018), and only a handful of studies has looked at more complex social factors that can underlie the decision to say less than what is conversationally required (cf. Bonnefon et al., 2009; Mazzarella, 2015 on politeness). Furthermore, the idea that failures to be informative are interpreted through social-pragmatic reasoning that is sensitive to the speaker's mental state has been challenged by theories that place part of this reasoning within the grammar proper (Chierchia, Fox, & Spector, 2012). The present study begins to fill an empirical gap by addressing how a rich network of mental states - including whether the speaker is able and willing to say more - is used to interpret under-informative sentences, and showing how this reasoning applies to different types of speakers and shapes future social interactions. From a theoretical standpoint, if - as we expect - speaker identity flexibly affects the interpretation of under-informative utterances, our results will provide support for a broadly Gricean picture over recent alternatives.

2. Experiment 1

2.1. Method

2.1.1. Participants

Based on previous behavioral work comparing native and non-native speakers (Lev-Ari, 2015; Lev-Ari & Keysar, 2012; Lev-Ari, van Heugten, & Peperkamp, 2017), we aimed to recruit a minimum of 50 to 100 participants per condition for this and all following experiments. Additionally, post-hoc power analyses indicated that the actual number of recruited participants resulted in high power for all experiments (Experiment 1 = 0.98, Experiment 2 = 0.89, Experiment 3 = 0.98, Experiment 4 = 0.99). For Experiment 1, 126 monolingual English speakers aged 18–47 ($M = 29.64$, $SD = 4.61$) living in the United

States, 62 of whom were female, were recruited from Amazon's Mechanical Turk. Participants were compensated \$0.30 for the 3-minute study. Individuals who participated in Experiment 1 and all following experiments provided informed consent approved by the University of Delaware's Institutional Review Board.

2.1.2. Materials and procedure

Participants saw a picture of a young Asian-looking woman and underneath it a description of either a native speaker, Emma (Native Speaker condition, $N = 63$ participants) or a non-native speaker, Yuqi (Non-Native Speaker condition, $N = 63$ participants). The description read: "This is Emma/Yuqi. Emma/Yuqi is a college student at the University of Delaware, majoring in history. She moved to Delaware from Boston/China three years ago and still has a strong Boston/Chinese accent. In her spare time, Emma/Yuqi likes to paint and play the piano." A comprehension question followed, which asked participants to indicate where Emma/Yuqi was from. Accuracy was high (90%). Then the picture of the woman reappeared next to a picture of a refrigerator that contained bananas, apples, and pears. The following text accompanied the picture: "Emma's/Yuqi's friend asks for a snack. Emma/Yuqi looks in the refrigerator and says: 'There are bananas and apples.'"

Participants were then asked: "Why didn't Emma/Yuqi say that there were bananas, apples, and pears in the refrigerator?" and were instructed to write in their own response.

2.2. Results

Responses were coded as involving inability or unwillingness, each with several sub-types (see Table 1). Three responses that included both types of justification (e.g., "She didn't know the word or she didn't want to tell her friend there were pears") were removed. Inability for native speakers was mostly associated with difficulty of perceiving, identifying or remembering the unmentioned object (31.74% of responses); for non-native speakers, inability was again associated with perceptual or cognitive difficulty (34.93%) but also with problems with naming the omitted object (41.27%). Within the unwillingness class, a frequent explanation for native speakers was deception (26.98%) and social considerations such as politeness towards others or saving face for one's own sake (25.40% combined); for non-native speakers, deception was the predominant sub-type but was only half as frequent as for native speakers (12.70%).

A binary logistic regression was then performed with Speaker (Native, Non-Native) as the independent variable and Justification (Inability, Unwillingness) as the dependent variable. The model accounted for a significant amount of variance, $\chi^2(1) = 17.69$, $p < .001$, R^2 (Hosmer-Lemeshow) = 0.10. As can be seen in Table 2 and Fig. 1, Justification varied by Speaker, such that the odds of a participant believing that the speaker was unwilling to be fully informative were 4.86 times greater in the Non-Native Speaker condition as compared to the Native Speaker condition. The proportion of Inability justifications was not significantly different from chance in the Native Speaker condition ($p = .130$), but differed from chance in the Non-Native Speaker

Table 2
Results of the binary logistic regression model for Experiment 1.

	β	SE	odds ratio	p	95% confidence intervals	
					Lower	Upper
(Intercept)	-0.42	0.26	0.66	.104	-0.93	0.08
Speaker	1.58	0.39	4.86	< .001	0.83	2.37

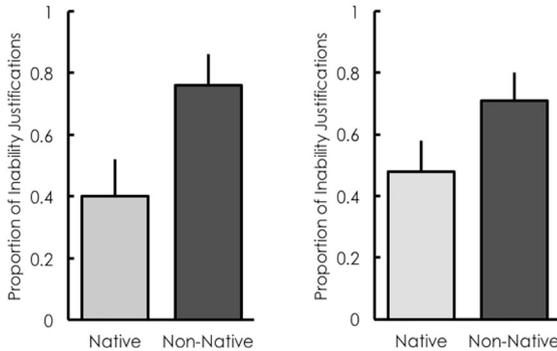


Fig. 1. Proportion of inability justifications in Experiments 1 and 2. Error bars represent 95% confidence intervals.

condition ($p < .001$). The full datasets for Experiments 1 through 4 can be accessed in the online supplemental materials.

2.3. Discussion

Experiment 1 offered empirical insights into the interpretation of under-informative utterances. As expected on the basis of pragmatic theory (cf. Geurts, 2010; Sperber & Wilson, 1995), under-informativeness was attributed broadly to either inability or to unwillingness of the speaker to say more. Importantly, as we had anticipated, native and non-native speakers' sins of omission were interpreted differently. People reasoned that, when non-native speakers left out information, they did so because they were unable to say more (due primarily to linguistic or perceptual/cognitive difficulty). By contrast, native speakers' information omission was equally likely to be interpreted as a sign of inability (mostly perceptual or other cognitive failure) or unwillingness (mostly a desire to deceptively withhold information, or to prioritize social concerns such as being polite to others and saving face for oneself). Overall, leaving out information was more likely to be attributed to inability (as opposed to unwillingness) in non-native compared to native speakers.

3. Experiment 2

Building on the previous finding, in Experiment 2, we asked participants to choose between an Inability (cognitive difficulty) and an Unwillingness (deception) explanation for a speaker's under-informativeness. We hypothesized that the asymmetrical appeal to unwillingness for native vs. non-native speakers would resurface even in a context that made no mention of linguistic difficulty.

The experiment introduced an inventor (either a native or a non-native speaker) who taught others about her invention but omitted one feature. Participants chose between two explanations (inability vs. unwillingness) for the omission. The omitted information was clearly known to the speaker and was highly relevant for the listeners (science fair visitors trying to learn about new inventions). Additionally, the context made both explanations plausible: the speaker had many other inventions and might have forgotten the feature ('inability'); furthermore, the omitted feature was a limitation that the speaker might have wanted to downplay ('unwillingness'). Of interest was whether, in line

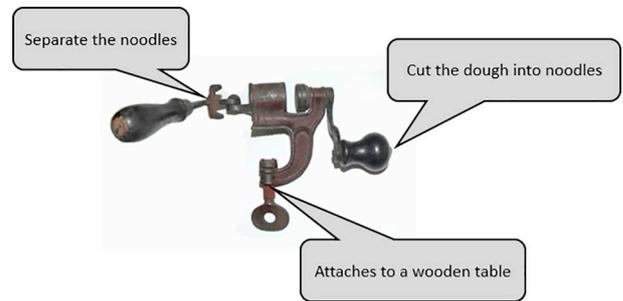


Fig. 2. Novel object used in Experiment 2 ("Zeg") and its three functions.

with Experiment 1, participants would assess potential explanations differently depending on whether the inventor was a native or non-native speaker.

3.1. Method

3.1.1. Participants

Two hundred monolingual English speakers aged 18–49 ($M = 29.77$, $SD = 5.72$) living in the United States, 111 of whom were female, were recruited from Amazon's Mechanical Turk. Participants were compensated \$0.20 for the 2-minute study.

3.1.2. Materials and procedure

Participants were first presented with the image of a novel object and its three functions in Fig. 2 and told: "Read about this Zeg and learn what it is. Try to remember what it does as best you can. Once you're done reading all of the information on this page, click the NEXT button." To encourage thorough examination of the object, the experiment would not advance until the participant had spent 30 s on the page (the NEXT button was not available for 30 s, and a countdown timer appeared in the corner of the page). Participants were then presented with descriptions of the inventor of the Zeg (see Fig. 3) - either Emma Smith with a strong Boston accent (Native Speaker condition, $N = 100$ participants), or Yuqi Chen with a strong Chinese accent (Non-Native Speaker condition, $N = 100$ participants). The description included the information that the Zeg was one of their many inventions. Comprehension questions followed the inventor description ("Where is Emma/Yuqi from?", "What instrument does Emma/Yuqi play?"). Accuracy on these questions was 94% and 76% respectively (a few participants who failed both questions were replaced). On the next screen, participants read the following text: "Emma/Yuqi is sharing her invention, the Zeg, at the amateur inventor club's annual public science fair. This is what Emma/Yuqi says about the Zeg to people who visit her display." This text was accompanied by a picture of a young Asian-looking woman next to a picture of the Zeg, with a speech bubble coming from the woman that contained the following description: "The Zeg cuts dough into noodles and separates them".

Participants then responded to the question: "Why didn't Emma/Yuqi say that the Zeg attaches to a wooden table?" Two options were provided, an Inability justification ("She forgot because she has so many inventions") and an Unwillingness justification ("She didn't want people to know that it doesn't attach to other surfaces").

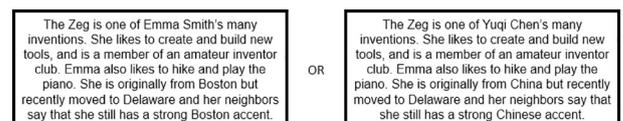


Fig. 3. Speaker descriptions used in Experiment 2.

Table 3
Results of the binary logistic regression model for Experiment 3.

	β	SE	Odds Ratio	p	95% Confidence Intervals	
					Lower	Upper
(Intercept)	-0.08	0.20	0.92	0.689	-0.47	0.31
Speaker	0.98	0.29	2.65	0.001	0.40	1.57

3.2. Results

Justifications were coded as 1 if they invoked Inability and 0 if they invoked Unwillingness. A binary logistic regression was performed with Speaker (Native, Non-Native) as the independent variable and Justification (Inability, Unwillingness) as the dependent variable. The model accounted for a significant amount of variance, $\chi^2(1) = 11.10$, $p = .001$, R^2 (Hosmer-Lemeshow) = 0.04. As can be seen in Table 3 and Fig. 1, Justification varied by Speaker, such that the odds of a participant believing that the speaker left out a piece of information due to inability were 2.65 times greater in the Non-Native Speaker condition ($M = 0.71$, $SD = 0.46$) as compared to the Native Speaker condition ($M = 0.48$, $SD = 0.50$). The proportion of Inability justifications did not differ significantly from chance in the Native Speaker condition ($p = .764$), but did so in the Non-Native Speaker condition ($p < .001$).

3.3. Discussion

Experiment 2 showed that sins of omission were more likely to be attributed to inability (as opposed to unwillingness) if committed by a non-native compared to a native speaker. This occurred despite the fact that the Inability choice did not mention language. This finding confirms the hypothesis that participants are less likely to interpret failures in the communicative signal (here, failures to observe the informativeness principle) as being willful in non-native compared to native speakers.

4. Experiment 3

In Experiment 3, we investigated how perceived reasons for under-informativeness impact future learning by asking participants to decide whether or not to learn from an under-informative inventor again. We expected that participants would avoid learning from an under-informative speaker (cf. Gweon et al., 2014), but that this effect would vary depending on the inventor's linguistic background. If under-informativeness is more likely to be attributed to inability instead of unwillingness in non-native vs. native speakers, participants should be more likely to choose to learn from an under-informative inventor who is a non-native as opposed to a native speaker.

4.1. Method

4.1.1. Participants

Four hundred new monolingual English speakers aged 18–59 ($M = 30.13$, $SD = 6.26$) living in the United States, 193 of whom were female, were recruited from Amazon's Mechanical Turk. Participants were compensated \$0.30 for the 3-minute study.

4.1.2. Materials and procedure

Procedure was similar to Experiment 2. Participants were first presented with the novel object and facts in Fig. 3 (except that “Attaches to a wooden table” was changed to “Attaches to a table” and the speaker descriptions began with “Emma Smith/Yuqi Chen is the inventor of the Zeg” instead of “The Zeg is one of Emma Smith's/Yuqi Chen's many inventions” to provide a more neutral context). Then a description of one of the inventors was presented (see Fig. 3). The same

comprehension questions as in Experiment 2 followed and were answered accurately 94% and 76% of the time respectively (as before, if participants failed both questions, they were replaced).

As in Experiment 2, participants next read the following text: “Emma/Yuqi is sharing her invention, the Zeg, at the amateur inventor club's annual public science fair. This is what Emma/Yuqi says about the Zeg to people who visit her display.” This text was accompanied by a picture of a young Asian-looking woman next to a picture of the Zeg, with a speech bubble that contained one of the following descriptions: “The Zeg attaches to a table, cuts dough into noodles, and separates the noodles” (Informative condition), or “The Zeg attaches to a table” (Under-Informative condition). Unlike Experiment 2, only one of the three functions was mentioned in the Under-Informative condition to increase the severity of information omission. Speaker (Native, Non-Native) and Informativeness (Informative, Under-Informative) were manipulated between-subjects, with equal numbers of participants ($N = 100$) in each of the four conditions.

Participants next responded to a Helpfulness question (“How helpful was Emma/Yuqi to people who visited her display to learn about the Zeg?”) using a scale ranging from 1 (not helpful) to 5 (helpful). The Helpfulness Rating served as a check that the Informativeness manipulation was effective: the Under-Informative inventors should elicit lower ratings than the Informative inventors (as in Gweon et al., 2014). Then participants read that “Emma/Yuqi is developing a new tool called the Plib” and saw a second novel object. Participants were asked: “How would you like to learn about the Plib?”, and had to click either on the picture of the previous inventor (with the name Emma/Yuqi mentioned underneath the picture as a reminder) or the picture of a new Asian-looking woman without any details given about her (except for the name Sue/Su – depending on Speaker condition - mentioned underneath her picture). The binary variable Teacher Choice (Same – Emma/Yuqi, New – Sue/Su) was our main dependent variable of interest, with our prediction being that participants would be more willing to choose to learn from an Under-Informative teacher that was perceived to leave out information due to inability (i.e., the Non-Native Speaker condition) over one who was unwilling to provide more information (i.e., the Native Speaker condition).

4.2. Results

A 2 (Speaker: Native, Non-Native) by 2 (Informativeness: Informative, Under-Informative) factorial ANOVA was performed on participants' mean Helpfulness Ratings (see Fig. 4). As predicted, perceptions of helpfulness were influenced by the Informativeness of the speaker, $F(1, 396) = 114.66$, $p < .001$, $\eta_p^2 = 0.22$, 95% CI [-2.00, -1.38], such that Informative inventors ($M = 3.47$, $SD = 1.00$) were judged as more helpful than Under-Informative inventors ($M = 1.87$, $SD = 1.22$). Helpfulness ratings did not vary by Speaker, $F(1, 396) = 0.58$, $p = .448$, $\eta_p^2 < 0.01$, 95% CI [-0.19, 0.43], and the Speaker by Informativeness interaction was not significant, $F(1, 396) = 0.65$, $p = .420$, $\eta_p^2 < 0.01$, 95% CI [-0.26, 0.62]. Thus people linked the helpfulness of a speaker simply to the informational content of their utterance.

To determine whether future learning behavior is affected by previous demonstrations of under-informativeness and non-native speaker status, a binary logistic regression was performed with Speaker and Informativeness as independent variables and Teacher Choice (Same, New) as the dependent variable (Fig. 4 and Table 4; Teacher Choice was coded as 1 (Same) or 0 (New) and Native Speaker and Informative served as the reference levels for the Speaker and Informativeness variables, respectively). The model accounted for a significant amount of variance, $\chi^2(3) = 61.50$, $p < .001$, R^2 (Hosmer-Lemeshow) = 0.11, 95% CI. Teacher Choice varied by Informativeness, such that an Under-Informative speaker reduced the odds of a participant choosing the same teacher by a power of 0.13. There was no significant effect of Speaker, but there was a significant Informativeness by Speaker

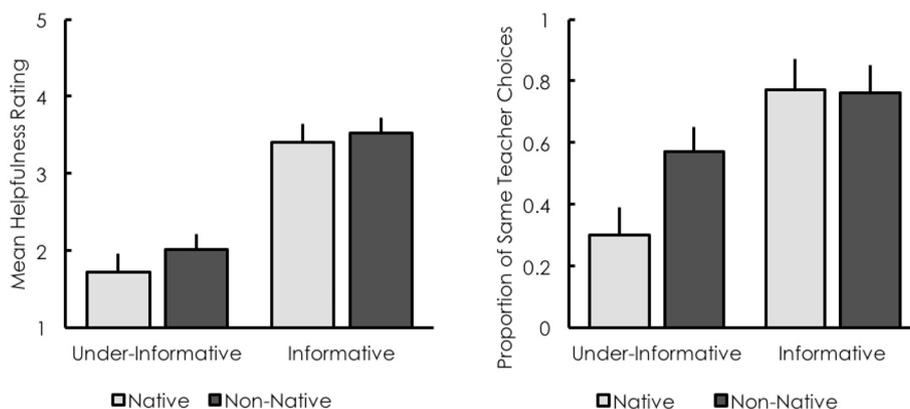


Fig. 4. Mean Helpfulness Ratings (left) and the proportion of Same Teacher Choices (right) in Experiment 3. Error bars represent 95% confidence intervals.

Table 4 Results of the binary logistic regression model for Experiment 3.

	β	SE	Odds ratio	p	95% confidence intervals	
					Lower	Upper
(Intercept)	1.21	0.24	3.35	< .001	0.76	1.70
Informativeness	-2.06	0.03	0.13	< .001	-2.71	-1.44
Speaker	-0.06	0.33	0.95	.868	-0.72	0.60
Informativeness*Speaker	1.18	0.45	3.27	.008	0.31	2.07

interaction. Specifically, post-hoc tests (Tukey) indicated that participants were more likely to choose to learn again from an Under-Informative Non-Native Speaker ($M = 0.57, SD = 0.50$) than an Under-Informative Native Speaker ($M = 0.30, SD = 0.46$), $p = .017$, 95% CI [-0.36, -0.02]. The likelihood of choosing to learn again from an Informative Native ($M = 0.77, SD = 0.42$) vs. Non-Native ($M = 0.76, SD = 0.43$) Speaker did not differ significantly, $p = .999$, 95% CI [-0.18, 0.16].

4.3. Discussion

As expected (see Gweon et al., 2014), under-informative speakers were deemed to be less helpful than fully informative speakers and were dispreferred as sources of further learning. Furthermore, as we predicted, under-informative speakers were more likely to be given a second chance to act as sources of knowledge if they were non-native speakers: 57% of participants chose to seek further information from an under-informative non-native speaker but only 30% were willing to do the same for a native speaker. Unlike our previous experiments that explicitly probed explanations of information omission, in the present experiment such explanations were computed spontaneously when needed and affected future inferences and behavior.

Given the present line of reasoning, one might consider it surprising that under-informative non-native speakers were not judged as more helpful than their native speaker counterparts. It appears that our participants' helpfulness judgments reflected perceptions of *informativeness* only, rather than a combination of informativeness and other social information (which was captured by the results of the learning trial). We return to this issue after the next experiment.

5. Experiment 4

In Experiment 3, we interpreted the higher likelihood that participants would switch to a new speaker in the Under-Informative Native speaker condition than in the Under-Informative Non-Native speaker condition as a reflection of attitudes towards the speaker. However, participants' selections in Under-Informative trials may have reflected

their expectations regarding the *alternative* speaker since that speaker differed across conditions (another native speaker, Sue, vs. another non-native speaker, Su). Even if participants penalized inability more than or similarly to unwillingness, because inability was attributed to the non-native status, and participants' only other alternative in the Non-Native speaker condition was another non-native speaker, they might have assumed that switching to the other speaker would not help (the new speaker might also be unable), and therefore chose randomly between the two speakers. In contrast, in the Native speaker condition, participants had no reason to assume that the alternative speaker would be either unwilling or unable, so they decided to switch speakers. Thus, by offering different response options for each of the two speakers, the design of Experiment 3 might have obscured the true source of the difference in how people chose to learn about a new object.

In Experiment 4 we addressed this possibility. We replicated the basic design of Experiment 3 but without introducing a specific new invention or new teacher. Instead we asked participants to tell us how likely they would be to visit the current inventor's display at a future science fair. Other things being equal, this task allowed us to assess whether under-informative (as well as informative) native and non-native speakers would be judged in their own right as a good source of future information. To assess likelihood of future visits, we used a 0–5 scale to obtain more nuanced preferences from participants compared to the previous binary task. For consistency, we used the same scale for the Helpfulness ratings. A final, minor change from Experiment 3 was that we adopted a stricter inclusion criterion by only analyzing data from participants who correctly answered the comprehension question about the place the inventor was from.¹

5.1. Method

5.1.1. Participants

Four hundred and fifty-seven additional monolingual English speakers aged 18–65 ($M = 28.60, SD = 7.28$) living in the United States, 256 of whom were female, were recruited from Amazon's Mechanical Turk. Participants were compensated \$0.30 for the 3-minute study. An additional 26 participants were recruited for the study, but their data were excluded from the analyses for answering the question “Where is Emma/Yuqi from?” incorrectly. (Without the exclusions, this question was answered correctly 95% of the time, similarly to Experiment 3.)

5.1.2. Materials and procedure

The procedure mirrored that of Experiment 3 with a few minor

¹ Applying stricter inclusion criteria and removing the data from participants who answered this question incorrectly in the preceding experiments did not change the overall pattern of results.

changes. As in the previous experiment, participants were first presented with a novel object (see Fig. 2) and its three accompanying facts in for 30 s. Then on the next screen, a description of one of the inventors (either native speaker Emma or non-native speaker Yuqi) was presented (see Fig. 3). The same comprehension questions as in Experiment 3 followed and yielded similar accuracy (72% accuracy for “What instrument does Emma/Yuqi play?”). Participants then read the inventor’s description of the Zeg that she was sharing with people who visited her booth at the science fair. As before, the inventor in the Informative condition said “The Zeg attaches to a table, cuts dough into noodles, and separates the noodles,” and the inventor in the Under-Informative condition said “The Zeg attaches to a table.” Speaker (Native, Non-Native) and Informativeness (Informative, Under-Informative) were manipulated between-subjects, with approximately equal numbers of participants in each of the four conditions: $N = 113$ in the Informative Native Speaker condition, $N = 113$ in the Under-Informative Native Speaker condition, $N = 115$ in the Informative Non-Native Speaker condition, and $N = 116$ in the Under-Informative Non-Native Speaker condition. Participants were then asked how Helpful Emma/Yuqi was to people visiting her display using a scale ranging from 0 (not helpful) to 5 (helpful).

The primary change to Experiment 4 from Experiment 3 came on the following screen: instead of learning about an additional tool being developed by the inventor and choosing to learn about from them or from a different individual, participants were simply asked “How likely would you be to visit Emma/Yuqi’s display at a future science fair?” Participants entered their response (Learning Choice Rating) on a scale from 0 (not at all) to 5 (extremely).

5.2. Results

As in Experiment 3, a 2 (Speaker: Native, Non-Native) by 2 (Informativeness: Informative, Under-Informative) factorial ANOVA was performed on participants’ mean Helpfulness Ratings (see Fig. 5). As seen in Experiment 3, perceptions of helpfulness were influenced by the Informativeness of the speaker, $F(1, 453) = 242.62$, $p < .001$, $\eta_p^2 = 0.35$, 95% CI $[-2.07, -1.47]$, such that Informative inventors ($M = 3.68$, $SD = 1.00$) were judged as more helpful than Under-Informative inventors ($M = 1.99$, $SD = 1.29$). Helpfulness ratings did not vary by Speaker, $F(1, 453) < 0.001$, $p = .990$, $\eta_p^2 < 0.01$, 95% CI $[-0.38, 0.22]$, and the Speaker by Informativeness interaction was not significant, $F(1, 453) = 0.55$, $p = .458$, $\eta_p^2 < 0.01$, 95% CI $[-0.27, 0.58]$.

Another 2 (Speaker: Native, Non-Native) by 2 (Informativeness: Informative, Under-Informative) factorial ANOVA was then performed with Learning Choice Ratings as the dependent variable to assess the effects of informativeness and native speaker status on future learning

behavior (see Fig. 5). As predicted, participants reported being more likely to learn again from Informative ($M = 2.99$, $SD = 1.44$) vs. Under-Informative ($M = 2.10$, $SD = 1.38$) inventors $F(1, 453) = 46.69$, $p < .001$, $\eta_p^2 = 0.09$, 95% CI $[-1.53, -0.79]$. The main effect of Speaker was marginally significant $F(1, 453) = 3.46$, $p = .063$, $\eta_p^2 = 0.01$, 95% CI $[-0.38, 0.35]$. Critically, the interaction between Speaker and Informativeness was significant, $F(1, 453) = 3.96$, $p = .047$, $\eta_p^2 = 0.01$, 95% CI $[0.01, 1.04]$; a Bonferroni-corrected post-hoc test indicated that (as in Experiment 3) participants were more willing to learn again from an Under-Informative Non-Native speaker ($M = 2.34$, $SD = 1.40$) as compared to an Under-Informative Native speaker ($M = 1.84$, $SD = 1.32$), $p = .040$.

5.3. Discussion

Experiment 4 replicated the results of Experiment 3: under-informative speakers were more likely to be given a second chance to provide information during social interactions if they were non-native speakers. Thus, as we hypothesized in the Introduction, being a non-native speaker has an unexpected social benefit.

As in Experiment 3, the Helpfulness ratings reveal that participants equated helpfulness with informativeness: they judged that an under-informative teacher is less “helpful” than an informative one, and perceived under-informative native and non-native speakers as equally (un)helpful. Nevertheless, as in Experiment 3, equally helpful speakers were treated differently in social interactions and learning – presumably because the likely source of their relative helpfulness was perceived to be different. We return to this idea more fully below.

6. General discussion

Recent research demonstrates differences in the comprehension of native and non-native speech (Gibson et al., 2017; Grey & Van Hell, 2017; Hanulíková et al., 2012) and negative social biases towards non-native speakers (Kinzler et al., 2007; Lev-Ari & Keysar, 2010, 2012, a.o.). Here we bridged and extended these two strands of research by investigating how pragmatic and further social inferences from what one says (and does not say) might differ depending on the status (native vs. non-native) of the speaker. We focused on under-informativeness, a phenomenon that has received considerable attention in psycholinguistics work (Bott & Noveck, 2004; Guasti et al., 2005; Noveck, 2001; Papafragou & Musolino, 2003). Our main hypotheses were that native comprehenders would treat under-informative utterances differently depending on the identity of the speaker, and that this difference would have implications for learning.

Overall, these hypotheses were confirmed. In Experiment 1, comprehenders were more likely to explain under-informativeness as the

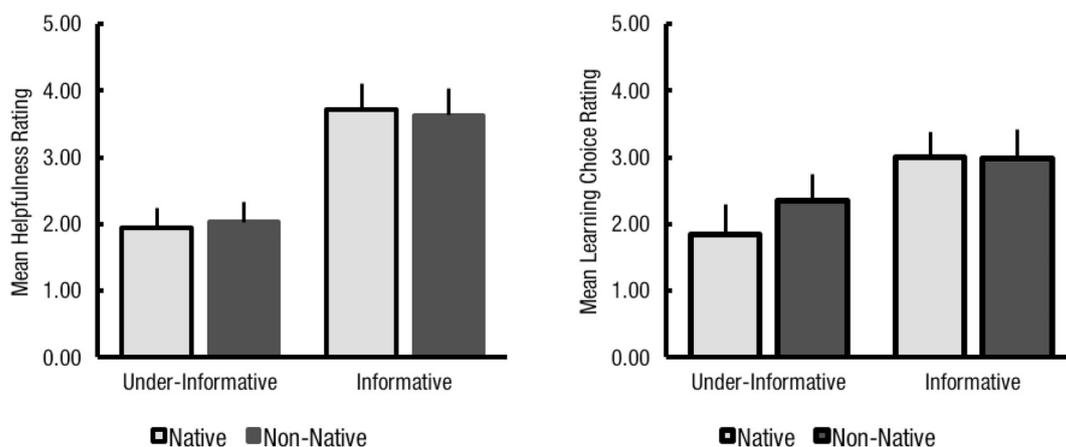


Fig. 5. Mean Helpfulness Ratings (left) and Learning Choice Ratings (right) in Experiment 4. Error bars represent 95% confidence intervals.

result of inability to give sufficient information – rather than unwillingness to do so – for non-native as compared to native speakers. Furthermore, inability explanations for native speakers mostly invoked difficulty with seeing, recognizing or remembering the unmentioned object but for non-native speakers they also often invoked difficulty with naming the object. Unwillingness explanations mostly invoked deception or conflict with one's own or the hearer's social preferences, and both sub-types were numerically less frequent for non-native speakers. In Experiment 2, the inability vs. unwillingness asymmetry was replicated in a forced-choice task, even though the provided inability explanation was non-linguistic in nature. We hypothesize that this result was due to a general bias to consider failed communicative behavior as less voluntary for non-native speakers. Finally, in Experiments 3 and 4, participants were more likely to choose to learn from an under-informative non-native speaker than an under-informative native speaker, presumably because they gave the benefit of the doubt to the speaker whose prior under-informativeness was less likely to have been willful.

Below we discuss implications of our findings for theoretical accounts of how non-native speech is processed, and for accounts of how pragmatic and social inferences are computed during language comprehension.

6.1. Implications for theories of non-native language processing

The present data contribute to a growing body of work demonstrating differences in how native and non-native speech is comprehended across multiple linguistic domains (Gibson et al., 2017; Grey & Van Hell, 2017; Hanulíková et al., 2012). In the domain of pragmatics, they show that, when a speaker is under-informative, listeners consider (native/non-native) speaker identity when making inferences about why the speaker failed to say more; moreover, these inferences have further consequences for social cognition and future behavior. The current data comport with – and explain – recent findings showing that listeners are more accepting of under-informative statements when those are produced by non-native as compared to native speakers (Fairchild & Papafragou, 2018). More broadly, our data support the position that foreign accents are not just physical properties of utterances but sources of information about the knowledge, preferences and intentions of the speaker that can themselves lead to further social evaluations.

From a theoretical standpoint, our results make two more specific contributions to the literature on non-native speech processing. First, our findings paint a more complete and nuanced picture of the social consequences of being a non-native speaker. Recall that prior research shows negative biases towards non-native speakers (e.g., Lev-Ari & Keysar, 2010, 2012) that seem to begin in infancy (Kinzler et al., 2007). Our data do suggest a cost for non-native speakers such that their communicative contributions are perceived as less likely to be the product of willful choice. Overall, however, they support the conclusion that being perceived as a somewhat inept communicator can have unexpected social benefits. In this sense, they are more closely aligned with recent results suggesting that the error-prone nature of non-native speech can have some processing advantages (Fairchild & Papafragou, 2018; Gibson et al., 2017; Hanulíková et al., 2012).

The present perspective, especially the selective preference for non-native speakers in Experiments 3 and 4, may appear puzzling given evidence that ineptness is socially penalized. In word learning studies, for instance, children are more likely to trust a reliable speaker (e.g., one who referred to a shoe as a “shoe”) than an unreliable speaker (e.g., one who referred to a shoe as a “ball”; Koenig & Harris, 2005). We do not see a puzzle here: even in our own data (see Experiments 3 and 4), under-informative teachers were considered less helpful and, as a group, were clearly dispreferred compared to fully informative, reliable speakers. Additionally, however, the grounds for under-informativeness mattered (in most prior developmental studies, the reasons for being an

unreliable speaker were left open). Linguistic ineptness had a benefit in our data only because the alternative was a case in which the speaker had equal chances of being inept vs. intentionally withholding information (cf. explanations for why native speakers omitted information in Experiments 1 and 2). Willful reluctance to impart necessary and relevant information can lead to communication breakdowns (Grice, 1975), since it violates the presumption that the speaker is co-operative (and further decreases the possibility that the speaker will be a good future source of knowledge). Because non-native speakers are considered less likely to willfully omit information, they are protected from the negative social consequences of choosing to say less than what is required in conversation. This account explains how equally unhelpful native and non-native communicators can be treated asymmetrically when people make learning choices (Experiments 3 and 4). Furthermore, it coheres with evidence that the very same ‘unhelpful’ action such as failing to provide a desirable object is judged differently by both human infants (Behne et al., 2005) and primates (Call et al., 2004) depending on whether the agent was unable or unwilling to act differently. Taken most broadly, the present account suggests that biases towards non-native speakers need to be embedded within a broader pragmatic framework of how social inferences are computed from regular processes of utterance comprehension.

A second contribution of our findings relates to theoretical accounts of the source of the processing differences associated with non-native speech. Recall that, on some models, the differences in how non-native speech is processed are attributed to the challenges that accented speech poses for intelligibility (e.g., Davis et al., 2005; Floccia et al., 2006; cf. Munro & Derwing, 1995; Clarke & Garrett, 2004; Bradlow & Bent, 2008). Other models propose that differences can also arise from the mere expectation that a linguistic message was formulated by a non-native communicator (on the role of expectations, see Lev-Ari, 2015; Gibson et al., 2017; Fairchild & Papafragou, 2018). Unlike most prior studies, sentence intelligibility in our paradigm was identical across types of speakers, since materials were presented in the written modality. Even in the absence of an actual encounter with a foreign accent, however, speaker-specific differences in processing linguistic stimuli emerged. Furthermore, these differences arose both when people were asked about the contents of a sentence they had read (Experiments 1 and 2) and when people processed non-native speech to make a learning decision (Experiments 3 and 4). Thus a simple, top-down manipulation of speaker identity mobilized expectations about non-native speech that subsequently affected social-pragmatic inferences. These findings provide support for the role of expectations for non-native speech comprehension. Beyond their theoretical significance, effects of non-native speaker identity on language processing in the absence of auditory or other information are socially and practically pertinent, given that information transmission in our society increasingly occurs via the internet between individuals who do not personally know one another (e.g., social networks, multiplayer video games, e-commerce) and often involves written as opposed to spoken text.

Naturally, it is highly likely that actually perceived (as opposed to imagined) accents exert additional effects on language processing. In general, one may expect that in face-to-face interactions with non-native speakers, a thick foreign accent would exacerbate the pattern of results we observed, because there would be additional auditory cues to signal to the listener that the speaker may have lower linguistic competence than a native speaker. However, it is also possible that the increased processing demands of a foreign accent would deter native listeners from choosing to learn from a non-native speaker, regardless of the quantity of information they provide. These possibilities have concrete real-world consequences. For instance, common virtual learning situations – including tutorials and online courses – could be influenced by factors such as the speaker's native language. The present findings raise further issues for non-native speech comprehension. First, it is important to consider whether different types of accents are equally likely to induce changes in pragmatic processing, and how the

comprehenders' specific language backgrounds might affect the results. For example, results may vary with social perceptions of L1, with speakers of more stigmatized languages potentially being seen as more incompetent than speakers of less stigmatized languages. In a similar vein, even though we do not expect different regional accents to affect the results (since a person with a Boston accent and a person with a Brooklyn accent are both native speakers of English), it remains possible that regional accents strongly associated with low socio-economic status might yield results similar to those we observed with non-native speakers. Indeed, relevant to both low-status foreign accents and low-status regional accents, perceptions of social status are correlated with perceptions of competence (e.g., Fiske, Cuddy, Glick, & Xu, 2002).

Second, our account predicts that the extent to which an under-informative non-native speaker is perceived as unable or unwilling to say more depends on their level of second language proficiency. Specifically, we expect that a speaker who is highly proficient in their second language with little to no detectable foreign accent would be judged similarly to a native speaker, and presumed to be omitting information due to unwillingness rather than inability. In support of this hypothesis, prior work demonstrated that judgments of under-informative sentences such as "Some dogs are mammals" differed between native and non-native speakers but only when the non-native speaker had a thick foreign accent: highly proficient, accent-free non-native speakers elicited the same linguistic judgments as native speakers (Fairchild & Papafragou, 2018). We anticipate that proficiency in the second language would affect the results in the present study as well.

6.2. Implications for theories of pragmatics and social cognition

Beyond the domain of non-native speech comprehension, our findings have implications for pragmatics and language comprehension. In the specific empirical domain of interest, the present results provide novel evidence for the complexity of inferences underlying the processing of under-informativeness (cf. also Bonnefon et al., 2009). More broadly, these data show that listeners consider both the speaker's abilities and preferences when making conversational inferences in ways that have been outlined by linguistic theories (e.g., Grice, 1975; Sperber & Wilson, 1995; Geurts, 2010, among many others) but have not yet been fully confirmed experimentally. The present results are harder to reconcile with accounts on which informativeness-related inferences are situated within the grammar proper (Chierchia et al., 2012). Relatedly, these findings support models of language processing that argue for a role of speaker identity and connect to other proposals according to which linguistic detail can carry sociolinguistic or other interpersonal information about the speaker (Beltrama, 2018).

An interesting open question is whether our results generalize to cases of temporary or more stable linguistic incapacitation in monolingual speakers, such as individuals with Alzheimer's, stroke patients, or even young children still acquiring their first language. It is very likely that in such situations, omissions of information are seen as being due to inability (either cognitive in the case of individuals with Alzheimer's or linguistic in the case of children) rather than unwillingness and therefore accepted to a greater extent in learning contexts similar to those in Experiments 3 and 4. On the other hand, speakers with Alzheimer's may be perceived as likely to consistently omit information (as compared to non-native speakers, for whom sins of omission may be rarer) due to cognitive deficits, and for this reason may be dispreferred as teachers.

Finally, our data raise different theoretical possibilities about how early in processing speaker effects emerge. One possibility is that non-native speaker identity is integrated at a late stage of processing, with judgments reflecting slow, effortful reasoning about the speaker's utterance. Alternatively, information about the speaker's identity and language background may be available immediately, due to expectations held by the listener about what certain groups of speakers are

likely to say (or not say) and the types of errors they will produce. In support of this possibility, non-native speaker status (Grey & Van Hell, 2017; Hanulíková et al., 2012) and other properties of the speaker such as topic knowledge (Bergen & Grodner, 2012) and gender (Van Berkum, Van den Brink, Tesink, Kos, & Hagoort, 2008) are known to affect sentence comprehension from the earliest moments of processing. Online behavioral and neural evidence can adjudicate between these two alternatives.

Author statement

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Declaration of competing interest

None.

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