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(In)sensitivity to incoherence in human communication

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A B S T R A C T

Human sensitivity to conversational coherence is often taken as a given, but there is reason to suppose that tolerance of incoherence is greater than assumed. In Galantucci and Roberts's (2014) laboratory study, participants showed surprising insensitivity to incoherence introduced by randomly crossing their conversations. In that study, however, it was impossible to control the nature of the incoherence. Here, we present a study in which we replaced genuine messages with messages guaranteed not to fit well with the conversation. Inserted messages were incoherent either with respect to task-relevant information or with respect to a salient social category, the interlocutor's gender. More than a third of participants failed to notice the incoherence. This provides evidence that the transmission of information in linguistic interaction is, contrary to widespread assumptions, not subject to reliable monitoring or regulation.

1. Introduction

The main theoretical approaches to human communication have been developed under the implicit assumption that the transmission of informational content in communicative exchanges can be (and indeed usually is) regulated in an orderly fashion (Grice, 1957; Sacks, 1992; Shannon and Weaver, 1949; Wilson and Sperber, 2004). This seems a very reasonable assumption to make because such exchanges involve two or more people interacting in real time in rich and noisy contexts. If the exchanges were not subject to orderly regulation, conversational chaos might be expected to arise rapidly. Hence, people should monitor the coherence of the conversations they are holding, and failures of coherence should be salient to them. Indeed, there is evidence suggesting not only that people are sensitive to communicational coherence (Black, 1988; Bublitz, 1988) but that they also attempt repairs when it seems to be lacking (e.g., Schegloff et al., 1977). In general, work on conversational coherence has focused primarily on either describing and categorizing coherence (see Halliday and Hasan, 1976, for a classic example) or on how cases of incoherence are repaired (Hayashi et al., 2013). Nevertheless, early research on spontaneous conversation encourages caution with regard to the assumption that it is routinely repaired, as people seem to have some degree of tolerance for incoherent exchanges (Cicourel, 1964; Garfinkel, 1967; Schutz, 1962). But these early findings did not lead to systematic research, leaving essentially unaddressed the question of how sensitive to conversational coherence people really are. To address this question, Galantucci and Roberts (2014; henceforth GR) conducted two laboratory studies involving spontaneous conversations in which moments of incoherence were inserted. Pairs of

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participants chatted with each other for 15 min, using an instant-messenger program, about a cartoon image of five famous people. Incoherence was inserted into these conversations by crossing them four times — for a total duration of 2 min — with other conversations in which different participants chatted about a different cartoon, depicting different famous people (Fig. 1).

In one study, intended to investigate narrowly focused conversation, each participant was told that their partner had the same picture, colored differently, and that their task was to find the color differences. In a second study, intended to investigate more broadly focused conversation, participants were simply told to chat about which of the famous people depicted they would most and least like to spend a day with. Across the two studies, about a third of participants failed to notice that their conversations had been crossed.

This was a striking result, and the interruption of spontaneous conversations with other spontaneous conversations ensured that the interruptions contained random lines from genuine conversations. However, this procedure led to interruptions that were inherently uneven; it was possible that a conversation would be interrupted by a line that happened to fit into the context of the conversation, or even that no messages would be sent during the period in which the conversations were crossed. To address this issue, GR performed post-hoc analyses of the transcripts to ascertain whether the conversation crossing had indeed produced detectable moments of conversational incoherence. These analyses confirmed that, overall, the crossed conversations contained such moments. Nevertheless, there remain disadvantages to this approach to studying conversational coherence. First, for those participants who were exposed to detectable incoherence, there was considerable variation in its severity, and this was outside the experimenters' control. In other words, GR provides only a relatively rough estimate of how sensitive people are to conversational coherence. Second, about 20% of GR's participants were not exposed to clearly detectable incoherence. Not only did these participants have to be excluded from the analysis, but the process of identifying them required recruiting naïve judges, making this a rather inefficient approach. Third, as GR documented (pp. 2, 4), it was likely that some of the participants in the study did not actually detect the crossing of the conversations but merely guessed their existence on the basis of general suspiciousness about psychological experiments (Kelman, 2007; MacCoun and Kerr, 1987). In other words, GR likely overestimated how well people detect conversational incoherence.

2. Enhancing GR's method: message replacement

Here, we present two studies that replicate GR while addressing the issues identified above. In both studies, as in GR, we had two participants chat over IM. However, instead of crossing two unrelated conversations, we swapped two messages in

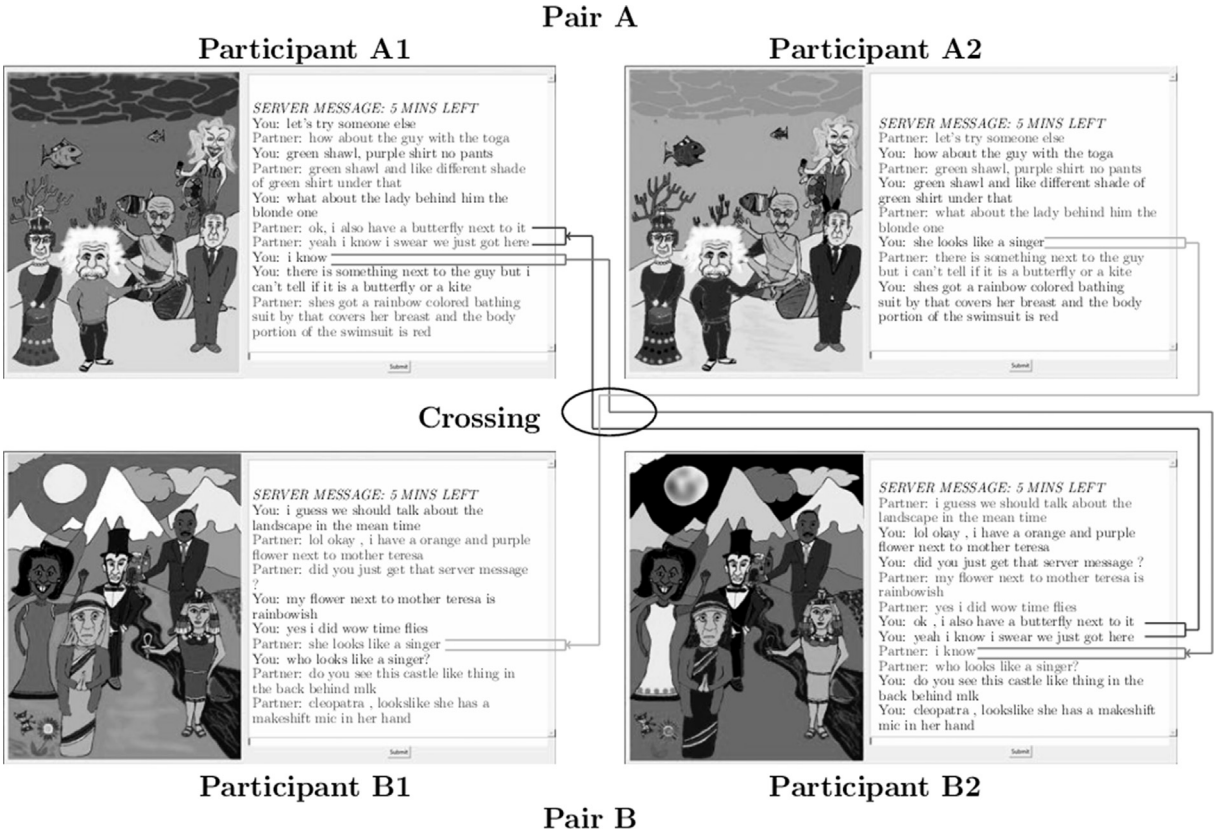

Fig. 1. (From Galantucci and Roberts, 2014) Diagram of concurrent conversations with crossed messages highlighted.

each conversation for messages of our own. These messages were designed to consistently generate obvious incoherence. This allowed us not only to ascertain whether participants had really detected the incoherence (by having them identify it at the end of the study) but also to manipulate the kind of incoherence they encountered. In the first study, the incoherence concerned task-relevant information. In the second study, it concerned information relevant to the social identity of the conversants.

3. Study 1: task relevant incoherence

3.1. Methods

3.1.1. Participants

40 native-English-speaking students, with no deficits in communicative ability, participated for $20 each.

3.1.2. Ethical statement

Ethical approval was granted by the Institutional Review Board at Yeshiva University. All participants gave written consent to participate.

3.1.3. Procedure

Pairs of participants chatted with each other for 15 min using an instant-messenger program, with each participant seated in a separate cubicle with a computer. Although the pair would meet each other before the experiment started, they could not see each other during the experiment. As in GR's second study, participants were shown a picture of several famous people and told to chat about which of them they would most and least like to spend a day with. The procedure differed from GR's study in the following two respects. First, instead of the cartoon used by GR, an image composed of six photos of famous historical people (Fig. 2) was used to stimulate conversation. Second, instead of crossing participants' conversations, two of the messages sent during the conversation (one from each participant) were replaced by fake messages which violated conversational coherence by implying that the image included a famous person whom it did not include. These messages all had the same phrasing as (a), but differed with respect to the name of the famous person (which varied across sessions) and the word "women", which was substituted by the word "men" for male participants.

(a) "of these six Oprahs kind of an icon for women like me".

Of course, on top of this intended incoherence, the message might introduce other forms of incoherence, such as the absence of an answer to a direct question or an abrupt change of topic (See Section *Inserted Message* for more details.)

In other respects, the procedure was the same as in GR's second study. Each participant would see the stimulus image on the left of the screen and the messaging window on the right (Fig. 1). Below the messaging window was a box in which new messages could be typed and, by pressing "submit", sent. Messages that the participant had sent appeared in blue and were preceded by "You:"; received messages appeared in red and were preceded by "Partner:". Participants were asked to chat for 15 min about which of the famous people depicted they would most or least like to spend a day with.

3.1.3.1. Inserted message. As stated above, one message sent by each participant in a pair would be replaced by an inserted message of the form "of these six [FAMOUS PERSON'S NAME]s kind of an icon for [wo]men like me". This replacement would occur at a random point in the conversation, but would always occur at least 270 s after the beginning of the conversation, at least 120 s before the end of the conversation, and not within 180 s of the other replacement. The famous person mentioned in the fake message would always be of the same gender as the participant who was supposed to have sent the message, but would not be among the famous people in the stimulus image. The name would instead be chosen from among the following four names: Oprah, Madonna, Gandhi, Mandela. A message from a female participant, for instance, might be replaced with the words "of these six Oprahs kind of an icon for women like me". The two inserted messages would never refer to the same famous person. The phrase "of these six" at the start of the sentence was included to ensure that the message would be interpreted as referring to the image on the screen and that the reference to the extra famous person could not be explained away as not being connected to it. Because, the focus of this study was on mismatched content, the wording and punctuation of the fake message were chosen to fit in with the style of messages likely to be sent by the participants themselves, based on the style of messages observed in GR's study.

It should be noted that, although each participant would see only one *inserted* message, there was a reasonable chance that they would be exposed to more than one odd message. For example, if a participant responded to an inserted message by saying, "Why bring up Oprah?" or even "Yes, I agree about Oprah", then this message would not have made sense to the other participant in the pair, who had not mentioned Oprah and had no knowledge that Oprah was mentioned in the inserted message. Finally, it is important to bear in mind that the appearance of an inserted message also meant the disappearance of a bona fide message, increasing the likely disruption to the conversation.

3.1.3.2. Post–experiment questionnaire. After 15 min had elapsed from the opening of the chat window, as in GR's study, the chat window closed and a new window presented the following questions one by one:

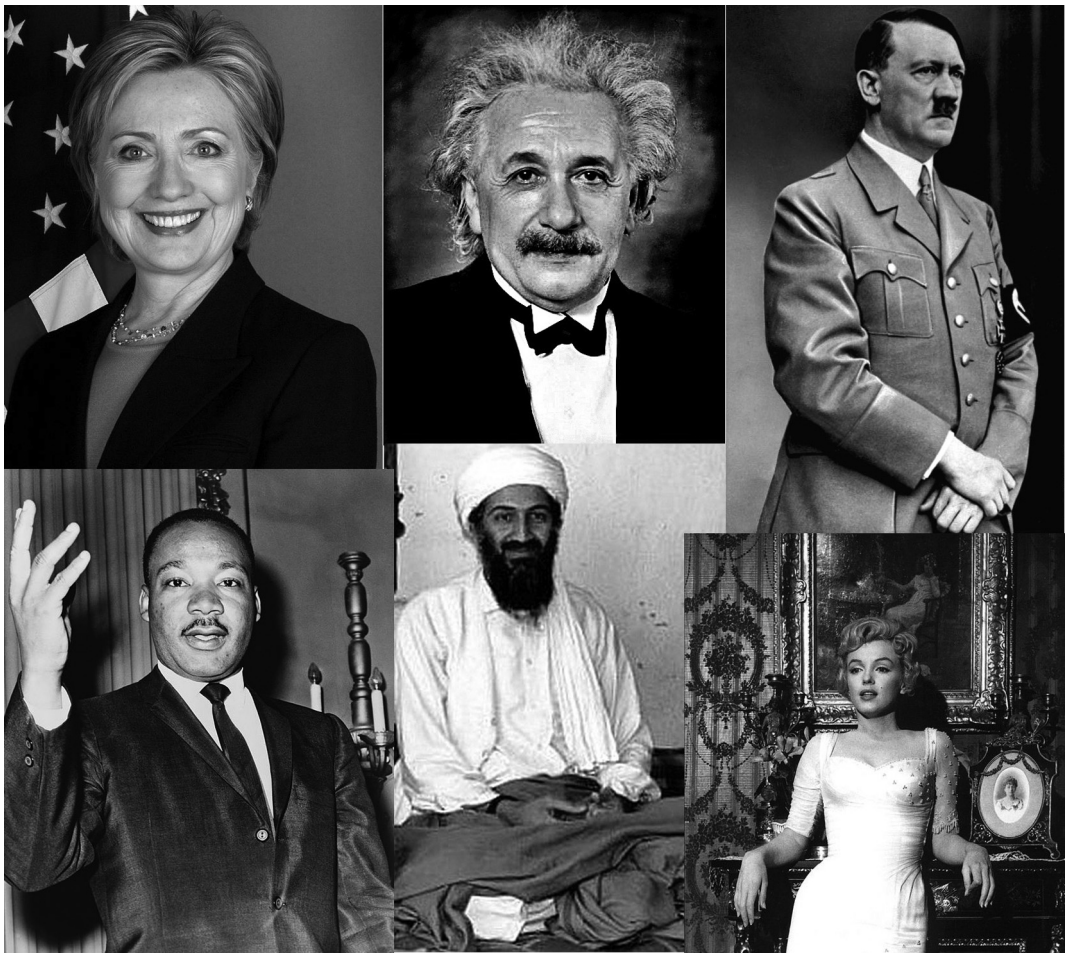

Fig. 2. Screenshot of the display used for both Message-replacement studies. The chat window on the right contains an actual conversation from Study 1. All photographs were taken from Wikimedia Commons (https://commons.wikimedia.org/) and are either public domain or available under a creative commons license.

1. How did you find the conversation today?
2. Did the conversation go smoothly?
3. Did you ever feel like you were having trouble communicating with your partner?
4. Did you notice anything unusual in the conversation?
5. Participants in this study are put in one of two groups. 50% of participants are put in the Normal-Conversation Group. If we put you in the Normal-Conversation Group then all the messages you received came from your partner. The other 50% of participants are put in the Inserted-Message Group. If we put you in the Inserted-Message Group then one of the messages you received did not come from your partner, but was inserted by us. (Note: This does not include server messages about time remaining.) Which group do you think you were in? Note: If you are correct, you will win $3!

Participants who answered "no" to Question 2, "yes" to Questions 3 or 4, or "Inserted-Message Group" to Question 5 were asked to explain their answers before the next question appeared.

Having finished answering Question 5, every participant was told that there had in fact been an inserted message and was shown a transcript of the conversation they had just been engaged in, which included all the messages the participant had actually sent or received. (The inserted message that the participant had received was included; the inserted message that the participant's partner had received was not.) Every message in the transcript was numbered and the participant was asked to scroll through and select the message they thought had been inserted. The distance in number of lines between the participant's guess and the actual inserted message was measured (henceforth *Transcript distance*). The transcripts were also checked for lines from partners which were not themselves inserted, but which *referred* to inserted lines (e.g., "I don't see

Oprah anywhere."). If such a line occurred, the Transcript distance between it and the participant's guess was also measured, and the lower value was used for analysis.

3.2. Results

3.2.1. Responses to Question 5

In answer to Question 5, 16 participants (40%) said they thought they were in the Normal-Conversation Group. The remaining 24 participants (60%) said they thought they were in the Inserted-Message Group.

3.2.2. Identification of inserted message

The transcript distance for one participant (who guessed that she was in the Normal-Conversation Group) could not be computed because, due to a misunderstanding, she did not perform the line identification task. For each of the remaining 39 participants, if the Transcript distance was greater than three lines this was taken as an indication that the participant had failed to identify the inserted message. There were 11 such participants (28.21%), seven of whom responded that they were in the Normal-conversation Group (46.67%) and four of whom responded that they were in the Inserted-Message Group (16.67%), suggesting that their answer to Question 5 might have been simply a guess. The difference in line identification between the two groups is significant ($\chi^2 = 4.39$, $p < .05$).

3.2.3. Unreliable guessers

As suggested by GR, participants' answers to Question 5 could have been a mere guess, independent from actual detection of the incoherent message. In order to identify such unreliable guessers, we adopted a very conservative procedure, based on two criteria.

The first criterion relied on the open-ended answers to Questions 2–5. In particular, we identified all participants whose guess on Question 5 was inconsistent with their open-ended answers. This could happen either because they guessed they were in the Inserted-Message Group, but said nothing else in the questionnaire to indicate that they had noticed the inserted message,[1] or because they guessed they were in the Normal Group but said something in the questionnaire that indicated that they had noticed the inserted message. In the interest of being conservative, participants in the latter group (of which there was one) were excluded on the basis of this criterion alone. (This was the same participant who failed to perform the line identification task.) Participants in the former group (of whom there were eight) were excluded only if they also failed to identify the line in the transcript. As noted above, there were four such failures among the participants who guessed they were in the Inserted-Message Group.

In total, therefore, we considered five participants to be *Unreliable guessers* — one who guessed she was in the Normal-Conversation Group and four who guessed they were in the Inserted-Message Group. The guesses of these participants were not considered for computing incoherence detection.

3.2.4. Incoherence detection

In answer to Question 5, 20 of the remaining 35 participants (57.14%; 95% CI[2] = [39.35% 73.68%]) correctly guessed that they were in the Inserted-Message Group. As illustrated in Fig. 3, this detection rate is not significantly better than chance.

3.3. Discussion

The results presented above replicate GR's findings with a more robust design: Even in a situation where a message was inserted into the conversation that was guaranteed to be out of place, a substantial proportion of participants failed to notice it; indeed, of the 35 participants whose responses can be treated as reliable, 43% remained convinced, when asked directly, that nothing unusual had occurred. One possible explanation for this result is that ensuring accuracy of content transmission (which would entail dealing with apparent conflicts and misunderstandings) did not play a very important role in the participants' conversations. In fact, it may not play a very important role in many conversations in which informational content is likely to be a mere complement to social routines (Dunbar et al., 1997; Malinowski, 1923). It may therefore be that our participants cared mainly about maintaining a socially pleasant interaction, such that maintaining coherence with respect to task-relevant content was rather less important. Indeed, one of the Unreliable guessers in the study said he had guessed he was in the Inserted-Message Group because his partner had mentioned watching the film *Inglourious Basterds*. He was more struck, in other words, by a conflict related to his expectations about his partner than by the conflict between the famous people they were supposed to be talking about and the one his partner mysteriously mentioned. In Study 2, this possibility is investigated further through the insertion of messages that conflict dramatically with participants' social expectations about their partners' identity.

[1] For this purpose, participants were considered to have noticed the inserted messages if they said anything that referred to the inserted message directly (e.g., "My participant mentioned someone who was not in the picture.") or suggested that not all messages had come from their partners.

[2] All CIs presented in this paper were computed using the Clopper–Pearson exact method.

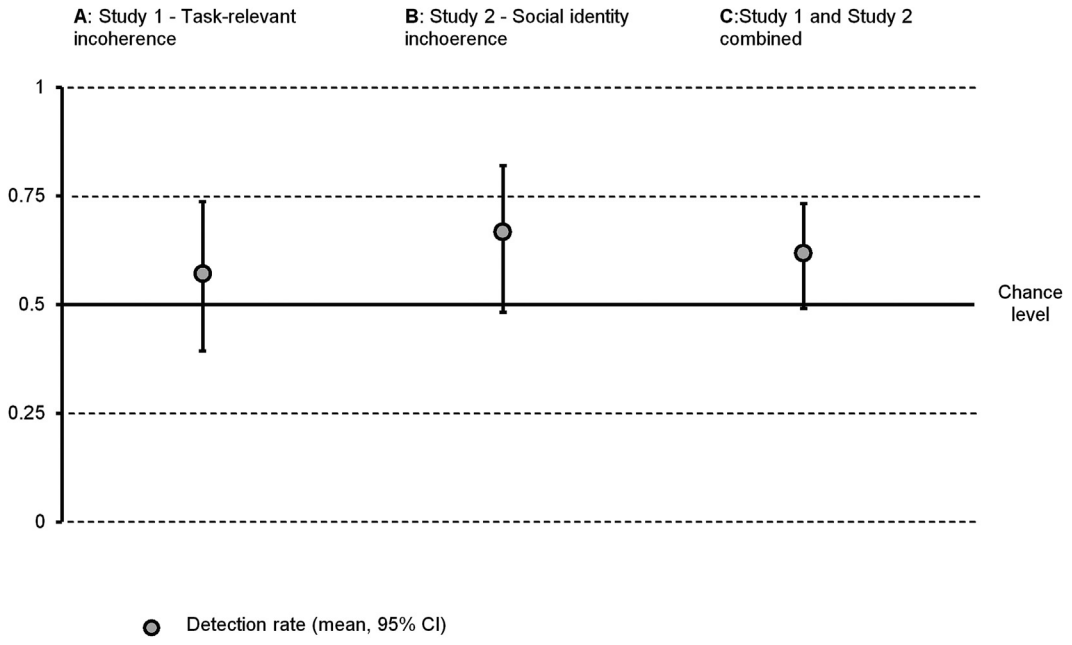

Fig. 3. Incoherence detection rates in (A) Study 1, (B) Study 2, and (C) Studies 1–2 combined.

4. Study 2: gender mismatch

Study 2 was identical to Study 1 in all respects except for the nature of the inserted message. In Study 2, the famous person mentioned in the message was chosen from among the names Hillary, Einstein, Marilyn, and MLK,[3] all of whom were depicted in the stimulus image. In every case, the famous name was chosen so as not to match the gender of the supposed sender, which was established at the start of the experiment, along with other demographic information, using an online form. For example, if the apparent sender had identified as male when they provided their demographic information then the fake message might read: "of these six Marilyns kind of an icon for women like me." To ensure that the gender mismatch would be noticeable, the two participants were introduced to each other at the start of the experiment and seated opposite each other while they completed consent forms and had the experiment explained to them. (The same was true of Study 1.) Experimenters were also instructed to note discreetly if, when providing demographic information, participants indicated in any way that they did not identify straightforwardly as male or female (the only two options permitted by the online form), if they did not obviously fit into one or the other category based on their appearance, or if their answer to the question contrasted with their apparent gender. No such cases occurred.

4.1. Results

4.1.1. Responses to Question 5

In answer to Question 5, 11 participants (27.5%) guessed they were in the Normal-Conversation Group and 29 (72.5%) guessed they were in the Inserted-Message Group.

4.1.2. Identification of inserted message

14 of the 40 participants (35%) failed to identify the inserted message, seven of whom guessed they were in the Normal-Conversation group (63.64%) and seven of whom guessed they were in the Inserted-message Group (24.14%). The difference in line identification between these two groups is significant ($\chi^2 = 5.47$, $p < .05$).

4.1.3. Unreliable guessers

The same criteria were used for identifying unreliability as in Study 1. Eleven participants provided answers that were inconsistent with their guess for Question 5,[4] and only four of these correctly identified the inserted incoherent message.

In consequence, there were seven Unreliable guessers, all of whom guessed they were in the Inserted-Message Group.

[3] A common abbreviation for Martin Luther King in the USA, which was widely used by participants in GR's study.

[4] For this purpose, participants were considered to have noticed the inserted messages if they said anything that referred to the inserted message directly, suggested that not all messages had come from their partners, or expressed any sort of confusion over their partner's gender.

4.1.4. Incoherence detection

In answer to Question 5, 22 of the remaining 33 participants (66.66%; 95% CI = [48.17% 82.04%]) correctly guessed that they were in the Inserted-Message Group. As illustrated in Fig. 3, this detection rate is not significantly better than the chance level.

4.1.5. Comparison of study 1 and study 2

Detection rates were 9.52% higher in Study 2 than in Study 1. The difference is not significant ($\chi^2 = .65$, $p = .42$).

4.2. Discussion

Across the two Message-replacement studies 26 out of 68 participants (38.24%; 95% CI = [26.71% 50.82%]) failed to notice when messages were inserted into their conversations. These messages not only did not come from their partners, but also blatantly conflicted with salient information they already had. Even if Unreliable guessers are not excluded, 27 out of 80 participants (33.75%; 95% CI = [23.55% 45.192%]) failed to notice across the two studies. These results replicate the results of GR's study, and bolster their claims. People are surprisingly insensitive to conversational incoherence in both narrowly focused and broadly focused conversation, regardless of whether the incoherence concerns the main topic of conversation or salient social categories. The results of the Gender Mismatch study are particularly striking. Gender is a highly salient element in human identity, being one of the most frequently used categories used by people to describe themselves and others (Deaux, 2001). Indeed, socially salient information in communicative exchanges is likely to be noticed by any social animal, as demonstrated, for instance, by playback experiments with nonhuman primates (Cheney et al., 1995).

The importance of social interaction in human evolution also draws attention to a potential limitation of the four studies conducted so far with this paradigm. They all involved written communication, and the participants could not see each other. The extent to which this was an unnatural environment should not be overstated — instant messaging is a very natural and familiar communication medium for very many people. However, given that for the vast majority of human evolutionary history writing did not exist, and that the medium in this case might have obscured useful cues to incoherence, it would be important to replicate our studies with face-to-face conversation, whether oral or signed. This would also address a potential limitation that participants likely varied in their ability to parse written text. However, it is worth noting that individual variation in linguistic ability extends well beyond comprehension of written text (Fillmore et al., 1979; Stromswold, 2001), and it should not be assumed that detecting incoherence would in fact be easier in face-to-face interaction. Without the visible on-screen record of the conversation provided to our participants, and with potentially greater pressure to maintain a pleasant social interaction, it might in fact be harder.

It is also worth noting the differences between the results of the four different studies conducted so far with this paradigm. While insensitivity is overall surprisingly high, and detection never went above chance level, slightly more of GR's participants failed to notice the incoherence in narrowly focused conversations than in broadly focused conversations (33% versus 27%) and, with respect to the Message-replacement studies, fewer participants missed the incoherence (and Transcript distance was lower) when it concerned their interlocutor's gender than when it concerned task-relevant information (33% versus 43%; Transcript distance 3.36 versus 7.53). These differences are relatively small, and not statistically significant. However, an important further step in this paradigm would be to probe more deeply the degree to which sensitivity to incoherence varies according to the kind of incoherence involved and the conversational context.

All the same, whatever differences there might be should not obscure the fact that, even with the most conservative analysis, at least a quarter of participants in every case failed to notice dramatic cases of incoherence in their conversations. This is inconsistent with a view that the transmission of information in human conversation is reliably monitored and regulated, and our findings have implications for our understanding of the role and purpose of human linguistic interaction. To better understand this, we consider it to be important to understand how and when it fails (Keysar, 2007; Tzanne, 2000; Verdonik, 2010), and we have introduced a novel experimental paradigm aimed at precisely that.

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