Surprising blindness to conversational incoherence in both instant messaging and face-to-face speech

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Abstract

Language is widely assumed to be a well designed tool for reliably communicating propositional information between people. This suggests that its users should be sensitive to failures of communication, such as utterances that are blatantly incoherent with respect to an ongoing conversation. We present experimental work suggesting that, in fact, people are surprisingly tolerant of conversational incoherence. In two previous studies, participants engaged in instant-messaging conversations that were either repeatedly crossed with other conversations or had lines inserted into them that deliberately contradicted available information. In both cases, a substantial proportion of participants failed to notice. In a new study, confederates inserted unexpected, nonsensical lines into face-to-face conversations. The majority of participants failed to notice. We argue these findings suggest that we should be wary of modeling spontaneous communication in terms of faithful information transmission, or language as a well designed tool for that purpose.

Keywords: communication; miscommunication; language evolution; change blindness

Introduction

A widely held view is that language is primarily a tool for reliably communicating propositional information between individuals, and that it is good at its job. This assumption, which is closely connected to what has been termed the *code model* of human communication (Blackburn, 1999), is not only widespread outside academia, but it also pervades much scholarly discourse. It is central, for instance, to models of communication that follow the work of Shannon and Weaver (1949); it has long been a guiding assumption of prominent adaptive accounts of language evolution (Pinker & Bloom, 1990); and research has been conducted demonstrating the communicative function of apparently maladaptive features of language (e.g., Piantadosi, Tily, & Gibson, 2012). This is not unreasonable, and it could scarcely be denied that a great deal of linguistic interaction involves communicating propositions. But that is not the same as saying that this is the primary purpose of linguistic interaction, or that language is a system finely tuned by evolution to fulfil that purpose. If that is so, then we should expect language users to be sensitive to cases of communicative failure, and for blatant cases of incoherence to be readily identified and rapidly corrected.

In fact, however, there are reasons to be wary of assuming that communication is all that reliable. Humans are poorer than might be expected at faithful information transmission in a variety of non-linguistic perceptual tasks (Rensink, O'Regan, & Clark, 1997; Simons & Levin, 1998; Simons & Chabris, 1999). With respect to language, there is evidence that comprehenders form representations that are merely "good enough" for the task they need to perform (Ferreira, Bailey, & Ferraro, 2002), while work on the "Moses illusion" has shown that comprehenders fail to detect inconsistencies in input where inconsistent material is semantically related to expected material (Park & Reder, n.d.). There is reason to suspect that even more jarring inconsistencies might be missed surprisingly often. One reason for this is that it is unclear whether reliable communication is in fact the primary function of a great deal of linguistic interaction. It has long been pointed that human conversations very often serve what have been termed *phatic* goals (Malinowski, 1923) – that is, they are aimed at creating and supporting social relationships. This observation has several consequences for the reliability of communication. First, it suggests that failures of communication, such as errors of fact or utterances that are incoherent with respect to surrounding discourse, may not be noticed by interlocutors, as speakers may focus on social coherence at the expense of communicational coherence. Second, even if failures of communication are noticed, they may not be queried or remedied – interrupting, correcting, or questioning one's interlocutor detracts from maintaining a pleasant social interaction. Third, whether or not observed instances of miscommunication are resolved, they are likely to be quickly forgotten, because they may not be especially important to the social goals of the interlocutors. In fact, the situation may be worse than has been suggested so far. It might be countered, for example, that even if phatic interactions are very common, speakers still generally want to convey information, and the language has various features to help them to do this. However, some of these very features may in fact make it easier for speakers to overlook cases of communication failure. For example, the ambiguity that Piantadosi et al. (2012) convincingly argue supports efficient communication also allows cases of apparent incoherence in one's interlocutor to be dismissed. In Gricean models of communication, moreover, a meaning is reconstructed via an inferential process that assumes relevance on the part of the speaker (Grice, 1975; Wilson & Sperber, 2004). While this process is beneficial to successful communication, it is also a means by which incoherent contributions to discourse can be explained away.

The above suggests that humans may be much less sensitive to incoherence in conversation than is typically assumed, but most work on miscommunication to date has relied on qualitative analysis of naturally occurring discourse (e.g., Tzanne, 2000), with very little work devoted to investigating it in controlled environments (see Mills, 2012, for a rare exception). To remedy this, we conducted a series of studies investigating people's sensitivity to conversational incoherence. Two of these studies, which have already been published (Galantucci & Roberts, 2014; Roberts, Langstein, & Galantucci, 2016), involved spontaneous instant-messaging conversations. These two studies will be described below in the Section *Previous studies*. We also report a new third study, which involved face-to-face conversation with a confederate who inserted a nonsensical line. In all three cases participants were asked whether they had noticed the incoherence (Galantucci, Roberts, & Langstein, submitted). Since the three studies are best understood in comparison with one another, we will present the previously published work in some detail.

Previous work: Insensitivity to incoherence in instant-messaging

In each of the two instant-messaging studies, 40 native native-English-speaking students, with no deficits in color vision or communicative ability, participated for $20 each. In the first study (henceforth Study A), participants' conversations were crossed with conversations by other naive participants. Study B was similar, but involved the automatic insertion of lines that were guaranteed to not fit well with information already provided to participants.

Study A: Crossed instant-messaging conversations (Galantucci & Roberts, 2014)

Procedure Participants took part in pairs. Care was taken that the members of a pair did not already know each other and met only at the start of the study. On arriving at the lab, members of a pair were seated in separate rooms and received the same scripted instructions. Each member of a pair sat in front of a computer displaying a cartoon of five famous people and an instant-messaging window (Figure 1). As in widely used instant-messaging programs, the messaging window consisted of two parts. At the bottom was a space where a participant could type messages and relay them to their partner. The rest of the window consisted of a space in which messages would appear. Messages the participant had sent appeared in black and were preceded by "You:"; received messages appeared in red and were preceded by "Partner:". Both members of the pair saw the same exact cartoon except that it was colored differently for each of them. (This was explained to both participants.)

The task given to participants was manipulated. Ten pairs of participants were put in the *Narrowly focused* condition and were asked to identify the color differences by using the instant-messaging software to chat for 15 minutes. The other ten pairs were put in the *Broadly focused* condition and were asked to discuss which of the five famous people they would most and least like to spend a day with.

Although the above account focuses on one pair only, each trial in fact involved two pairs, Pair A and Pair B (both pairs were always in the same condition). The two pairs performed the same task simultaneously, but with different cartoons. Pair A's cartoon contained five different famous people from Pair B's cartoon, set against a very different background (Figure 1). The software ensured that the task began at the same time for both pairs, but no participant was aware of the existence of the other pair. Over the course of each conversation there were four 30-second *crossings* during which each member of Pair A was re-partnered with a random member of Pair B. Participants were not warned before the study that these crossings would occur (indeed, no participant was even aware of the existence of the other pair), and there were no markers to indicate that they were occurring. All messages received, whoever had sent them, continued to appear in red preceded by "Partner:" (Figure 1). Crossings occurred at random points but began at least three minutes into the conversation.

After 15 minutes had elapsed the chat window closed and a new window presented the following questions one by one:

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 No-Crossing Group. If we put you in the No-Crossing Group then all the messages you received came from your partner. The other 50% of participants are put in the Crossing Group. If we put you in the Crossing Group then some of the messages you received came from a different participant who intended them for someone else and did not know that they would come to you. Which group do you think you were in? Note: If you are correct, you will win $3!

Participants who answered “no” to Question 2 or “yes” to Question 3 or 4 were asked to explain their answers before the next question appeared.

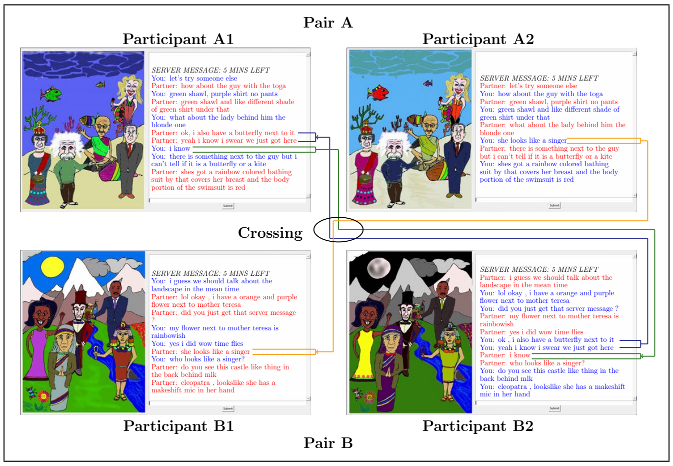

Figure 1: Example conversations from Study 1 (Narrowly focused condition) with crossed messages highlighted.

Results

Questions 2–4 were used to exclude participants whose answers to those questions were inconsistent with their answer to Question 5. In the Narrowly focused condition there was one *Inconsistent detector* (i.e., a participant who guessed “Crossing Group” in answer to Question 5, but otherwise claimed to have noticed nothing out of the ordinary) and no *Inconsistent Non-detectors* (i.e., participants who claimed to have noticed something odd, but answered “No-Crossing Group on Question 5); in the Broadly focused condition there were four Inconsistent detectors and one Inconsistent Non-detector. These patterns suggests the existence of a bias toward suspecting unusual circumstances. To test this, we replicated the study with 20 new participants and no crossings (i.e., each participant chatted with the same partner for the entire session). Consistent with the presence of such a bias, six participants (30%) incorrectly answered that they were in the Crossing Group (four in the Narrowly focused condition and two in the Broadly focused condition).

Crossing detection rates In the Narrowly focused condition, 11 out of 19 participants answered that they were in the Crossing Group, leading to a detection rate of 57.9%. This rate is not significantly different from chance: 95% CI [33.5%, 79.7%] (Figure 3; all CIs presented in this paper were computed using the Clopper–Pearson exact method).

In the Broadly focused condition 10 out of 15 participants answered that they were in the Crossing Group, leading to a detection rate of 66.7%. Again this rate is not significantly different from chance (95% CI [38.4%, 88.2%]; Figure 3) and is rather far from the expectations of the sample reported in the introduction.

Crossing detection rates for blatantly crossed conversations A possible explanation for the low detection rates is that crossing the conversations did not in fact lead to blatant violations of coherence. To check whether this was the case we analyzed the transcripts of the conversations in two ways.

First, we read the transcripts, looking for out-of-the blue references to famous people or salient items not present in the cartoon and which had not been mentioned earlier in the conversation. Such references should have provided blatant indications that the conversation had been crossed with a different one.

The second analysis relied on four naive judges, who were given ten transcripts each for each condition: five from the No-Crossing Group (i.e., from the control study reported above) and five from the Crossing Group. Transcripts were distributed in such a way that (a) every judge received one transcript from each set, and (b) each transcript was given to one judge. We explained the basics of the study to the judges and asked them to decide which condition each transcript came from. Judges were paid $10 an hour or given course credit (in either case the reward was doubled if discrimination was perfect). There was no time-limit for completing the task.

This led us to exclude seven participants who were likely not exposed to blatant indications of crossings. For the Narrowly focused condition, this produced a crossing detection rate of 67%. For the Broadly focused condition this produced a crossing detection rate of 72.7%. In neither case is the rate significantly different from chance (95% CI [38.4%, 88.2%] and [39%, 94%] respectively).

Although the detection rates in the Broadly focused condition were higher than in the Narrowly focused condition, the results are consistent: People are surprisingly insensitive to conversational incoherence.

Study B: Inserted lines in instant-messaging conversations (Roberts et al., 2016)

Study 1 provided intriguing evidence that people are less sensitive to conversational incoherence that might have been expected. However, there are reasons to be wary of the findings. The procedure used led to incoherencies that were inherently uneven, meaning there was no way to ensure that conversations would include noticeable interruptions. This problem was somewhat diminished by including three crossings in every conversation, and (as described above) the resulting conversations were carefully checked in two ways to ensure that participants had in fact been exposed to clear incoherence. Nevertheless, an obvious step was to replicate the study with more controlled interruptions. Study 2 (reported in Roberts et al., 2016) did precisely this by automatically inserting lines that were guaranteed not to be consistent with ongoing conversations. Furthermore, it compared two different kinds of interruption: Inserted lines that conflicted with shared task-relevant information and lines that conflicted with the interlocutor’s apparent gender.

Procedure The same procedure was employed for Study 2 as for the Broadly focused condition of Study 1, except in two respects. First, instead of the cartoon used in Study 1, an image composed of six photos of famous historical people (Figure 2) was used to stimulate conversation. Second, there was no crossing of conversations. Instead, two of the messages sent during the conversation (one from each participant) were replaced by fake messages (always at least 270 seconds after the beginning of the conversation and within 120 seconds of the end). All inserted messages all had the same phrasing:

> of these six [FAMOUS PERSON]s kind of an icon for [WOMEN/MEN] like me.

There were two between-subjects conditions (with 10 pairs each). In the *Gender-swap* condition the famous person named was chosen from among Hillary, Einstein, Marilyn, and MLK, all of whom were depicted in the photograph (Figure 2), but the phrase "women like me" or "men like me" was chosen to conflict with the apparent sender's real gender. For example, a line that supposedly came from a female participant might read "of these six Einsteins kind of an icon for men like me". In the *Character-swap* condition the reverse was true: The gender was as expected, but the famous person referred to was not in the picture, but would be chosen from among the names Oprah, Madonna, Gandhi, or Mandela (e.g., a line supposedly from a female participant might read "of these six Oprahs kind of an icon for women like me"). Across both conditions a sentence ending "for women like me" would always refer to a female celebrity and a sentence ending "for men like me" would always refer to a male one. The same two famous people were never used for both inserted lines in the same conversation.[1]

After 15 minutes had elapsed, as in Study 1, a questionnaire was presented. This differed only with respect to Question 5, which referred to "the Normal-Conversation Group" and the "Inserted-Message Group" instead of "No-Crossing Group" and "Crossing Group". 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.

Figure 2: Image used to stimulate conversation in Study 2. All photographs were taken from Wikimedia Commons (https://commons.wikimedia.org/) and are either public domain or available under a creative commons license.

Results

In the interest of being conservative, Inconsistent detectors were excluded only if they also failed to identify the line in the transcript. In the Gender-swap condition there were seven Inconsistent detectors and no Inconsistent Non-detectors. In the Character-swap condition there was one Inconsistent Non-detector and four Inconsistent detectors. These participants were excluded from further analysis.

Detection rates In the Gender-swap condition 66.66% of participants (95% CI = [48.17% 82.04%]) correctly guessed that they were in the Inserted-Message Group. In the Character-swap condition 57.14% of remaining participants (95% CI = [39.35% 73.68%]) correctly guessed that they were in the Inserted-Message Group. In neither case was the detection rate significantly better than chance (Figure 3).

Identification of inserted message The transcript distance for one participant in the Character-swap condition (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 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.

In the Gender-swap condition there were 14 such participants (35%), seven of whom responded that they were in the Normal-Conversation group (63.64%) and seven of whom thought they were in the Inserted-message Group (24.14%),

[1] It should be noted that, on top of the incoherence generated by the informational conflict, 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. Furthermore, the inserted line might generate messages from the receiver (e.g., "Why bring up Oprah?") which would not make sense to the other participant, who had no knowledge of the inserted message.

suggesting that their answer to Question 5 might have been simply a guess. The difference in line identification between these two groups is significant ($\chi^2 = 5.47$, $p < .05$).

In the Character-swap condition 11 participants (28.21%) failed to identify the inserted message, 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%). The difference in line identification between the two groups is significant ($\chi^2 = 4.39$, $p < .05$).

NEW STUDY: Inserted lines in face-to-face conversation

Study B found similar results to Study A, with rather more controlled interruptions. However, both studies involved instant messaging rather than face-to-face conversations. While it is important to stress that instant messaging is a very natural communication medium for a great number of people, especially college students like our participants, it remains possible that our results had something to do with the nature of the interaction. We therefore conducted Study 3, in which participants chatted face-to-face with confederates (Galantucci et al., submitted).

Methods

Participants 30 native English-speaking students (16 female, 14 male; mean age 24.73, SD = 6.43), with no deficits in communicative ability, participated for $20 each.

Procedure Each participant engaged in face-to-face conversation with a confederate. In order to elicit a spontaneous and lively conversation, they were asked to discuss five thought-provoking questions such as "Would you rather be color blind, or not be able to understand puns?" or "Would you rather live the rest of your life on a tree or in a cave?". The five questions were written on a whiteboard in front of the individuals, who were told that they had about 15 minutes to order them from funniest to least funny and from hardest to answer to easiest to answer.

At some point during the conversation the confederate would utter the nonsensical sentence "Colorless green ideas sleep furiously". The confederate was instructed to utter the sentence clearly and audibly, at least eight minutes into the conversation, and at a point where the participant was silent. One minute after the sentence was uttered, the conversation was interrupted by an experimenter and the participant and the confederate were escorted to two separate rooms for a follow-up questionnaire. When the 30 participants were asked at the end of the study whether they ever suspected that the person they conversed with was a confederate, only five of them answered positively, and none of them mentioned the nonsensical sentence as the reason for the suspicion.

The questionnaire was as in Studies 1 and 2 apart from Question 5, which referred to "the Control Group" and the "Nonsensical Sentence Group" (but was otherwise identical to Question 5 in Studies 1 and 2). Right after answering Question 5, all participants were asked to estimate how confident they were in their answer, using a scale from 1 to 10 (where 1 corresponded to "Not certain at all" and 10 to "Completely certain"). Then, the participants who thought they were in the Nonsensical Sentence Group were asked to identify the nonsensical sentence uttered by the confederate in a list which included 20 other nonsensical sentences.

Results

Responses to Question 5 In answer to Question 5, 10 participants (33.33%) said they thought they were in the Nonsensical Sentence Group. This detection rate is not significantly different from chance (95% CI [17.3% 52.8%]).

There were no Inconsistent detectors in Study 3. Furthermore, the mean confidence rating for the 20 participants who said they thought they were in the Control Group was 8.8 (95% CI [7.81 9.79]), while the mean confidence rating for the 10 participants who said they thought they were in the Nonsensical Sentence Group was 7.7 (95% CI [6.34 9.06]; Figure 3).

Recognition of the nonsensical sentence Of the 10 participants who said they thought they were in the Nonsensical Sentence Group, only one correctly recognized the sentence "Colorless green ideas sleep furiously" in a list that included 20 other nonsensical sentences. In other words, 90% of the participants who detected the nonsensical sentence forgot it within a few minutes from hearing it. This finding is consistent with the well established fact that recalling linguistic materials that lack a coherent overall meaning is a substantial challenge (Marks & Miller, 1964).

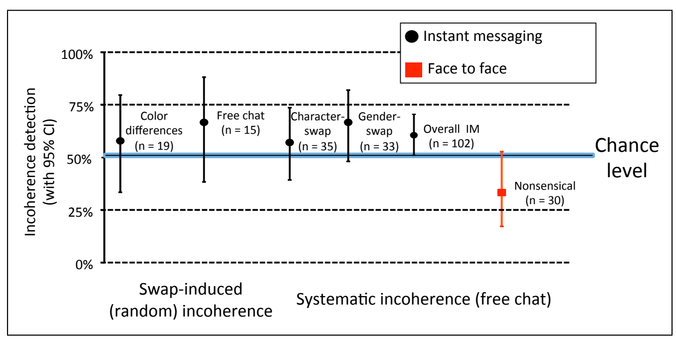

Figure 3: Detection rates across all three studies

Discussion

In each of the three studies described here participants were surprisingly blind to cases of blatant incoherence in spontaneous conversation (Figure 3). Even in the condition with the highest detection rate (the Gender-swap condition of Study 2), more than 25% of participants failed to notice the incoherence. (This rises to a third once Inconsistent detectors are excluded.) The results from Study 3 are particularly striking: In face-to-face conversation a full two thirds of participants failed to notice the introduction of a meaningless line that could have no relevance to the rest of the conversation, and only one of the participants who did notice the line could identify it a few minutes later. These results sit awkwardly with the view that language is the product of biological evolutionary purposes fine-tuning it for reliable communication. If that were the case, one would expect language users to be reliable communicators, sensitive to instances of communicative failure. Our findings are more consistent with accounts that see language as having evolved to serve social goals alongside communicative ones (Dunbar, 1996), or accounts of language evolution that downplay the role of adaptive biological evolution generally, emphasizing the role of cultural evolution instead (Dediu et al., 2013; Tamariz & Kirby, 2016; Tomasello, 2010).

In either case, it is likely that the social, phatic, dimension of conversation is an important part of the explanation for our findings. This would help to explain why incoherence detection was particularly poor in Study 3, in which participants conversed face-to-face and were thus under a greater social pressure than in the other two studies, where they could not see each other. It might also help to explain why the *highest* detection rate was observed in the Gender-swap condition of Study 2, where the inserted line had a social significance lacking in Study 3 or the Character-swap condition of Study 2 (or, indeed, the majority of crossings in Study 1). However, the difference between conditions in Study 2 was not significant, and other differences make it difficult to compare this condition with the other studies directly.

Identifying precisely what mechanisms lie behind our findings, and how their relative importance varies from context to context, is an important next step in this investigation. In the meantime, however, we have presented compelling evidence that human linguistic communication is not as reliable as tends to be assumed, as well as a paradigm for investigating this phenomenon in a controlled setting.

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