

## **Gestures become more informative after negative feedback**

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### **Abstract**

When objects or people are described repeatedly in conversation, the repeated references tend to be reduced variants of initial references. This can be seen both in speech, and in gesture. Previous studies focused on successful repeated references, produced in contexts of common ground. A question is whether repeated references are also reduced in contexts where there is less, or no common ground, for example during communicative problems. In particular, the present study asks whether gestures which are produced in repeated references following negative feedback become more informative for the addressee. Participants viewed silent video clips, each showing one gesture, taken either from object descriptions before any feedback was given, or from object descriptions given after (repeated) negative feedback. With each video clip participants were shown two objects. The task was to decide which of the two objects was the target associated with the gesture they were shown. Results showed that participants were better at this task when presented with gestures produced following (repeated) negative feedback. This leads us to conclude, firstly, that after having received negative feedback, gestures are not reduced, but become more informative, and secondly, that this might be done with the addressee in mind.

### **1 Introduction**

When people communicate, they often refer to particular objects or people. For example, in a conversation about pets, someone might mention “that small ginger cat”. This referring expression may be multimodal, that is, the speaker may accompany speech with hand gestures, for example one gesture indicating the size and one gesture indicating the location of the cat in question. Also, the same cat might be referred to more than once during the conversation. Previous studies have shown that when people produce such repeated references, these repeated references are often reduced, lexically, acoustically, and gesturally. In a seminal study by Clark and Wilkes-Gibbs (1986), participants had to repeatedly describe the same tangram figures. It was found that repeated descriptions were lexically reduced, for example from an initial description of “a person who’s ice skating, except they’re sticking two arms out front”, to a sixth description of the same figure as “the ice skater” (Clark & Wilkes-Gibbs, 1986, p. 12). In the case of our pet example, a repeated reference to the cat that is lexically reduced could be “the cat”. Repeated references have also been shown to be reduced acoustically. Bard et al. (2000), for example, found that references to given information were less intelligible when they were taken out of context and presented to naïve listeners. Finally, repeated references have also been found to be reduced with regard to gesture. Previous studies (e.g. Galati & Brennan, 2014; Jacobs & Garnham, 2007) found that the number of gestures is lower in repeated references than in initial descriptions. This reduction in gesture in repeated references is not that surprising, given that speech and gesture are closely related (Kendon, 2004; McNeill, 1992) and tend to be co-expressive.

The reduction process in repeated references can be explained by the fact that repeated references are usually produced in a context of common ground (Clark & Brennan, 1991). After all, after an ini-

tial description has introduced the object, there is common ground between interlocutors, and a reduced repeated description is sufficient to still know which object is being discussed. In line with this, previous work (Hoetjes, Koolen, Goudbeek, Krahmer, & Swerts, 2015) showed that gestures in repeated references were reduced with regard to their number and precision. However, this reduction did not make the gestures less informative. In a gesture interpretation experiment, Hoetjes, Koolen, et al. (2015) presented the less precise gestures, produced in repeated references, to addressees, and it was found that addressees were equally likely to link them to the object they referred to as they did for the gestures from initial references, which were not reduced.

Studies like the ones mentioned above studied repeated references in contexts in which communication was successful, either because interlocutors gave each other explicit positive feedback, or implicit positive feedback (e.g. because the correct object was selected). In these cases there is common ground between interlocutors, and repeated references can easily be reduced without causing communication problems. A question is whether such reduction processes in repeated references also occur in cases of communicative problems, when arguably there is less, or no, common ground between speakers. If there are communicative problems, these may become apparent because one of the interlocutors gives negative feedback (e.g. by saying “Sorry, which cat”, or by not identifying the cat in question). Presumably, a following repeated reference to the same object may not be reduced but may instead be enhanced somehow, for example by not reducing the number of words or gestures but by keeping them constant, or even increasing them (e.g. negative feedback could cause a repeated reference to the above mentioned cat to become “the small ginger cat over there with a stripy tail”), so that the addressee is more likely to correctly identify the target object.

Focusing on gesture production, only a few studies have been done that address the question whether there is also reduction in repeated references in cases of communicative problems. Holler and Wilkin (2011) conducted a study in which participants had to retell fragments from a television series to a confederate addressee. The addressee gave scripted negative feedback (e.g. requesting clarification) at predetermined points in the narrative. Because of this feedback, participants were required to re-describe part of their retellings. When comparing 100 pairs of gestures that were produced before and after the feedback, it was found that in 60% of the cases, the gestures became either larger, more precise, or visually more prominent. Holler and Wilkin state that this change in gesture production means that utterances became clearer for the addressee. In other words, the negative feedback led to gestures that were more informative for the addressee than the gestures produced before the negative feedback.

In a study by Hoetjes, Krahmer and Swerts (2015) participants had to describe objects to a confederate addressee, who had to identify the target object from a set of objects. In several cases, the addressee provided negative feedback by identifying the incorrect object. This negative feedback meant that the participant had to describe the same object again, until it had been correctly identified. There were several objects that each participant had to describe three times immediately after another (two of these descriptions occurred after negative feedback). In this production experiment, it was found that the repeated descriptions produced after negative feedback were reduced with regard to the number of words but not the number of gestures, causing an increase in relative gesture rate. Moreover, in line with the study by Holler and Wilkin (2011), a separate perception experiment showed that the gestures produced in repeated references after negative feedback were considered marginally more precise than the gestures produced before any feedback was given.

The results from these two studies show that, unlike in the studies where references were repeated in contexts of common ground, after receiving negative feedback, gestures in repeated references are not reduced. This means that repeated references are not always reduced variants of initial references, but whether the object description is reduced depends on the communicative context (i.e. whether there is common ground or not). Although these findings are in themselves interesting in relation to previous work on repeated references, we do not yet know whether the increased accuracy in gesture after negative feedback is also communicatively meaningful. That is, does the fact that gestures in repeated references after negative feedback become more precise also help the addressee in identifying the correct object? Therefore, the question addressed in the present study is whether gestures that are produced following negative feedback become more informative for an addressee. If this is the case, we propose that this change in gesture production by the speaker could be done with the addressee in mind. This study builds upon work conducted in the previously mentioned studies by Hoetjes, Krah-

mer and Swerts (2015) and by Hoetjes, Koolen, et al. (2015). Specifically, it uses the same material as in the perception experiment by Hoetjes, Kraemer and Swerts (2015), and the same procedure as in the gesture interpretation experiment in Hoetjes, Koolen, et al. (2015).

## 2 Method

### 2.1 Participants

Sixty-nine participants (21 males,  $M = 21$  years old, range 18-28 years old) took part in this study. The participants were undergraduate students who received partial course credits. None of the participants had taken part in any of our previous studies on gestures in repeated references (as reported in Hoetjes, Koolen, et al., 2015; Hoetjes, Kraemer, et al., 2015).

### 2.2 Material

Participants were presented with 88 short video clips. The video clips were played without sound, to avoid any influence of speech. Each video clip showed someone producing one gesture, and lasted between 1 and 6 seconds. The video clips were the exact same as used in the perception judgment experiment in our previous work on repeated references (Hoetjes, Kraemer, et al., 2015), which were taken from the recordings of that study's production experiment. The 88 video clips, consisting of 44 pairs of video clips, were selected as follows. Video pairs consisted of one video showing a gesture from an initial description, and one video showing a gesture produced after negative feedback (so produced during a second or third reference). The video pairs showed gestures produced by the same speaker, and both gestures referred to the same part of the same object. To avoid overrepresentation of a small number of speakers, no more than two gesture pairs from each speaker were used. Pairs of video clips always consisted of one video taken from an initial reference, and one video taken from a repeated (second or third) reference. There was a fairly equal distribution between gestures from second and from third references (23 of the pairs were taken from initial and second descriptions, and 21 pairs were taken from initial and third descriptions). The gestures in the video clips were all iconic gestures, illustrating an aspect of the object that was being described. In total, this led to a set of 44 gesture video clip pairs – 88 video clips in total. 44 video clips showed a gesture produced in an initial reference (before feedback), 22 videos showed a gesture produced in a second reference (after negative feedback), and 22 videos showed a gesture produced in a third reference (after repeated negative feedback). The video clips were presented individually (not in pairs), and semi-randomly, such that two video clips of one pair were never presented one after another. A still of one of the video clips can be seen in figure 1.

### 2.3 Instruments

For each video clip, the participants were presented with two pictures (A and B) on one piece of paper. These pairs of pictures always showed one object that was actually being described in the video clip (i.e. the correct object), and one object which looked similar but which had a main 'body' shape which was different from the other object (i.e. the incorrect object). The order in which the correct object was being presented (A or B) was counterbalanced over trials. An example picture set showing the answer possibilities for one trial can be seen in figure 2.



Figure 1. Still from one of the video clips. The arrows indicate path and direction of the gesture.

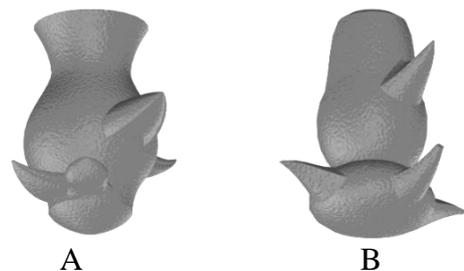


Figure 2. Example of answer possibilities.

## 2.4 Procedure

Participants took part in the experiment individually. The video clips were presented one after another in a PowerPoint presentation, and participants were free to go through this presentation of the 88 video clips by themselves. Video clips started playing as soon as a new slide was opened and participants were only allowed to see each video clip once. For each video clip there was a separate piece of paper with the two answer possibilities for that particular trial on it (as in Figure 2). The task was to decide, on the basis of the one gesture shown in the video clip, whether the gesture was produced during the description of object A or object B. Participants filled in their answer on an answer form. Before the experiment started, participants were given written instructions, the opportunity to ask questions, and two practice trials to help them get used to the short video clips. The entire experiment took about 25 minutes.

## 2.5 Design

The experiment had one independent variable, repetition, with three levels (initial, second, third). The study was set up in a within subject design. Each participant was presented with all video clips. The video clips showed gestures that were produced during initial references (preceding feedback), second references (following negative feedback), or third references (following repeated negative feedback).

## 3 Results

The number of times that participants chose the correct object was counted and analysed using a chi-square analysis. The results can be found below in table 1. We found that there was a significant association between repetition and the number of times that the correct object was selected,  $\chi^2(2) = 23.290$ ,  $p < .001$ . If we look at the distribution of percentage of correct versus incorrect answers, we see that for gestures produced during initial and third references, there were more correct than incorrect answers (as indicated by the subscripts in Table 1). If we look at the percentage of correct answers across the three conditions, we can see that there were more correct answers (54.8%) for gestures produced after initial negative feedback (second references) than for gestures produced before any feedback was given (53%), and even more correct answers (60.5%) for gestures produced after repeated negative feedback (third references).

*Table 1.* Number (and percentages) of correct and incorrect answers, across conditions (initial, second and third references, 2<sup>nd</sup> and 3<sup>rd</sup> references were produced after negative feedback). Within conditions, subscripts indicate significant differences between percentage of correct and incorrect answers.

	Initial	Second	Third	Total
Correct	1608 <sub>a</sub> (53%)	832 <sub>a</sub> (54.8%)	918 <sub>a</sub> (60.5%)	3358 (55.3%)
Incorrect	1428 <sub>b</sub> (47%)	686 <sub>a</sub> (45.2%)	600 <sub>b</sub> (39.5%)	2714 (44.7%)
Total	3036 (100%)	1518 (100%)	1518 (100%)	6072 (100%)

## 4 Discussion and Conclusion

The research question of this study was whether negative feedback would change gesture production in repeated references in such a way that gestures would become more informative for a naïve viewer. The results showed that as more negative feedback was given (especially in third references), participants more often correctly selected the object during which description the gesture was originally produced. We can therefore conclude that gestures after negative feedback become more informative.

The findings complement previous work on gesture production in repeated references after negative feedback. In particular, the studies by Holler and Wilkin (2011) and by Hoetjes, Krahmer and Swerts (2015) showed that when interlocutors provide feedback that indicates that there was some sort of communicative problem (e.g. by explicitly asking for more information, or by selecting the incorrect referent), gestures in repeated references are not reduced, but can increase, with regard to their size, precision, or prominence. However, it was previously unclear whether these changes in gesture production are also useful for an addressee. We can now provide evidence that the changes in gesture

production that occur in repeated references when communication is unsuccessful are in fact useful for an addressee and might be done with this addressee in mind.

We can relate the findings of this study also to previous work on gesture production in repeated references where there was no negative feedback. Specifically the study by Hoetjes, Koolen, et al. (2015) found that in repeated references, speakers produced fewer and less precise gestures. When conducting their gesture interpretation experiment however, it turned out that these changes in gesture production did not make the gestures less informative, i.e. in their experiment they found that participants were equally likely to correctly select the target object based on a gesture from an initial or from a repeated reference. In the current study, the same procedure was used. We can therefore directly compare the results of their gesture interpretation experiment to the results of the current study. In the study by Hoetjes, Koolen, et al. (2015) object descriptions were repeated in a context of common ground, without communicative problems. In the current study the object descriptions were repeated because the addressee provided negative feedback, indicating that there were communicative problems. Combining the findings from both studies it can be concluded that when gestures are produced during repeated object descriptions, they only become more informative if the discourse context requires it. When there are no communicative problems and there is common ground between speaker and addressee, there is no need to make the gesture more informative for the addressee. When negative feedback indicates that there are communicative problems, and consequently there is less, or no, common ground, gesture production in repeated references is adapted in such a way that the gesture can help the addressee in correctly identifying the target object.

To conclude, this study suggests that gestures can provide valuable information in a discourse context. In this case, participants were able to select the correct object above chance level, after only viewing one gesture (which is a hard task, especially without the original speech), and this ability increased when these gestures were produced after negative feedback. Based on these findings, we would like to claim that by adapting their gestures when communication is unsuccessful in such a way that they become more informative, speakers help the addressee, and thereby help to keep the overall communicative situation as successful as possible.

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