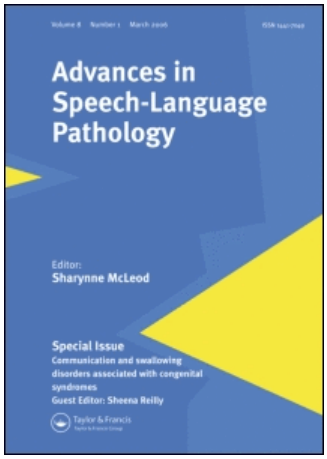

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Can gesticulation help aphasic people speak, or rather, communicate?

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COMMENTARY

Can gesticulation help aphasic people speak, or rather, communicate?

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Abstract
As Rose (2006) discusses in the lead article, two camps can be identified in the field of gesture research: those who believe that gesticulation enhances communication by providing extra information to the listener, and on the other hand those who believe that gesticulation is not communicative, but rather that it facilitates speaker-internal word finding processes. I review a number of key studies relevant for this controversy, and conclude that the available empirical evidence is supporting the notion that gesture is a communicative device which can *compensate* for problems in speech by providing information in gesture. Following that, I discuss the finding by Rose and Douglas (2001) that making gestures does facilitate word production in some patients with aphasia. I argue that the gestures produced in the experiment by Rose and Douglas are not guaranteed to be of the same kind as the gestures that are produced spontaneously under naturalistic, communicative conditions, which makes it difficult to generalise from that particular study to general gesture behavior. As a final point, I encourage researchers in the area of aphasia to put more emphasis on communication in naturalistic contexts (e.g., conversation) in testing the capabilities of people with aphasia.

Keywords: *gesture, gesticulation, aphasia, lexical retrieval.*

First of all, I would like to take this opportunity to applaud Miranda Rose's comprehensive and integrative review of research into gesture and aphasia (Rose, 2006). It clearly represents multidisciplinary progress. Gesture researchers can test and refine their theories by learning about the ''experiment of nature'' that aphasia represents, while speech-language pathologists can – hopefully – use theories of gesture to improve upon their research and treatment methods. In the following discussion I evaluate two rival hypotheses about the function of gesture, and some often quoted experimental evidence that is relevant to this discussion. For the rest of this paper, I use the word *gesture* to mean *gesticulation* from ''Kendon's continuum'' (Kendon, 2004; see also McNeill, 1992), the classification of different types of gesture behavior that has also been followed in the lead article. This category contains what McNeill (1992) has called the class of *imagistic* gestures, and it is this class of gestures that the controversy is about.

Does gesture facilitate word-form encoding or understanding?

The first of the hypotheses under discussion I will call the Mutually Adaptive Modalities hypothesis (henceforth, MAM). The MAM predicts that if speakers attempt to communicate spatial information in an environment with lots of ambient noise (e.g., in a noisy factory or a bar with loud music), the speaker will be more likely to produce gestures, because (a) gesture is a modality that is suitable for the expression of spatial information, and (b) using speech to get the information across is less effective because of the ambient noise. Conversely, when giving route directions on the telephone, the MAM predicts that the speech will contain more spatial language, as the gesture modality is not effective in audio-only communication. Experimental evidence for the MAM hypothesis is supplied by Melinger and Levelt (2004) who found that speech that is accompanied by gesture is less explicit than speech that isn't. Further experimental evidence is provided by some of the studies discussed below.

The rival hypothesis is the Lexical Retrieval Facilitation (LRF) hypothesis, endorsed by Hadar, Krauss and collaborators (Hadar & Butterworth, 1997; Krauss, 1998; Krauss, Chen, & Gottesmann, 2000; Rimé, Schiaratura, & Ghysselinckx, 1984), which assumes that producing gestures facilitates the retrieval of phonological word forms from the mental lexicon during speaking. Obviously, this debate is central to the study of gesture and aphasia: gestures

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could either help the speaker in retrieving the proper word form (the LRF hypothesis) or alternatively they could aid the listener in decoding the communicative intention of the speaker. For an extensive discussion of how individuals with aphasia can use gesture to improve their communicative abilities in naturalistic contexts, I refer the reader to Goodwin (2000; 2006). It is important to note that that there is no reason the LRF and MAM hypotheses could not both be true at the same time. Nevertheless, most authors that defend the LRF hypothesis have also claimed that gesture is not communicative.

In an overview below, I discuss a number of key studies relevant to this debate, and argue that a number of the studies that are presented as evidence for the LRF hypothesis have not taken into account the alternative explanation that gesture and speech are an integrated multimodal communicative system, in which one modality can compensate for problems or limitations in another modality.

Morrell-Samuels and Krauss (1992) found that the onset of gestures usually precedes the word they are affiliated to. Furthermore, the less familiar a word is, the larger is the time interval by which the gesture precedes the speech. The authors argue that this makes it plausible that gestures facilitate lexical retrieval, because with the low familiarity words, gesture has more time to have its facilitatory effect. More parsimonious is the explanation that because low frequency[1] words are known to be produced slower than high frequency words (Jescheniak & Levelt, 1994), the onset of the gesture will therefore be earlier (relative to the onset of the speech) for the low frequency words.

A more direct way of testing the hypothesis that gesturing facilitates the speaking process itself is to prevent participants from gesturing and look at the effects this has on their speech. Graham and Argyle (1975) presented geometrical line drawings to what they called ''encoders''. Encoders were either native speakers of Italian or native speakers of English. The task of the encoder was to describe those drawings to a ''decoder'' who had to reproduce the drawing. In one condition encoders were allowed to gesture, while in the other they were not. The accuracy of the reproduction was higher when the encoder was allowed to gesture. This effect was even stronger for those drawings that were rated to be of low codability, demonstrating that the information presented in the encoder's gesture had a positive effect on the communication between encoder and decoder. No effects on the content of the speech were found. In Graham and Heywood (1975) essentially the same experiment was run with only English speaking participants. They coded a large number of speech-related dependent variables, of which only a few turned out to differ significantly between the gesture and the no-gesture condition. The elimination of gesture led to an increase in expressions describing spatial relations and to a decrease in the number of demonstratives. Also, the time spent pausing (in speech) increased in the no-gesture condition. As the authors note, these findings need not be explained by the assumption that the production of speech is facilitated by gesturing. Rather, it is likely that the increased number of phrases describing spatial relations and the increased pausing time are a compensation for not being able to use the gesture modality, as is also suggested by the MAM hypothesis.

Rimé, Schiaratura, and Ghysselinckx (1984) let their participants engage in free conversation about predefined topics. During the second half of the conversation, the head, hand and arm movements of the participant were immobilised by devices attached to the armchair of the participant. It was found that the vividness of the imagery in the speech *decreased* when the hands were immobilised. At first sight these results seem to contradict the aforementioned findings by Graham and Argyle (1975), and Graham and Heywood (1975): they found an *increase* in ''spatial'' speech, while Rimé et al. found a *decrease* in spatial speech. However, a crucial difference is that in the studies by Graham and Argyle (1975), and Graham and Heywood (1975), the participants were requested to speak about the presented line drawings, while in the study by Rimé et al. participants were free to select the content of their speech. Assuming, again, that gesture is a communicative device that serves especially well to transmit spatial information, and following the logic of the MAM hypothesis, in the studies by Graham and Argyle (1975), and Graham and Heywood (1975) participants were forced to compensate for the lack of gesture by producing more spatial descriptions in speech, while in the study by Rimé et al. participants could have avoided talking about topics containing spatial information, thereby circumventing the problems the participants of the Graham and Argyle (1975), and Graham and Heywood (1975) studies had.

Finally, Rauscher, Krauss and Chen (1996) prevented their participants from gesturing as well. The participants in their study had to describe cartoon animations to listeners, while during half of the time they were not allowed to move their hands. Their findings were: (1) that speech with spatial content was less fluent when gesturing was not permitted, (2) speech without spatial content was not affected, and (3) that the frequency of (non-juncture) filled pauses in the speech increased in the no-gesture condition, but only when the participants were producing speech with spatial content. The authors conclude from these findings that gesture facilitates access to the mental lexicon, for the effects of preventing gesture are similar to those of word-finding difficulties. However, these results can more parsimoniously be interpreted as evidence that gesture functions as a compensatory communicative device, as the MAM hypothesis predicts. Given that

the gesture modality is much more efficient in expressing spatial information, the loss of fluency in the no-gesture condition is predictable: the generation of speech with spatial content needs to be adapted (i.e. become more accurate and elaborate) when the gesture modality is not available. If the content of the speech is not spatial, this problem does not occur, which is exactly what the authors found. The authors' conclusion that their findings show that gesturing facilitates lexical access therefore seems unwarranted.

Beattie and Coughlan (1999) provided the most direct test of the LRF hypothesis. They elicited Tip Of the Tongue (TOT) states in experimental subjects. TOT states are states in which we "are sure that the information [about the word we are looking for] is in memory but are temporarily unable to access it" (Brown, 1991, p. 204). Beattie and Coughlan allowed half of their subjects to gesture, but asked the other half to keep their arms folded during the experiments, preventing them from gesturing. Then the subjects were presented with definitions and were then asked which word is described by the provided definition. This induced a number of TOT states in their participants. The straightforward prediction of the LRF hypothesis in this experiment is that the people who are allowed to gesture will "resolve" (in the sense of "finally finding the word they are looking for") a higher proportion of TOT states than those who had their arms folded. This turned out not to be the case. The main finding of this study was that "significantly more TOT states were resolved when gestures were absent than when they were present" (p. 49). In other words, the presence of gesture *lowered* the probability of resolving the TOT state. This finding is a straightforward falsification of the LRF hypothesis. In contrast, the MAM hypothesis can plausibly explain this finding that the occurrence of gesture goes together with a lower probability of resolving the word finding difficulty: the more difficult it is to find the word, the more likely it is for the gesture channel to be used to compensate for the impending processing difficulties in the speech channel, to get the concept that is in the communicative intention across to the listener. In other words, the presence of gesture indicated that the word-finding difficulties are *more* serious and therefore *less* likely to be resolved.

It seems that there is very little empirical evidence that favors the LRF hypothesis over the MAM hypothesis. Although the reported findings that a higher gesture frequency is related to problems in speech provide circumstantial evidence for the LRF hypothesis, they can always be explained in a more straightforward way by the Mutually Adaptive Modalities hypothesis.

There is, however, one intriguing study where the MAM hypothesis cannot be invoked to explain the result, which is the study by Rose and Douglas (2001), also discussed in the lead article. For three of the investigated patients, it was found that the probability of correctly naming a picture was higher when they made an iconic gesture about the depicted item. There are two reasons why this cannot be explained by the MAM hypothesis and, for that reason, by the processing model for gesture and speech called the Sketch Model (De Ruiter, 2000), which centrally incorporates the MAM hypothesis. The first reason is that the gestures in their study were *always* produced (because that was the instruction), so these gestures cannot be assumed to be an adaptive response to problems in the speech. Second, and more importantly, the subjects in this experiment were trying to perform a task, and not communicating something to a listener. So how then did this facilitatory effect arise? It is tempting to conclude that, at least for these three patients, the LRF hypothesis is true. However, there are some aspects of the experimental procedure that are in need of explicitation and/or clarification before we can generalise from this study to the use of gesture "in the wild", i.e. in natural conversation. First, the authors state that "[The participants'] ability to spontaneously produce an iconic gesture associated with 20 items was also ascertained". I assume that this was ascertained by asking the participants to make a gesture of which the interpretation corresponds to each of the 20 items. Without wanting to split semantic hairs, this is not truly spontaneous. As many a gesture researcher has discovered, it is notoriously hard to get people to produce gesticulations under experimentally controlled conditions. Especially if the *nature* of the produced items is under experimental control, evoking spontaneous productions is – by definition – impossible. People normally gesticulate a lot when they are in conversation, or when they are telling a story, but these gestures are created on the fly, they are not conventionalised, and they are part of a multimodal utterance that is being constructed in real time. If one asks participants to produce an iconic gesture describing a certain object (i.e., in a picture) they can do that, but the gestures thus produced have at least one property in common with emblematic gestures and not with gesticulation, namely that there does not need to be any speech accompanying the gestures. In other words, asking participants to produce an iconic gesture to express a certain concept, the *entire* communicative load is placed on the gesture, whereas in natural conversation, the communicative load can be distributed over both gesture and speech. So it is possible that the iconic gestures produced by the participants in the experiment by Rose and Douglas (2001) were more stand-alone (in the sense of being interpretable without speech, like emblems), which could have facilitated the retrieval of the proper word forms under these circumstances.

If this is the case, it becomes important to know *when* the gestures were produced, relative to the speech. If there was some time delay (say, more than

500 ms) between the production of the gesture and the word, it is possible that the subjects have visually perceived their own gestures, which in turn could have triggered a gesture comprehension process which could have primed the word forms of the related concepts, thereby facilitating their retrieval. If, on the other hand, the gesture is produced (roughly) simultaneously with the produced word, this explanation may be ruled out and one could suspect that some production-internal facilitation has taken place.

Final note

Related to the above discussion, I want to conclude with the recommendation that researchers who study aphasia and gesture rely more on proficiency tests that take into account the fact that the natural home of speech and gesture is natural, face-to-face interaction. Although gesture is to some degree an independent field of research, the phenomenon of gesture, especially in the narrow sense of gesticulation, cannot be studied separately from the communicative context in which it occurs.

Note

1 Although word familiarity and frequency are technically speaking not the same thing, they are highly correlated.

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