



Does our speech change when we cannot gesture?

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Abstract

Do people speak differently when they cannot use their hands? Previous studies have suggested that speech becomes less fluent and more monotonous when speakers cannot gesture, but the evidence for this claim remains inconclusive. The present study attempts to find support for this claim in a production experiment in which speakers had to give addressees instructions on how to tie a tie; half of the participants had to perform this task while sitting on their hands. Other factors that influence the ease of communication, such as mutual visibility and previous experience, were also taken into account. No evidence was found for the claim that the inability to gesture affects speech fluency or monotony. An additional perception task showed that people were also not able to hear whether someone gestures or not.

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1. Introduction

Human communication is often studied as a unimodal phenomenon. However, when we look at a pair of speakers we can quickly see that human communication generally consists of more than the mere exchange of spoken words. Many people have noted this and have been studying the multimodal aspects of communication such as gesture (Kendon, 2004; McNeill, 1992). Studying multimodal aspects of communication is not a recent thing, with Dobrogaev stating back in the 1920s that human speech consists of three inseparable elements, namely sound, facial expressions and gestures. According to Dobrogaev it is unnatural to completely leave out or suppress one of these three aspects and doing so will always affect the other two aspects of speech (Chown, 2008). However, by suppressing one of these inseparable elements, we can find out more about the relationship between all multimodal elements

of communication, such as speech and gesture. In fact, Dobrogaev studied the effect of not being able to gesture on speech (Dobrogaev, 1929) by restraining people's movements and seeing whether any changes in speech occurred. He found that speakers' vocabulary size and fluency decreases when people cannot gesture. This study is often cited by gesture researchers, for example by Kendon (1980), Krahmer and Swerts (2007), McClave (1998), Morsella and Krauss (2005) and Rauscher et al. (1996), but unfortunately it is very difficult to track down, it is not available in English and therefore its exact details are unclear. Other studies, however, have since done similar things, with people looking at the effect of (not being able to) gesture on language production and on acoustics.

1.1. Influence of (not being able to) gesture on language production

There have been several studies looking at the effect of not being able to gesture on speech, with different findings. In a recent study, Hostetter et al. (2007) asked participants to complete several motor tasks, with half of the participants being unable to gesture. They found some small effects of the inability to gesture, in particular that speakers

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use different, less rich, verbs and are more likely to begin their speech with “and” when they cannot use their hands compared to when they can move their hands while speaking. In a study on gesture prohibition in children, it was found that words could be retrieved more easily and more tip of the tongue states could be resolved when the children were able to gesture (Pine et al., 2007). Work by Beattie and Coughlan (1999) however, found that the ability to gesture did not help resolve tip of the tongue states.

There have also been some studies on gesture prohibition that focused on spatial language. It has been found that speakers are more likely to use spatial language when they can gesture compared to when they cannot gesture (Emmorey and Casey, 2001). Graham and Heywood (1975), on the other hand, found that when speakers are unable to gesture, they use more phrases to describe spatial relations. This increase in use of spatial phrases might be a compensation for not being able to use gesture (de Ruiter, 2006).

According to the Lexical Retrieval Hypothesis, producing a gesture facilitates formulating speech (Alibali et al., 2000; Krauss, 1998; Krauss and Hadar, 2001; Rauscher et al., 1996), and not being able to gesture has been shown to increase disfluencies (Finlayson et al., 2003). In a study by Rauscher et al. (1996) it was found that when speakers cannot gesture, spatial speech content becomes less fluent and speakers use more (nonjuncture) filled pauses. However, a study by Rimé et al. (1984) found no effect of being unable to gesture on the number of filled pauses.

Overall, there seems to be some evidence that not being able to gesture has an effect on spatial language production (as one would expect considering that gestures are prevalent in spatial language, e.g. Rauscher et al., 1996), but other findings remain inconclusive and are sometimes difficult to interpret.

1.2. Influence of (not being able to) gesture on acoustics

Apart from his claims on vocabulary size and fluency, the study by Dobrogaev (1929) is often associated with the finding that people’s speech becomes more monotonous when they are immobilized. This has, as far as we know, never been replicated, but several other studies have looked at some acoustic aspects of the direct influence of gestures on speech. For example, it has been found that producing a facial gesture such as an eyebrow movement often co-occurs with a rise in pitch (F0) (Cavé et al., 1996) and that manual gestural movement also often co-occurs with pitch movement (Flecha-García, 2010; McClave, 1998), also described in the so-called “metaphor of up and down” (Bolinger, 1983). Bernardis and Gentilucci (2006) found a similar result, namely that producing a gesture enhances the voice spectrum, or, more specifically, that producing a gesture at the same time and with the same meaning as a specific word (such as the Italian word ‘ciao’ accompanied by a waving gesture) leads to an increase in the word’s second formant (F2). Also on an acoustic level, Krahmer

and Swerts (2007) found that producing a beat gesture has an influence on the duration and on the higher formants (F2 and F3) of the co-occurring speech. In a perception study, Krahmer and Swerts (2004) found that listeners also prefer it when gestures (in this case eyebrow gestures) and pitch accents co-occur. The above mentioned studies suggest that there is also a relationship between gesture and speech on an acoustic level. However, we are not aware of any studies that looked at the effect of not being able to gesture on acoustics in general and on pitch range specifically.

1.3. Other factors influencing gesture production

In the present study we want to look at the effect of not being able to gesture on several aspects of speech production. It has been assumed, for example in the above mentioned Lexical Retrieval Hypothesis, that there is a link between gestures and cognitive load. Arguably, not being able to gesture can be seen as an instance of an increased cognitive load for the speaker. We can then hypothesize that not being able to gesture affects speech even more in communicatively difficult situations where speakers also have to deal with an additional increased cognitive load, because of the context or because of the topic. An increased cognitive load due to context could occur when people cannot see each other when they interact. An increased cognitive load due to topic could occur when people have to do a task for the first time, compared to a decreased cognitive load when speakers have become more experienced in that task. We aim to take both these aspects of cognitive load into account in order to compare and relate the cognitively and communicatively difficult situation when people have to sit on their hands to other communicatively difficult situations, namely when there is no mutual visibility and during tasks with differing complexity, in this case when participants are more or less experienced (due to the number of attempts).

In fact, both mutual visibility and topic complexity have been shown to influence gesture production. Previous studies (Alibali et al., 2001; Bavelas et al., 2008; Emmorey and Casey, 2001; Gullberg, 2006; Mol et al., 2009) have found that speakers still gesture when they cannot see their addressee, although the nature of the gestures changes, with gestures becoming fewer and smaller. Also, a study by Clark and Krych (2004) found that mutual visibility leads to more gesture production and helps speakers do a task more quickly.

Several studies suggest that there can be an influence of topic complexity on the production of gestures. It has been argued that gestures facilitate lexical access (Krauss and Hadar, 2001; Rauscher et al., 1996) and are thus mainly produced for the speaker herself. More complex tasks and a larger cognitive load will thus lead to more gestures to help the speaker. On the other hand, research has also suggested that gestures can be largely produced for the addressee and thus mainly serve a communicative purpose

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