Can we hear a gesture? The influence of gestures on speech.

Marieke Hoetjes, Emiel Krahmer, Marc Swerts.
Tilburg centre for Cognition and Communication (TiCC), School of Humanities,
Tilburg University, The Netherlands.

Human communication consists of more than just the exchange of spoken words. When people speak, they use all kinds of audiovisual cues, such as intonation, but also body posture, facial movements and speech-accompanying gestures. Speech-accompanying gestures can be defined as the symbolic movements that are produced in speech, by most people and in most conversations (McNeill 1992; Kendon 2004). People are generally not aware of producing or perceiving them, which means that even though these gestures are omnipresent they are often overlooked when studying language use.

However, previous research has shown that there is a close relationship between speech and gesture, although the exact nature of this relationship is still unclear (see de Ruiter 2007, for an overview). We do not, for example, know whether and in what way gestures actually influence our speech and whether this means that it is possible to hear when somebody is gesturing. Some authors (e.g. Krahmer and Swerts 2007) have shown that gestures may have a directly noticeable impact on speech, but this study only focused on beat gestures (i.e. rhythmic gestures typically used to emphasize a word or phrase). In addition, there is a well-known and often referred to claim that speakers who are not able to gesture produce speech that is more monotonous (Dobrogaev 1929). However, this paper cannot be traced and to the best of our knowledge nobody has ever replicated this finding. In the present study, we aim to replicate Dobrogaev's finding and find out whether the influence of gestures on speech can also be seen in iconic gestures, as compared to Krahmer and Swerts' beat gestures.

To study the effects of gestures on speech, an experiment was conducted. Thirty eight Dutch first year student pairs took part in a director-matcher game in which the director had to watch video clips depicting a person tying different kinds of tie-knots and, after watching these video clips, instruct the matcher to tie an actual tie in the same manner as in the video clips. All directors had to sit on their hands for either the first half or the second half of the experiment. The goal of the experiment was to see whether, and if so, how, the directors' speech changes when they are 'tied down' and unable to gesture compared to when they are free to move their hands as they please.

The data obtained in this experiment was used to look at several aspects regarding the influence of gestures on speech. We conducted a perception test to see whether people can hear when somebody is gesturing and the fragments from the perception test were analysed with regard to acoustic aspects of speech such as minimum and maximum pitch, pitch range and mean intensity across conditions.

The perception test was set up as follows. Twenty pairs of sound fragments from the audio recordings of the tie knotting experiment were selected and presented to twenty participants. The pairs of sound fragments consisted of two recordings of the same director instructing the same matcher, using as much as possible the same words in both recordings (see figures 1 and 2 for a sound pair example). The pairs of recordings consisted of one audio fragment produced when the director was unable to use his or her hands and one audio fragment produced when the director was able to gesture and actually produced at least one iconic gesture. The participants of the perception test took part voluntarily and did not participate in the original tie knotting experiment. They received some information about the setup of the original tie knotting experiment and were asked to judge for each pair of sound fragments in which of the two the speaker gestured. The participants' instructions did not

mention whether they should focus on a specific aspect of speech and the participants were only allowed to listen to each fragment once, forcing them to base their decision on initial impressions.

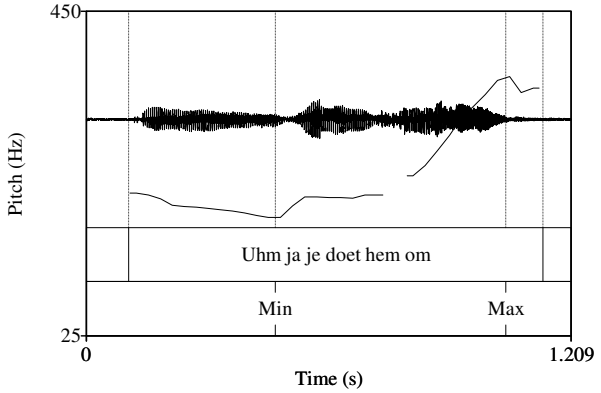

Figure 1. Example of director's instruction when able to gesture, director says: *Uhm ja je doet hem om*, 'Uhm yeah you put it around'.

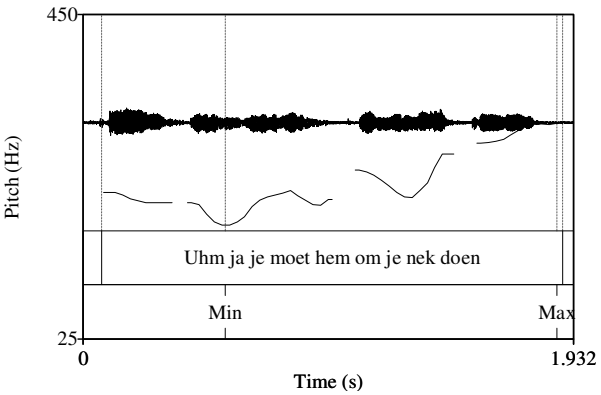

Figure 2. Example of director's instruction when unable to gesture, director says: *Uhm ja je moet hem om je nek doen*, 'Uhm yeah you have to put it around your neck'.

Results showed that there is no perceivable influence of iconic gestures on acoustic aspects of speech. The twenty participants did not score significantly different from chance level, with a mean of 10.95 correct answers in 20 trials (one-sample $t(19)=1.843$, $p=.08$). The perception test shows that people, when presented with two lexically and syntactically highly similar phrases, find it impossible to hear whether someone gestures or not.

For all twenty pairs of sound fragments, the minimum, maximum and mean pitch height in Hz, the pitch range in Hertz and mean intensity in dB was measured. There was no significant effect of ability to gesture on any of the measures (see table 1).

Table 1. Acoustics across conditions (pitch in Hz, intensity in dB).

	Gesture (*SD*)	No Gesture (*SD*)	Mean total
Mean Max Pitch	248.5 (*83*)	251.65 (*93.5*)	250
Mean Min Pitch	136.5 (*47*)	138.75 (*60*)	137.62
Mean Pitch	192.5	195.2	193.85
Mean Pitch range	112 (77)	112.9 (67)	112.45
Mean Intensity	65.40 (5.9)	65.95 (6.2)	65.67

Overall, we can say that the perception test and the acoustic pitch and intensity analyses did not reveal statistically reliable acoustic differences between utterances produced with and without iconic gestures. It was therefore not possible to replicate previous findings on the acoustic influence of gestures on speech. Moreover, we found no evidence that speech is more monotonous when people are unable to gesture.

Dobrogaev, S. M. (1929). "Ucnenie o reflekse v problemakh iazykovedeniia [Observations on reflexes and issues in language study]." Iazykovedenie i Materializm 105-173.

Kendon, A. (2004). Gesture. Visible action as utterance. Cambridge, Cambridge University Press.

Krahmer, E. and M. Swerts (2007). "The effects of visual beats on prosodic prominence: acoustic analyses, auditory perception and visual perception." Journal of Memory and Language **57**: 396-414.

McNeill, D. (1992). Hand and mind. What gestures reveal about thought. Chicago, University of Chicago Press.

de Ruiter, J. P. (2007). "Postcards from the mind: the relationship between speech, imagistic gesture, and thought." Gesture **7**(1): 21-38.