# The influence of body posture and gesture on the evaluation of verbal utterances addressment and comprehensibility


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## Abstract

During everyday communication co-speech gestures represent a ubiquitous tool to underpin the verbal content of a message. In addition to gestures, other non-verbal information, such as the direction in which a speaker's body is oriented, is particularly important during face-to-face interaction. However, the influence of bodily orientation (frontal vs. lateral) and gestures on the evaluation of comprehensibility and addressment of verbal utterances has not been investigated, so far. It might be hypothesized that meaning-bearing gesture in a frontal context improves the comprehensibility and the addressment of a verbal message. In fact, we found a significant interaction of the factors gesture (gesture/no-gesture) and body orientation (frontal/lateral) for the evaluation of addressment, indicating that frontally presented co-verbal gesture was evaluated as most addressing. Though for comprehensibility the interaction was not sig., comprehensibility was evaluated highest in the context of frontally presented co-verbal gesture. Gesture seems to have a general positive effect on comprehension as indicated by higher comprehension scores and faster evaluations. However, the main effect of body orientation on evaluations suggests that a frontal perspective additionally seems to contribute to comprehension. These data demonstrate the importance of body orientation and gesture on the evaluation of the comprehension and addressment of verbal utterances. Our results suggest a beneficial effect for frontally presented co-speech gesture.



**Keywords:** iconic gesture, addressment, bodily orientation, reaction times


## Introduction

Iconic gestures (cf. McNeill, 1992) are closely related to shape or form descriptive information in the real world (e.g., "he caught a big fish", spreading the arms to indicate the size of the fish), thus subserving an important and beneficial role in everyday communication (e.g., (Kelly, Barr, Church, & Lynch, 1999; Wu & Coulson, 2007)).

Beside gestures, body position and eye gaze also convey important non-verbal information for communication (Holler, Kelly, Hagoort, & Ozyurek, 2010; Özyürek, 2002). During everyday communication people usually talk to each other in a classical face-to-face position. In a group conversation or in a discussion round situation, however, speakers are sometimes seen from a lateral position. It is unclear, if the posture *per se* has an effect on the communicative process in the presence or absence of co-speech gesture information. For instance, in a group setting a speaker may position his or her body towards a particular person and compose his or her gestures explicitly for that listener (see Özyürek, 2002). In this way, the speaker uses his or her body to guide communication. Furthermore, by using MEG (Kilner, Marchant, & Frith, 2006) and fMRI experiments (Straube, Green, Chatterjee, & Kircher, 2011; Straube, Green, Jansen, Chatterjee, & Kircher, 2010), it has been shown that body posture can influence neural mentalizing processes. However, the influence of bodily orientation (frontal vs. lateral) and gesture (gesture vs. no-gesture) on the evaluation of comprehensibility and addressment of verbal utterances has not been investigated, so far.

Based upon previous research, we hypothesized that a frontal view enhances the social relevance (addressing function) of the message and consequently facilitates semantic information processing, in particular when gestures are presented. In line with the subjective evaluations we also expected reaction times to be shortest (fastest evaluations) when gestures are presented in a frontal position.

# Method

### Participants

Twenty native German, right-handed subjects (12 female, Age: Mean=23.45, SD=2.54) participated in the study. Subjects were paid 30 € for participation. The local ethics committee approved the study.

### Materials

Different video clips of an actor either performing meaningful co-speech (iconic) gestures or speaking without producing gestures were recorded. Both, gestures as well as speech utterances, were produced in a natural way though explicit instructions - that the actor should come up on its own with gestures to the prepared sentences - were given before. The actor was instructed to avoid facial expressions (e.g., smile) as well as different gaze orientations (e.g., averting the eyes). Moreover, the actor was simultaneously filmed from a frontal and a lateral perspective by two independent cameras. The verbal content was identical across all four conditions. All sentences followed the same simple syntactic structure using regular subject-verb-object constructions.

Video clips were 5s long, each with at least 0.5 s at the beginning and end of the clip during which the actor neither spoke nor moved (for the same procedure, see (Green et al., 2009; Kircher et al., 2009; Straube, Green, Bromberger, & Kircher, 2011; Straube, Green, Chatterjee, et al., 2011; Straube et al., 2010; Straube, Green, Sass, Kirner-Veselinovic, & Kircher, 2012; Straube, Green, Weis, & Kircher, 2012)).

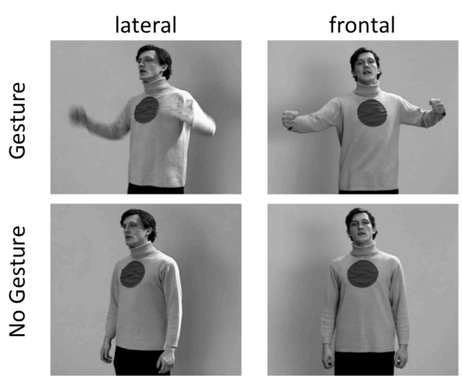


Fig. 1: Experimental conditions for the speech sample: "He caught a big fish".

### Procedure

Participants gave written informed consent and were instructed to evaluate the 96 video clips (24 clips x 4 conditions) subsequently according to the dimensions 'addressment' and 'comprehensibility' on a 7-point likert scale (1 corresponds to "not addressed"/"not comprehensible"; 7 corresponds to "highly addressed"/"highly comprehensible"). After the video was presented for 5 s, the questions appeared and remained on the computer screen until the answer was given. Subjects were instructed to take their decision spontaneously, but based on the whole video (both gesture – if available – as well as speech information were to be included).

Video clips were presented in a pseudo-randomized order and counterbalanced across subjects. For the current analyses rating and reaction time data were used.

### Analyses

Data were analyzed using the generalized linear model (GLM) as implemented in the SPSS software package. Main effects for the different manipulations were calculated (frontal vs. lateral, gesture vs. no gesture) as well as their factorial interaction. Data were corrected for multiple testing according to the Bonferroni procedure.

# Results

### Addressment rating and reaction times

A sig. main effect for co-speech gesture (G) was found (F=28.12, p<.001), generally rated as more addressing than the speech only conditions. The analysis of rating values for posture (frontal vs. lateral) revealed a sig. main effect (F=29.73, p<.001), indicating that frontal position is evaluated more addressing. The interaction between gesture (G/NG) and posture (f/l) was found to be sig. (F=6.40, p<.05), indicating highest addressment scores for the frontally presented gesture condition. Thus, gesture in the context of frontal (fG) actor position was evaluated as most addressing. The laterally presented no gesture (lNG) condition was found to be least addressing (see Fig. 2).

No sig. main effect was found with respect to reaction times for gesture and body orientation, respectively. However, a significant interaction of both factors ($F_{1,19}$=6.913 p<.05) indicates shortest reaction times in the lNG condition, followed by fG, lG and fNG (see Table 1/ Figure 2,3).

### Comprehensibility rating and reaction times

With respect to comprehensibility, a significant main effect was found for gesture (F=12.78, p<.005) and body orientation (F=7.53, p<.05). Overall, gesture conditions achieved highest rating values (see Table 1/ Figure 2). No sig. interaction was found between gesture*posture.

Reaction times were generally shorter for the gesture conditions - fG revealed shortest values, resulting in a sig. main effect for gesture (F=10.23, p=.005). No sig. main effect body posture or interaction between both factors was found for the reaction times.

Table 1: Rating values and reaction times

| | No Gesture (NG) | | Gesture (G) | |
|---|---|---|---|---|
| | frontal | lateral | frontal | lateral |
| Addressment | 3.81 (1.36) | 2.22 (1.22) | 5.27 (1.45) | 3.13 (1.47) |
| RT | 1.61 (.89) | 1.26 (.62) | 1.36 (.71) | 1.48 (.94) |
| Comprehensibility | 6.30 (.84) | 6.20 (.91) | 6.83 (.28) | 6.66 (.28) |
| RT | 1.15 (.67) | 1.19 (.75) | .81 (.59) | 1.02 (.67) |

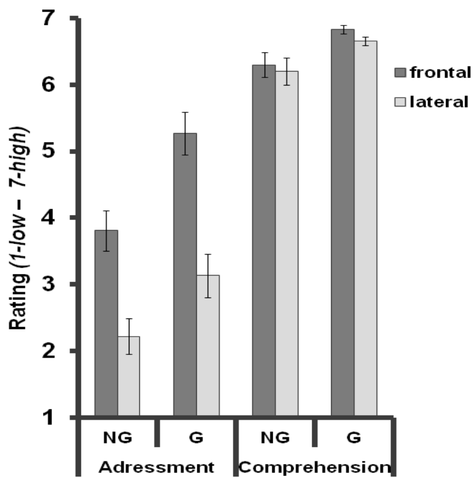


Figure 2: Rating values for the frontal (dark gray), lateral (light gray), no-gesture (NG) and co-speech gesture (G) conditions.

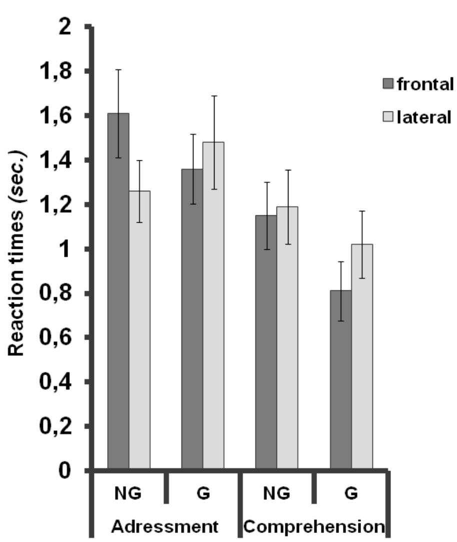


Figure 3: Reaction times for the frontal (dark gray), lateral (light gray), no-gesture (NG) and co-speech gesture (G) conditions.

## Discussion

In the current investigation the role of body posture (frontal vs. lateral) as well as the presence or absence of gesture was examined focusing on differences in addressment and comprehensibility ratings. The same linguistic content was presented with or without accompanying iconic gesture in a frontal or lateral view and followed by an evaluation task.

As assumed, a significant main effect for addressment was found for G as compared to NG. Results moreover showed a sig. interaction between body position and gesture as gesture together with a frontally speaking actor was evaluated as most addressing. Hence, addressment evaluations are primarily based on the presence or absence of gesture in the context of a frontal bodily position, as indicated by the sig. interaction effect.

With respect to comprehensibility, we demonstrated that the latter could be facilitated not only by co-verbal gestures, but also by body orientation, as indicated by higher comprehension scores for both G>NG and f>l. However, since we obtained no sig. interaction of body orientation and gesture with regard to comprehension evaluations, the main effect f>l could also be explained by differences in face orientation alone. Thus, further research is needed to support the assumption that the whole appearance of the actors' orientation interacts with gesture perception and improves comprehension. Furthermore, reaction times indicated faster evaluations of utterance comprehensibility only for the gesture in contrast to the no-gesture condition, indicating a stronger effect of gesture (in contrast to body orientation) on decision times.

In sum, frontally presented gesture is first, most addressing and second, most comprehensible for the addressee, even if the sentence content remains equal across experimental conditions. In line with previous work, our data support the view that the additional information channel of iconic co-verbal gestures plays a beneficial role in speech comprehension (e.g., (Green et al., 2009; Kelly, Creigh, & Bartolotti, 2009; Wu & Coulson, 2007)). Even if the addressee's view was lateral, gesture was evaluated as being more comprehensible than frontally presented speech only. Future research is necessary to support the findings of the current study and to further investigate the potential role of social cues and 'mentalizing' processes in the context of body orientation and gesture information processing. Here, different effects of body orientation and gesture on contextual encoding could be of particular interest (see (Straube, Green, Chatterjee, et al., 2011)). Moreover, neuroscientific investigations may shed further light on the neural basis of frontal vs. lateral co-speech gesture processing. First imaging results (Straube, Green, Jansen, Chatterjee, et al., 2010) point to complex multisensory pathways interacting with perceptual as well as semantic levels. Finally, future studies are needed to replicate or extent our findings using more indirect or implicit comprehension tasks (e.g., test what the actor was displaying with manipulations of the quality of the speech, i.e. using different signal-to-noise ratios), which are less likely to be affected by meta-cognitive processes.


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