

## Behavioral and Neural Correlates of Deictic Reference

David Peeters<sup>1,2,3,4</sup>, Aslı Özyürek<sup>1,4</sup>, Peter Hagoort<sup>1,3,4</sup>

1. Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands, david.peeters@mpi.nl
2. International Max Planck Research School for Language Sciences, Nijmegen, The Netherlands.
3. Donders Institute for Brain, Cognition, and Behaviour, Nijmegen, The Netherlands.
4. Radboud University, Nijmegen, The Netherlands.

**Keywords:** Deixis; ERP; Demonstratives; Dutch; Turkish

Establishing triadic joint attention on a referent is a very basic human communicative ability. People generally use deictic speech (e.g., demonstratives such as *this* and *that*) and gesture (e.g., pointing) to do so. Despite large scale cross-linguistic descriptions of demonstrative systems (Diessel, 1999), the mechanisms underlying the production and comprehension of such referential acts are not well understood. Therefore, we tested the factors that influence how people use demonstratives in triadic situations across two different languages (Dutch and Turkish) based on previous descriptive work (Experiment 1), and the neural mechanisms underlying the comprehension of multimodal deictic reference in Dutch (Experiment 2).

In Experiment 1, twenty-nine Turkish and twenty-four Dutch participants were presented with pictures including a speaker, an addressee, and an object (the referent). They noted which demonstrative they would use in the depicted situations. The distance of the referent and the addressee's focus of visual attention on the object were systematically manipulated in the pictures. In Turkish, both the referent's distance and the addressee's attention influenced demonstrative choice. In Dutch, on the other hand, demonstratives were used only on the basis of the distance of the referent.

In Experiment 2 we exploited the finding that in Dutch, demonstratives were used on the basis of distance. Twenty-three Dutch participants saw pictures containing a speaker and two similar objects. One of the objects was close to the speaker, whereas the other was either distal from the speaker but optically close to the participant ("vertical orientation"), or distal from both ("horizontal orientation"). The speaker pointed to one of the objects, and participants heard sentences spoken by the speaker containing a demonstrative that could be congruent or incongruent (e.g., a proximal or distal demonstrative for an object close to the speaker). Also, we manipulated whether the speaker referred to the object using a correct label or not ("semantic violation"). EEG was recorded to investigate the neural mechanisms and time-course underlying the comprehension of multimodal reference.

Interestingly, the incongruent use of a demonstrative influenced comprehension only in the vertical orientation. When the speaker referred to the object close to herself, such a violation led to a negative deflection, significant 200-600 ms after demonstrative onset. This effect had a time-course and scalp distribution similar to the N400 effect we found for the semantic violation. In contrast, when the speaker referred to the object close to the participant, incongruent demonstrative use led to an early, positive effect, significant 100-300 ms after demonstrative onset. Thus, the comprehension of multimodal referential acts depends not only on the referent's location from a speaker's point of view, but also from the addressee's perspective.

In sum, our findings show that in different languages both similar and different factors play a role in how people produce demonstratives in context. Furthermore, the brain's sensitivity to different spatial properties (i.e., the addressee's perspective, the orientation of objects) reveals new insights about the processes underlying demonstrative reference.

[1] Diessel, H. (1999). *Demonstratives. Form, Function, and Grammaticalization*. Amsterdam: John Benjamins.