

## Augmented iconicity: Mutual benefits of gesture theory and kinetic data analysis

Irene Mittelberg (Natural Media Lab, RWTH Aachen University)

This talk aims to highlight some ways in which empirical research into multimodal interaction may inform gesture theory and vice-versa. Adopting a cognitive-semiotic perspective (Mittelberg 2013a; Wolf et al. 2017), I will present a set of studies carried out in the Natural Media Lab (RWTH Aachen University), which – while cutting across various modalities and disciplinary boundaries – have two things in common. They a) were motivated by questions central to semiotic and cognitive linguistic theory and b) involve motion-capture technology (MoCap). In multimodal interaction research, MoCap has proven to be a useful tool to investigate furtive gestures and head movements in minute detail. Compared to 2-D video recordings, 3-D numerical MoCap data represent quickly emerging and vanishing hand shapes and movements on a millimeter and millisecond scale. For example, visualizing otherwise invisible traces of gestural motion allows for new insights into the dynamic and schematic gestalt properties of communicative movements (Mittelberg 2019a/b).

First, the focus will be on *qualitative* analyses of gestures metonymically evoking actions and/or objects, by showing how a gesture's iconicity may be augmented through visualizing and freezing its motion trajectory. MoCap plots of gestures employed to describe paintings, for instance, have revealed formal and aesthetic qualities that facilitate deriving the underlying embodied image schemas and force dynamics (Mittelberg 2013b, 2018). Second, I will discuss *quantitative* approaches that involve pattern analysis within and across study participants, involving, e.g., heat maps visualizing the speakers' individual styles of using gesture space. In another study, gesture signatures of selected movement types served as input for an algorithm searching the MoCap data set for similar trajectories and retrieving all the tokens of a given gesture type (Schüller et al. 2017). Finally, I will address some of the challenges that come with exploiting MoCap technology in the context of interdisciplinary gesture research.

### References:

- Mittelberg, I. (2013a). Balancing acts: Image schemas and force dynamics as experiential essence in pictures by Paul Klee and their gestural enactments. In: M. Borkent et al. (eds.), *Language and the Creative Mind*. Stanford: CSLI. 325–346.
- Mittelberg, I. (2013b). The Embodied mind: Cognitive-semiotic principles as motivating forces in gesture. In: C. Müller, A. Cienki, E. Fricke, S.H. Ladewig, D. McNeill & S. Tessendorf (Eds.) (2013). *Body – Language – Communication: An International Handbook on Multimodality in Human Interaction*. Berlin, New York: Mouton de Gruyter. 750-779.
- Mittelberg, I. (2018). Gestures as image schemas and force gestalts: A dynamic systems approach augmented with motion-capture analyses. *Cognitive Semiotics* 11 (1). <https://doi.org/10.1515/cogsem-2018-0002>
- Mittelberg, I. (2019a). Peirce's universal categories: On their potential for gesture theory and multimodal analysis. *Semiotica* 228. 193-222. DOI 10.1515/sem-2018-0090
- Mittelberg, I. (2019b). Visuo-kinetic signs are inherently metonymic: How embodied metonymy motivates form, function and schematic patterns in gesture. Research Topic 'Visual Language', *Frontiers in Psychology* 10, 254. DOI=10.3389/fpsyg.2019.00254.
- Schüller, D., Beecks, C., Hassani, M., Hinnell, J., Brenger, B., Seidl, T., Mittelberg, I. (2017). Automated Pattern Analysis in Gesture Research: Similarity Measuring in 3D Motion Capture Models of Communicative Action. *Digital Humanities Quarterly* 11, 2.
- Wolf, D., Reikittke L.-M., Mittelberg I., Klasen M., Mathiak K. (2017). Perceived conventionality in co-speech gestures involves the fronto-temporal language network. *Frontiers in Human Neuroscience*, doi: 10.3389/fnhum.2017.00573