

Sensorimotor Simulation in Schizophrenia: Evidence from Action and Object Naming

Moritz Wackerbarth¹, Juliane Bergdolt², Katja Koelkebeck², Antje Lorenz¹

¹ Bielefeld University, Department of Linguistics, Germany

² Bielefeld University, Medical School and University Medical Center OWL, Protestant Hospital of the Bethel Foundation, Department of Psychiatry and Psychotherapy, Germany

Background: Sensorimotor simulation has been argued to occur to varying degrees during concept retrieval. Evidence from clinical populations suggests that pathological changes to the dopaminergic system can impair simulation capability. Speakers with Parkinson's disease exhibit selective impairments in producing motion-related language: pictures depicting high motility actions (i.e., actions requiring great bodily effort to carry out) are named with higher latencies compared to pictures depicting low motility actions [1, 2]. We investigated whether similar patterns occur as a function of dysregulated neuromodulation, a core pathophysiological mechanism in schizophrenia (SZ). In patients with SZ, dysregulation of the dopaminergic system has been associated with a variety of motor-related symptoms that may further impair sensorimotor simulation during motion-related language processing.

Method: This is an ongoing study, using a primed picture naming task in which participants with SZ (n = 9 until today) and neurotypical and mentally healthy adults (currently n = 31) participated. The task includes a set of 80 line drawings of actions and objects (40 each) that have been pretested for their depicted motion content and operationalized categorically (high vs. low). Naming targets are presented once with a semantic associatively related lexical distractor and once with an unrelated lexical distractor (SOA = 0). Naming latency and accuracy were analyzed as effects of participant group, motion content and type of distractor. Secondary analyses included motion content of actions and objects as continuous factors and image type (word category) as an additional predictor.

Results: Data from 9 participants with SZ and 31 healthy controls are reported (Figures 1, 2). Participant group significantly influenced response behavior. Participants with SZ generally named images with greater latency and lower accuracy compared to controls. No evidence for priming was observed in either group, and motion content did not significantly modulate naming performance. Secondary analyses revealed a dissociation-like pattern in participants with SZ but not in controls concerning response measure and image type. Participants with SZ named action images with greater latency compared to object images. By contrast, participants with SZ produced significantly more errors compared to controls when naming object images but not action images.

Discussion: Due to the lack of effects of motion content, our results are not compatible with impaired sensorimotor simulation in patients with SZ per se. Global effects of participant group, where patients named images with greater latency and lower accuracy, align with general impairments in cognitive processing that have been associated with SZ [3–5], as well as types of antipsychotic medication. The dissociation-like pattern observed for action and object images might reflect an interaction of such impairments with material-inherent factors like event structure (being more complex for action images) and naming agreement. The degree to which sensorimotor simulation occurs in language processing is highly task-dependent and its effects are fragile. We will thus further discuss our results with respect to methodological concerns, including the type of task and behavioral measures employed in the present study.

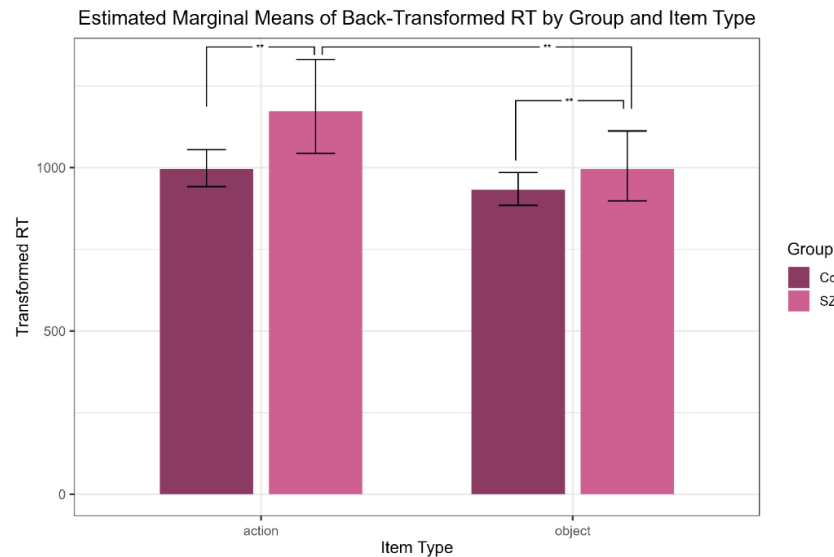


Figure 1: Naming latency as an effect of image type and participant group (Co = control group; SZ = patient group).

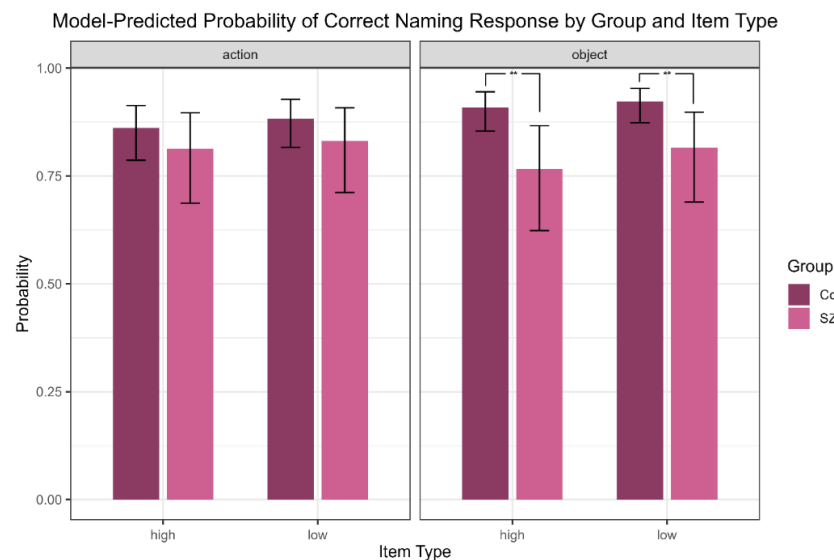


Figure 2: Naming accuracy as an effect of image type, motion content and participant group (Co = control group; SZ = patient group).

References

- [1] Bocanegra, Y., García, A., Lopera, F., Pineda, D., Baena, A., Ospina, P., Alzate, D., Buriticá, O., Moreno, L., Ibáñez, A., & Cueto, F. (2017). Unspeakable motion: Selective action-verb impairments in Parkinson's disease patients without mild cognitive impairment. *Brain and Language*, 168, 37–46. <https://doi.org/10.1016/j.bandl.2017.01.005>
- [2] Boulenger, V., Mechtouff, L., Thobois, S., Broussolle, E., Jeannerod, M., & Nazir, T. (2008). Word processing in Parkinson's disease is impaired for action verbs but not for concrete nouns. *Neuropsychologia*, 46(2), 743–756. <https://doi.org/10.1016/j.neuropsychologia.2007.10.007>
- [3] Hahn, W., Domahs, F., Straube, B., Kircher, T., & Nagels, A. (2021). Neural processing of nouns and verbs in spontaneous speech of patients with schizophrenia. *Psychiatry Research: Neuroimaging*, 318, 111395. <https://doi.org/10.1016/j.psychres.2021.111395>
- [4] Kuperberg, G., Delaney-Busch, N., Fanucci, K., & Blackford, T. (2018). Priming production: Neural evidence for enhanced automatic semantic activity preceding language production in schizophrenia. *NeuroImage: Clinical*, 18, 74–85. <https://doi.org/10.1016/j.nicl.2017.12.026>
- [5] Nazli, Ş., Koçak, O., Kirkici, B., Sevinç, M., & Kokurcan, A. (2020). Investigation of the Processing of Noun and Verb Words with fMRI in Patients with Schizophrenia. *Noro Psikiyatri Arsivi*, 57(1), 9–14. <https://doi.org/10.29399/npa.23521>