

# SIGNAL EMBODIMENT ENHANCES GESTURE'S COMMUNICATION SUCCESS

Nicolas Fay<sup>\*1</sup>, Bradley Walker<sup>1</sup>, T. Mark Ellison<sup>2</sup>, Zachary Blundell<sup>1</sup>, Naomi De Kleine<sup>1</sup>,  
Murray Garde<sup>3</sup>, Casey J. Lister<sup>1</sup> and Susan Goldin-Meadow<sup>4</sup>

<sup>\*</sup>Corresponding Author: nicolas.fay@gmail.com

<sup>1</sup>School of Psychological Science, University of Western Australia, Perth, Australia

<sup>2</sup>Collaborative Research Centre for Linguistic Prominence, University of Cologne, Cologne, Germany

<sup>3</sup>School of Culture, History and Language, Australian National University, Canberra, Australia

<sup>4</sup>Department of Psychology, University of Chicago, Chicago, USA

## Introduction

The origin of language of one of the oldest question in science, but vocal-first and gesture-first theories remain speculative due to a lack of direct evidence. Here we present empirical evidence to inform this debate.

Philosophers and early explorers recommended using ‘*the universal language of the hands*’ to communicate with indigenous people (Quintilian 95CE; Cooperrider, 2019). Evidence for the universality of gesture was found in a recent paper that compared the communication success of gesture to (non-linguistic) vocalization cross-culturally (Australian and Ni-Vanuatu producers) and cross-experientially (sighted and severely vision-impaired Australian producers) (Fay et al., 2022). Like other referential communication studies (e.g., Ćwiek et al., 2021; Fay et al., 2013), communication success was measured by having a group of interpreters guess the meaning of each of the gesture/vocal signals produced (using a multiple choice format). Communication success was twice as high for the gestured signals than for vocal signals across the two experiments reported (61.17% versus 29.04%), and gesture’s success was driven (in part) by its greater universality; the gestured signals produced by different participants were more similar in form than their vocal signals (i.e., they were more universal), and the degree of signal similarity was positively correlated with communication success.

Fay et al (2022) appealed to embodied theories of language and cognition to explain the success and universality of the gestured signals. Embodied theories highlight the importance of the body, and the body's interactions with the environment, to cognition (e.g., Clark, 1999; Hostetter & Alibali, 2008). Fay et al (2022) argued that whereas gesture lends itself to signal embodiment (e.g., communicating the word 'drink' via manually simulating raising a container to one's mouth), the opportunity for signal embodiment is absent in the vocal modality.

Here, we re-analyzed the data collected by Fay et al (2022) to test an embodied account of the communication success of gestured signals. Producers communicated a large number of words (997 distinct words), an equal number of which were verbs, nouns and adjectives. In their analysis Fay et al (2022) did not distinguish between the different word categories. In the gesture modality, an embodied account predicts that verbs provide greater scope for signal embodiment than nouns, and nouns provide greater scope for embodiment than adjectives. If correct, communication success will be higher for verbs than nouns, and communication success will be higher for nouns than adjectives. In the vocal modality there is little scope for signal embodiment, so no specific prediction is made with regard to the communication success of the different word categories. This is tested in the current study.

## **Method**

Re-analysis of the data collected by Fay et al (2022) and made openly available on the Open Science Framework: <https://osf.io/36jpy/>

## **Results & Discussion**

As predicted by an embodied account, in the gesture modality verbs were communicated more successfully than nouns and nouns were communicated more successfully than adjectives: 78%, 74%, 60% for Australian Producers, 64%, 55%, 46% for Ni-Vanuatu Producers and 60%, 48% and 38% for Severely Vision-Impaired Producers. No such pattern was evident in vocal modality: 33%, 31%, 34% for Australian Producers, 16%, 14%, 13% for Ni-Vanuatu Producers and 30%, 35% and 41% for Severely Vision-Impaired Producers. Our findings indicate that signal embodiment is important to gesture's communication success. Similarities in the way people use gesture to embody meaning may also explain why gestured signals were found to be more universal than vocal signals.

## References

- Clark, A. (1999). An embodied cognitive science? *Trends in Cognitive Sciences*, 3(9), 345–351. [https://doi.org/10.1016/S1364-6613\(99\)01361-3](https://doi.org/10.1016/S1364-6613(99)01361-3)
- Cooperrider, K. (2019). Universals and diversity in gesture: Research past, present, and future. *Gesture*, 18(2–3), 209–238. <https://doi.org/10.1075/gest.19011.coo>
- Ćwiek, A., Fuchs, S., Draxler, C., Asu, E. L., Dediu, D., Hiovain, K., Kawahara, S., Koutalidis, S., Krifka, M., Lippus, P., Lupyan, G., Oh, G. E., Paul, J., Petrone, C., Ridouane, R., Reiter, S., Schümchen, N., Szalontai, Á., Ünall-Logacev, Ö., ... Perlman, M. (2021). Novel vocalizations are understood across cultures. *Scientific Reports*, 11(1), 10108. <https://doi.org/10.1038/s41598-021-89445-4>
- Fay, N., Arbib, M., & Garrod, S. (2013). How to Bootstrap a Human Communication System. *Cognitive Science*, 37(7), 1356–1367. <https://doi.org/10.1111/cogs.12048>
- Fay, N., Walker, B., Ellison, T. M., Blundell, Z., De Kleine, N., Garde, M., Lister, C. J., & Goldin-Meadow, S. (2022). Gesture is the Primary Modality for Language Creation. *Proceedings of the Royal Society B: Biological Sciences*.
- Hostetter, A. B., & Alibali, M. W. (2008). Visible embodiment: Gestures as simulated action. *Psychonomic Bulletin & Review*, 15(3), 495–514.