

The iconic affordances of gesture and vocalization in emerging languages in the lab

Oxana Grosseck^{1,2}, Marcus Perlman³, Gerardo Ortega³, and Limor Raviv^{2,4}

¹Corresponding Author: oxana.grosseck@mpi.nl

²Radboud University, Nijmegen, Netherlands

³LEADS, Max Planck Institute for psycholinguistics, Nijmegen, Netherlands

⁴English Language and Linguistics, University of Birmingham, UK

⁵cSCAN, University of Glasgow, Glasgow, UK

Iconic signals play an essential role in bootstrapping a novel communication system and getting it off the ground (e.g., Fay et al., 2013; Perlman et al., 2015). However, iconicity may not be uniformly or readily available across modalities, and the relative iconic affordance of speech vs. gestures has long been a subject of interest and controversy given its relevance to language origins (e.g., Kendon, 2017). Specifically, while there is a wide consensus that the gestural modality holds great potential for iconicity (which is often taken as support for the gesture-first hypothesis for language evolution, e.g., Fay et al., 2014; Corballis, 2002), recent work suggests that the vocal modality affords more iconicity than previously thought (e.g. Perlman, 2017; Dingemanse et al. 2015) - supporting a more multimodal view of language origins. Yet despite the importance of assessing the relative iconic affordance of each modality during the emergence of a novel communication system, only a handful of studies directly compared the communicative success of novel signal creation across modalities using the same stimuli and experimental procedure (Macuch-Silva et al., 2020; Fay et al., 2013, 2014, 2022; Lister et al., 2021). Of these, only two (Lister et al., 2021, Fay et al., 2022) examined signals' degree of iconicity by measuring guessing accuracy with naïve participants - but only for known concepts and signals produced in isolation (i.e., not during communication or as a part of a structured system). Furthermore, it is still unclear how iconicity evolves over time during the formation of a novel communication system. While some work suggests that iconicity decreases over repeated interactions to make space for more systematic and/or efficient signals (tones: Verhoef et al., 2016; drawings: Fay & Ellison, 2013), the one study that tested this with vocalizations found that iconicity *increased* over rounds, alongside conventionalization (Perlman et al., 2015) – suggesting that iconicity trajectories may be modality-specific.

Here, we present the first empirical study to directly test the iconic affordances of the gestural and vocal modalities for different dimensions of meaning (shape, size, motion, speed), as well as how this iconicity changes over time across modalities during the formation of a new language. To this end, we introduce a novel paradigm for evaluating the fine-grained iconicity of productions with respect to individual referent features (Fig. 1). In a pre-registered online experiment (<https://osf.io/gh6xp>), >1200 naïve participants are exposed to audio/video recordings of one vocal and one gestural sign referring to novel multi-dimensional stimuli. These were collected from 18 dyads playing an emergent referential communication game for multiple rounds in a virtual environment (Motiekaityte et al., in prep). Upon exposure, participants are asked to guess the meanings depicted in the recording following a 4-step decision tree, with each step corresponding to one feature of the referent, and with the alternatives at every step being determined by the participant's previous choice. For each feature, we record guessing accuracy as well as whether the participant believed the feature was encoded in the video.

We predict that: (H1) iconicity will be present in both gestures and vocalizations, yet with overall more iconicity in gestures; (H2) Iconicity trajectories over the course of dyadic interaction will differ across modalities, with iconicity decreasing for gestures (i.e., lower guessing accuracy for later productions) and possibly increasing for vocalizations; (H3) Some features (e.g., shape) will be better guessed in gestures, while others (e.g., speed) will be guessed well across modalities. Based on preliminary results from N=300 participants, gestures are indeed guessed better than vocalizations (H1), especially for features like shape and motion (H3).

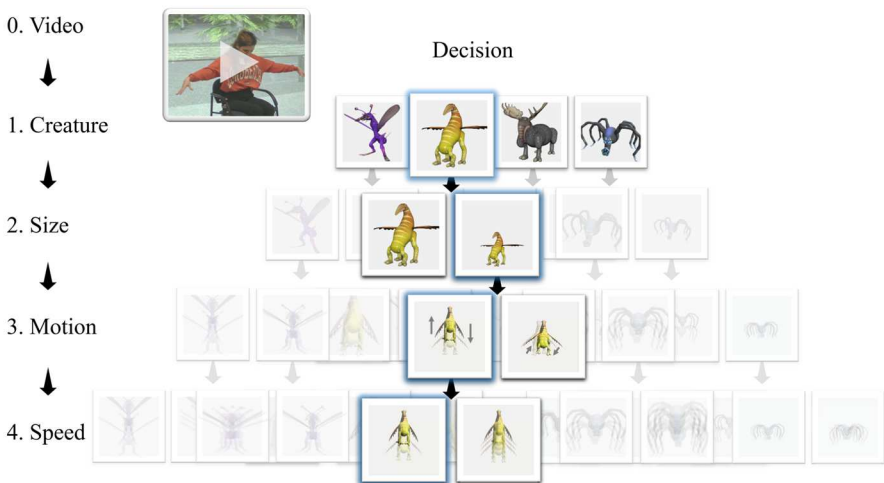


Figure 1. Design of the iconicity experiment, with an example trajectory through the decision tree.

References

- Dingemanse, M., Blasi, D. E., Lupyan, G., Christiansen, M. H., & Monaghan, P. (2015). Arbitrariness, iconicity, and systematicity in language. *Trends in Cognitive Sciences*, 19(10), 603–615.
- Corballis, M. C. (2002). *From hand to mouth: The origins of language*. Princeton University Press.
- Fay, N., Arbib, M., & Garrod, S. (2013). How to bootstrap a human communication system. *Cognitive science*, 37(7), 1356-1367.
- Fay, N., Ellison, T.M. (2013). The Cultural Evolution of Human Communication Systems in Different Sized Populations: Usability Trumps Learnability. *PLoS ONE*, 8(8): e71781.
- Fay, N., Lister, C. J., Ellison, T. M., & Goldin-Meadow, S. (2014). Creating a communication system from scratch: gesture beats vocalization hands down. *Frontiers in Psychology*, 5, 354.
- Fay, N., Ellison, M., & Garrod, S. (2014). Iconicity: From sign to system in human communication and language. *Pragmatics & Cognition*, 22(2), 244-263.
- Fay, N., Walker, B., Ellison, T. M., Blundell, Z., De Kleine, N., Garde, M., ... & Goldin-Meadow, S. (2022). Gesture is the primary modality for language creation. *Proceedings of the Royal Society B*, 289(1970), 20220066.
- Kendon A. (2017). Reflections on the "gesture-first" hypothesis of language origins. *Psychonomic bulletin & review*, 24(1), 163–170. <https://doi.org/10.3758/s13423-016-1117-3>
- Lister, C. J., Burtenshaw, T., Walker, B., Ohan, J. L., & Fay, N. (2021). A Cross-Sectional Test of Sign Creation by Children in the Gesture and Vocal Modalities. *Child Development*, 92(6), 2395-2412.
- Macuch Silva, V., Holler, J., Ozyurek, A., Roberts, S.G. (2020). Multimodality and the origin of a novel communication system in face-to-face interaction. *R. Soc. open sci.* 7: 182056.
- McLean, B., Dunn, M., & Dingemanse, M. (2023). Two measures are better than one: Combining iconicity ratings and guessing experiments for a more nuanced picture of iconicity in the lexicon. *Language and Cognition*, 1-24.
- Perlman, M., Dale, R., & Lupyan, G. (2015). Iconicity Can Ground the Creation of Vocal Symbols. *Royal Society Open Science* 2 (8): 150152.
- Perlman, M. (2017). Debunking two myths against vocal origins of language: Language is iconic and multimodal to the core. *Interaction Studies*, 18(3), 376–401.
- Verhoef, T., Kirby, S., & De Boer, B. (2016). Iconicity and the emergence of combinatorial structure in language. *Cognitive science*, 40(8), 1969-1994