

GROUP SIZE AND LINGUISTIC STRUCTURE IN SILENT GESTURE

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Evidence from natural languages suggests that properties of social environments are instrumental in shaping linguistic features, with languages of smaller or more isolated communities exhibiting more complexity (Lupyan & Dale, 2010, Wray & Grace, 2007) and less regularity (Lupyan & Dale, 2010, Meir, Israel, Sandler, Padden & Aronoff, 2012). In a recent artificial language study, Raviv, Meyer and Lev-Ari (2019) found that participants communicating within larger groups produced more systematic languages. They attributed this to the (initially) more variable input received by people in larger groups, which produced cultural selection pressures favoring systematicity as a means of reducing the cognitive strain of communicating with multiple partners.

We set out to extend this *input variability* hypothesis to be more readily applicable to accounts of sign languages in relation to social structure (e.g., Meir et al., 2012). Manual communication offers considerable opportunities for iconic signaling, which is associated with increased transparency of novel signals (Thompson et al., 2009) and may therefore counteract an effect of group size on the emergence of systematic structure. To investigate this possibility, we asked hearing non-signers to communicate using pantomime in groups of differing sizes. Below we report the procedure and results for the first two rounds, since conditions were similar across all group sizes for these rounds only.

We conducted the experiment online, using the Jitsi video-conferencing platform. Participants ($n = 26$) were all masters students taking part at home as part of an introductory course on language evolution. Overall, we tested 3 groups of 5 people, 2 groups of 4, and 1 group of 3. Participants took turns to communicate a selection of concepts, presented as typed English words for their

groupmates to interpret. The stimulus set was adapted from Motamedi et al. (2019), such that each item corresponded to a *thematic category* (e.g., *Religion*, *Music*, *Food*) and one *functional category* (*Person*, *Object*, *Location* or *Action*). Thus, the concept *Singer* corresponds to the categories of *Music* and *Person*, *Concert Hall* corresponds to *Music* and *Location*, and so on.

Following Motamedi et al. (2019), recordings of participants' gestures were manually coded for *shape* and *number of hands* (e.g., *2hTakePhoto* for gestures in which both hands are used to mime taking a photograph) and *use of functional markers* (gestures shared across items within a given functional category that may be interpreted as indicating that category, e.g., pointing to one's chest to denote a person). Coded trials were then analyzed using two measures of efficiency, namely *utterance length* and *frequency of repetitions*, and two measures of systematicity: *entropy* and *proportion of functionally marked utterances*, both of which indicate the recombination of elements across trials. Mixed effects linear regression models (with participant and round as random effects) found a significant negative effect of group size on entropy ($\beta = -0.32$, $SE = 0.14$, $t = -2.26$, $p = 0.032^*$), but no effect on the proportion of functionally marked utterances. Marginally significant positive effects of group size were found for utterance length ($\beta = 0.43$, $SE = 0.23$, $t = 1.88$, $p = 0.073$) and frequency of repetitions ($\beta = 0.43$, $SE = 0.22$, $t = 2.00$, $p = 0.058$).

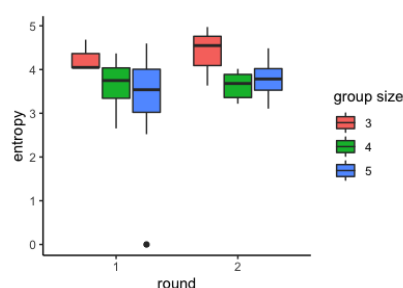


Figure 1. Mean entropy of participants' gestures. Error bars represent bootstrapped 95% confidence intervals

These results thus offer tentative support for the claim that larger groups produce more systematic gestures. However, the marginally significant results for gesture length and repetition frequency may suggest that larger group size hinders efficient communication. Though limited by our use of a small convenience sample, which was partly determined by pedagogical considerations, we argue that these findings provide a good basis for further investigation.

References

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