ICONICITY IN SIGN GROUNDING: REPRESENTATION OR DISAMBIGUATION?

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Recently there has been renewed interest in how communication systems ground their meaning (e.g., Harnad, 1990; Galantucci, 2005; Nölle et al., 2018), with a focus on the mechanisms underlying language evolution (Kirby, 2017). A recurrent experimental finding is that participants tend to resort to iconicity as a main strategy for bootstrapping meaning when creating a communication system from scratch (Garrod et al., 2007; Tamariz, 2017). This resonates with studies suggesting that languages are less arbitrary than often thought as they display systematic sound-meaning correspondences (Dingemanse et al., 2015; Blasi et al., 2016). While iconicity undoubtedly plays a central role in symbol grounding, we argue that a more nuanced look at grounding mechanisms beyond iconicity is overdue. We hypothesize that some of the experimental findings in laboratory studies on emergent communication might be biased by a particular task-design, where participants communicate concepts to each other using drawing, touchpad or gesture, without sharing a visual-spatial context. This leaves deictic communication (such as pointing) impossible that otherwise could point to indexicality as another fundamental grounding mechanism (Deacon, 1997; Diessel, 1999; Tomasello, 2008). We argue that even experimental observations subsumed under 'iconicity' might in fact incorporate elements of indexicality, metonymy and systematicity. In classic experimental semiotic tasks, like the Pictionary games (Garrod et al., 2007) or Silent Gesture experiments (e.g., Christensen et al., 2016; Motamedi et al., 2019) it is noticeable that discrimination in the form of identifying a target amongst competitors is central. Re-analysing data from a recent gesture study (Nölle et al., 2018) reveals how such a finite meaning space allows for strategies that build on minimal discrimination via pointing to a unique trait or using association based on common ground: E.g., in order to represent the top right stimulus in Fig. 1A, Danish participants in the study used a SMOKING gesture, since the Danish queen is known for smoking. We tested to what extent participants relied on a) this type of abstract association, that is whether gestured traits were present in the stimulus or not and b) minimally

discriminating traits in the given context; in other words, the applicability of a given sign to the referential environment. We also hypothesized that informational bottlenecks from the original study could affect to what extent such semiotic strategies would be used to ground communication systems. We took the most extreme conditions, 1) the Closed+Immediate condition and 2) the Open+Displaced condition and had 3 naïve coders code how present/associative and applicable to the referential context gestured traits were on every trial (Fig 1A). We hypothesized that informational bottlenecks motivating systematicity, such as an expanding meaning space and displacement of the referential environment, should also affect how associative and generalizable gestures would become. We therefore expected more associative gestures and more gestures that did not refer to unique traits in condition 2.

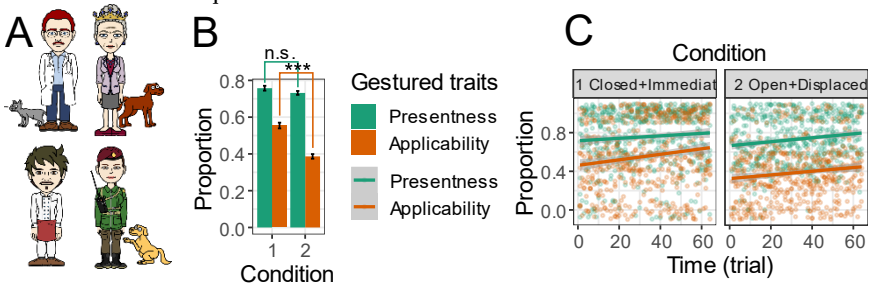

Figure 1 **A** Example Stimulus set (Note: the sets used in experiment 2 by Nölle et al., 2018 contained 16 stimuli on every trial). The referent environment determined how gestures were coded on both dimensions. E.g., the top right stimulus could be communicated with gestures expressing GLASSES (present+applicable to one target), MOUSTACHE (present+applicable to many targets), SYRINGE (associative+one), or PETTING (associative+many). **B** Proportions of presentness and applicability across all gestures produced to communicate a single stimulus. **C** Development over time.

For our analysis, we treated both variables as factors with two levels and asked for the proportion of these levels across all gestures produced on each trial. We found a main effect of applicability (p<.001) and two-way interaction between condition and factor (see Fig 1B) as well as main effect of time (p<.001, Fig 1C). There was no difference in presentness of gestured traits across conditions. See supplementary materials for full dataset and linear mixed effects models.

Our results suggest that while participants in these kind of Silent Gesture tasks prefer expressing traits that are present in the environment, a good proportion is associative (which is unaffected by informational bottlenecks). Participants are thus not only "representing" targets iconically, but grounding meaning through metonymic relations. Furthermore, pairs sharing a stable perceptual space (condition 2) seem to orient to minimally distinguishing traits more than participants who don't.

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