SIGNAL AUTONOMY IS SHAPED BY CONTEXTUAL PREDICTABILITY

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At the heart of any communication system is the goal of reducing uncertainty about the intended meaning of the speaker. In achieving this aim, speakers not only rely on the conventional meaning of linguistic forms, but also on how these forms interact with the contextual information at hand. In short, when context is known and informative, it helps in reducing uncertainty about the intended meaning (Piantadosi, Tily & Gibson, 2012). This relationship between context, meaning and uncertainty has important consequences for how cultural evolutionary processes shape the structure of linguistic systems. A recurrent observation is that languages vary in their *signal autonomy*: the degree to which a signal can be interpreted in isolation, without recourse to contextual information (Wray & Grace, 2007). One hypothesis is that signal autonomy is causally related to *contextual predictability*: to what extent can a speaker estimate and therefore exploit the contextual information that a hearer is likely to use in interpreting an utterance.

To investigate these claims, we experimentally simulate the relative pressures from speakers and hearers in a communication game, with the main manipulation being to the *referential context*: the relationship between a target object and a set of distractor objects, and how these impact upon the task of discrimination (Winters, Kirby & Smith, 2015). For the training phase, participants were trained on an artificial language, which consisted of randomly generated sets of 2-3 syllable signals. These signals were then assigned to four images that differed from each other on the dimensions of shape and colour (e.g., *blue blob*, *grey oval*, *red square*, *yellow star*). The trained language was therefore ambiguous with respect to whether the signals referred to colour, shape, or both colour and shape. Participants were then assigned fixed roles of either a *speaker* or a *hearer* for the communication phase. In each trial, speakers typed a signal for a target image, and hearers used this signal to discriminate the target from a set of three distractors (the context). There were a total of 16 target images a speaker needed to convey over three blocks of 32 trials.

To test for the effect of referential context on signal autonomy we manipulated two variables: (i) context-type (across trial predictability) and (ii) access to context (within trial predictability). Context-type is the extent to which a partic-

ular dimension (e.g., shape) is relevant for discrimination across successive trials. For the *Shape Different* referential contexts, the context-type remains consistent across trials, as targets and distractors differ in shape, but share the same colour. *Mixed* context-types vary across trials: half of the trials consist of contexts in which the target and distractors differ in shape (but share the same colour) and half in which they differ in colour (but share the same shape). We also manipulated whether the speaker had knowledge about the relevant distinctions needed to communicate with the hearer. In the *Shared* conditions, speakers had access to the context (i.e., the target and distractors that hearer was confronted with), whereas in the *Unshared* condition speakers only saw the target in isolation (although the hearer's task remained the same: to distinguish a target from a set of three distractors). This gives us four conditions: *Shape-Different Shared*, *Shape-Different Unshared*, *Mixed Shared*, *Mixed Unshared*. By decreasing contextual predictability within and across trials we predict that speakers will respond by creating more autonomous signals (and vice versa).

Our results show that context does shape the degree of signal autonomy: when the context is predictable, languages are organised to be less autonomous (more context-dependent) through combining linguistic signals with context to reduce uncertainty. When the context decreases in predictability, speakers favour strategies that promote autonomous signals, allowing linguistic systems to reduce their context dependency. For the Shape-Different Shared condition, which was maximally predictable in terms of context-type and access to context, speakers only conveyed the shape dimension in their linguistic systems, leaving out the colour dimension as this was irrelevant to communicative success (resulting in low autonomy). Conversely, in the Mixed Unshared condition, which had the lowest contextual predictability, speakers consistently opted for strategies that promoted compositional structure: this allowed for autonomous systems that specified both colour and shape within the linguistic system. For the conditions in-between these two extremes of contextual predictability – Shape-Different Unshared and Mixed Shared – speakers were more heterogeneous in their strategy choice, with the resulting systems varying in their degree of autonomy. Taken together, these results show how pragmatic factors can play a salient role in the cultural evolution of language, with manipulations to contextual predictability shaping the types of systems that emerge over repeated interactions between speakers and hearers.

Bibliography

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