

## Larger communities develop more granular and better structured categories

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Languages differ in how they divide the meaning space. For example, Greek splits the color category which English defines as blue into two different categories, whereas Berinmo assigns all blue and green shades together into a single category. The source of these cross-linguistic differences is of great interest as the structure of a category can influence communicative efficiency and non-linguistic cognitive performance. This paper shows that larger communities create more granular and better structured categories, and that their advantage is driven by the greater constraints on diffusion that they experience.

Linguistic structure has been shown to be shaped by community structure. Larger communities have larger sound inventories. They also tend to have simpler morphology, but the simplicity might be more efficient and learnable. This study tests whether the structure of semantic categories is similarly shaped by community structure, as well as uncovers the responsible mechanism for the effect.

We ran 100 simulations in which populations of agents communicated about a 20x20 meaning space for 50,000 rounds. We manipulated population size and density in a crossed manner. In each round, each agent communicated to someone in their network about a randomly selected meaning. Success was measured by the distance of the comprehended meaning from the intended one. Agents selected a label to produce by searching their history for the closest and most successful label, and when none was available, created a new label. Partners interpreted the label according to their past experience with the label (weighting tokens by their success), or, if the label was unfamiliar, by selecting the meaning farthest from any communicated in their past history. If a label or a meaning was not used for at least 500 interactions, the agent forgot it.

The results of the simulations show that larger communities divided the meaning space into more categories (Fig 1a). Furthermore, these categories were more balanced in size (Fig 1b). As a consequence, larger communities communicated more successfully (Fig 1c). Analyses revealed that the effects were driven by the greater diffusion barrier large communities experience. As labels spread, their category boundaries were less consistent in larger communities. Lower consistency induced narrowing in meaning, which, in turn, increased category maintenance.

The study thus shows that community size influences the structure of semantic categories and can thus have implications for communication efficiency and cognitive performance. The study also shows that social dynamic constraints can lead to the emergence of better systems.

