

# Language, Perceptual Categories and their Interaction: Insights from Computational Modelling

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The question how humans acquire perceptual categories is far from being resolved. Specifically the balance between nature and nurture remains the topic of heated debate. We present a computational model and take as case study colour categories to study two issues in perceptual category acquisition. The first issue is the effect of linguistic communication on categories during their acquisition: we demonstrate how categories can become coordinated under the influence of language. The second issue concerns the amount of coordination needed between the categories of individuals in order to achieve unambiguous communication. We show that, depending on how strictly linguistic utterances are interpreted, coordination of the individuals' categories is not always a prerequisite for successful communication.

In order to investigate the influence of language on category acquisition, we have constructed two models. In the first, language has a direct influence on the category formation: both categories and their forms are learned in one stage; in the second model learning is divided in two stages: in the first stage the agents induce their categories individually from the environment and in the second stage they learn the forms for communicating about these categories without further changing their category repertoires.

Our model seems tolerant to the degree the categories are coordinated between agents. Even if the agents are not at all coordinated, as is the case in the model where categories are acquired without the influence of language, the agents still manage to acquire a term-category mapping which allows for good communication, provided that the interpretation of the hearer is not strict. However, if the hearer interprets a form by relating it to only one referent, communication breaks down if categories are not coordinated.

Our model suggests that perceptual categories can be rather different without hampering linguistic communication. The reason for this is that the membership to a perceptual category decays gradually and continuously, making the mapping of a referent in the world onto a category tolerant to differences in individuals' categories. This has been reported in human colour categories, but our model suggests that this might be the case for any other type of categories with a continuous membership.