# Using Computational Modelling and Clustering to Explore Individual Differences in Category Learning

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## Abstract:

The behavioural mechanisms underlying human category learning have been previously investigated; however, existing research struggles to disentangle learning from cognitive bias and lacks an efficient method to quantify variability in learning processes. The present study addresses these gaps by adopting a novel computational model to capture inter-individual differences. Twenty-four undergraduate students completed a category learning task involving a series of category discrimination trials in which they learned category rules through trial and error. They pressed on a key if they believed two stimuli matched in shape or colour and another key if the stimuli did not match in both. After each response, they received feedback to guide their learning. We fitted a computational model for each participants individual data. This model captured learning performance with two components: (1) Participants' learning curve was measured with a sigmoid function which modeled the learning progress across trials with the parameters: learning speed, latency, and outcome. (2) Cognitive bias was measured with a cubic spline function (i.e. imbalance scores at the start, latency, and end of learning). Further clustering analysis of learning and bias curves was applied to categorize individual learning types, revealing four distinct learner profiles: (C1) non-learners, (C2) non-biased learners, (C3) strongly biased learners, and (C4) late learners. These findings provide a computational framework for classifying individual learning variability in category learning. The results highlight that individual differences, particularly in cognitive bias, significantly influence how category rules are learned and encoded into memory, offering insight into the interaction between bias and learning.