PACKER: An Exemplar Model of Category Generation

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Abstract

FILLER

Keywords: Categorization; etc

Introduction

- One of our most intriguing cognitive capabilities is the ability to generate new ideas and concepts.
- Most of the formal work on concepts and categorization has focused on category learning
- Work in the field has ... [standard passage] ... However, the creative use of conceptual knowledge has been has scarcely been the subject of scientific inquiry.
- *Briefly* review Ward's contribution. Use words like 'foundational', 'canonical', etc. Mention main psychological principle(s) Ward discovered about how people create new categories (copy and tweak?). Need to cite an formal work in this line. Looks like Ward or Barsalou may have made one (see pg. 93 of Jern & Kemp, 13)
- Jern & Kemp as pioneering contemporary research on formal models of category generation. Main psychological principle
- **Our angle**: Jern & Kemp capture one aspect of generating new categories: they should be informed by statistics of features across categories related to the new category (potentially also including that the new category should have good category coherence). However, it misses a major aspect of generating new categories – They should be different from the other related categories. We define a novel exemplar model for category generation, the PACKER model, which creates new categories by balancing two constraints: (1) new categories should be different from the contrast category and (2) new categories should have be internally coherent.
- *Need to make this clear*: we are not suggesting Jern & Kemp have failed to capture a core aspect of generation, but that there are other properties that can be explained through one of the field's oldest traditions.

Previous work

- Review some of Ward's work. Use words like 'foundational', 'canonical', etc. Mention empirical findings, how they were shown, and that they held across children and adults
- Ward not enough. Not just copy and tweak. People use distributional information across (multiple) related categories to generate new categories. Summarize Jern & Kemp's empirical results from Expts 4 and 5.
- Copy-and-tweak exemplar model
- Jern & Kemp's hierarchical Bayesian model

PACKER: An Exemplar Model

- Standard passage: "exemplar models have enjoyed broad success in explaining classification learning... " (add more domains that exemplar models have been applied to). Here we test a novel exemplar model of generation.
- Model performance is constrained by two forces – categories are generated such that same-category examples should be similar to one another, and opposite category examples should not be similar to one another.
- Mathematical description, make sure to describe influence of parameters on performance.

Qualitative (less mathematical description of) predictions

- Category *structure* affects performance only insofar as it constrains inter-exemplar similarities.
- Category *location* in the space is crucial because it constrains remaining possible locations.
- **Maybe**: show positive space, negative space, and combination of spaces to describe model performance.

Behavioral Experiment

- Testing the model in a simplified domain, following paradigm set by Jern & Kemp.
- Goal is to determine if category *structure* is the only determinant of generation. Category structure is held constant, location in space is manipulated.

- Description of Jern & Kemp and copy-and-tweak model predictions.
- Depiction of our exemplar model predictions. *Ideas*: Representative simulations, aggregate heat-map, probability spaces following 0 and 1 items generated.

Participants & Materials

Procedure

Results

- Following predictions of our exemplar model, the main interest was the use of space above and below the contrast category. [If-then logic]...
- Obvious effects of category location: do people tend to place the new category somewhere else? See Figure 3, Table 1.
- The more interesting issue: does the remaining space constrain what types of categories people come up with?
- Analysis is tricky because vertical range is not normally distributed (see Figure 3). Report parametric / nonparametric stats.
- Following core prediction of exemplar model, fewer participants used the top and bottom of the space when assigned the Bottom category, report 2x2x2 contingency table stats.
- However, we also observed a great deal of individual differences in the form of ... [report types of categories, maybe show samples?]

Simulations

Discussion

Acknowledgments

Table 1: Behavioral results.

Middle	Used top rows	No top rows
Used bottom rows	31	18
No bottom rows	11	1

Bottom	Used top rows	No top rows
Used bottom rows	22	8
No bottom rows	29	2

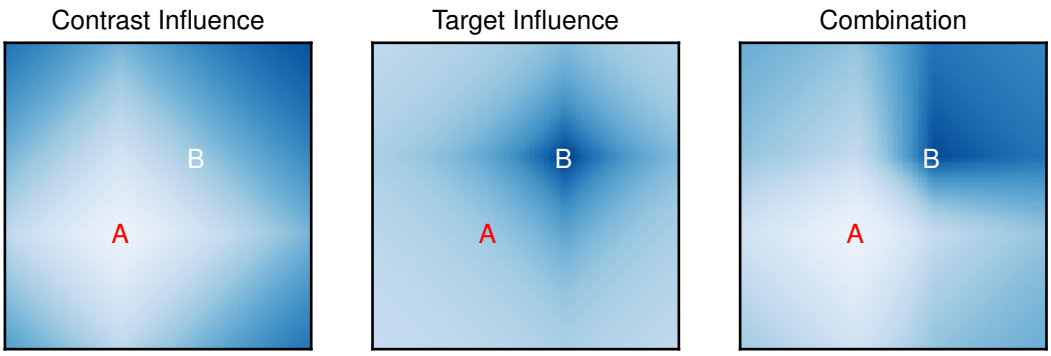

Figure 1: Exemplar generation following exposure to one member of category 'A' and one member of category 'B'. Areas in which generation is not likely are shaded white, high probability areas are shaded blue. *Left*: Model generation gradient when only considering the contrast category (A). *Center*: Model generation gradient when only considering the targeted category (B). *Right*: The combined spaces.

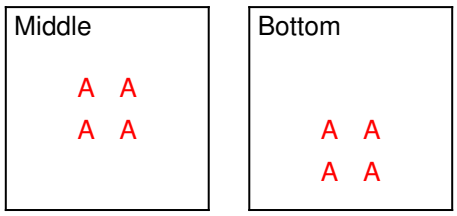

Figure 2: Experiment conditions.

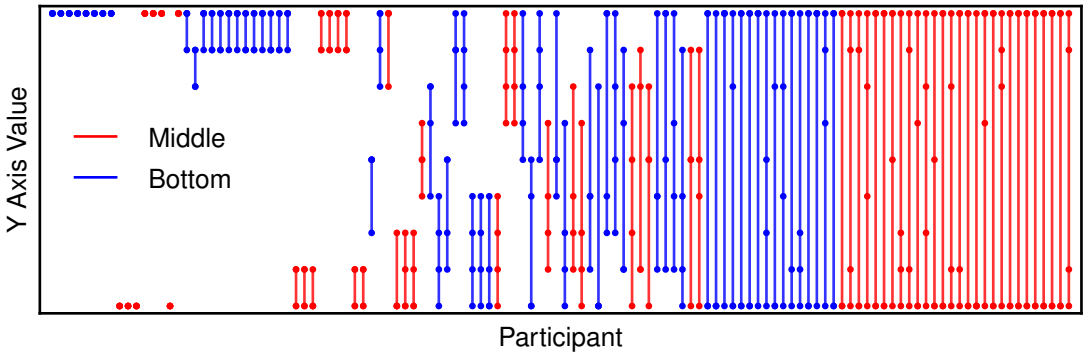

Figure 3: Behavioral results. Each line shows the minimum and maximum value of a generated category along the Y (vertical) axis. Dots along each line represent the positions of individual exemplars in the category, and each participant's category is shown on a separate line. Participants are sorted by overall Y axis range, and then by condition.