Creating Something Different: Similarity and Contrast Effects in Concept Generation.

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1 Abstract

Filler!

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2 Introduction

The creation of novel concepts and ideas is a highly intriguing – yet infrequently studied – topic of research in human cognition. The creative use of conceptual knowledge is a core element of scientific investigation, wherein the generation of new ideas is critical to designing experiments and explaining observations. However, due to its complexity, little is presently known about the cognitive processes underlying the creative generation of new concepts.

Much of what we know about conceptual generation comes from the foundational literature on creative cognition. In a classic series of reports, Ward & colleagues (Marsh, Ward, & Landau, 1999; Ward, 1994, 1995; Ward, Patterson, Sifonis, Dodds, & Saunders, 2002; Ward et al., 2002) established that category generation is highly constrained by prior knowledge. For example, Ward (1994) observed that participants asked to generate new species of alien animals tended to produce features possessed by earth species. Likewise...

3 Snippets

Jern and Kemp (2013) showed that difficult topic of creative generation could be studied through the well-developed methodology from the field of categorization. Specifically, they found that learners trained on artificial categories typically generated new artificial categories with similar distributional properties.

In this paper, we provide a systematic examination of conceptual generation using the well-developed methods and theoretical frameworks from the literature on human category learning. We also introduce a novel exemplar model of category generation, PACKER (*Producing Alike and Contrasting Knowledge using Exemplar Representations*), which explains much of what we observe in the creative use of conceptual knowledge. One of the core principles of PACKER (as well as its name) are inspired by earlier work in category learning (see Hidaka & Smith, 2011).

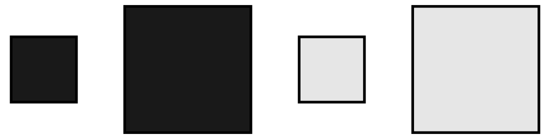

Figure 1: Sample stimuli used in Experiments 1 and 2.

4 Experiment 1

4.1 Participants & Materials

183 participants were recruited from Amazon Mechanical Turk. Participants were randomly assigned to one condition: 64 participants were assigned to the Cluster condition, 61 were assigned to the Row condition, and 58 were assigned to the XOR condition. Stimuli were squares varying in color (RGB 25–230) and side length (3.0–5.8cm). See Figure 1 for samples. The assignment of perceptual features (color, size) to axes of the domain space (x, y) was counterbalanced across participants.

4.2 Procedure

Participants began the experiment with a short training phase (3 blocks of 4 trials), where they observed exemplars belonging to the 'Alpha' category. Participants were instructed to learn as much as they can about the Alpha category, and that they would answer a series of test questions afterwards. On each trial, a single Alpha category exemplar was presented, and participants were given as much time as they desired before moving on. Each block consisted of a single presentation of each of the members of the Alpha category, in a random order. Participants were shown the range of possible colors and sizes prior to training.

Following the training phase, participants were asked to generate four examples belonging to another category called 'Beta'. As in Jern and Kemp (2013), generation was completed using a sliding-scale interface. Two scales controlled the features (color, size) of the generated example. An on-screen preview of the example updated whenever one of the features was changed. Participants could generate any example along an evenly-spaced 9x9 grid, except for any previously generated Beta exemplars. Neither the members of the Alpha category nor the previously generated Beta examples were visible during generation. Prior to beginning the generation phase, participants read the following instructions:

> As it turns out, there is another category of geometric figures called "Beta". Instead of showing you examples of the Beta category, we would like to know what you think is likely to be in the Beta category.
>
> You will now be given the chance to create examples of any size or color in order to show what you expect about the Beta category. You will be asked to produce 4 Beta examples - they can be quite similar or quite different to each other, depending on what you think makes the most sense for the category.
>
> Each example needs to be unique, but the computer will let you know if you accidentally create a repeat.

Following generation, participants completed a generalization phase wherein they classified novel examples into the Alpha and Beta categories without feedback. On each trial, a single example was presented, and participants were asked to classify it by clicking buttons labeled “Alpha” or “Beta”. Participants classified a total of 81 items sampled along a 9x9 grid, including the members of the Alpha and Beta categories (randomly intermixed). These data were, however, collected to address a separate set of questions, and we do not discuss them in this paper.

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