

Fading in the face of a non-category: Generalization of reward depends on the category label

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Background

- Only recently, reward conditioned generalization on a continuous dimension has been studied in humans (Lee et al., 2018).
- Just as generalization in associative learning is similarity based (ref. Shepard, 1987), similarity based generalization is also at the core of many categorization models (e.g. Nosofsky 1986).
- However, it has not yet been investigated, how reward magnitude (the amount of payoff) influences generalization. One could expect a stronger response strength for high reward stimuli and a narrower generalization (as found by Kahnt et al., 2012).
- Categorization however, has different faces: Classical A/B (two category) tasks, but also A/non-A (one category) tasks are used throughout the literature. Hendrickson et al. (2019) found differences in generalization for a category sample size manipulation dependent on whether participants completed a one category or a two category task. Similarly, we expect differences in generalization depending on the category label the stimulus is associated with.

Method

- Reward magnitude was manipulated on 3 levels: high vs. low, medium vs. low and equal (low). The categorization task completed was either a one category task (A / Non-A) or a two category task (A / B).
- In 20 training trials, participants (N=473) had to categorize two stimuli by indicating a category label and were rewarded with a high or low reward for correct decisions.
- In the test phase, they were given a wider range of objects for which they had to indicate their reward expectation. In a second question, that depended on the answer to the first, they either categorized the reward (high/low) they expected or in case of no reward expectation or equal reward indicated the category membership (A/B/Non-A) of the presented object.

Fig 1. Hypotheses depiction

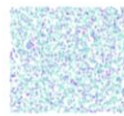
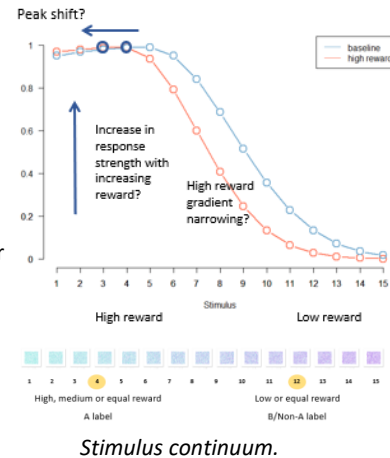


Fig 2. Example categorization trial.

Feedback & Questions? Discuss with me!

<https://uni-bremen.zoom.us/j/97196439413?pwd=Znc4d1hHamdrU3NMmc3plb1V4NThQZz09>

Reward expectation depends on the category label

- Unexpectedly, three subgroups in reward expectation were found (Fig. 3): A group that always expected reward (1), a group that expected reward around the training stimuli (2) and a group that did not expect reward around the Non-A/B stimulus (3).
- 80% of participants with response pattern 3 completed the one category task. Thus, for a subgroup, reward generalization is dependent on a carrying category.

Generalization broadens without unique feature association

- Categorization generally follows relational rules and is accurate within these (Subgroup 1 and 2).
- However, Participants of subgroup 2 miscategorize low rewarded stimuli in the high reward condition.
- Participants of subgroup 3 show a gradient widening (beyond the center boundary stimulus), here, category A/high reward categorization becomes fuzzy and broadens. This effect is especially evident in the baseline, where equal rewards did not allow for further discrimination.

Fig 3. Response patterns in reward expectation.

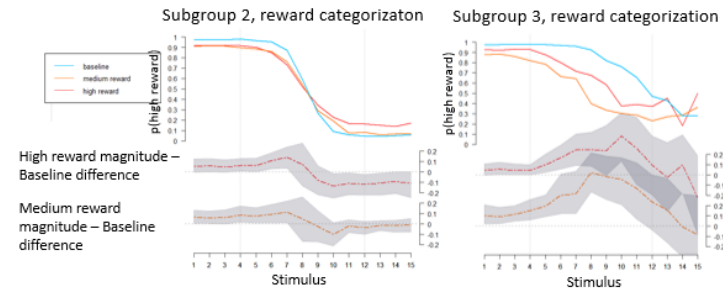
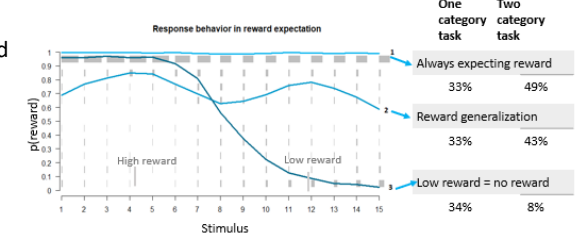


Fig 4. High reward generalization by reward condition.

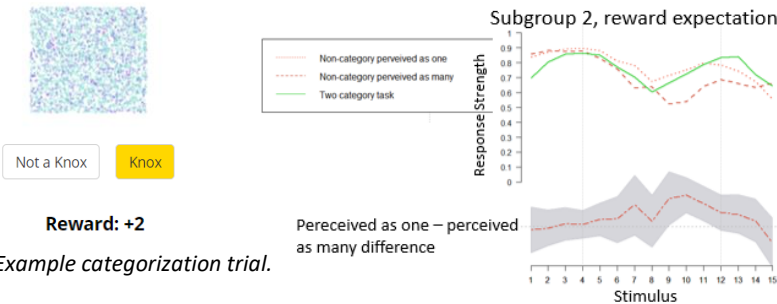


Fig 5. Reward expectation in the two category task and the one category task, with Non-A being perceived as one or many categories

The Non-A category cannot hold

- How do participants imagine the non-category? This may influence response behavior strongly. The non-category may be perceived as diffuse because participants think of it as being fragmented and consisting of many categories. Indeed, 38% of participants in the one category task perceive the Non-category as consisting of 2 or more categories. Reward expectation is lowered for a fragmented category.

Outlook: Our next experiment manipulates Non-A perception to substantiate results and further investigate the influence of Non-A on generalization.

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