

# Exaggeration of Stimulus Attributes in the Representation of Relational Categories

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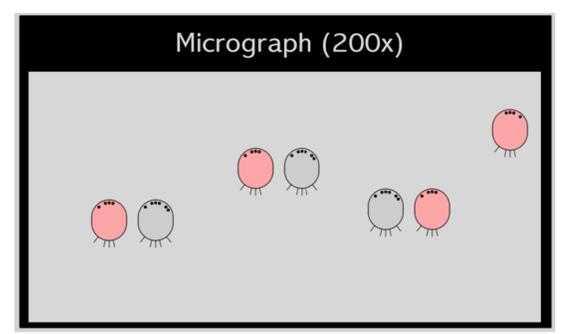
## Motivation

A central goal of the present study is to explore how featural categories are represented differently from relational categories.

Earlier work has suggested an *extreme-value hypothesis*: when a category is defined in relation, exemplars with exaggerated values along this stimulus dimension are judged as better members of the category. Featural categories, on the other hand, are not exaggerated. One limitation of the previous studies was using a poorly suited dependent measure to test the goodness of given extreme exemplars, rather than the degree of exaggeration of encoded attributes. In the present study, we created a novel task to measure directly the degree of representational exaggeration.

## Training Phase

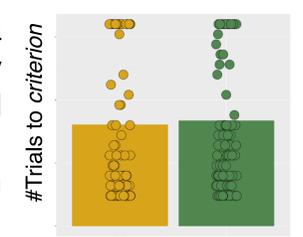
**Task:** A classic two-category classification task - whether the micrograph reflects disease Azolitis (A) or Leporidis (L)?



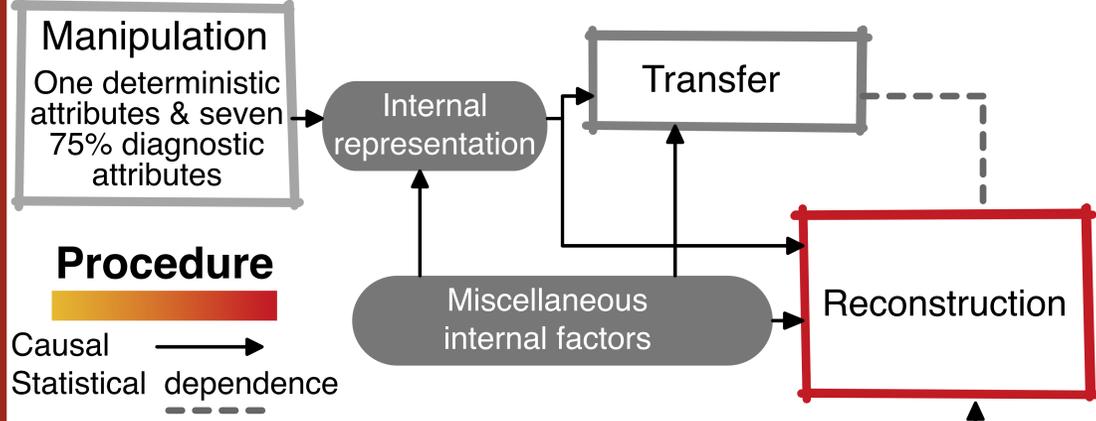
311 OSU students were recruited. Each subject was randomly assigned to one subgroup, in which one **relation** OR one **feature** was deterministic (100% diagnostic of the correct disease), while other relations and features were non-informative.

E.g., in the subgroup defined by **feature** in #cells, any micrograph with **four** diseased (pink) cells reflects Azolitis (as shown in the pic), while any micrograph with **eight** diseased cells reflects Leporidis; in the subgroup defined by **relation** in D1, any micrograph with **more** diseased cells than healthy cells (grey) reflects Azolitis, otherwise reflects Leporidis.

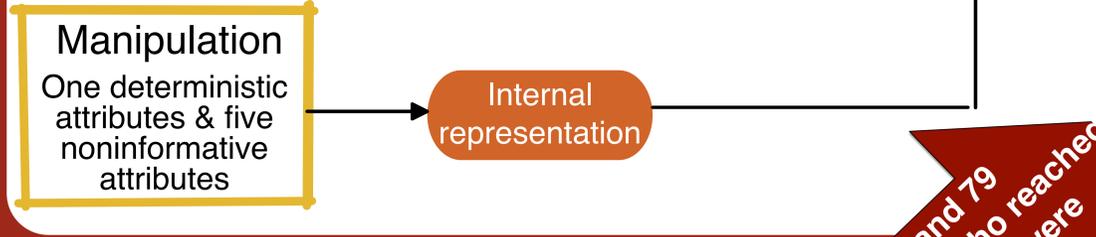
Trials were organized in blocks of 16. Subjects were required to correctly diagnose at least 15 out of 16 in a row of two blocks to reach the *criterion*. Otherwise, they would run through all 320 trials. Subjects who failed were treated as if they reached it on the last trial. No significant difference was found between **relation** and **feature** groups.



Previous experiment in Du et al., (2021): quasi-experimental design

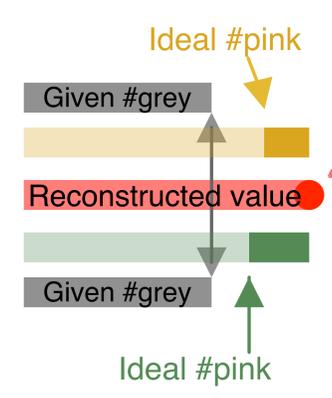
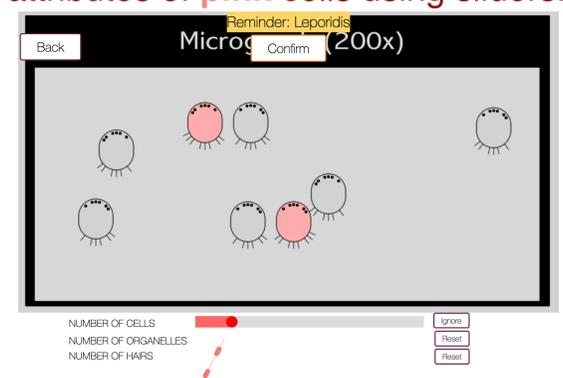


Present experiment: true experimental design



## Reconstruction Phase

**Task:** construct a good member of Azolitis or Leporidis by adjusting the attributes of pink cells using sliders.

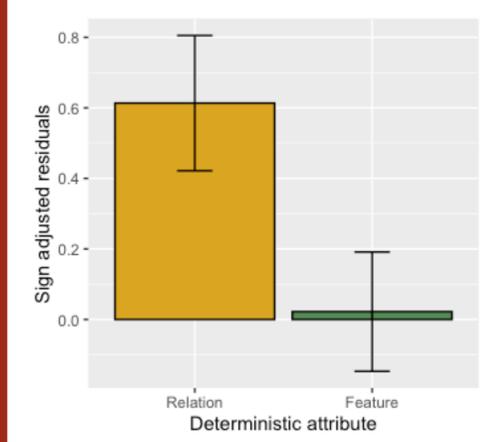


Given trained features and relations were based on different measures, we defined different ideal values as zero degrees of exaggeration for relation (calculate Michelson contrast to make sure ideal differences were within the range of trained differences) and feature (i.e., 4 or 8).

Then we defined the measure of main interest: *sign adjusted residuals*, the differences between reconstructed and ideal values, to illustrate the degree of exaggeration

Only 71 and 79 subjects who reached the criterion were considered in reconstruction

## Results & Conclusion



- We replicate and reinforce our earlier results, supporting the extreme-value hypothesis. Concretely, participants who spontaneously chose a relational categorization strategy or were experimentally induced to adopt one tended to exaggerate the task-relevant stimulus dimension.
- Overall, the evidence obtained using our novel reconstruction task adds to the literature suggesting that the representation of at least some relational categories is different from that of featural categories.

**References:**

- Barsalou, L. W. (1985). Ideals, central tendency, and frequency of instantiation as determinants of graded structure in categories. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 11(4), 629-654.
- Du, A. Y., Hummel, J. E., & Petrov A. A. (2021). Probing the Mental Representation of Relation-Defined Categories. In T. Fitch, C. Lamm, H. Leder, & K. Tessmar-Raible (Eds.) (2021). Proceedings of the 43rd Annual Meeting of the Cognitive Science Society (pp. 2024-2030). Vienna, Austria.
- Gentner, D. & Kurtz, K. J. (2005). Relational categories. In W. K. Ahn, R. I. Goldstone, B. C. Love, A. B. Markman, & P. W. Wolff (Eds.) *Categorization inside and outside the laboratory*. Washington, DC: APA.
- Kittur, A., Holyoak, K. J., & Hummel, J. E. (2006). Ideals aren't always typical: Dissociating goodness-of-exemplar from typicality judgments. In R. Sun & N. Miyake (Eds.), *Proc. Of the 28th Annual Conference of the Cognitive Science Society* (pp. 429-434). Mahwah, NJ: Erlbaum.