Category Knowledge Facilitates Value-Based Decisions

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Introduction

- We effortlessly learn the value of visual cues in the environment through trial and error and organize these cues into categories.
- However, questions remain about how and whether learned value is applied to new cues.
- Here we explore how categories are learned and used to guide choices.

Methods

Participants: 100 American adults recruited on Amazon MTurk.
Experimental paradigm:

Stimuli

- 84 paintings across galleries of 6 [1]
- All paintings in the **same gallery** were by the **same artist**

Category training – group level

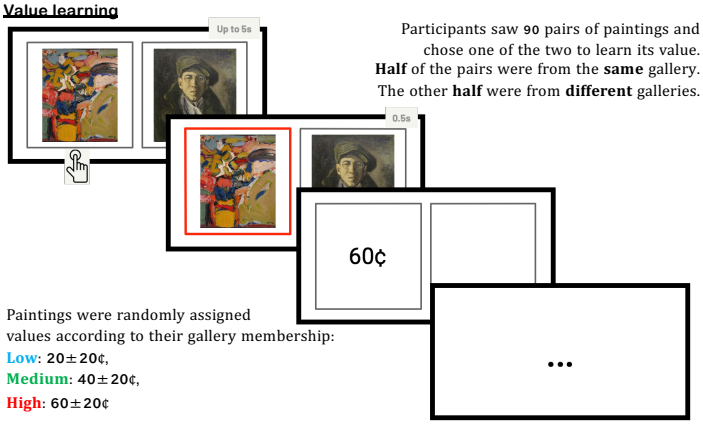
Participants learned gallery membership of paintings through trial and error

Three galleries of six paintings each were shown one at a time for up to 10s, repeated five times. Participants indicated the gallery membership and received feedback on their response.

Category training – item level

To further consolidate their knowledge of a painting's gallery membership, participants saw each painting one at a time for up to 3s and indicated its gallery membership (72 trials). They received feedback on their response.

Value learning

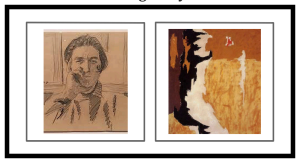


Participants saw 90 pairs of paintings and chose one of the two to learn its value. **Half** of the pairs were from the **same** gallery. The other **half** were from **different** galleries.

Paintings were randomly assigned values according to their gallery membership:
Low: 20±20¢,
Medium: 40±20¢,
High: 60±20¢

Generalization test

Within gallery choice



45 pairs of **novel** paintings by the **same** artist

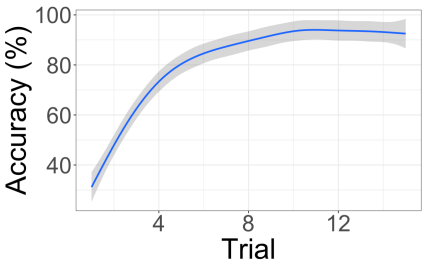
Between gallery choice

45 pairs of **novel** paintings by **different** artists

Participants saw pairs of **novel**, **never-before-seen** paintings and had to choose the higher-valued ones. To prevent further learning, they did not receive feedback on their decisions. Since all novel paintings were works of the **same artists as during training**, they could use their prior category and value knowledge to guide decisions here.

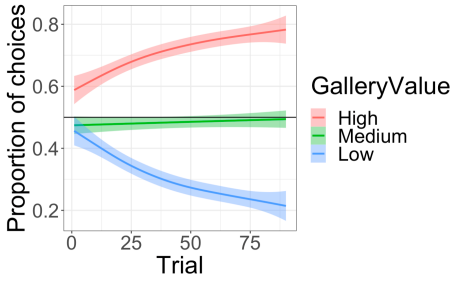
Results

Training



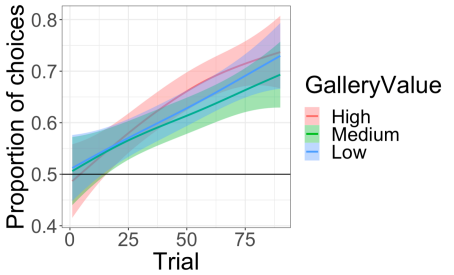
Participants learned gallery membership of paintings

Plot shows the group-averaged percent accuracy (y-axis) of identifying the correct gallery membership of paintings over the course of group-level category learning (trials, x-axis). The blue line is the smoothed moving average and the surrounding grey ribbon is the SEM.



Participants learned the values of each gallery

Plot shows the proportion of choices (y-axis) that participants on average chose paintings from each gallery (high-valued=red, medium=green, low-blue) over successive trials (x-axis). Each line shows the smoothed moving average and ribbons are the SEM. Sum of choice proportions > 1 as choices are between 2 of 3 galleries.



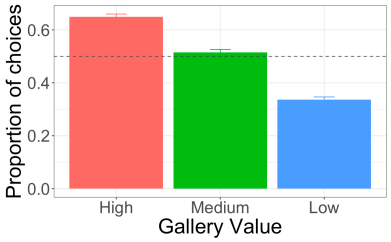
Participants chose paintings of higher value *regardless of gallery value*

Plot shows the proportion of choices (y-axis) that participants on average chose the higher-valued painting from each gallery over successive trials (x-axis). Lines show smoothed moving averages and ribbons indicate the SEM

Testing

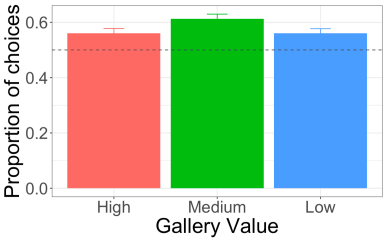
Participants generalized category and value knowledge to guide decisions on novel paintings

Plot shows the proportion of choices (y-axis) that participants on average chose paintings from each gallery (x-axis). Error bars indicate SEM.



Participants generalized learned knowledge to choose higher-valued paintings novel *regardless of gallery value*

Plot shows the proportion of choices (y-axis) that participants on average chose the higher-valued painting from each gallery (x-axis). Error bars indicate SEM.



Discussion

- Category knowledge is useful for value-based decision making
  - Usage of pre-computed average values for efficient decisions
  - Category value is generalizable to novel situations
- Future work may explore the nature of representations that underlie category-guided value-based decision making

References
[1] Durkin, C., Hartnett, E., Shohamy, D., & Kandel, E. R. (2020). An objective evaluation of the beholder's response to abstract and figurative art based on construal level theory. *Proceedings of the National Academy of Sciences*, 117(33), 19809-19815. Chicago

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