Value-Directed Memory Encoding Alters Goal-Directed Attention: A Comparison of Value-directed and Memory-directed Encoding

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Introduction

- We encounter a virtually infinite amount of information daily
- Given capacity limits of the central nervous system, important information must be selected, prioritized, and remembered over unimportant information[1]
- One way this can be tested is through value-directed remembering (VDR) paradigms
- These paradigms typically assign values or monetary rewards to stimuli. Participants try to remember the higher value stimuli in order to maximize their scores[2] (e.g. **DOG $1.00 … HOUSE $0.01**)
- Higher-valued stimuli are better remembered than lower-valued stimuli[3]
- Despite these established paradigms, most published research has never provided a control condition. Therefore, we do not know whether value directed encoding works by increasing memory for high-value, suppressing memory for low-value, or both

Value-directed encoding
Memory-directed encoding

- C1: HV = Control, LV < Control
  -Selective ignoring/forgetting of LV
- C2: HV > Control, LV < Control
  -Increased attention allocation/strategy selection; Selective ignoring/forgetting of LV
- C3: HV > Control, LV = Control
  -Increased attention allocation/strategy selection

The current study examines how high- and low-value items are selectively encoded compared to prototypical memory encoding, as well as how these encoding processes influence participants' subjective reports of being on task.

Experiment 1

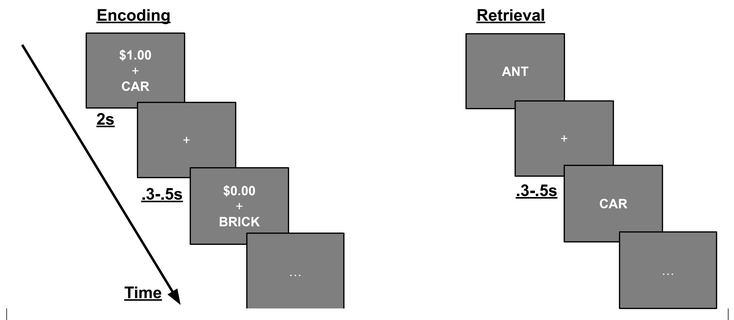
37 Participants (5 removed HR < 0.5, 2 removed +/- 2 SD D-Prime)

Study phase: 40 nouns randomly assigned a high-value ($1.00) or low-value ($0.00), presented randomly

Test phase: 80 words, including all 40 from the study phase, self paced responses

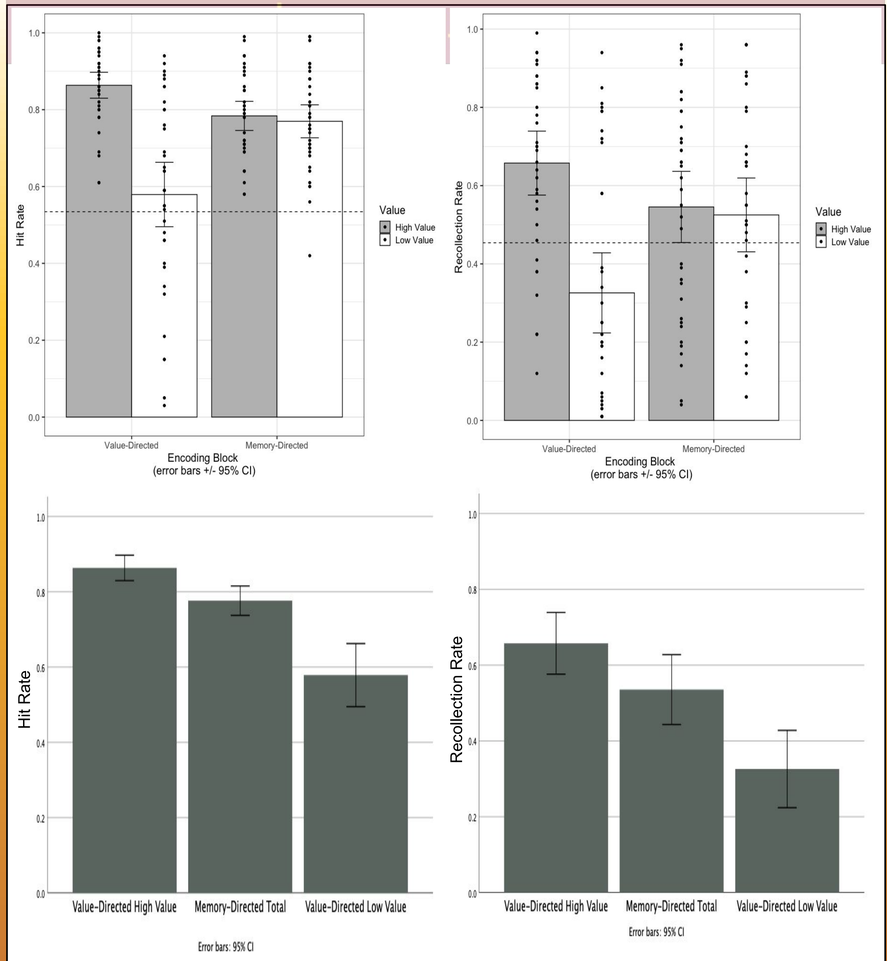
Response options: *Definitely New, Maybe New, Maybe Know, Definitely Know, Remember*

Study and test phase 1 block, 8 blocks completed (4 Value-directed encoding and 4 Memory-directed encoding, with one always following the other)



Alternating blocks of Value-directed and Memory-directed encoding (ignore values, maximize total items remembered)

Experiment 1 Results



- Higher hit-rate for high-value items in value-directed encoding, $F(1,36) = 49.67$, p<.001; no difference in memory-directed encoding. Same pattern for recollection, $F(1,36) = 57.22$, p<.001
- Memory for high-value items in value-directed encoding was better than pooled memory in memory directed-encoding, $t(36) = 5.73$, p<.001; low-value items in value-directed encoding remembered worse

Experiment 2

185 participants (10 removed Hit Rate < 0.5, 1 Value-directed Hit Rate < 0.5, 9 Memory-directed Hit Rate < 0.5, 1 False-Alarm Rate > 0.9, 2 +/- 2 SD D-Prime)

Replication of Experiment 1 with the following changes:

- Data collected online due to COVID-19

- Items randomly assigned either a high-value ($1.00) or low-value ($0.01)

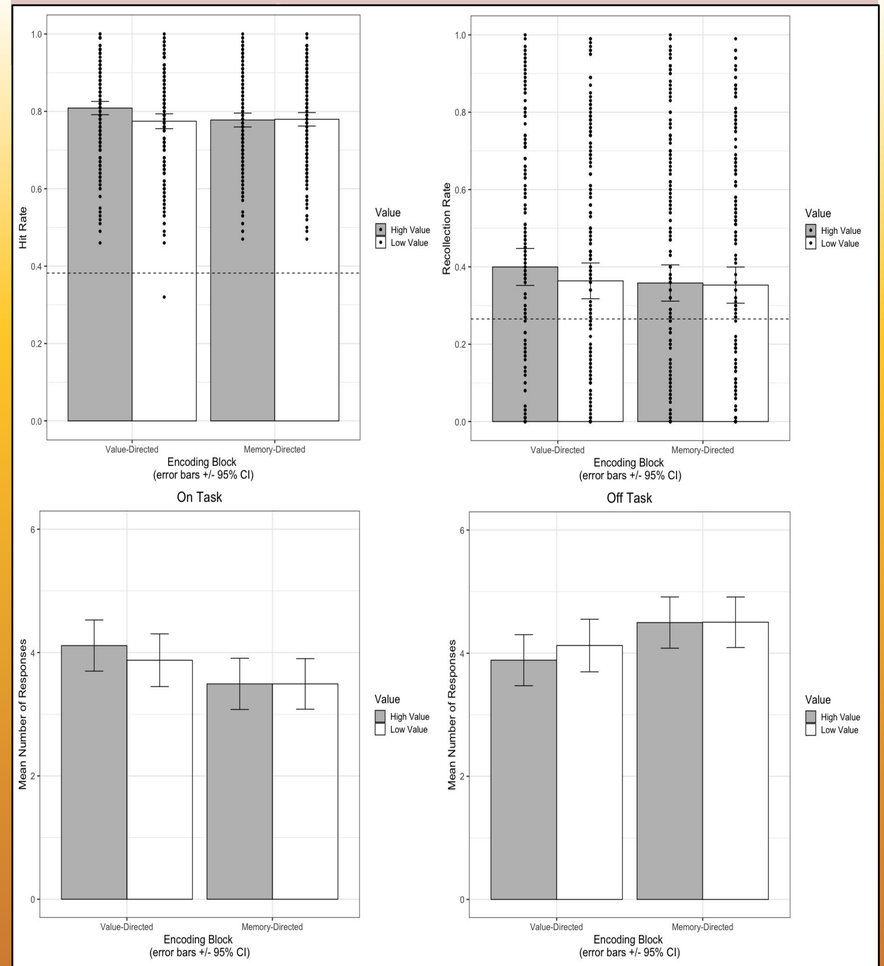
- Thought probes during encoding (4 per block; 2 following high-value item, 2 following low-value item), pseudorandom intervals

- Thought probe question and response options:

- What were you thinking about in the few seconds preceding this screen?

1) I was focused on the current task 2) I was thinking about my performance on the task ***3) I was thinking about sights/sounds in my environment 4) I was thinking about things unrelated to the task 5) My mind was blank***

Experiment 2 Results



- Higher hit-rate for high-value items in value-directed encoding, $F(1,184) = 23.17$, p<.001; no difference in memory-directed encoding. Same pattern for recollection, $F(1,184) = 21.83$ p<.001
- More on task reports , $F(1,184) = 27.15$, p<.05, and fewer off task reports, $F(1,184) = 26.35$, p<.05, in value-directed encoding, compared to memory directed encoding.

Conclusion

Experiment 1:
- The effects of value were seen in hit-rate and recollection in Value-directed encoding and there were no differences in performance in Memory-directed encoding.
- Importantly, high-value items in Value-directed encoding were remembered better than the overall memory performance in Memory-directed encoding.
- These findings suggest how value may lead to deeper encoding.

Experiment 2:
- Similar effects of value on memory from Experiment 1 were observed in Experiment 2.
- For the added thought probes, more on-task and fewer off-task subjective reports in the Value-directed encoding condition provides evidence for how value modulates memory and augments attentional processes.

References

1. Broadbent, D.E. (1958). Perception and Communication. *Pergamon Press.*

2. Watkins, M.J., Bloom, & Bloom, L.C. (1999). Selectivity in Memory: An exploration of willful control over the remembering process. *Unpublished manuscript.*

3. Castel, A.D., Benjamin, A.S., Craik, F.L., & Watkins, M.J. (2002). The effects of aging on selectivity and control in short-term recall. *Memory & Cognition, 30(7), 1078-1085.*