The effects of real-world novelty exposure on episodic memory specificity across development

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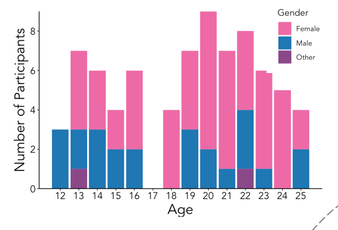
Background

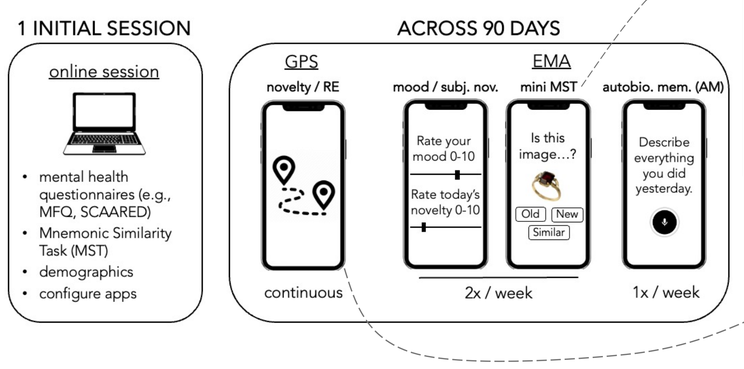
- Autobiographical memory (AM), or the ability to recall the specific details of one's own past through "mental time travel"[1] is at the core of human identity[2]
- Deficits in memory appear in depression[3] and anxiety[4], which tend to emerge in childhood and adolescence[5]
- Across development, there is improvement in the specificity of memory[6], as well as increased exposure to novelty in the real world[7]
- **How do day-to-day fluctuations in novelty exposure modulate autobiographical or task-based memory specificity? Does this relationship vary with age and relate to mental health measures?**

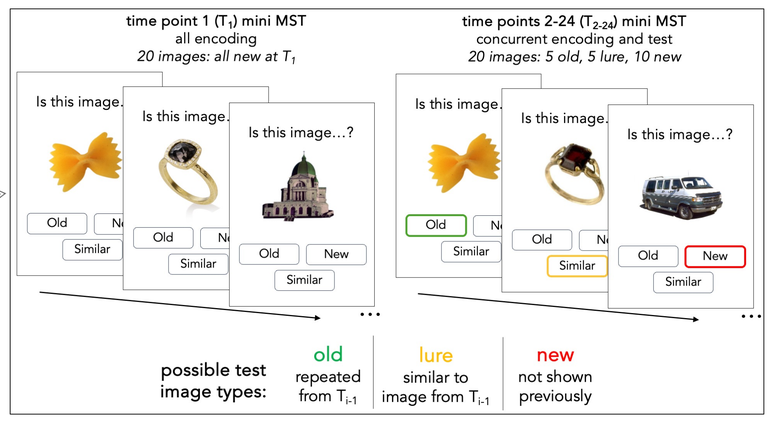
Study Design and Tasks

Participants

- N=76 of goal 120
- Age 12-25
- Greater NYC area







GPS novelty: number of novel latitude-longitude coordinates visited on a given day (not previously visited in the study window; first 10 days of data held out)

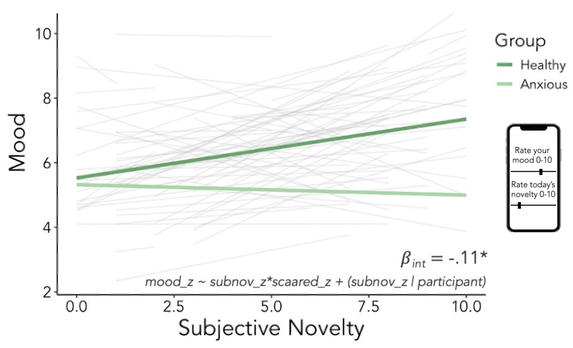
GPS roaming entropy (RE): p_{ij} is the within-day historical probability that location *j* was visited by participant *i and n* is the total number of unique locations in the environment, at a GPS resolution of 4 decimal degrees

$$RE = \sum_{j=1}^{n} (p_{ij} \times (\log_2 p_{ij})) / \log(n)$$

Results

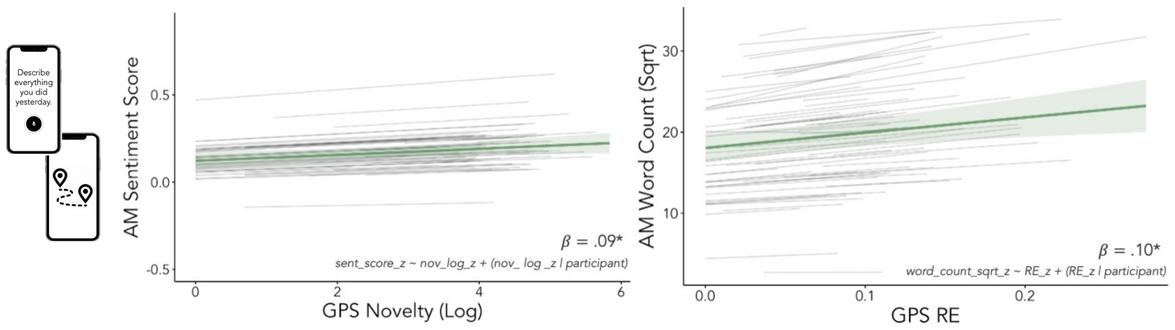
Mood is influenced by subjective daily novelty and mental health

Participants below the clinical cut-off for anxiety according to the SCA(A)RED had better mood on days with higher subjectively reported novelty. This effect was not present for those with high anxiety. *$p < .05$

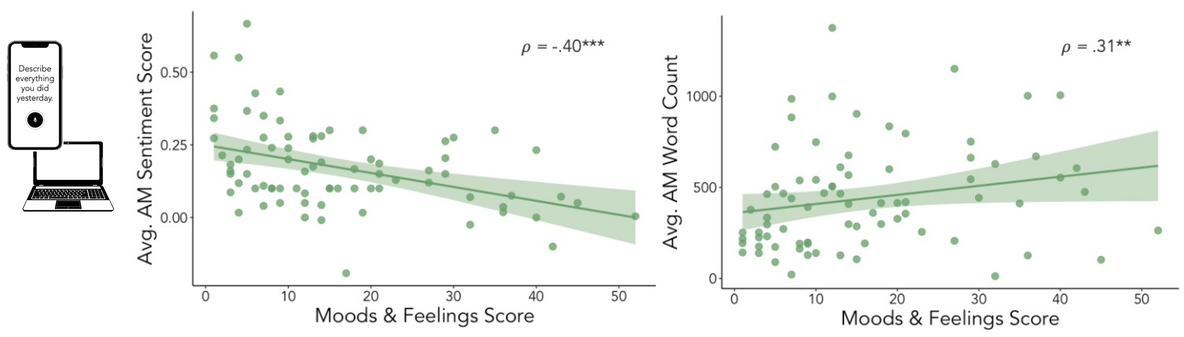


Autobiographical memory (AM) is influenced by real-world novelty/exploration and mental health

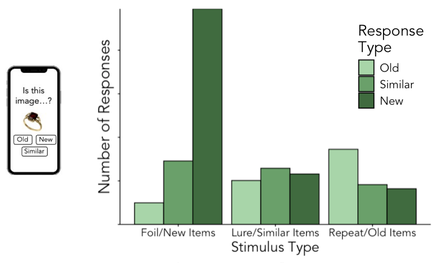
(Below) AM sentiment is more positive on days with greater GPS novelty (left). AM word count is higher on days with greater GPS RE (right). *$p < .05$



(Below) For participants who are more depressed and anxious, AM sentiment is more negative (left) and AM word count is higher (right). ***$p < .001$, **$p < .01$



Task-based (mini MST) response distribution and model

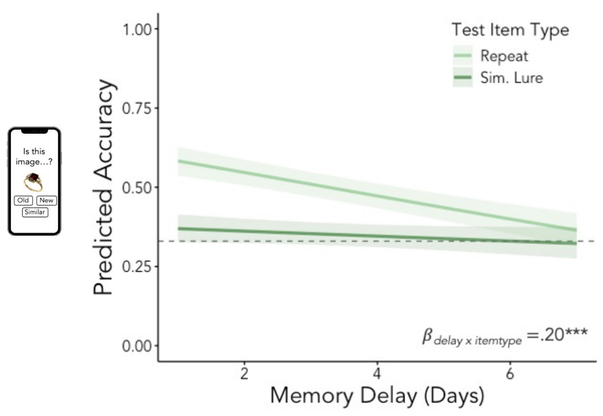


Distribution of participant responses to each item type.

We modeled the task-based memory data as follows, with only lure and repeat items in the model, and where an accurate response consists of "old" to repeat items and "similar" to lures:

accuracy ~
*age_z * item_type_z * log_novelty_enc_z * log_novelty_retr_z + (1 | participant)*

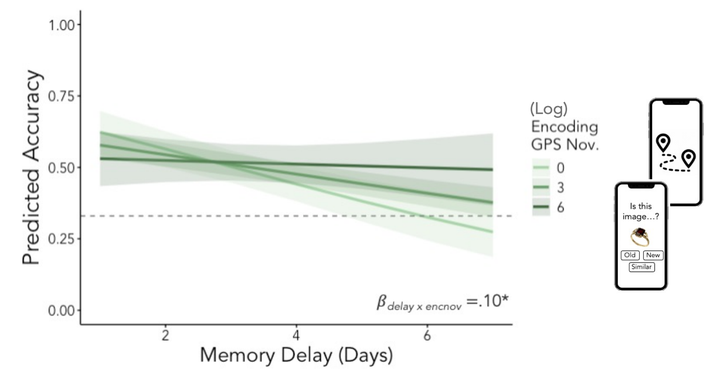
Task-based specific vs. general memory is differentially influenced by delay



Memory performance decays with time (β = -.27, $p < .001$), which is driven by decreased performance in identifying repeated items correctly as "old", whereas identifying lure items as "similar" is not significantly affected by delay (β_{int} = -.20, $p < .001$).

Task-based memory benefits from real-world novelty

Memory performance decays with time for items encoded on days low in real-world novelty, but is protected from decay if the tested item was encoded on a day high in real-world novelty (β_{int} = -.10, $p < .05$).



Conclusion & Future Directions

Task-based and autobiographical memory collected via EMA are impacted by mental health and real-world exploration & novelty exposure, measured by GPS & self-report

- What is the effect of novelty on the level of episodic detail in autobiographical memory?
- How are error rates in task-based memory impacted by novelty at encoding/retrieval?
- How do time of year, day of the week, and weather impact novelty effects on memory?
- Are there any age effects in the types of novelty experienced or the influence of novelty on memory?

References, Contact, & Funding

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