

Predictable stimulus onsets improve memory

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Introduction

- Does knowing when the next stimulus will come improve memory for that stimulus?
- Variable ISIs are used in neuroimaging studies
- Self-directed learners benefit even from simply choosing their ISI—relative to yoked learners who were given the random (to them) ISIs (Markant et al. 2014)
- Is it knowing when the next stimulus will appear, or the act of choosing? Decouple choosing & predictability

Experiment 1: Online

Participants: 143 workers on Amazon Mechanical Turk.

Procedure:

- Recognition memory task: study 60 strange objects for 750ms each



- Yes/no recognition test on the 60 old + 60 novel items
- Three between-subject study conditions varying the distribution of three ISI durations (short: 500, medium: 2000, or long: 4000ms):

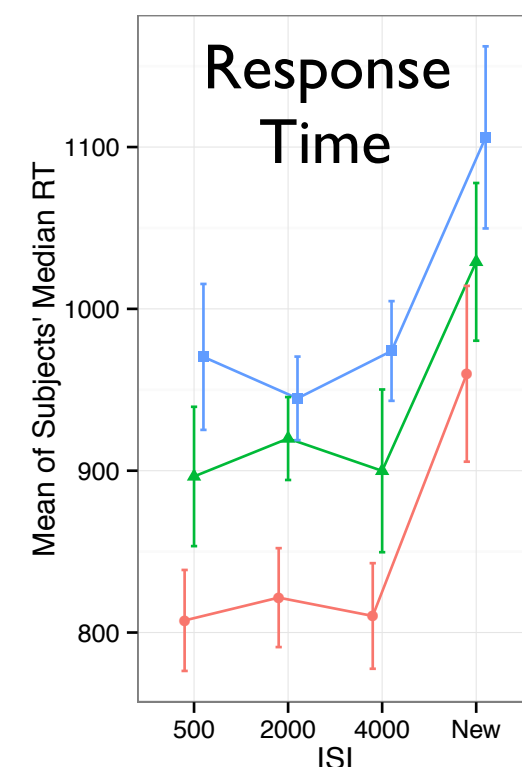
- **Blocked:** 20 consecutive items at same ISI (random block order), e.g.: [SS..SMM..MLL..L]
- **Random:** completely randomized ISI order, e.g. [SSMSLSMML..]
- **Rhythmic:** interleaved, e.g.: [SMLSMLSML..] (random ISI order)

- Same total duration of study: 20 items at each ISI (175 seconds)

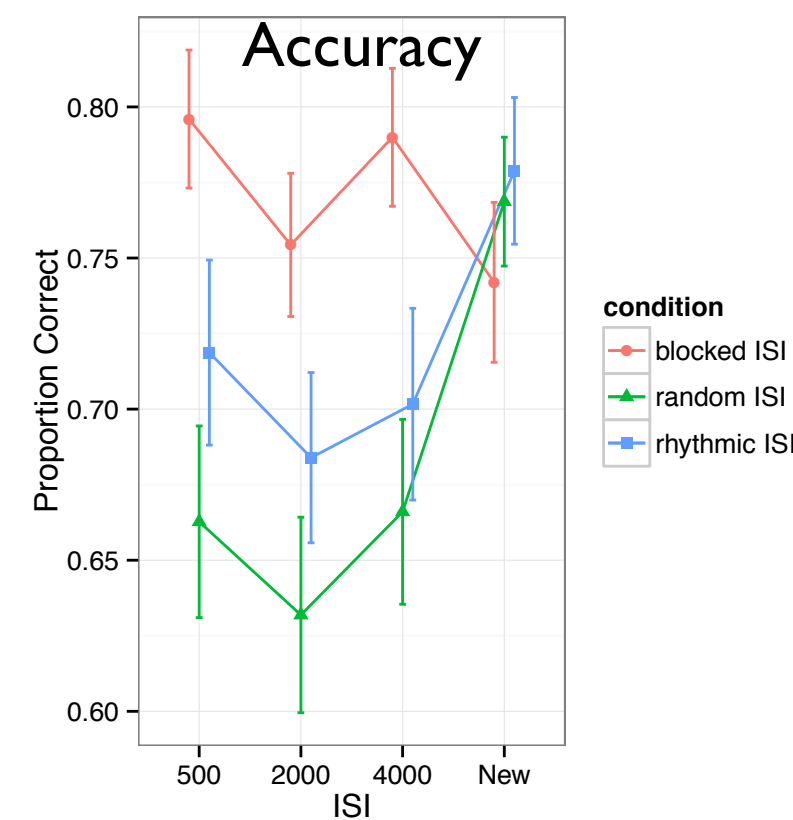
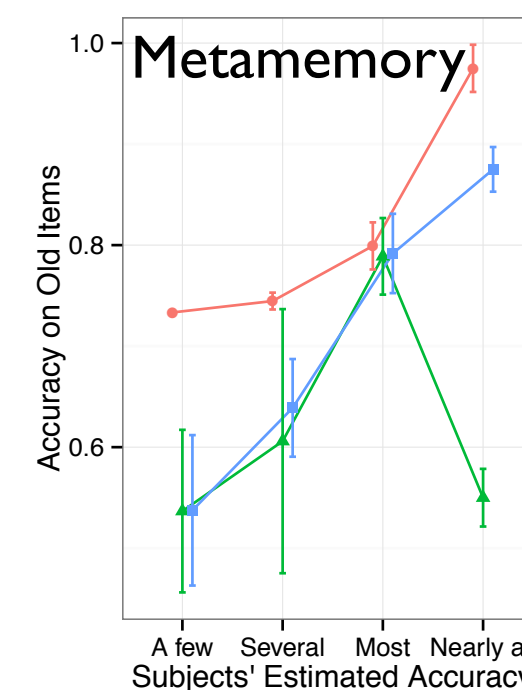
- Subjects per condition: 46 blocked, 52 random, 45 rhythmic

Experiment 1 Results

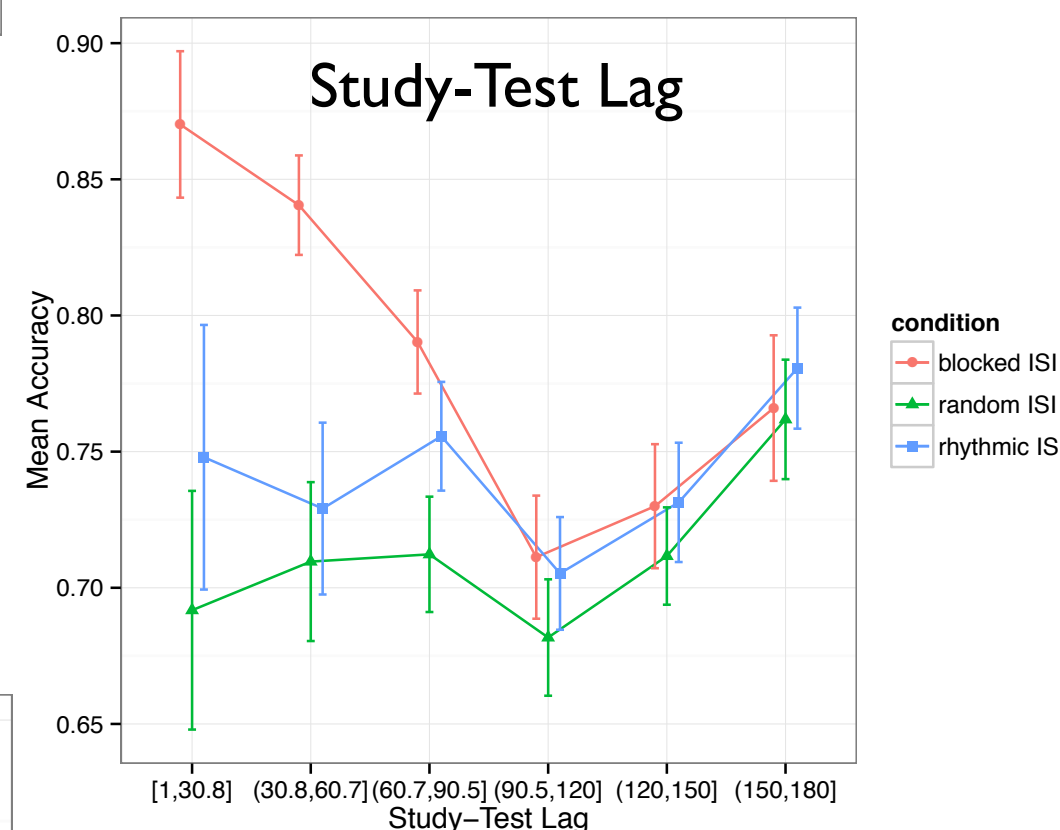
- LMER: **rhythmic** (OR: .64) and **random** (OR: .47) significantly worse than **blocked** ISI
- ISI before this stim is better predictor than next stim
- Accuracy on 2000ms ISI less than 500ms—why?



- All conditions show a modest primacy benefit
- **Blocked-ISI** benefits from recency (context that becomes hard to retrieve?)



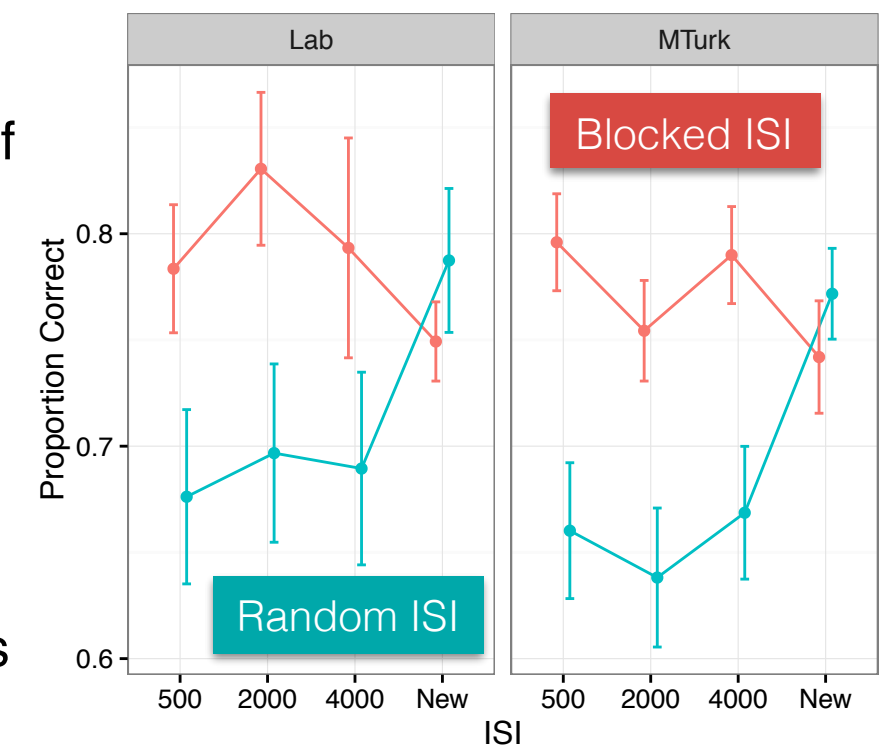
- Response times also show the **blocked** ISI advantage
- **blocked** (850 ms) less than **random** (936 ms) or **rhythmic** (999 ms)



- Asked how many items they thought they remembered correctly on a 6-point scale ranging from “None” to “All”
- Sig. correlated with their hit rates ($r=.43$), but higher in **rhythmic** (.6) and **blocked** (.39) than **random** (.28)

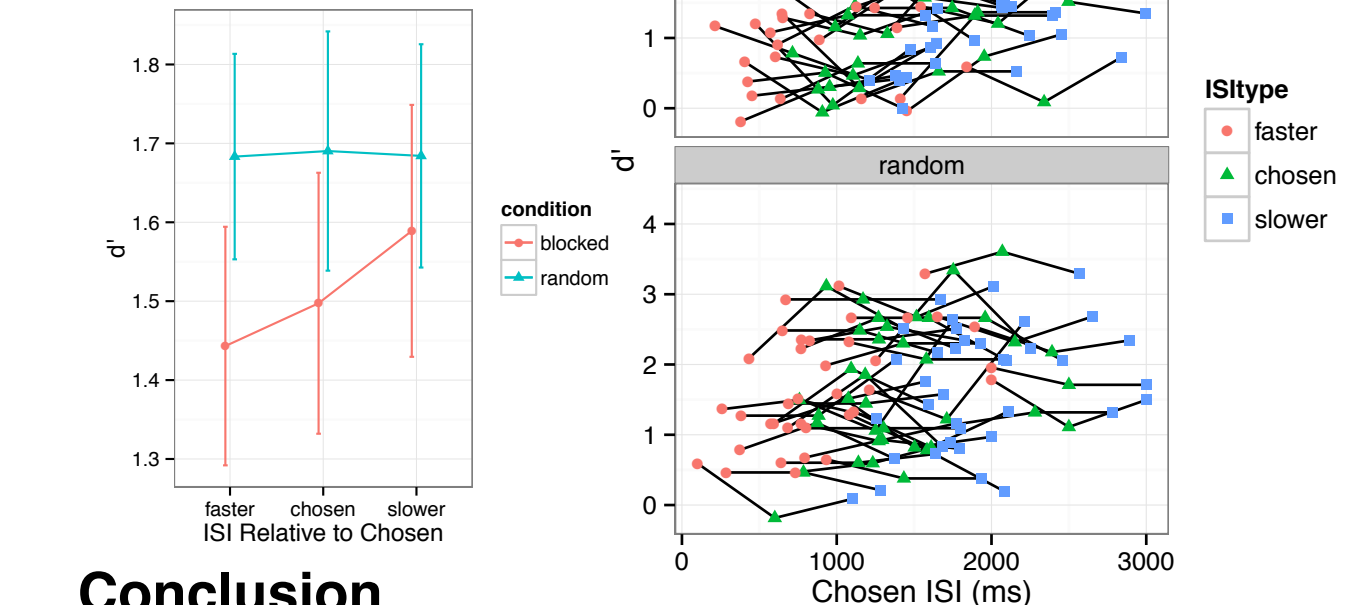
Experiment 2: Replicate in Lab

- 36 subjects
- Similar levels of performance
- Same main effect, but no 2000ms dip
- Robust advantage for predictable ISIs



Experiment 3: Preferred ISI?

- Ss told they could control how quickly some of the stimuli would appear—like controlling how fast a lecture is delivered.
- Given a slider: 600 - 2500ms (default 1500) and saw a randomly-colored square flash at chosen ISI
- Studied 20 items at their **chosen** ISI, 20 500ms **faster**, and 20 500ms **slower**—random or blocked
- Mean and median chosen ISI: ~1400ms
- No consistent effect, but random doesn't hurt: 500ms doesn't matter?



Conclusion

- Predictable stimulus onset times improve memory
- Memory experiments on MTurk are feasible—just tell them not to cheat, and then ask if they did)

References

1. Markant, D.B., Dubrow, S., Davachi, L., and Gureckis, T.M. (2014). Deconstructing the effect of self-directed learning on episodic memory. *Memory, & Cognition*.