How does the fMRI scanning environment affect criterion shifting?

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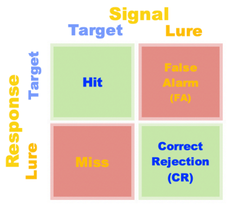
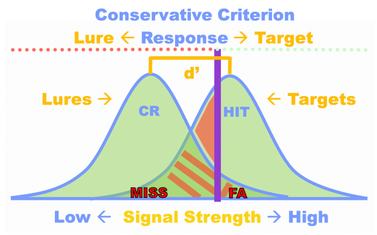
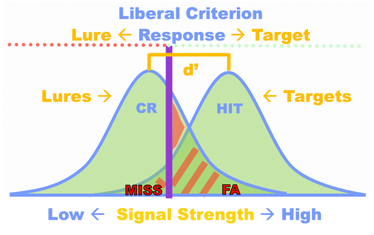
Background



- Signal Detection Theory: Examines discriminability between targets and lures
  d' = Z(Hit rate) – Z(FA rate).[1]
  - Decision criterion: (bias toward responding "target" or "lure"):
    c = -0.5 x [Z(Hit rate) + Z(FA rate)]
  - Criterion shift = c(conservative) – c(liberal)



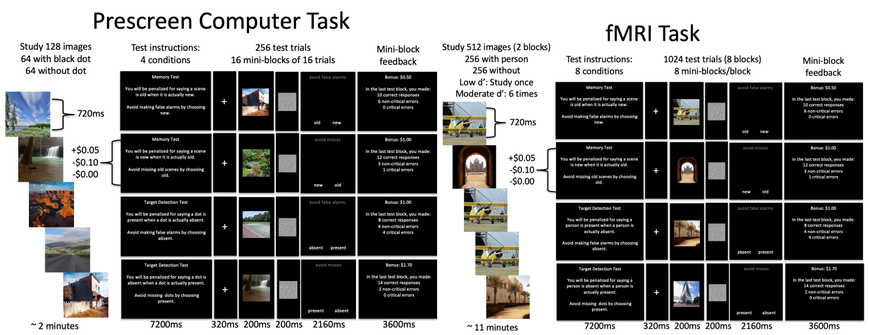


- **Question**: *Does the fMRI scanning environment weaken criterion shifting stability?*
  - These between-subjects studies aimed to evaluate the stability of criterion shifting across recognition memory and visual perception domains both at a computer and during neuroimaging collection inside an MRI scanner.
  - Explore how the fMRI scanning environment may disrupt the stability of criterion shifting.
- **Hypothesis**: The fMRI scanning environment will weaken the stability of an individual's decision criterion shift.

Methods

Recognition memory and visual perception task

- Study condition: Participants initially studied scene images that either contained a person or not.
- Testing condition: participants made recognition (scene studied or not) and perceptual (person present or absent) judgments.
- Manipulation:
  - *Positive:* criterion shift influenced by awarding 5 cents for correct responses while only penalizing one of two error types
  - *Negative:* lost 10 cents for false alarms (FA; conservative condition) or misses (liberal condition). In the scanner, participants performed a longer version of the task (4 times as many test trials with longer study sessions).



Methods Continued

First study (MP1)

Young adults (*N* = 30), who attend University of California, Santa Barbara and sufficiently shifted decision criteria during a prescreening task, and then were tested in a 3T Prisma MRI scanner.

Second study (MP2)

Participants (N = 30) conducted the same task as study 1; however, outside the MRI scanner.

Results: Study #1

Study 1 Findings

Figure 1

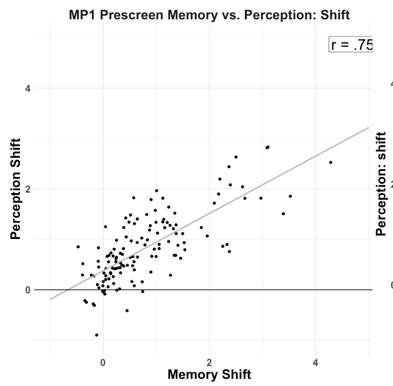


Figure 2

Figure 3

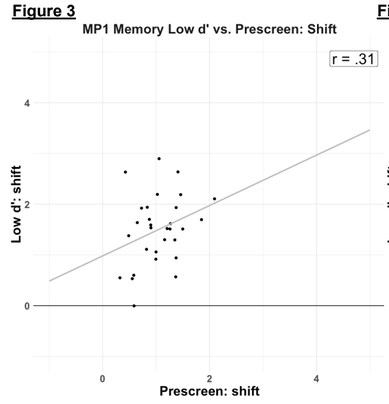
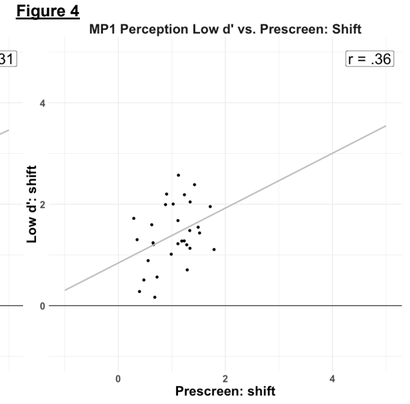


Figure 4



- A strong relationship existed between the degree participants shifted decision criteria between a visual detection task (perception) and a recognition memory task (memory) for both the prescreen and fMRI tasks
- Criterion shift stability remained weaker between parts 1 and 2 for both recognition and perceptual judgments.

Results: Study #2

- Again, criterion shifting remained high across decision domains for the prescreen and fMRI study. However, there continued to be a weaker relationship between parts 1 and 2 for both recognition and perceptual judgments.

Results: Study #2 Continued

Figure 1

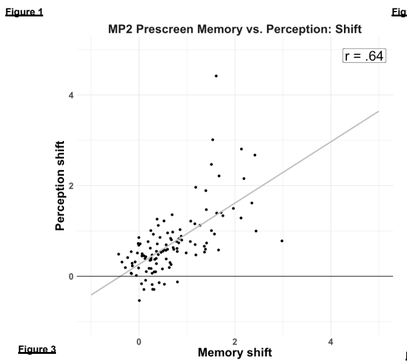


Figure 2

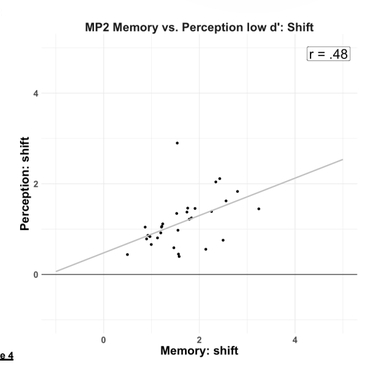


Figure 3

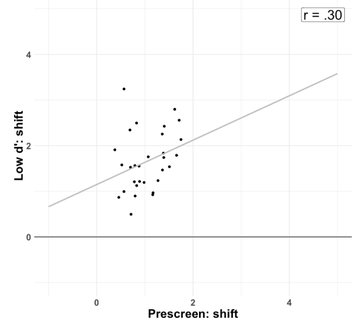
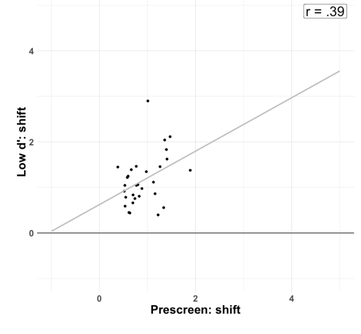


Figure 4



Conclusion

- Contrary to our prediction, the scanner environment did not greatly impact criterion shifting stability.
- The demands of the shortened prescreen task versus the longer fMRI task may have weakened criterion shift stability, not the fMRI scanning environment itself.

Future directions

- How do differing task demands affect criterion shifting?
- How do people set a baseline decision criterion when the consequences of a false alarm and miss are equal or unknown?
- What are the neural mechanisms that underlie shifting and maintaining a decision criterion
- Many fMRI studies require participants to make explicit decisions even when decision-making is NOT the cognitive process of interest. Does a person's decision criterion bias such fMRI results?

References

1. Green, D. M., & Swets, J. A. (1966). Signal detection theory and psychophysics. Oxford, England: John Wiley.

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