

Voluntary temporal attention improves perception even in the absence of temporal competition

Jennifer Motzer, Karen Tian & Rachel Denison

Department of Psychological & Brain Sciences, Boston University

Background

- Perception can be impaired when successive stimuli appear close together in time, demonstrating **temporal competition** for representational resources¹⁻²
- Voluntary temporal attention** can enhance the perception of a stimulus at a relevant moment in time at the expense of earlier and later stimuli³⁻⁵
- Determining whether these perceptual trade-offs require temporal competition would provide insight into the mechanisms of selection by voluntary temporal attention

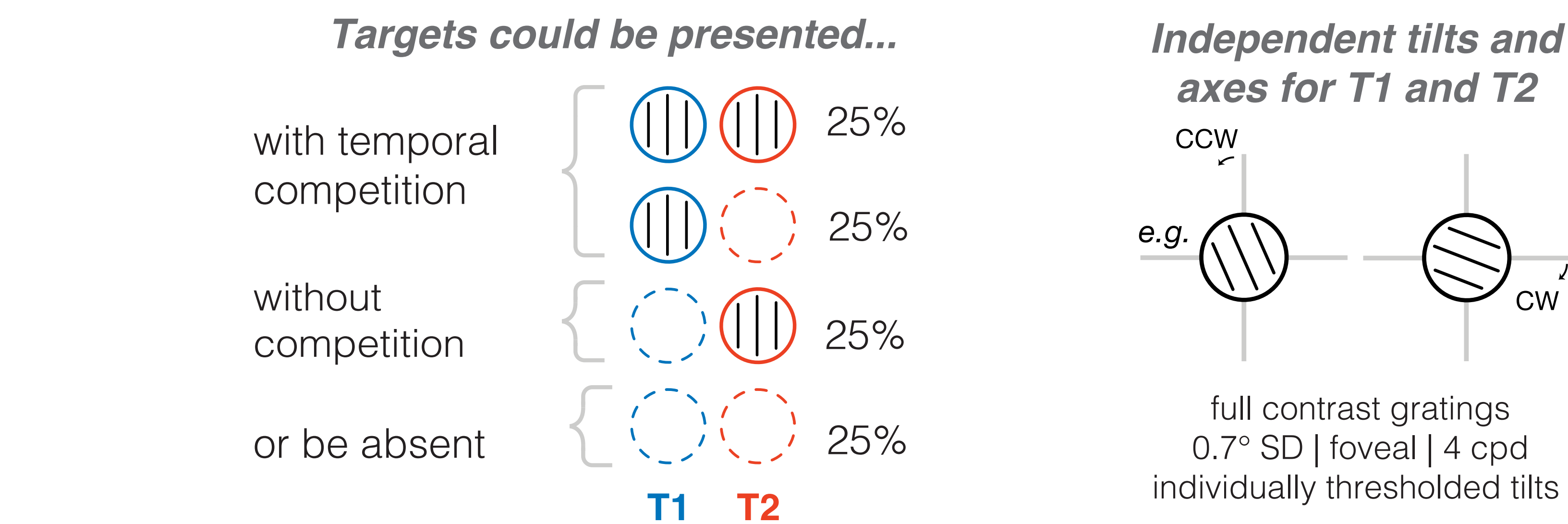
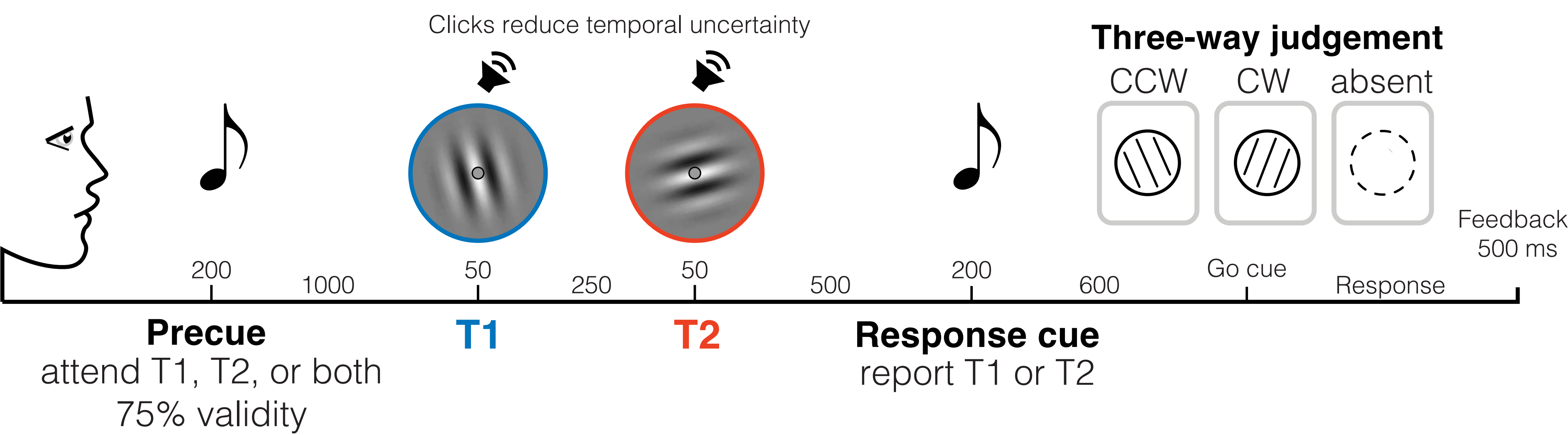
Question

Does voluntary temporal attention enhance performance even without temporal competition?

Temporal cueing task

Independent manipulation of voluntary temporal attention and temporal competition

n = 15 | 2-3 sessions | 1280 trials per observer
online fixation monitoring



References

- Tkacz-Domb & Yeshurun (2021). Cognition, 206, 104506.
- Sahar & Yeshurun (2024). J Exp Psychol Gen, 153(2), 339-351.
- Denison, Carrasco & Heeger (2021). Nat Hum Beh, 5, 1674-1685.
- Denison, Tian, Heeger & Carrasco (2024). Nat Comm, 15, 9061.
- Zhu, Tian, Carrasco & Denison (2024). PNAS Nexus, 3(12).
- Desimone (1998). Phil Trans R Soc Lond B, 353(1373):1245-55.

Hypotheses

If voluntary temporal attention...

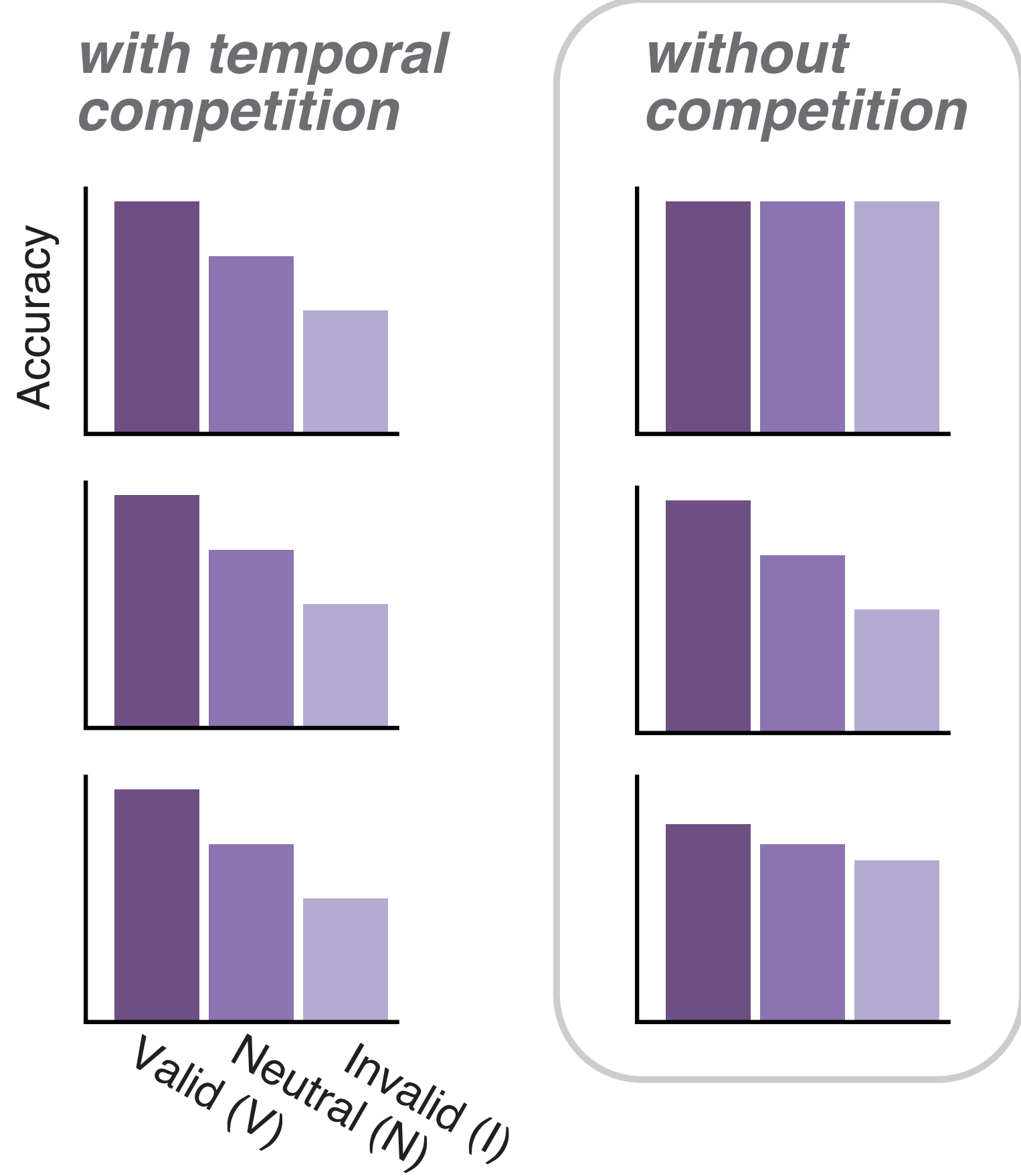
- selects among *actively* competing stimulus representations⁶
- biases stimulus representations *prior* to a competitive stage^{4,5}
- interacts with temporal competition³

then attention should affect performance...

only when there is temporal competition

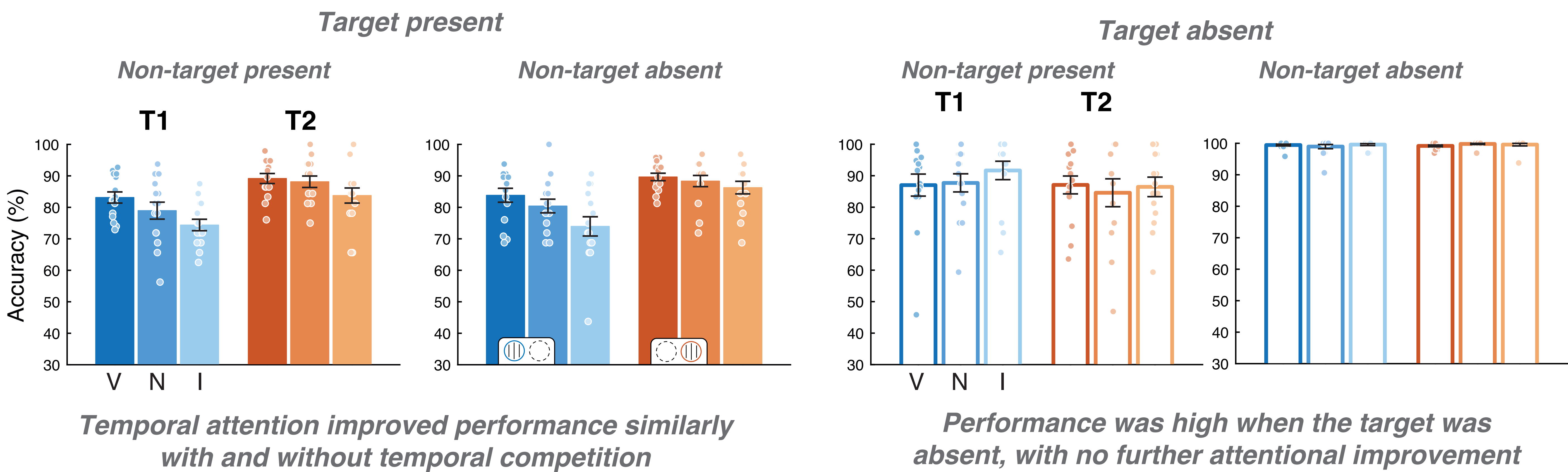
even without temporal competition

more with than without temporal competition



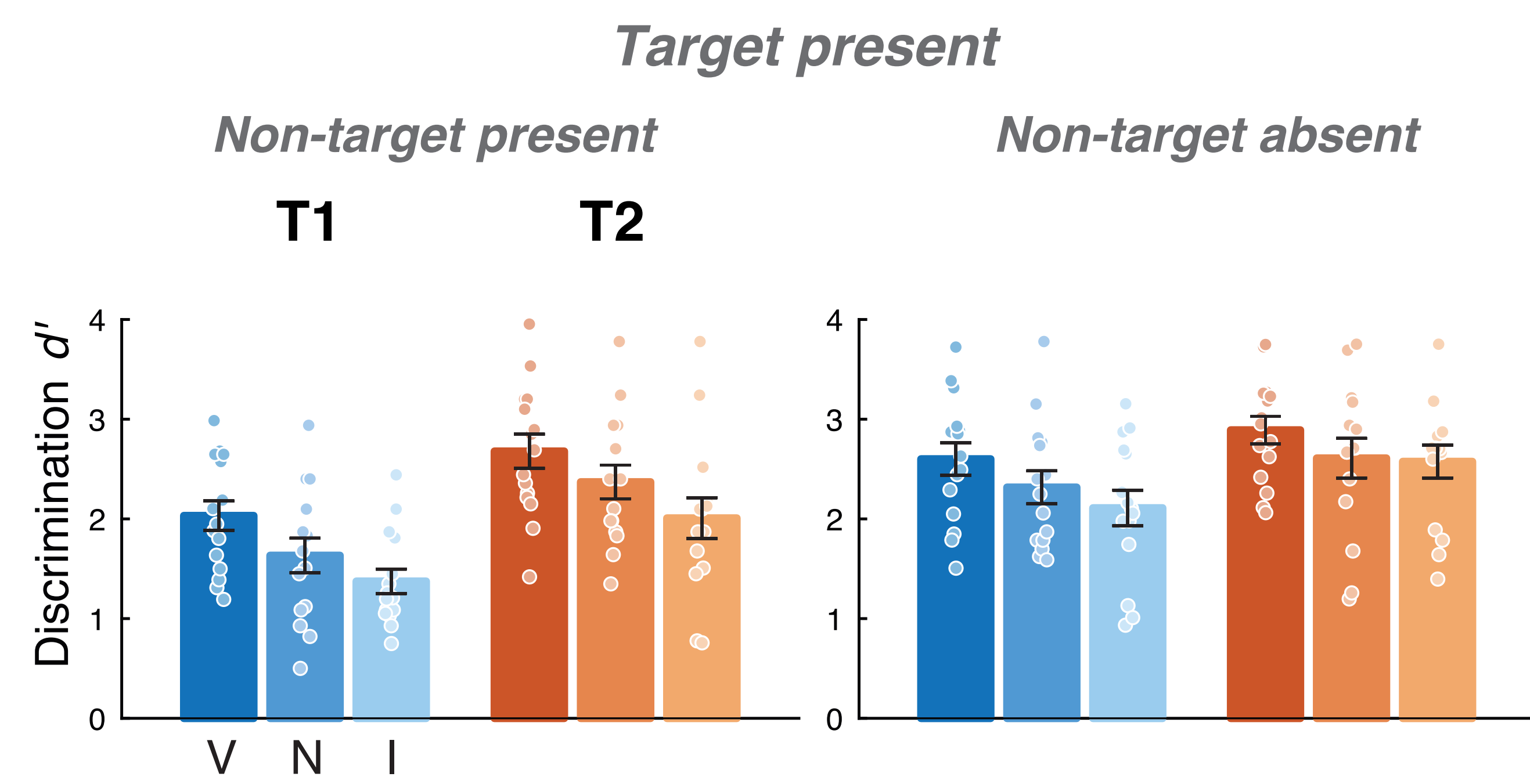
Results

Voluntary temporal attention enhanced performance even without temporal competition

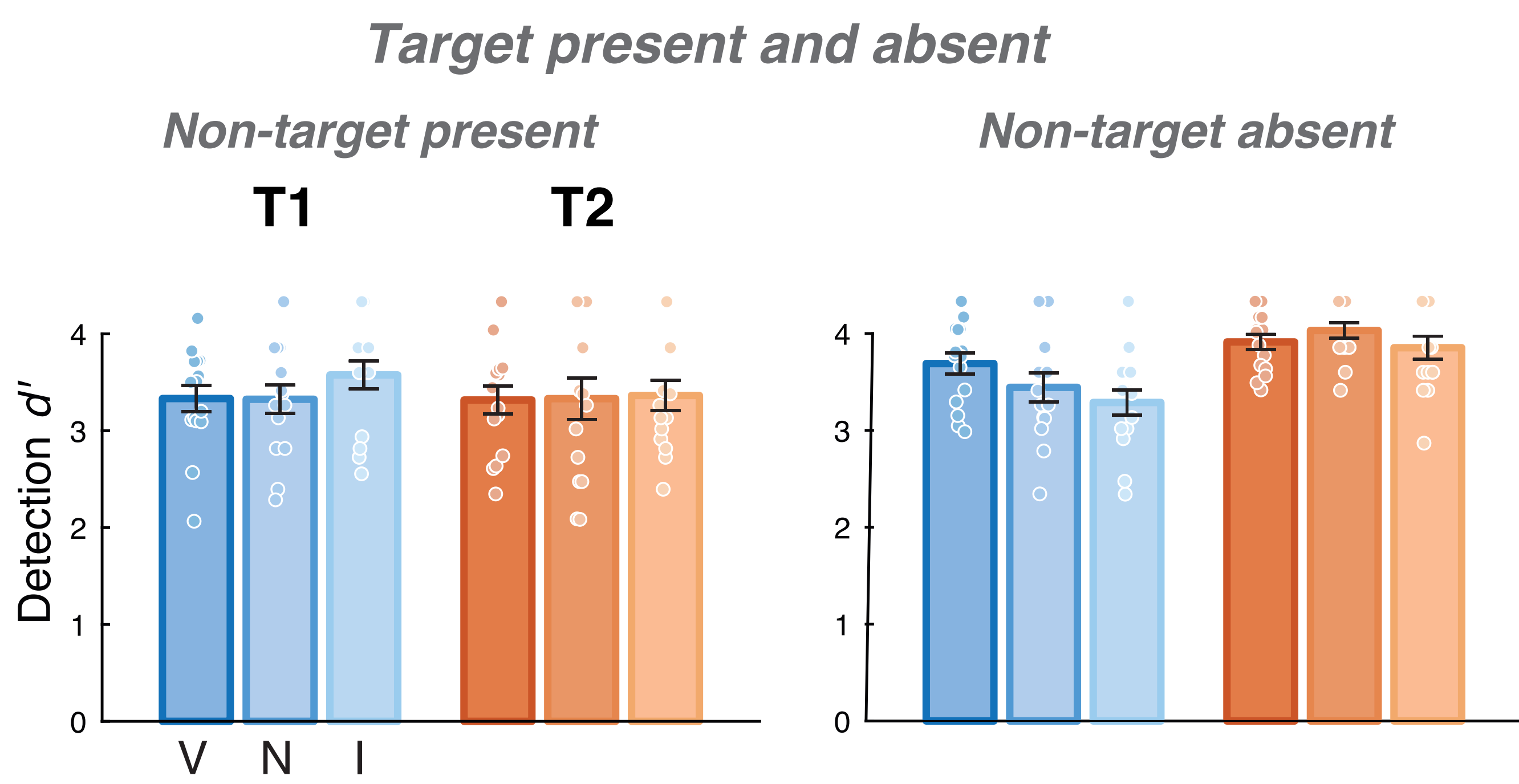


Signal detection theory analysis

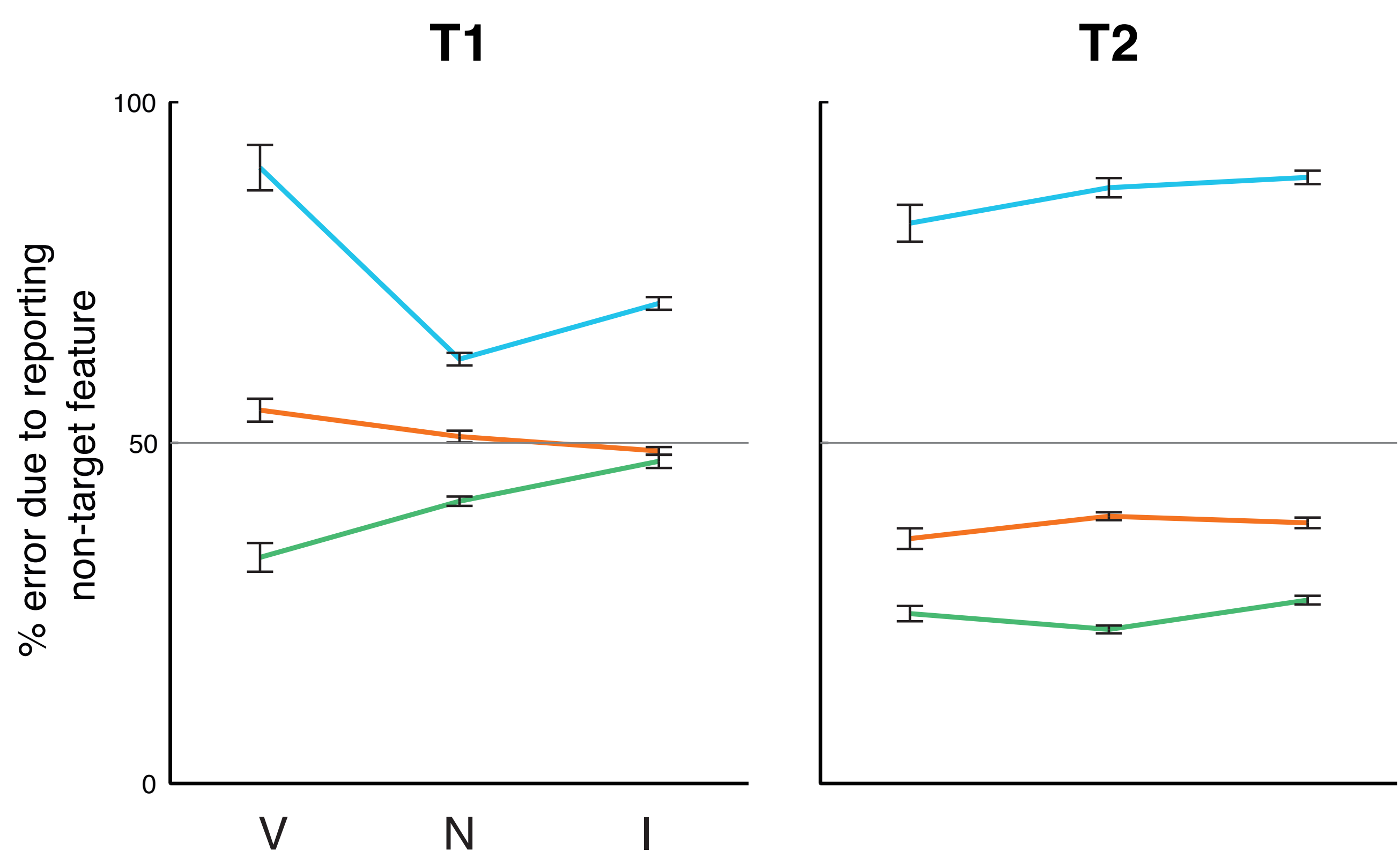
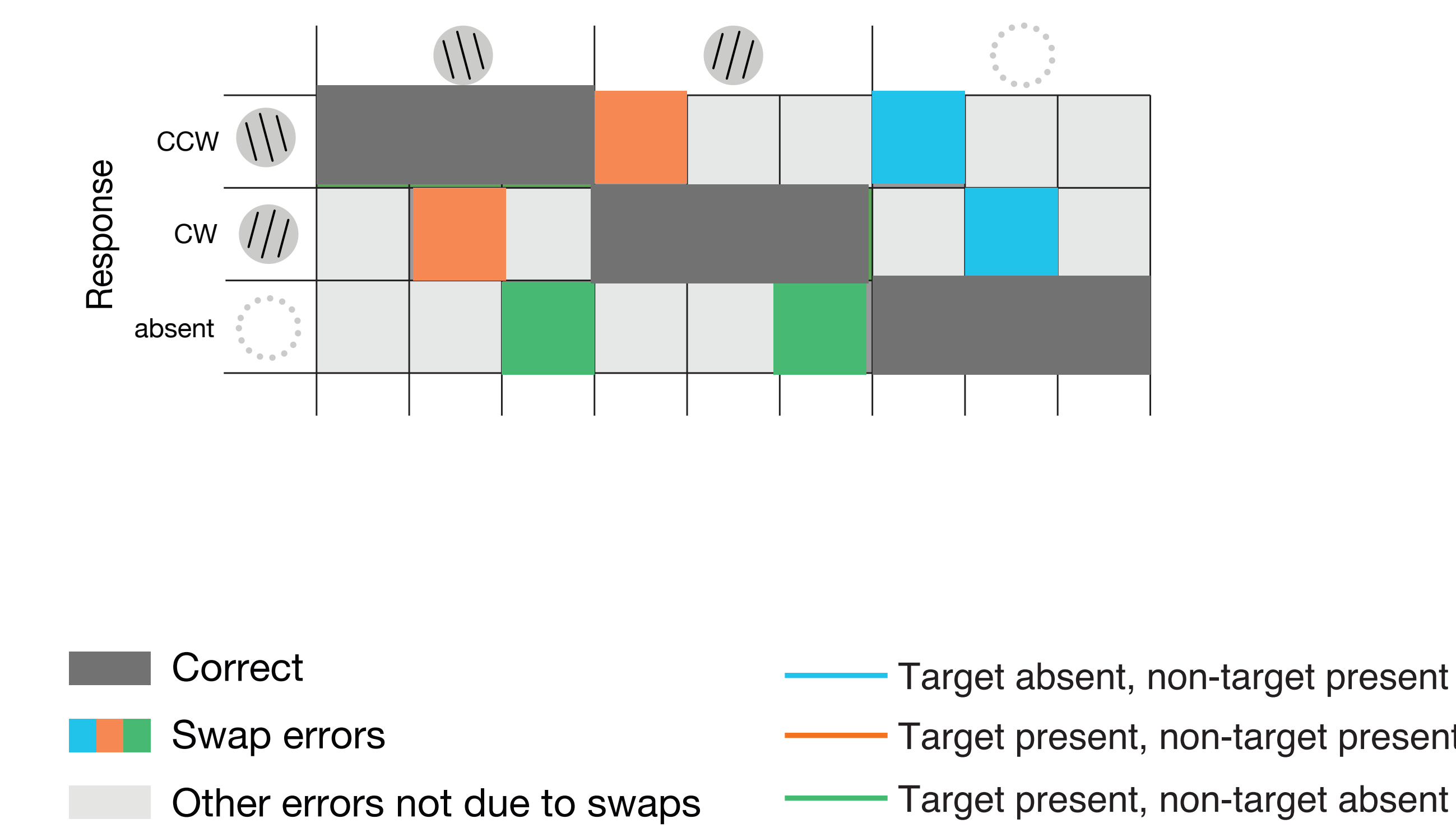
Temporal attention enhanced T1 tilt discrimination sensitivity with and without temporal competition



As expected, suprathreshold detection sensitivity was high



Temporal attention affected sensitivity to the non-target



Conclusions

- Voluntary temporal attention enhances performance even without temporal competition
- The attentional improvement was similar whether a target was presented with or without competition
- These results suggest that temporal attention biases stimulus information prior to a competitive stage**

Funding: BU startup to R.D., NDSEG to K.T.

Contact: jmotzer@bu.edu, ktian@bu.edu | **Web:** sites.bu.edu/denisonlab

Error bars indicate ± 1 SEM. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$