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

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Background

- Perception can be impaired when successive stimuli appear close together in time, demonstrating **temporal competition** for representational resources[1-2]
- **Voluntary temporal attention** can enhance the perception of a stimulus at a relevant moment in time at the expense of earlier and later stimuli[3-5]
- Determining whether these perceptual trade-offs require temporal competition would provide insight into the mechanisms of selection by voluntary temporal attention

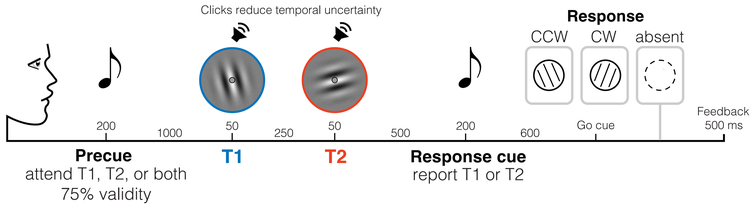
Question

Does voluntary temporal attention enhance performance even without temporal competition?

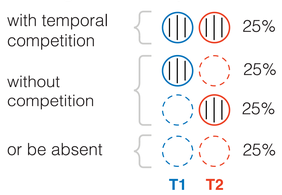
Temporal cueing task

Independent manipulation of voluntary temporal attention and temporal competition

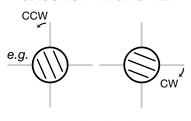
n =15 | 2-3 sessions |1280 trials per observer
online fixation monitoring



Targets could be presented...



Independent tilts and axes for T1 and T2



full contrast gratings
0.7° SD | foveal | 4 cpd
individually thresholded tilts

References

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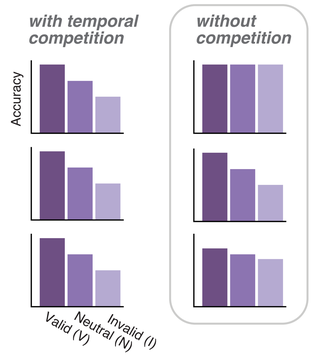
6. Desimone (1998). Phil Trans R Soc Lond B, 353(1373):1245-55.

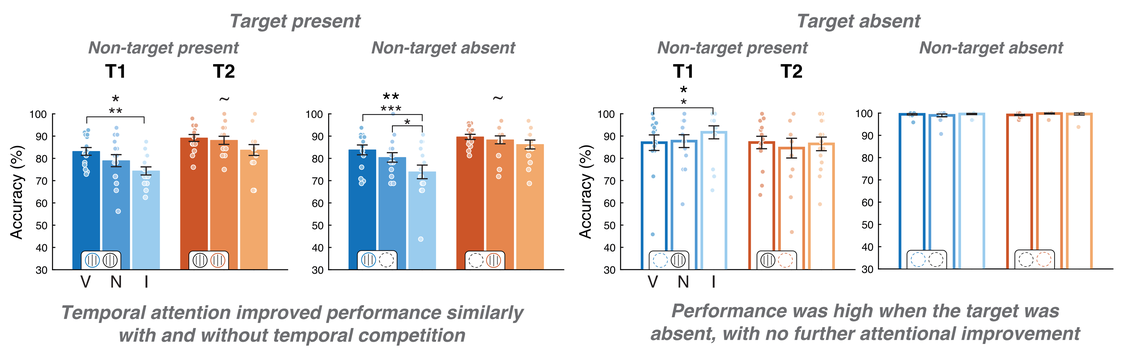
Hypotheses

If voluntary temporal attention...	*then attention should affect performance...*
① selects among actively *competing* stimulus representations[6]	only when there is temporal competition
② biases stimulus representations *prior* to a competitive stage[4,5]	even without temporal competition
③ interacts with temporal competition[3]	more with than without temporal competition



Results

Voluntary temporal attention enhanced performance even without temporal competition

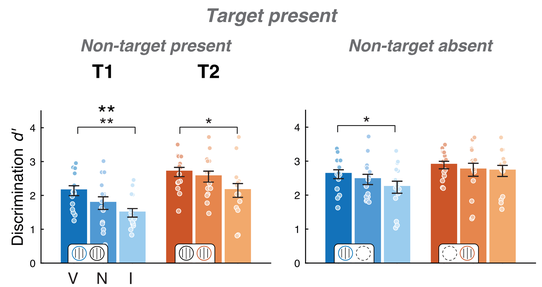


Temporal attention improved performance similarly with and without temporal competition

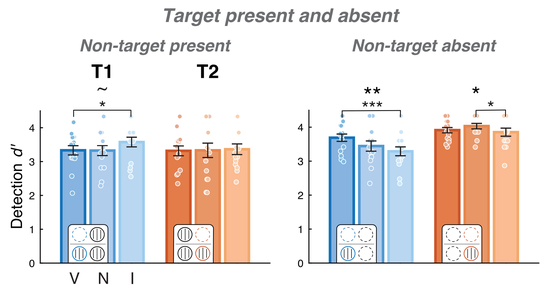
Performance was high when the target was absent, with no further attentional improvement

Signal detection theory analysis

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

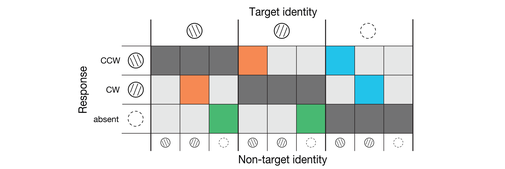


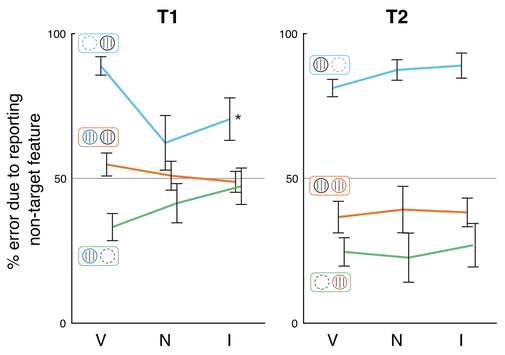
Temporal attention improved detection sensitivity when the non-target was absent



Error bars indicate ± 1 SEM. ~p<0.1, *p<0.05, **p<0.01, ***p<0.001.

Higher rate of swap errors when the non-target was present





Conclusions

- Voluntary temporal attention enhanced 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**

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