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Probing for Intention: Latent Awareness or Metacognitive Reflection

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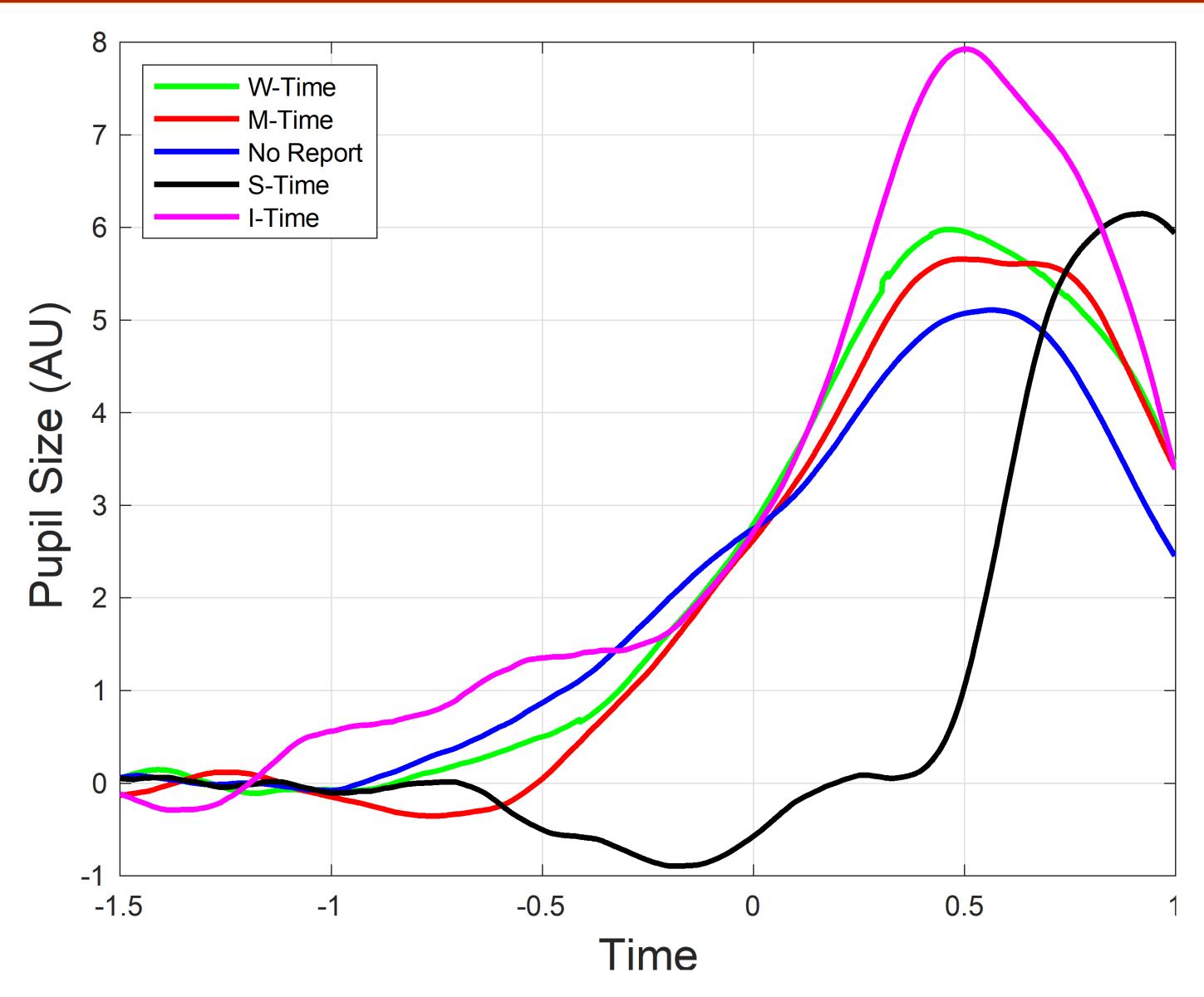
Research Question

Can people be latently aware of having an intention to move, or are prior findings attributable to metacognition?

Background

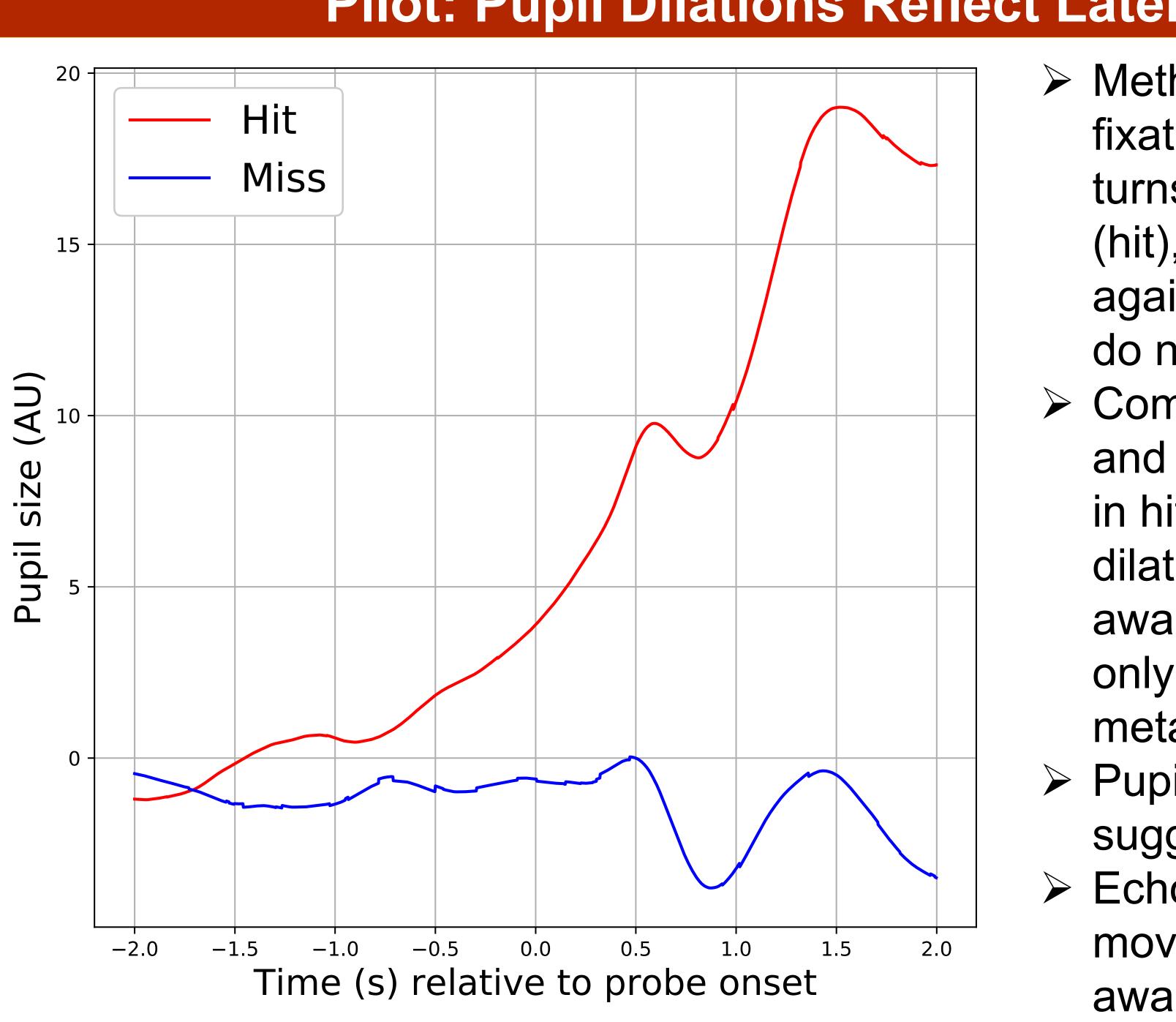
- earlier, ~800 ms²; does this reflect a *latent* awareness? attention^{3,4}, decision making⁵, and cognitive load⁶. motor processes (below), perhaps latent awareness?
- \succ Explicit awareness of intention ~200ms before movement.¹ > Interruption/probe method estimates intention onset Pupil dilations reflect mental processes: awareness and > Pupil dilations before spontaneous actions reflect non-

Prior experiment: Pupil dilations & spontaneous actions



- \succ Method (N=11): move spontaneously, report timing of intention (W), movement (M), or no report. Controls: don't move & report time of a sound (S) or imagine moving and report time of imagined movement (I).
- \succ Replicate finding that pupil dilates before movements⁷.
- > Dilations similar for all trials except for S, indicates process is non-motoric, doesn't reflect attention to intention.

Probing for Intentions: Latent Awareness or Metacognitive Reflection? Kate Harder, Jake Gavenas, Aaron Schurger, Uri Maoz



- \succ Pre-movement pupil dilations may reflect latent awareness of upcoming movements. \succ Two issues to resolve:
- Unclear if "latent awareness" is a legitimate construct, or if participants make a metacognitive judgment
- Does not control for explicit awareness/ preparatory process.

> New paradigm:

- Use a sound colored fixat
- Always inhibit
- Ask participa confidence, whether the
- See if drift-c for intention
- Record EEC to pupil size inhibitory co

Pilot: Pupil Dilations Reflect Latent Awareness

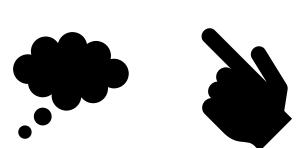
Discussion + Future Directions

nd as the "probe" instead of	f Normal Trial —
ation cross.	
ibit when probe occurs.	
pants about intention plus	
, and ask participants abou	It Probe Trial —
ey inhibited a movement.	
diffusion model accounts	
n awareness + confidence G, link readiness potential e, theta oscillations to ontrol.	References: (1) Libet e Neurosci. (2006); (3) W Consciousness and Cog Neurosci. (2010); (6) Ga Psychophysiology (1985

 \succ Method (N=4): move spontaneously, fixation cross may turn red. If cross turns red and subjects had intention (hit), press space after it turns green again (1 sec). If no intention (miss), do not move.

Compare pre-probe pupil size of hit and miss trials. Elevated pupil size in hit trials means pre-movement dilations associated with latent awareness of an intention; dilations only after probe would suggest metacognitive relfection. > Pupil dilates before hit-probes, suggests latent awareness. Echoes EEG results relating premovement signal to latent awareness⁸.

"Move whenever"



"Beep = don't move"



Intention & Inhibition Questions

et al., Brain (1983); (2) Matsuhashi & Hallett, Eur. J. Vierda et al., PNAS (2012); (4) Kang & Wheatley, ognition (2015); (5) Einhauser et al., Front. Hum. Gavas et al., IEEE (2017); (7) Richer & Beatty, 85); (8) Parés-Pujolràs et al., *Neuroimage* (2019)