

# Dissociating competition effects within Perception and Working Memory

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## 1) Introduction and Study 1

- Stimuli compete for attention<sup>1</sup>, and the response to a stimulus is reduced when a second stimulus appears simultaneously in the same receptive field<sup>2,3,4</sup>.
- The effects of such competition extend beyond attention, and limit visual working memory (WM)<sup>5,6</sup>.
- Items presented in close versus far spatial proximity, during WM encoding, were associated with reduced precision and more non-target responses (Figure 2) as measured by a mixture model (Figure 1)<sup>7</sup>.

Figure 1. The Mixture Model<sup>7,11</sup>.

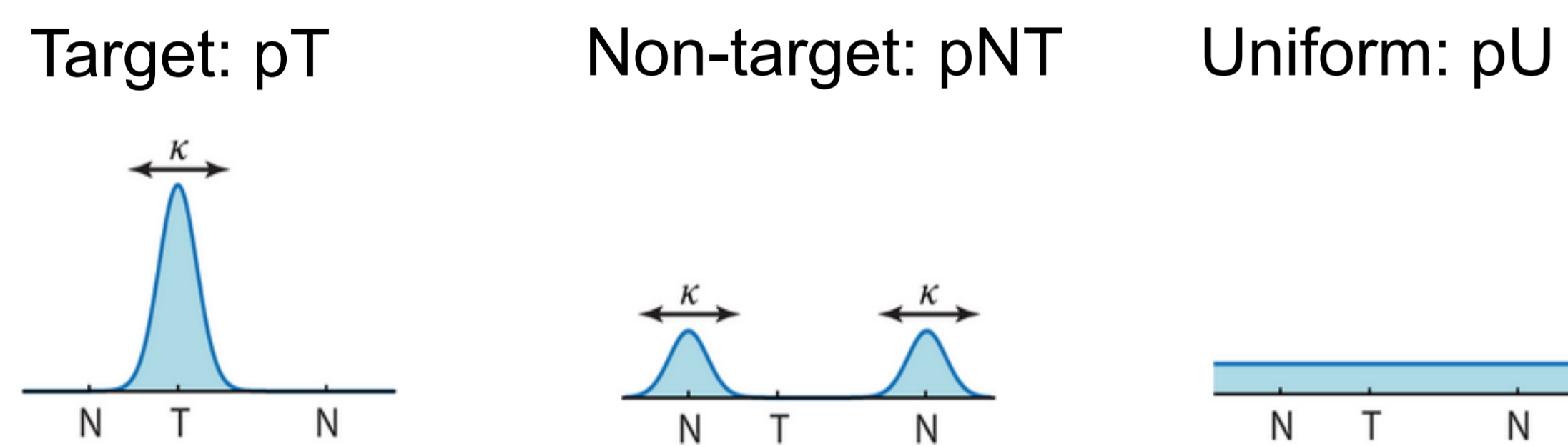
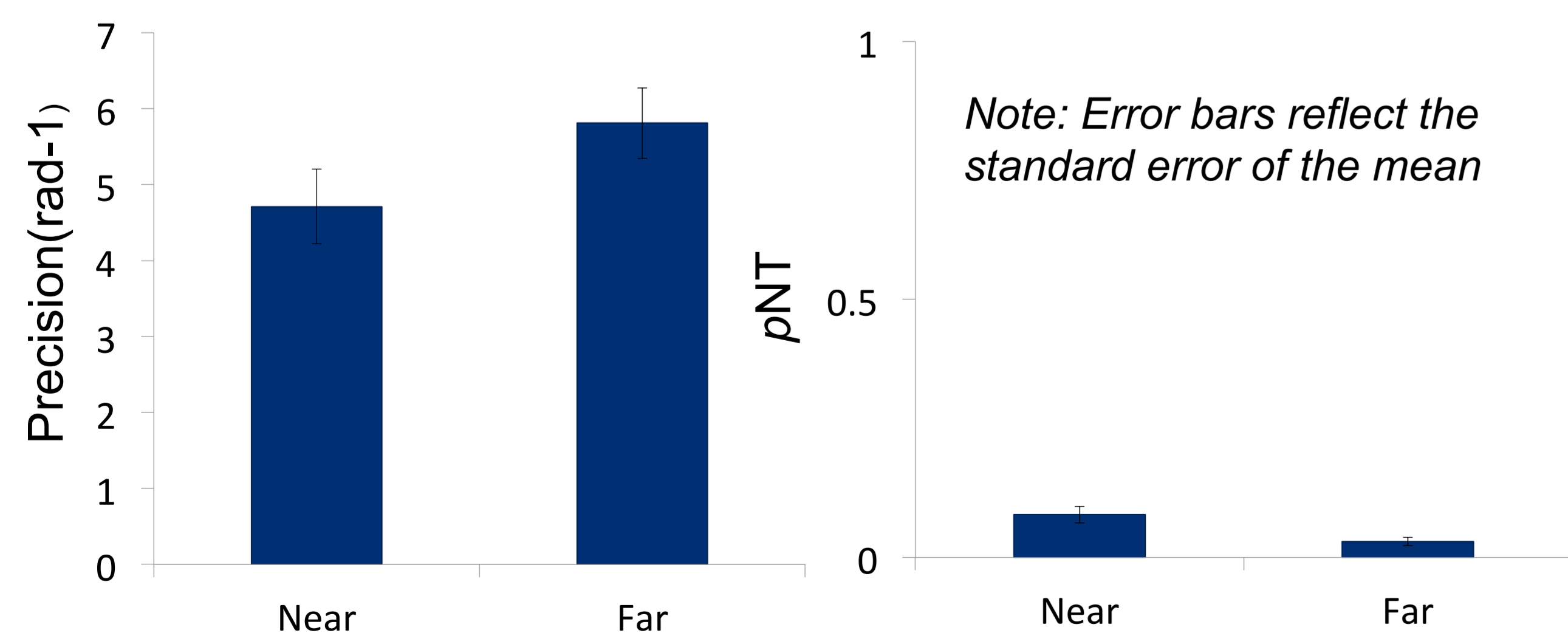
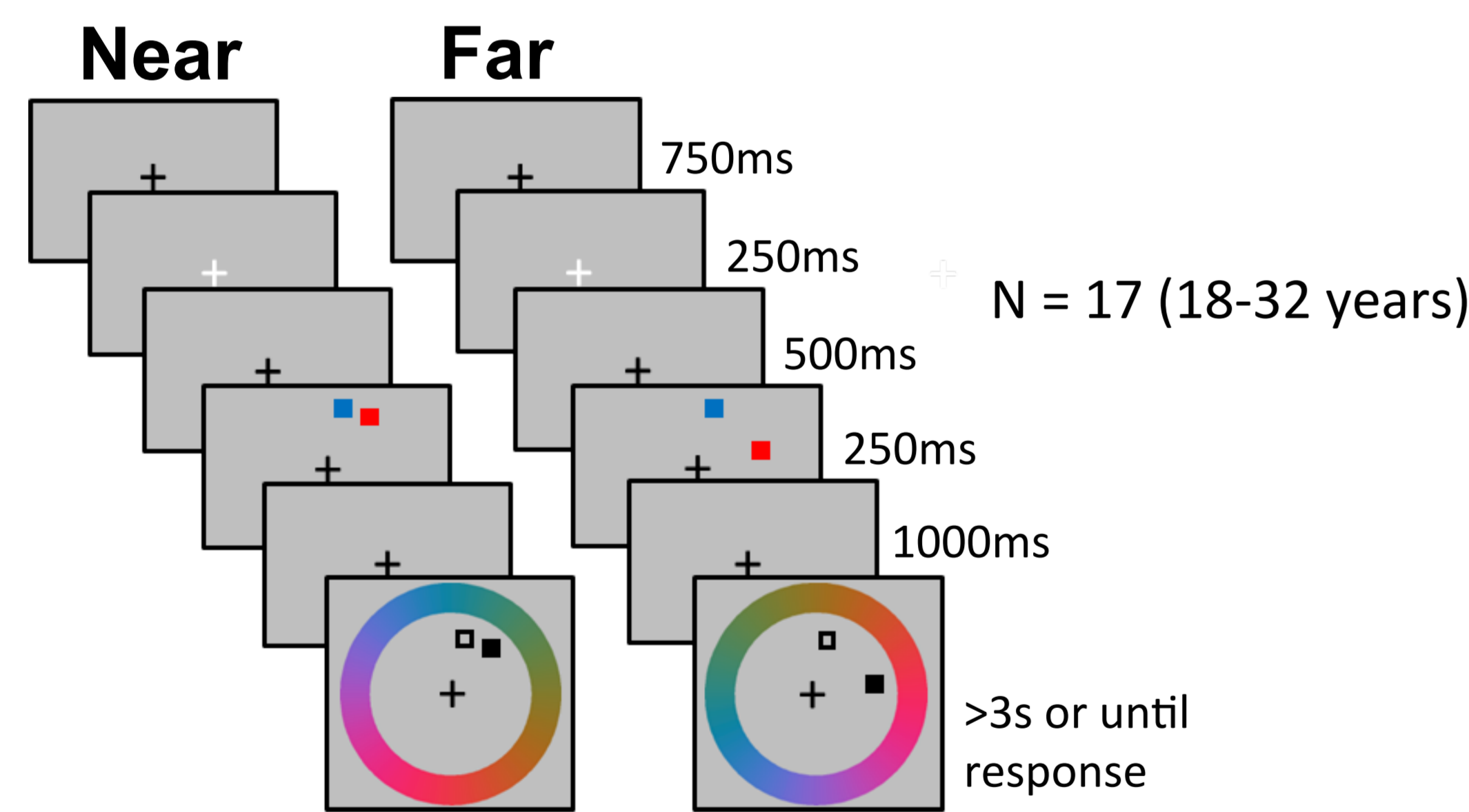


Figure 2. Previous Experiment<sup>6</sup>.

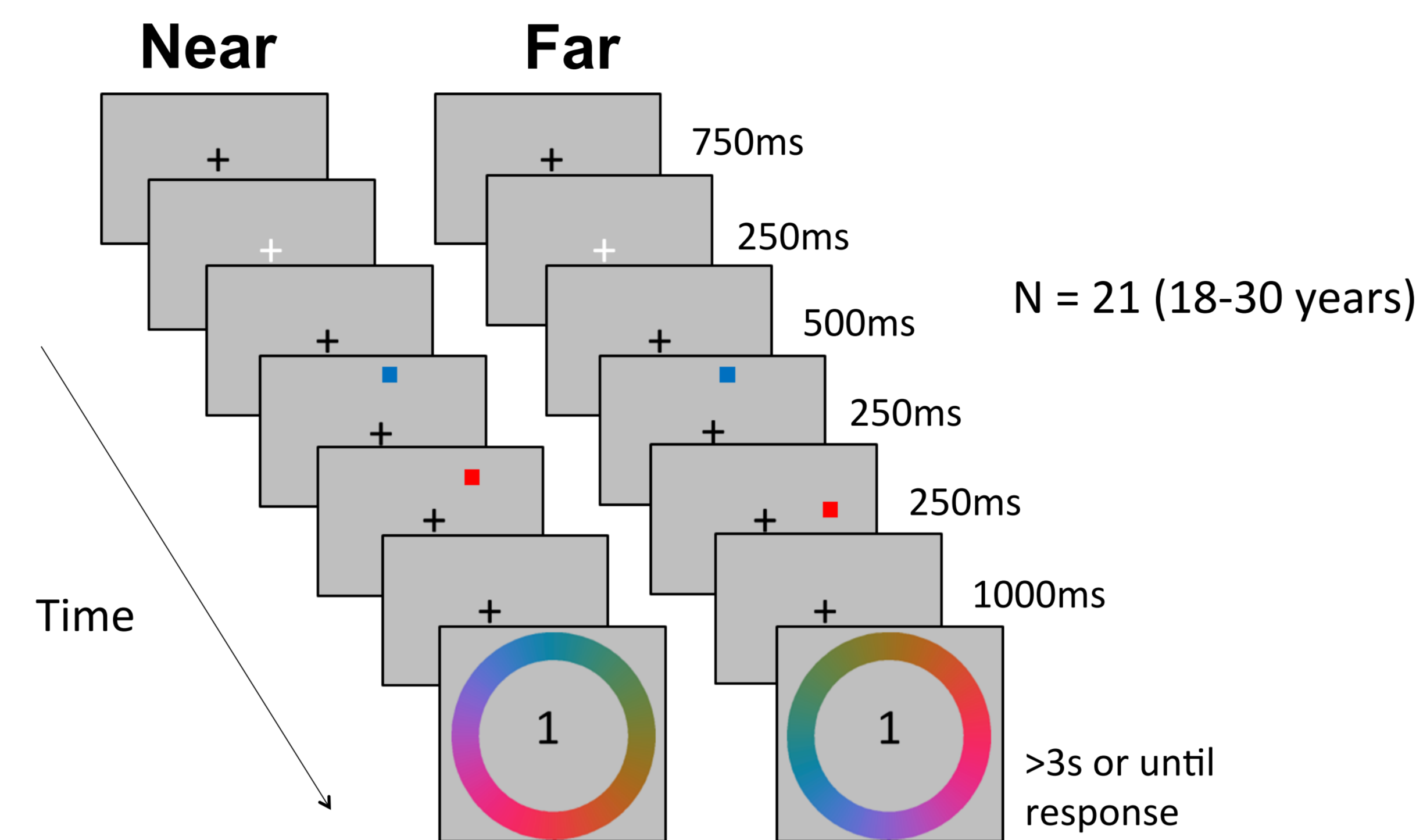


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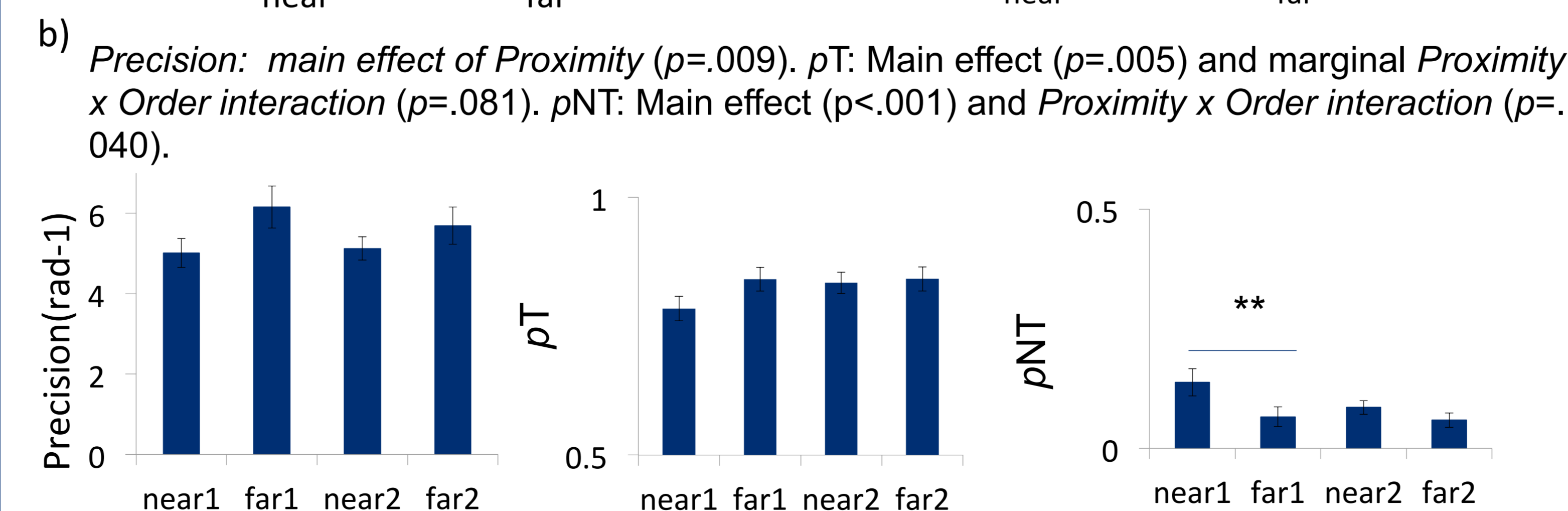
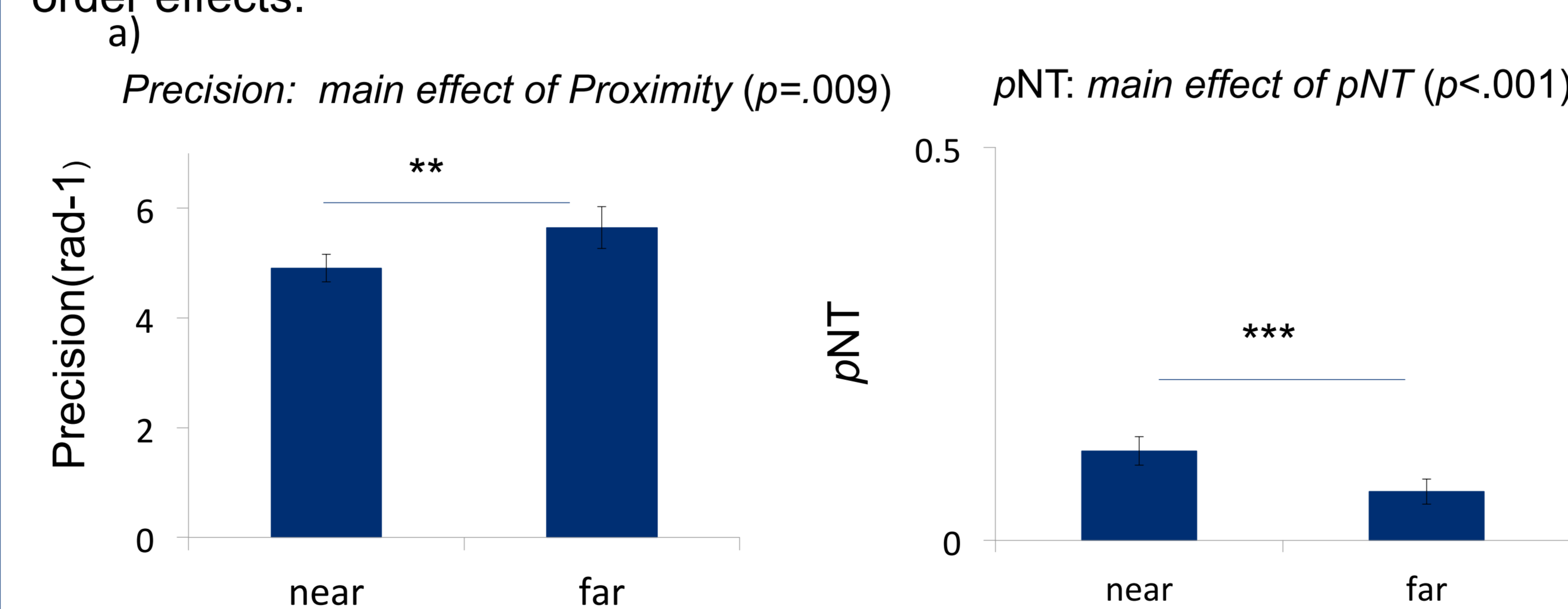
## 2) Study 2

Figure 3. The stimulus sequence for Study 2.



- Two sequentially presented squares. The second square was located within a visual angle of either 0.6° (near condition) or 7° (far condition) from the first stimulus (Figure 3). WM performance was assessed using a mixture model (Figure 1) to obtain measures of WM precision,  $pT$ , and  $pNT$  from the response distributions (Figure 4)<sup>7</sup>.
- We analysed the effects of proximity and order (whether the cued stimulus was presented first or second).

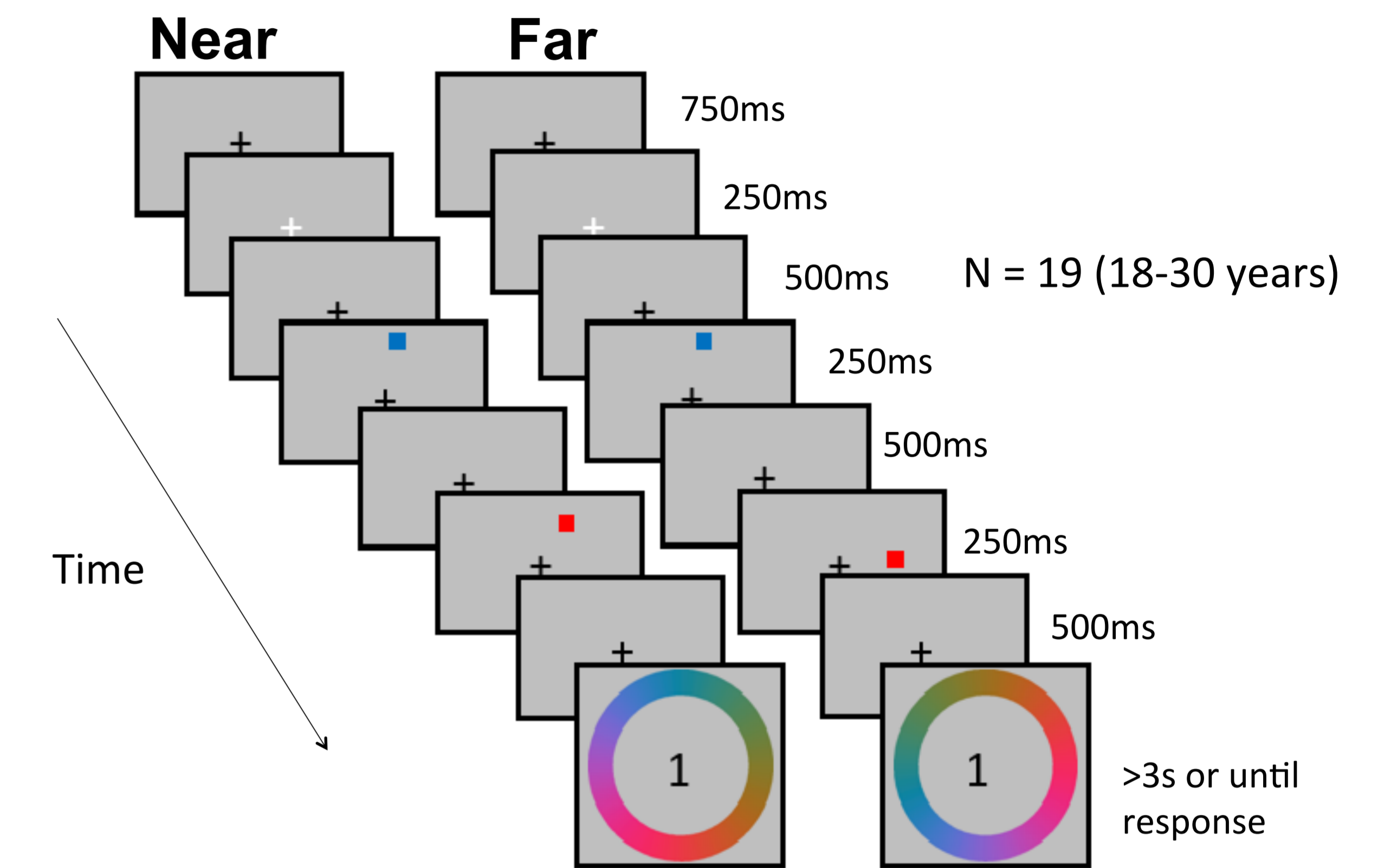
Figure 4. The results of the mixture model analysis for a) proximity and b) order effects.



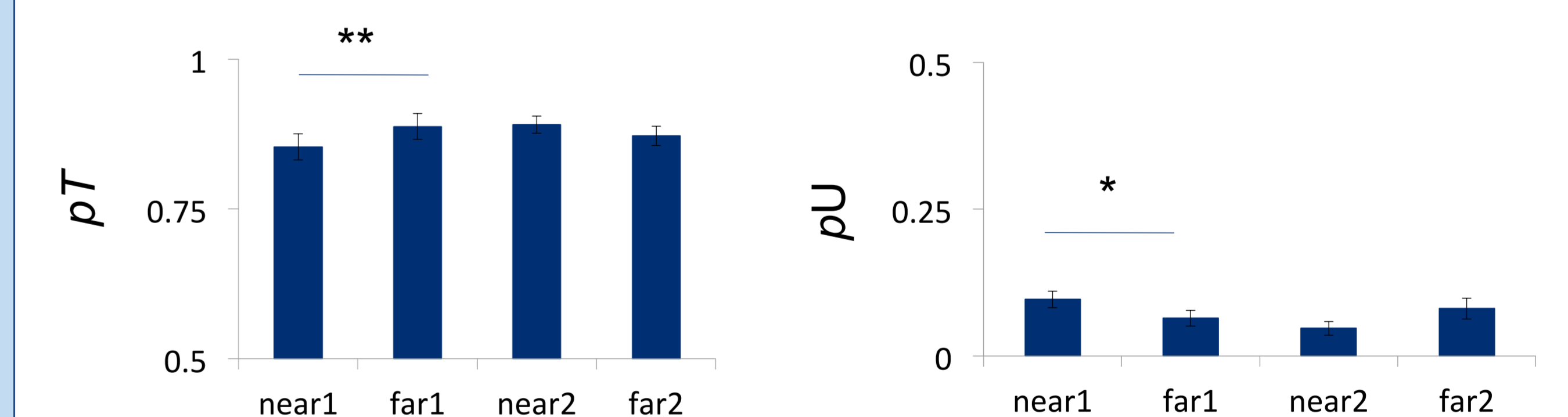
Note: Error bars reflect the standard error of the mean. \*\*  $p < .001$ , \*  $p < .05$

## 3) Study 3: perception (iconic memory) or WM?

Figure 5. The stimulus sequence for Study 3.



- Two sequentially presented squares separated by an inter-stimulus interval of 500ms. The total time from the onset of the first square until the colour wheel was balanced between Studies 2 and 3.
- No main effect of proximity on precision,  $pT$  and  $pNT$ . Significant proximity \* order interaction on  $pT$  ( $p=0.028$ ) and  $pU$  ( $p=0.036$ ).



Note: Error bars reflect the standard error of the mean. \*\*  $p < .001$ , \*  $p < .05$

## 4) Conclusions

- Competition has previously been examined by comparing simultaneous (high competition) versus sequential (low competition) stimulus presentation<sup>8,9,10</sup>. We demonstrate that sequentially presented items still compete.
- Reduced spatial distance between simultaneous and sequentially presented targets is associated with *reduced WM precision and a greater probability of reporting the un-cued stimulus, only when the items have the opportunity to compete perceptually or in iconic memory.*
- Competition within WM associated with a reduced probability of recalling the 1st stimulus presented to the visual system. One explanation is that the neurons in a receptive field can no longer be utilised for WM maintenance once they have to encode a new stimulus.