Classification reveals distraction-resistant representations in working memory

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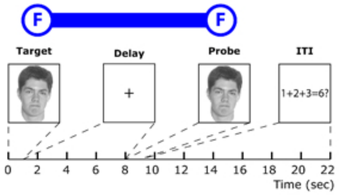
1 Study design

1. Delayed recognition of Faces, Scenes, & Objects

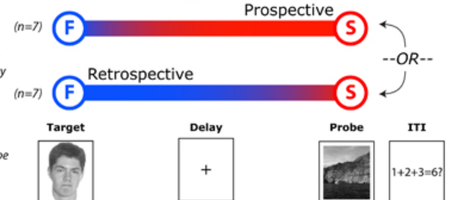


- *Non-famous faces, scenes, & common objects*
- *All pictures in grey scale*
- *120 total trials (40 of each)*
- *4 TRs (0-8s) from each trial used to train classifier*

2. Learn arbitrary cross-category stimulus pairings (offline)

3. Delayed paired-associate recognition

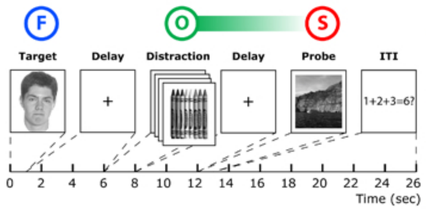
- *Subjects were instructed which cognitive strategy to use.*



- *Respond Y/N whether the Probe was the correct associate of the Target.*

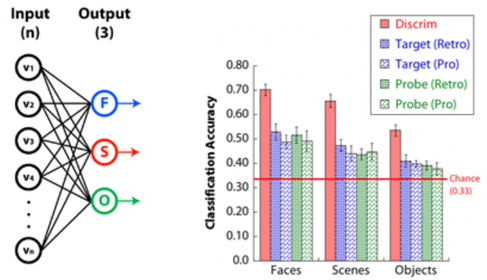
- 144 total trials
  48 F-S & S-F
  48 F-O & O-F
  48 S-O & O-S

- *On 1/2 of trials, RSVP **distraction** of irrelevant stimuli during delay*
- *Distractors were always chosen from different category than target & probe*

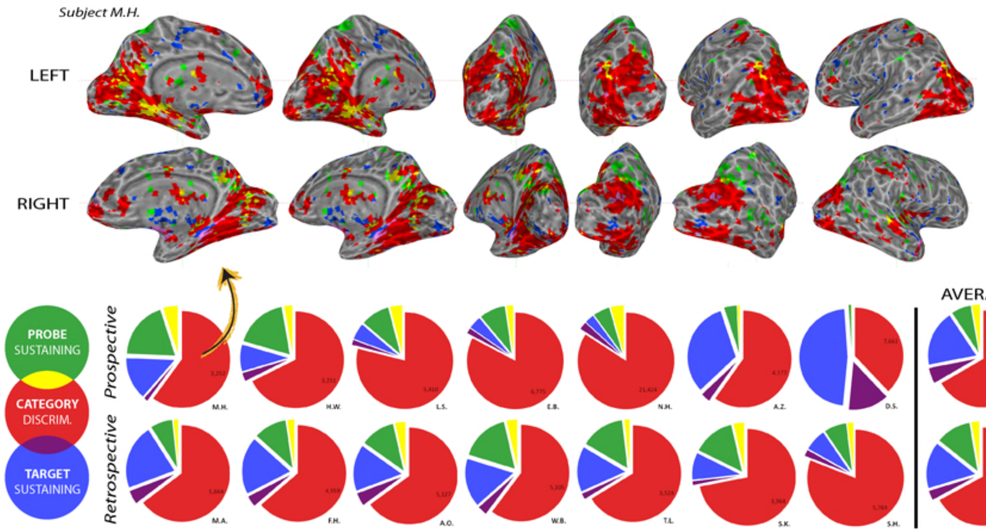


2 Training a classifier

a) Network architecture **b)** Training performance



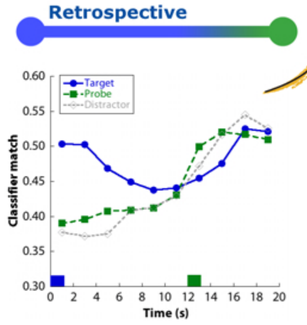
3 Discriminating & distraction-resistant voxels

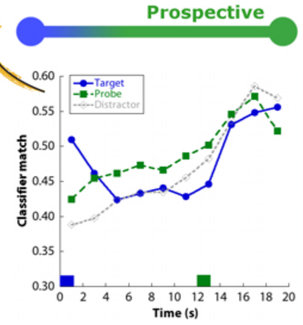


4 Decoding : *Category-discriminating* voxels

Result - During the delay period, 'retrospective' subjects maintained a trace of the target while 'prospective' subjects represented the anticipated probe.

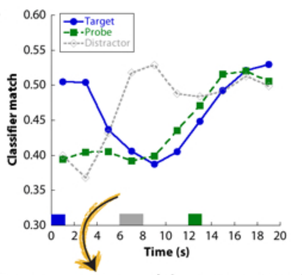
No Distraction

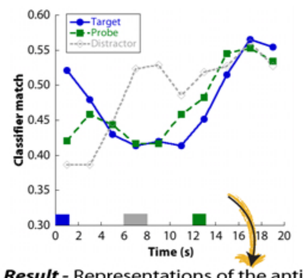




* ***Note*** - Classifier could *not* reliably decode stimulus representations in PFC alone.

Distraction





Result - Representations of the target stimulus were eclipsed by the distractors. Following distraction, activity corresponding to the anticipated probe stimulus was enhanced.

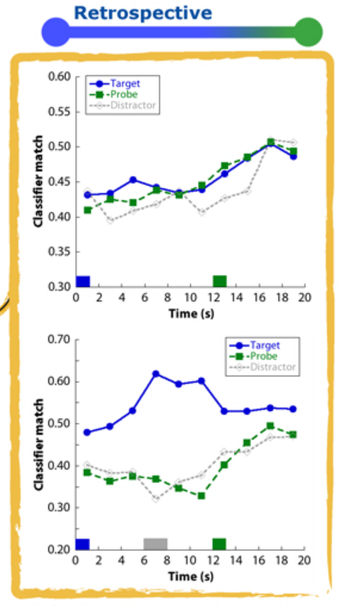
Result - Representations of the anticipated probe stimulus were temporarily eclipsed by the distractors. However, following the offset of distraction, prospective representations rebounded and were enhanced.

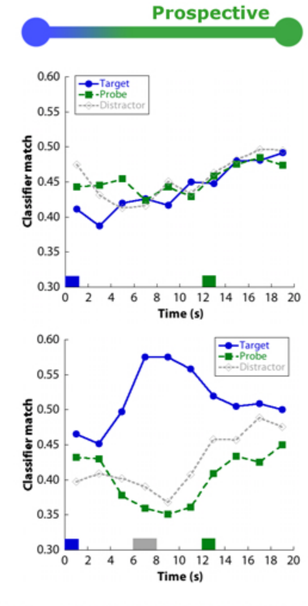
5 Decoding : *Target-sustaining* voxels

No Distraction

Cognitive focus on *Target*

Distraction



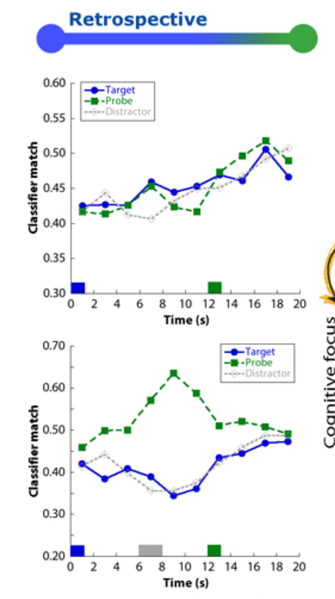


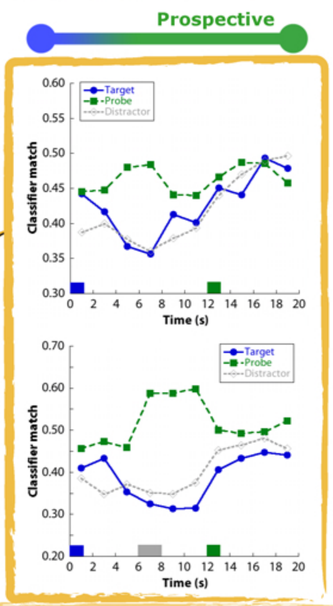
6 Decoding : *Probe-sustaining* voxels

No Distraction

Distraction

Cognitive focus on *Probe*





Conclusions

1. Upon distraction during WM retention, the human brain, like the monkey's, prioritizes preparing for the future (prospective coding) over remembering the past (retrospective coding).
2. This property was observed in posterior brain regions (including IT), but not in PFC.
3. Distinct, distributed brain regions were identified that sustained the target and probe stimuli during distraction. These regions did not sustain these representations in the absence of distraction (with the exception of 'prospective' subjects and the probe stimulus).

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