Shaping visual memories with real-time fMRI neurofeedback

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1. INTRODUCTION

1.1. Background

Competition-dependent forgetting

Item representations that linger in a moderately-active state (red image) in working memory (WM) are susceptible to degradation from competitive processes, subsequently impairing long-term retention (Norman et al., 2007; Detre et al., 2013; Lewis-Peacock & Norman, 2014).

1.2. Hypotheses

Competitive interactions between items on simulate trials will cause impaired long-term memory for un-cued items, compared to isolate trials.

1.3. Approach

Real-time fMRI decoded neurofeedback

Participants will be trained in two implicit neurofeedback contexts, designed to modulate the relative evidence for cued and un-cued items:

1. compete: reward high levels of decoded evidence for cued items
2. isolate: reward low levels of decoded evidence for un-cued items

2. METHODS

2.1. Scanning paradigm

WM/LTM baselines

WM retrocue task: transfer (no feedback) (50% new items)

2s

LTM recognition task

2s

2.2. fMRI experimental design

WM retrocue task with neurofeedback

LTM recognition task

fMRI neurofeedback

3. RESULTS

Neurofeedback modulates relative evidence for cued & un-cued items

Greater differentiation between cued and un-cued item evidence values in isolate than in compete context (p=0.047)

Weak transfer to runs without neurofeedback, but predicted LTM effect

No consistent sustained transfer of learned modulations across all runs

Long-term memory performance for un-tested items

Consistent with...

4. CONCLUSIONS

Neurofeedback about delay period activity patterns taught participants to endogenously modulate competition in WM.

Despite success during neurofeedback training runs, participants showed weak transfer of learned modulations to runs without feedback.

Consistent with competition-dependent forgetting...