

SAINT LOUIS UNIVERSITY

Modulation of affective interference during working memory

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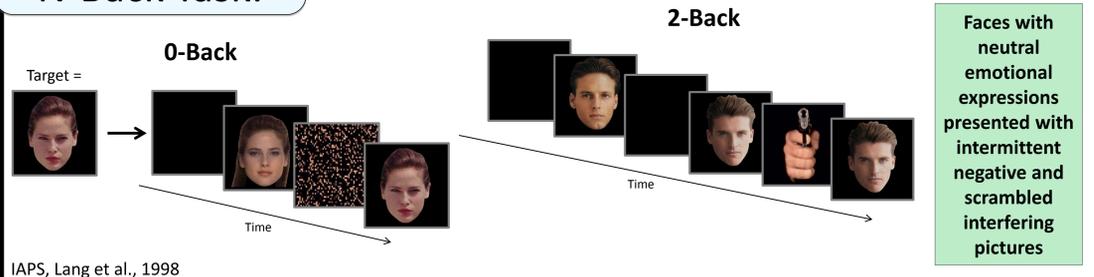
Introduction:

- Goal-directed behavior requires two competing forms of mental control:
 - The ability to concentrate and maintain information over time despite distraction
 - The ability to flexibly switch between goals and apply updates from working memory (WM)
- The balance between retaining information and cognitive flexibility is regulated by the allocation of attention
 - Focused attention maintains task-relevant information over time despite distraction, while the flexible allocation of attention promotes rapid and frequent updating of WM and increased monitoring for task-irrelevant but potentially important stimuli
- Task-irrelevant emotional distraction has been shown to disrupt WM
 - Early, automatic processing of emotionally salient information modulates later cognitive processes
- However, factors that regulate the allocation of attention to task-irrelevant emotional distraction during WM remain unclear

Goal of Current Study:

Examine whether psychological variables modulate the impact of affective interference on the maintenance of task-relevant representations in WM

N-Back Task:



IAPS, Lang et al., 1998

Methods:

Participants

- Healthy adults, ages 18- 38
- No current or prior psychiatric diagnoses
- No major medical or neurological conditions

Behavioral Analyses

N-Back task:

- Mean accuracy and reaction time by interference type and WM load

Questionnaires:

- Pearson's or Spearman's correlations between Scramble-IAPS difference scores and sleep, anxiety, and mood self-report inventories

Imaging Analyses

Image Acquisition:

- 3T Siemens Trio Scanner
- T1-weighted MP-RAGE (TR=1950 ms, TE=2.26 ms, TI=900 ms, flip angle 9°, 1X1X1 mm slices)
- T2-weighted structural (TR=2500 ms, TE=442 ms, flip angle 120°, 1x1x1 mm slices)
- Functional EPI (TR=2500 ms, TE=27 ms, 4x4x4 mm slices, 36 slice whole-brain FoV, flip angle 90°) to measure blood oxygen level-dependent response (BOLD) during N-Back task

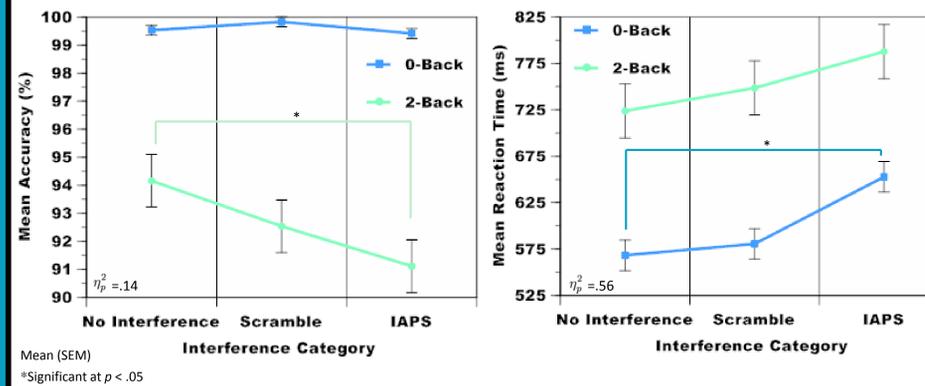
Image Preprocessing:

- Slice time correction, elimination of intensity differences, motion correction, intensity scaling (to obtain a whole-brain mode value of 1000), and atlas registration by affine transformation (Ojemann et al., 1997)
- Transformation into 3 mm³ voxels in Talairach space
- General linear model with baseline, trend, and task-related regressors, uncorrected
- Contrasts: IAPS vs. Scramble, IAPS vs. No Interference (by WM load)

	n=23	Mean (S.D.);
Female	11	^a Epworth Sleepiness Scale score;
Age	22.39 (5.22)	^b Stanford Sleepiness Scale score;
Caucasian (%)	34.8	^c Pittsburgh Sleep Quality Index score;
Epworth ^a	8.35 (4.50)	^d State-Trait Anxiety Inventory-State score;
Stanford ^b	2.61 (.84)	^e State-Trait Anxiety Inventory-Trait score;
PSQI ^c	4.48 (2.39)	^f Patient Health Questionnaire-9 score;
STAI-State ^d	30.09 (8.57)	^g Profile of Mood States- Total Mood Disturbance score
STAI-Trait ^e	34.48 (10.21)	
PHQ-9 ^f	4.22 (3.92)	
POMS-TMD ^g	45.70 (18.05)	
Tension-Anxiety	13.09 (3.70)	
Depression	17.09 (3.44)	
Fatigue	12.30 (3.97)	
Vigor-Activity	23.39 (5.92)	
Anger-Hostility	13.48 (1.95)	
Confusion-Bewilderment	13.13 (4.64)	

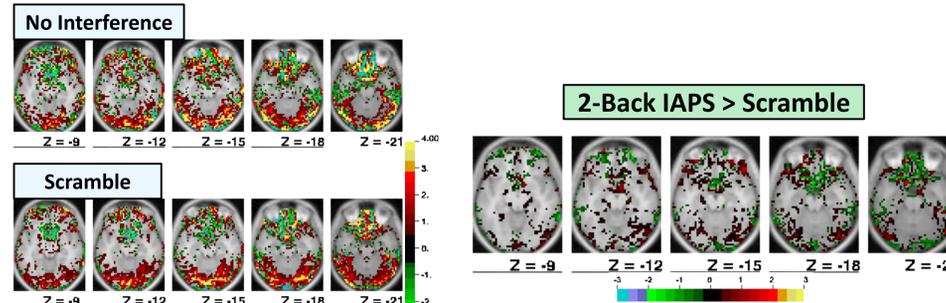
Results:

Interference Differences in Task Performance

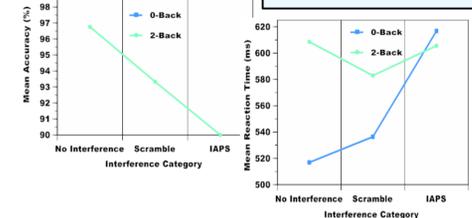


Mean (SEM)
*Significant at $p < .05$

2-Back Task-related Brain Activity

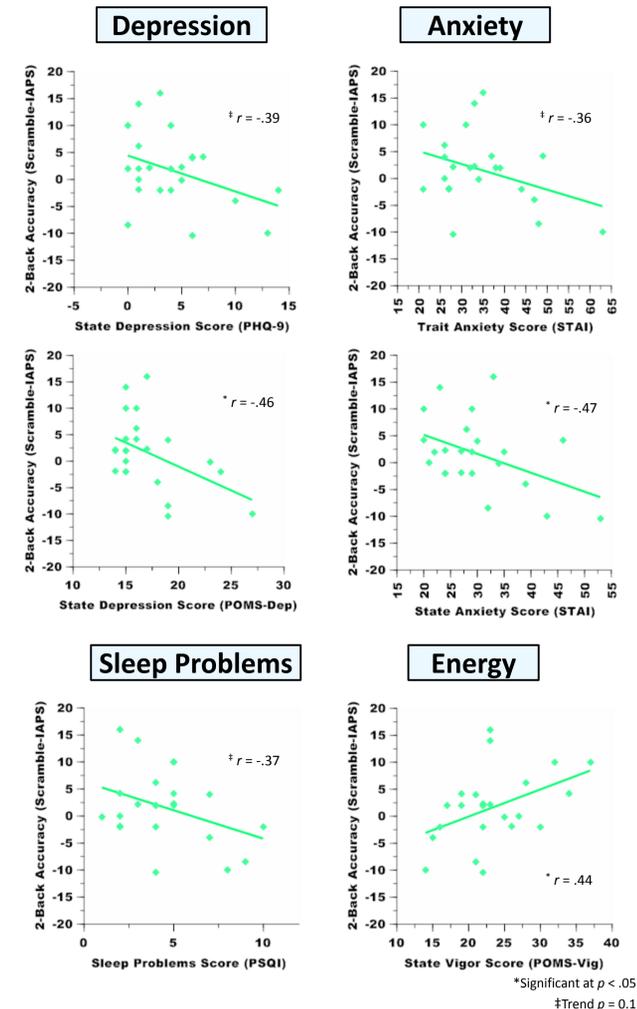


N=5 Task Performance



Better Psychological Functioning Associated with Greater Disruption of WM Following Emotional Distraction

2-Back Accuracy Difference Score (Scramble-IAPS)



Discussion & Conclusions:

- Behaviorally, negatively valenced distracters were associated with significantly slower reaction times (0-Back) and worse accuracy (2-Back) than neutral or no interference
- Fewer self-reported symptoms of depression, anxiety, sleep problems, and low energy were associated with a greater effect of negative distracters on task performance
- Results of preliminary fixed-effects fMRI analyses suggest greater recruitment of visual attention brain regions following negative relative to neutral or no interference during high WM load
- These findings suggest that attention is automatically directed towards processing emotionally salient yet task-irrelevant information, and that better psychological functioning amplifies this effect under heightened cognitive demand
- Consistent with previous research suggesting that positive mood heightens attentional flexibility, thereby biasing cognitive processes towards more flexible, but also more distractible, behavior

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