Influence of the BDNF Val66Met Polymorphism on Spatial and Temporal Working Memory

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INTRODUCTION

BDNF

neurotrophin responsible for regulating neurons survival, growth and synaptic plasticity and crucial for long-term memory (Huang & Reichardt, 2001).

Val66Met (rs6265)

polymorphism at 66th codon of the *BDNF* that leads to alteration of cortical morphology and reduction of volume of the hippocampus (Benarroch, 2015; Egan et al., 2003). It also leads to malfunction of most cognitive functions, especially those related to memorizing (Hansell et al., 2007).

GENOTYPES

Val/Val – subjects without polymorphism
Val/Met – subjects with polymorphism
Met/Met – subjects with polymorphism

WORKING MEMORY

Temporal WM: enhanced left frontal theta, posterior alpha, and left posterior

Spatial WM: enhanced right frontal gamma (Roberts, Hsieh, & Ranganath, 2013).

HYPOTHESES

1. Met group will perform lower than Val/Val group due to the effect of the Val66Met polymorphism on memory processing for both types of WM.
2. Performance in spatial and temporal conditions will differ significantly as these types of WM recruit brain networks with different localization and oscillatory activity (Roberts, Hsieh, & Ranganath, 2013).
3. Met group may use different attentional strategies as polymorphism may also affect the way attentional resources of the WM system are recruited.

METHOD

SAMPLE

N=32
16 Val/Val carriers (7 men)
15 Val/Met carriers (6 men)
1 Met/Met female carrier
Mean age: 22.21 (SD ± 2.94)
Healthy subjects, no psychiatric disorders

DESIGN

1 training block
5 experimental blocks
28 trials in each block
Total: 168 trials
Eye tracking: EyeLink 1000 Plus eye tracker, sample rate = 1000 Hz

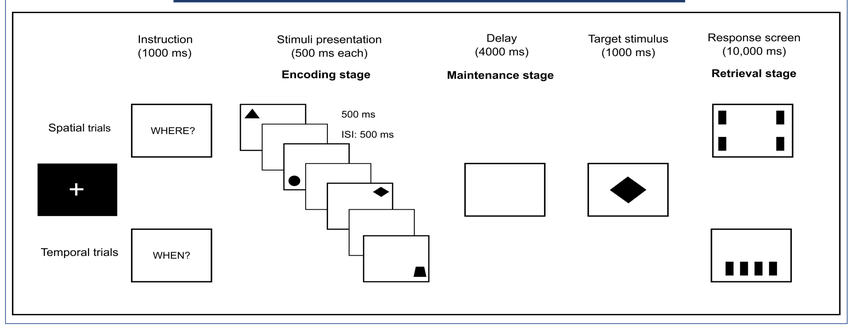
MEASURES

Independent Variables
- Group (Val/Val and Met)
- Type of trial (spatial and temporal)
- Block (5)
- Target button (4)

LME ANOVA

Dependent Variables
- Reaction Time (RT)
- Accuracy
- Fixation Duration
- Number of saccades

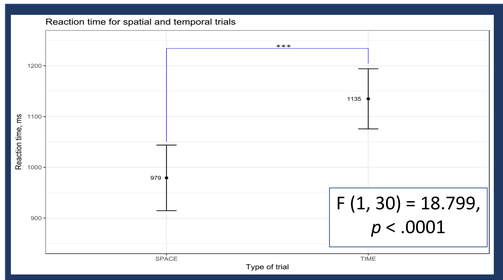
WORKING MEMORY TASK

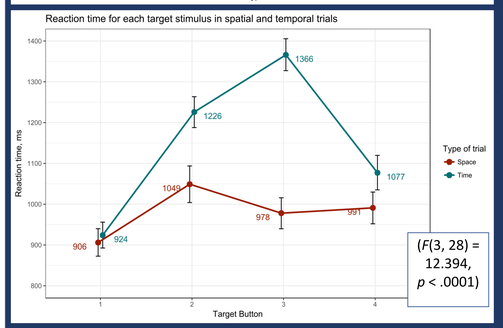


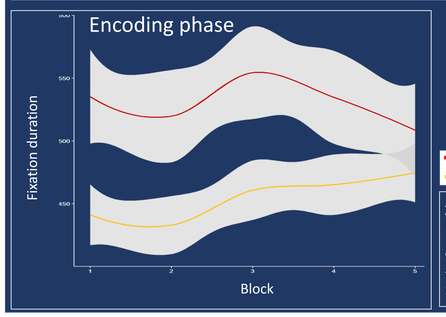
ACCURACY RATES

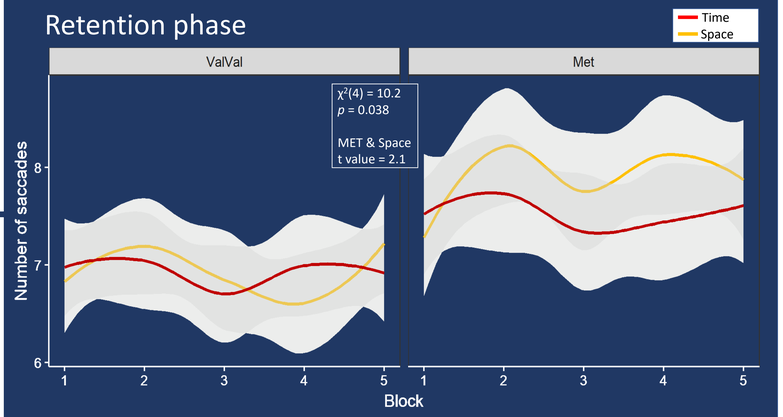
	Val-carriers	Met-carriers
Spatial trials	81.05% ± 1.19 SEM	86.76% ± 1.04 SEM
Temporal trials	83.64% ± 1.13 SEM	85.90% ± 1.07 SEM
Overall accuracy for both types of trials	82.34% ± 0.82 SEM	86.33% ± 0.74 SEM

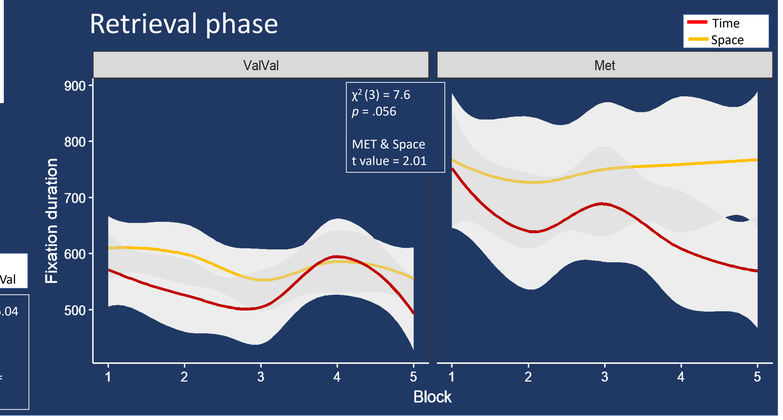
RESULTS











DISCUSSION

- ❑ Temporal trials stimuli were encoded verbally. Hence, primacy-recency effect is present.
- ❑ Stimuli in the spatial condition are retained separately.
- ❑ At the end of experiment, ValVal subjects increased attentional load by elongation of fixation duration on encoding stage.
  - Impaired frontal functioning (Bachmann et al., 2012)
  - Activity-dependent release of BDNF (Chen et al., 2004)
- ❑ Met subjects rehearsed more spatial information than temporal at the end of the experiment
  - Spatial information – fronto-parietal circuit (Spellman et al., 2015)
  - Retrieval of spatial information is harder in general (Delogu et al., 2012)

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