From Cartoons to Concealed Knowledge: How Mind-Wandering Shapes EEG Detection

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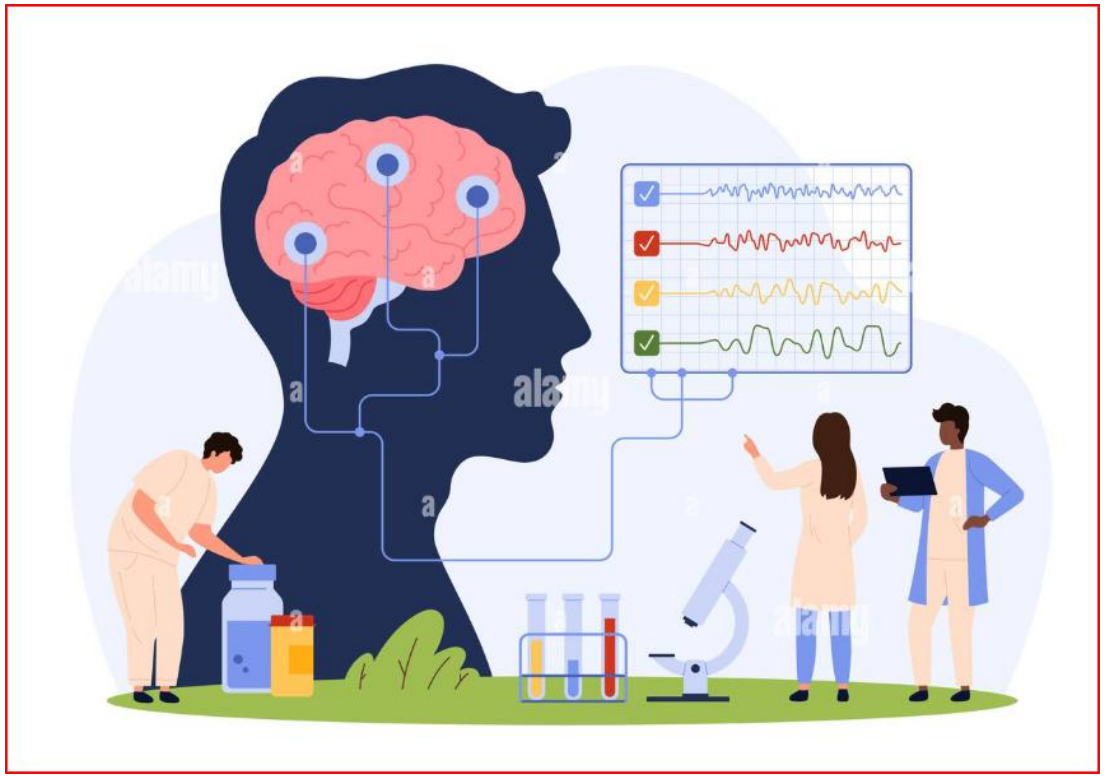
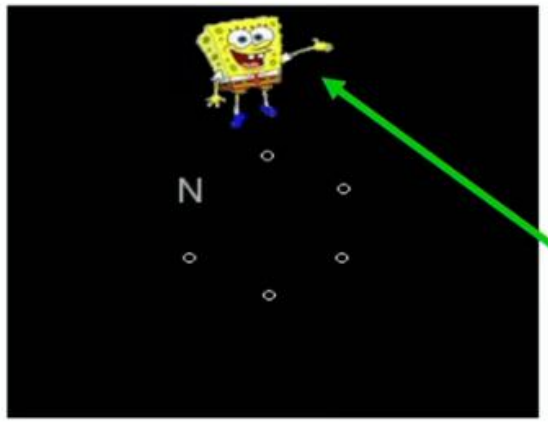
Join us - help turn wandering minds into concealed knowledge detectors!



https://www.ariel.ac.il/wp/neurois/

The science of distraction

Test of susceptibility to *irrelevant distractions
(Forster & Lavie, *J. Exp. Psychol. App*. 2008)



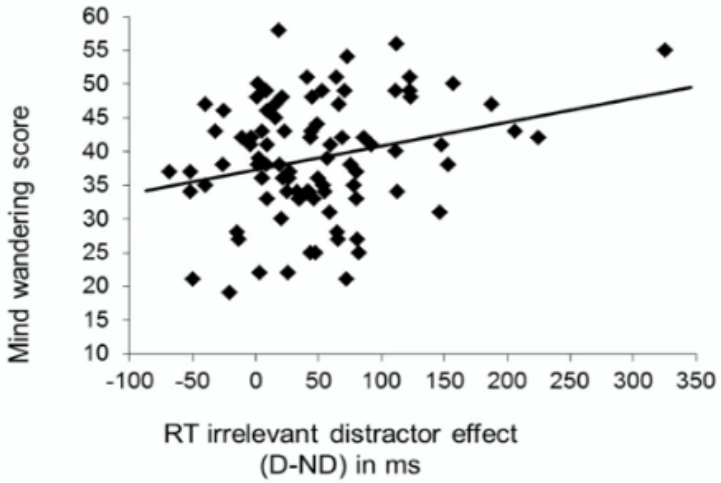
Brief display presentations
Central task- speeded response X or N? (measure of reaction times)

*Irrelevant distractor- cartoon image, presented on10% of the displays

People are slower on the letter task (by 10%) in the presence of the distractor

Slide taken from a presentation by Nillie Lavie, October 2014

Individual differences in distraction by external sources, can predict susceptibility to mind wandering (Forster & Lavie, 2013)



Daydreaming/mindwandering frequency Questionnaire

example item: **I daydream at work (or school)**

a. **Infrequently**
b. **Once a week**
c. **Once a day**
d. **A few times during the day**
e. **Many different times during the day**

Mind wandering (score on the Daydreaming Frequency sub-scale) correlated positively with mean irrelevant distractor cost (mean RT for distractor trials - mean RT for no-distractor trials, in milliseconds).

RT - reaction time; D -distractor; ND - no distractor

Slide taken from a presentation by Nillie Lavie, October 2014

CIT and the P300 Differential Response

The CIT (concealed information test):

The suspect may be asked:

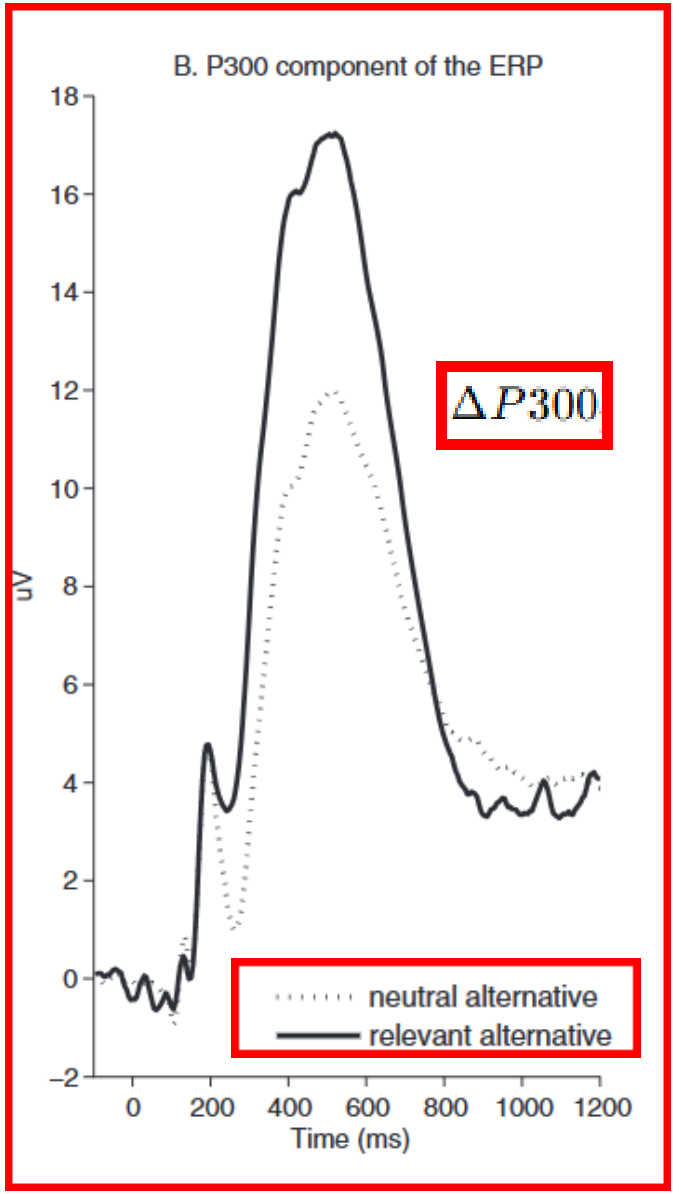
(1) Did you steal a sum of: 0.5 million; 1 million; 1.5 million; 2 million; 2.5 million?

(2) Did you flee the crime scene in: a Nissan; a Toyota; a Subaru; a Honda; a Mazda?

(3) Did you threaten the employee with: a shot gun; a revolver; a knife; a baseball bat; a pair of scissors?

The suspect's physiological responses to the actual probe items are compared with his responses to the control items.

A consistent measurement of differential reactions to the probe items will bring the examiner to the conclusion that the suspect knows them.



Taken from Meijer et al., 2014

Rationale

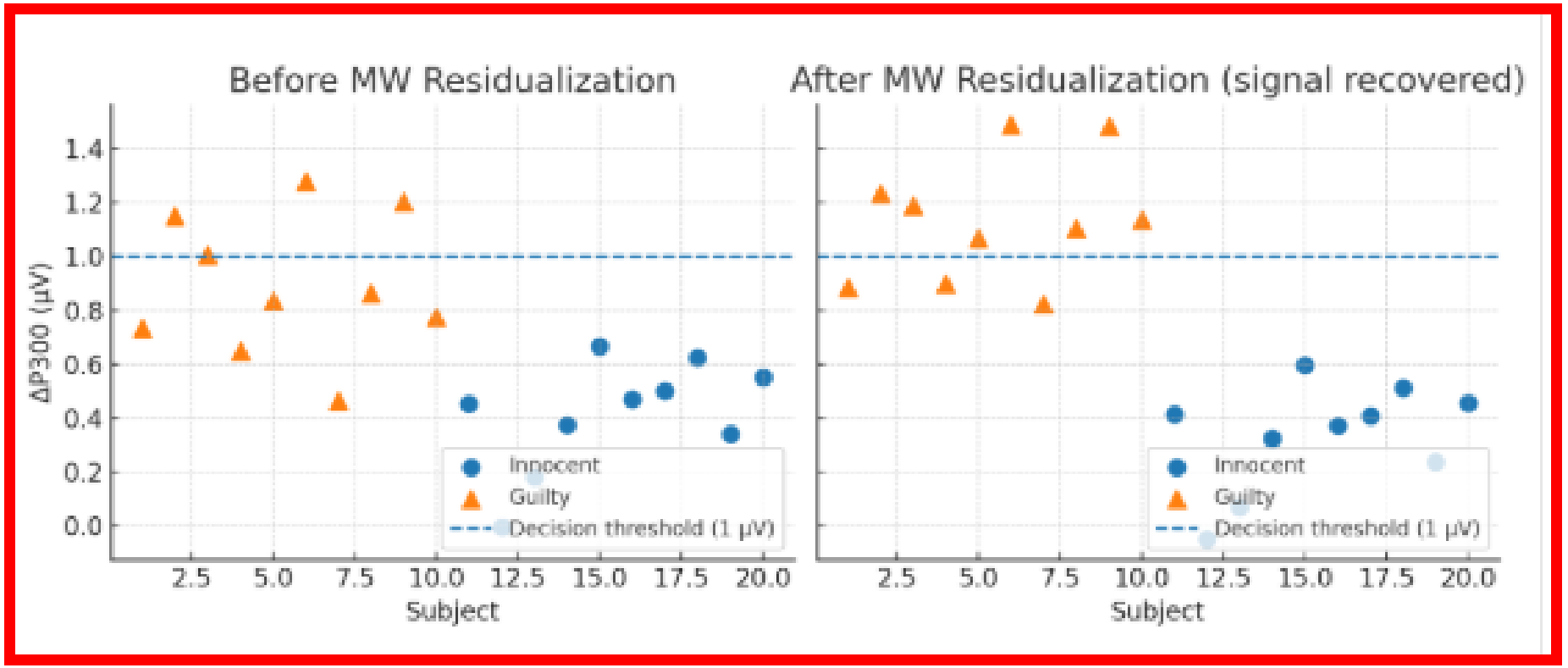
We already know from the cartoon-distraction (Lavi) study that people prone to mind-wandering get more easily pulled away by visual distractors.

Now, imagine using that same EEG “mind-wandering fingerprint” to boost the accuracy of lie detection.

We’ll include the mind-wandering probability in a regression model, so we can see how focus affects the P300 difference between probe and control stimuli.

Effect of MW Residualization (signal recovered)

Example using mock data



Guilty cases: Mind-wandering suppresses their true P300. Removing it restores the full signal, so scores go up.

Innocent cases: Their probe P300 is small even when focused, so removing mind-wandering doesn't change their score much.