

Reading your mind with EEG (or not) measuring time travel, emotion and stickiness of thoughts during mind wandering



Ludi van Leeuwen & Anne Schipper

supervisor: Marieke van Vugt

-INTRODUCTION-

Mind wandering (MW) is familiar for most of us. It is when your attention shifts from a task to unrelated thoughts. This can negatively influence studying¹ to name one. If it would be possible to measure mind wandering with **EEG (Electroencephalography)**, then this could have interesting implications for understanding the human mind by monitoring when mind wandering occurs and how this affects our behaviour. We wanted to know if we could see differences in EEG when subjects were thinking in certain categories during MW.

-METHOD-

We used existing data in which MW was triggered in subjects (n=30) by the Sustained Attention to Response Task (SART): a reliable method². EEG was used to measure brain activity during the task. The subjects were asked to score their level of MW and also their thoughts in three categories: **time travel**: thinking about the past, present or future; **emotion**: negative to positive, and **stickiness**: how hard it was to let the thought go. We predominantly used the MatLab toolbox 'EEGlab' to perform the statistical tests and to create plots of the **Event Related Potentials (ERP's)**, that is, the brain activity followed after an event. In our case, mind wandering in a certain category was the event we analysed.

-CONCLUSION-

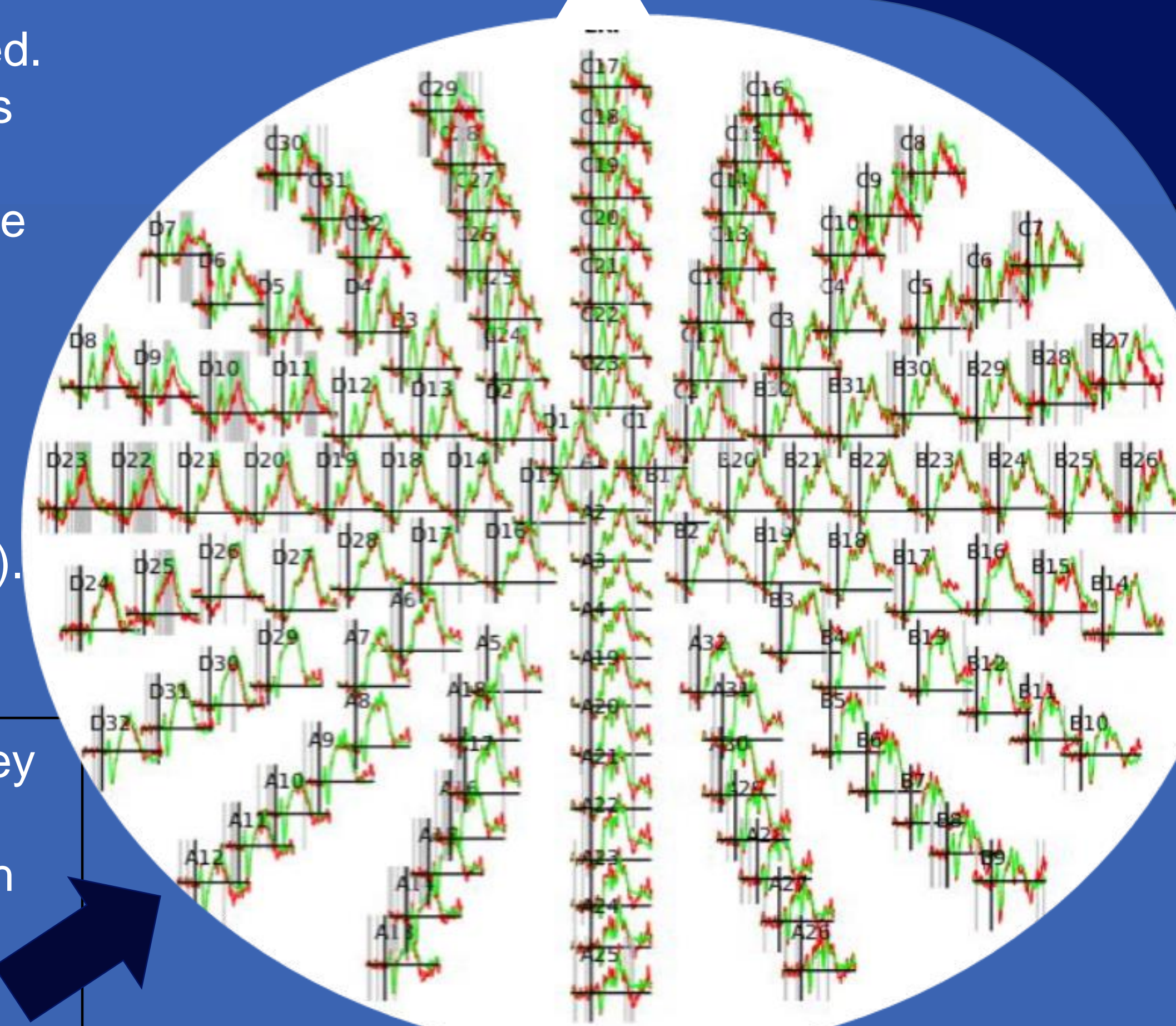
The approach we used to analyse the EEG data with EEGlab was not sufficient to gain any significant results. However, when we did not correct for multiple comparisons, some results were very significant and those are the results shown on this poster.

-RESULTS-

In the results, two states are being compared. We compared the following self-reported thoughts **during mind wandering**:

- 1. Time travel**: thinking about the present vs future and past vs present
- 2. Emotion**: sad vs happy thoughts
- 3. Stickiness**: easy to disengage vs hard to disengage from the thought

This is an average ERP plot per EEG electrode. the grey area means they are sig. different (<0.05). A sig. difference means that it is possible to distinguish certain states of thought with EEG.



This is an average ERP plot per EEG electrode. the grey area means they are sig. different (<0.05). A sig. difference means that it is possible to distinguish certain states of thought with EEG. The triangle represents the nose

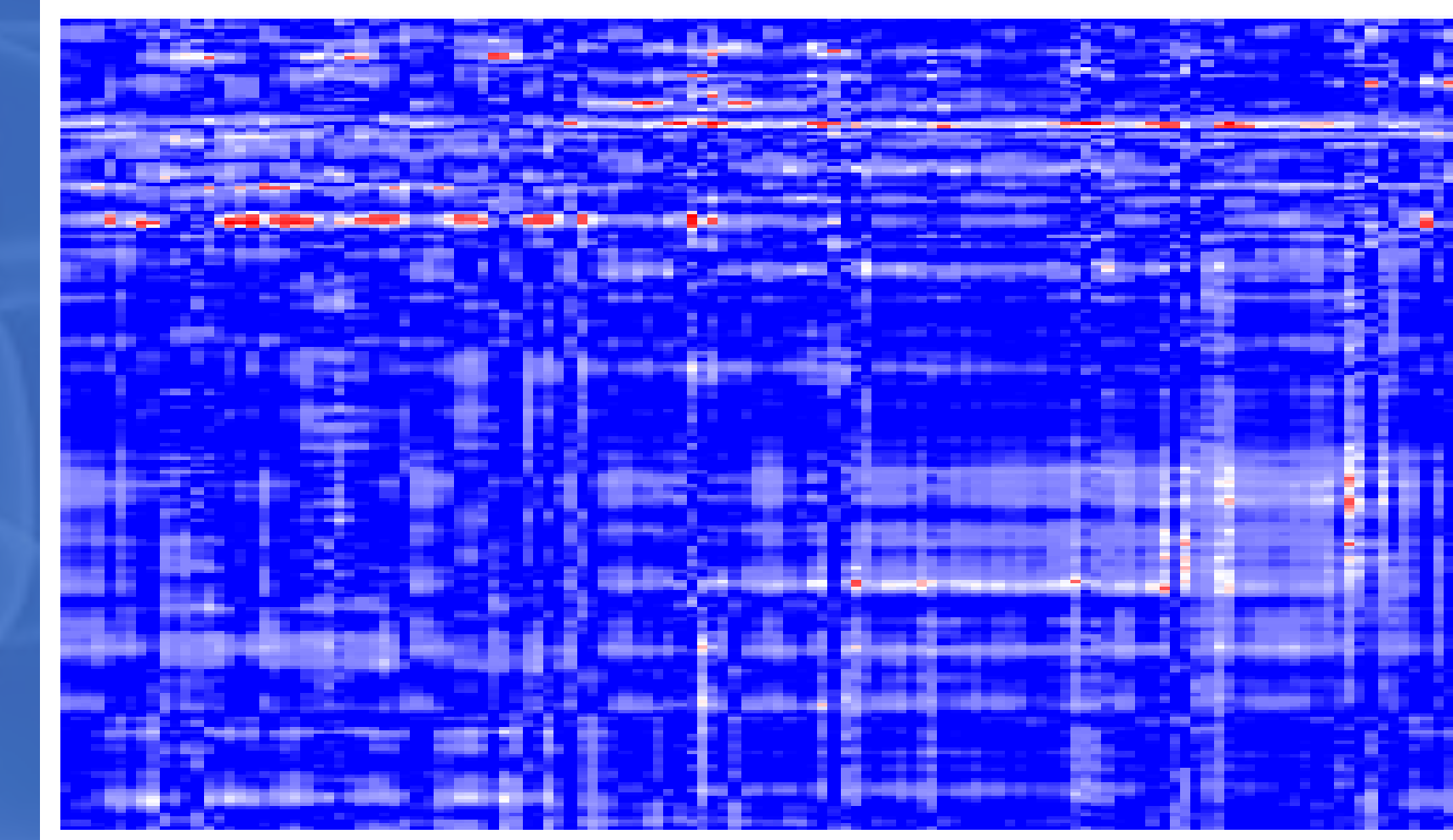
BAYES FACTOR RESULTS

These heatmaps show the Bayes Factors for the uncorrected t-values between the compared states. If the plot is **red**, the Bayes factor is **>3**, which means that the H1 (there is a difference) is 3 times more likely than the H0 (no difference).

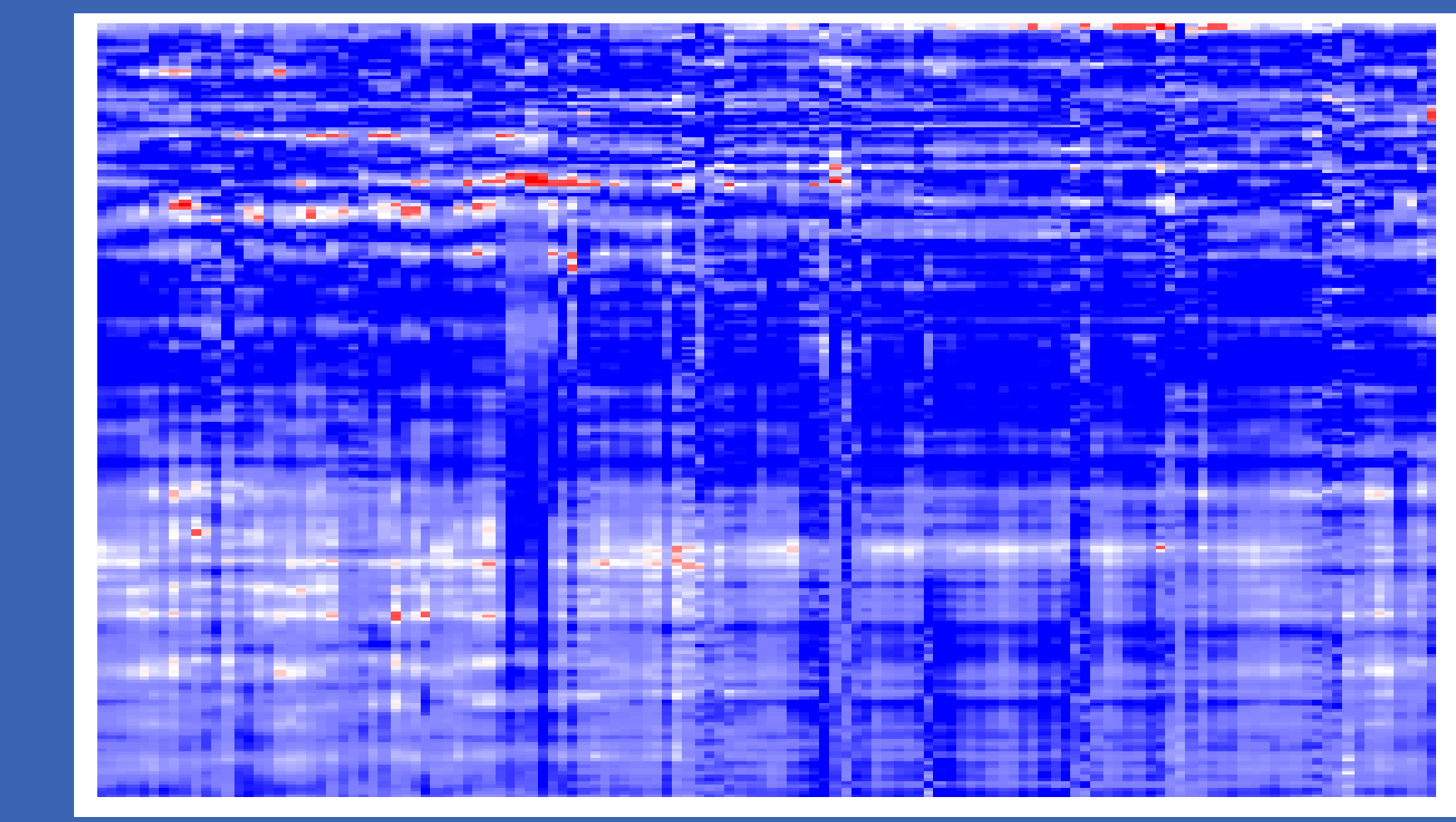
If the plot is **blue** the Bayes factor is **≤0.33**, meaning H0 is 3 times more likely than H1. If the plot is **white** there is not enough evidence for either.

From these heatmaps, it is clear that H0 is most often the case.

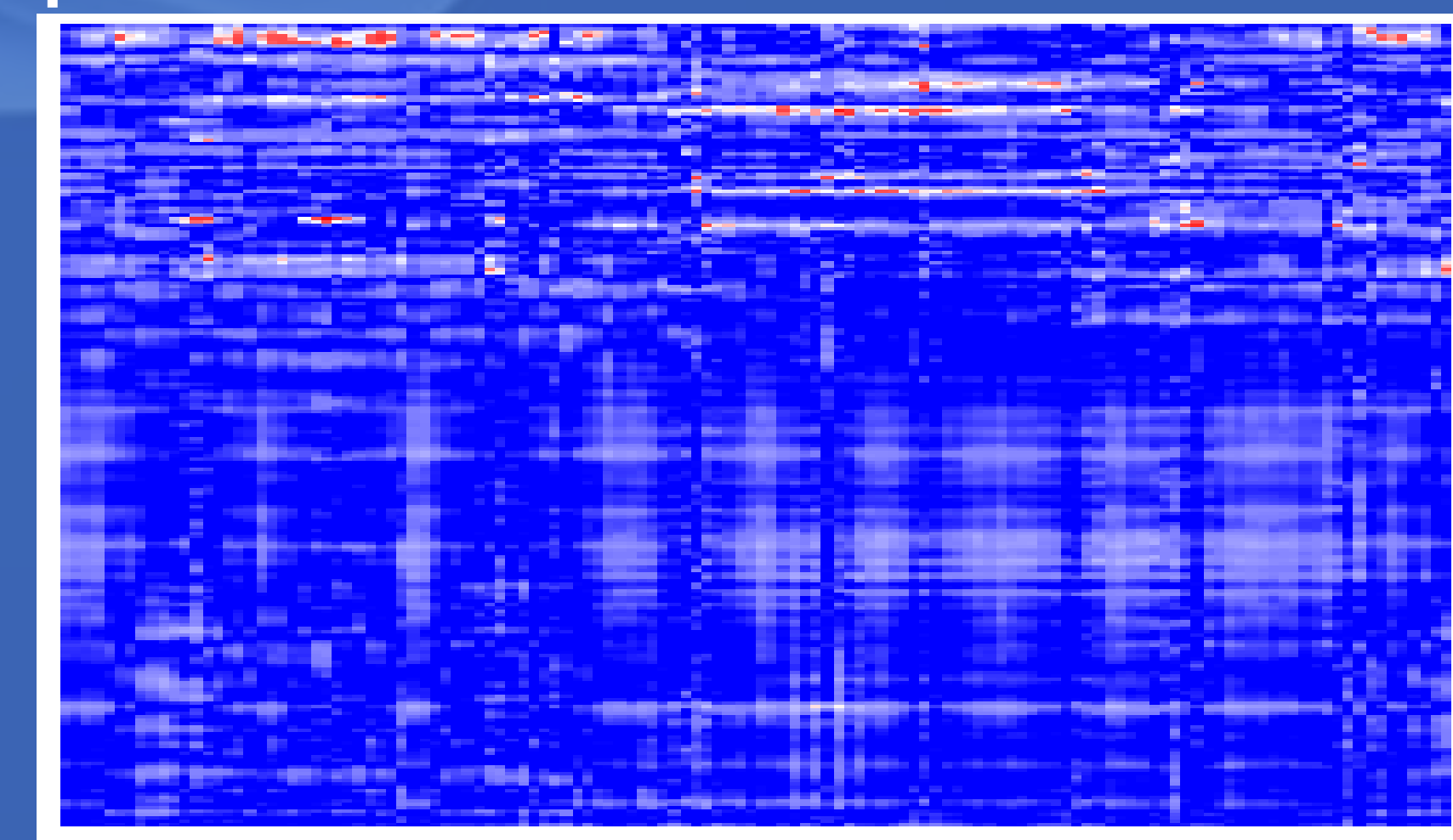
past- present



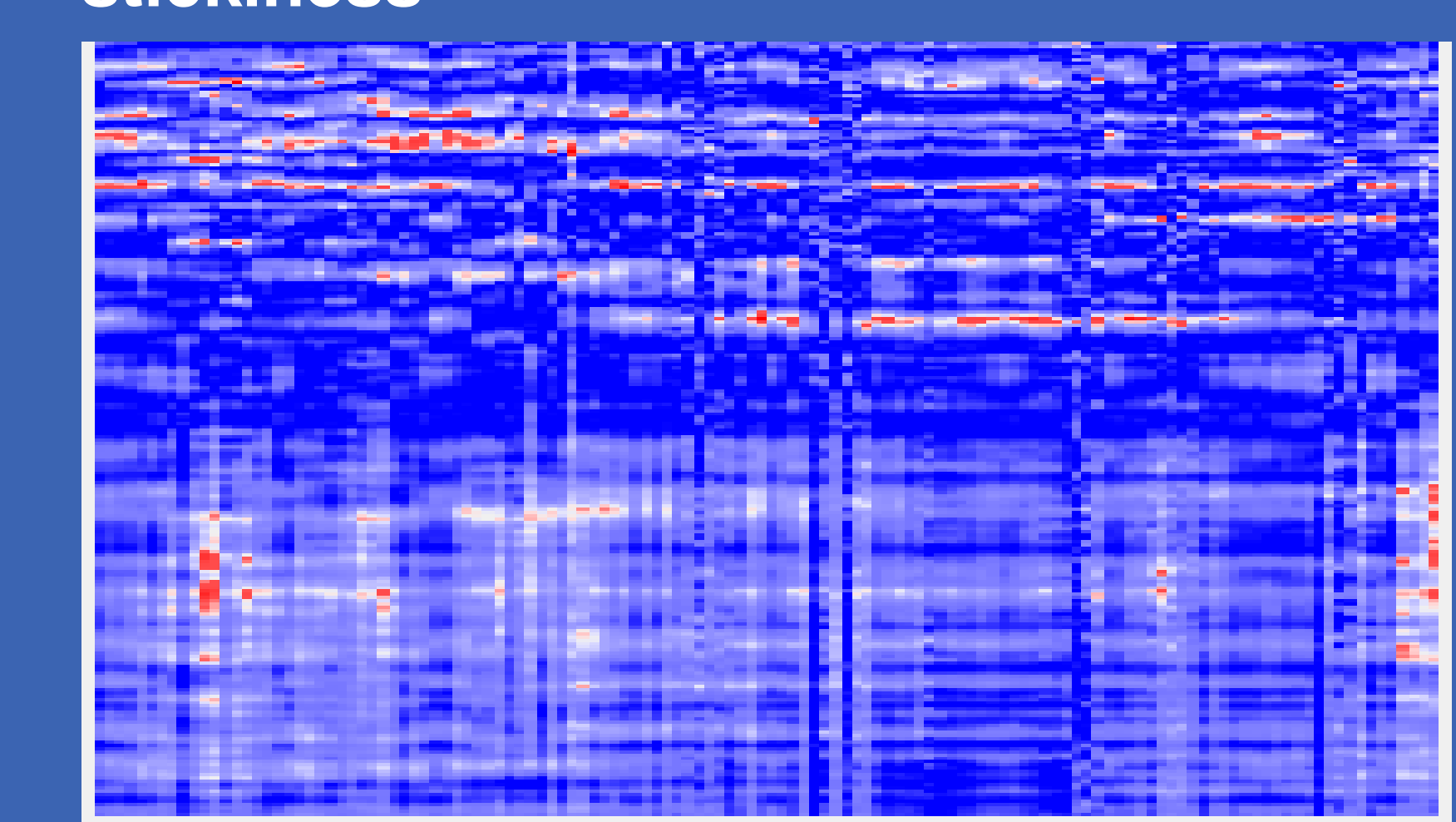
emotional valence



present - future



stickiness



electrodes

timepoints

References

1. Christopher A. Sanchez, Jamie S. Naylor (2018). Mindwandering while reading not only reduces science learning but also increases content misunderstandings. *Journal of Applied Research in Memory and Cognition*.
2. Daniel Smilek, Jonathan S.A. Carriere, J. Allan Cheyne (2010). Failures of sustained attention in life, lab, and brain: Ecological validity of the SART. *Neuropsychologia*, 48(9)