Cognitive Neuroscience & Cognitive Systems — University of Kent

brain+cognitive sciences

Target Discriminability and the Time Course of Attentional Selection

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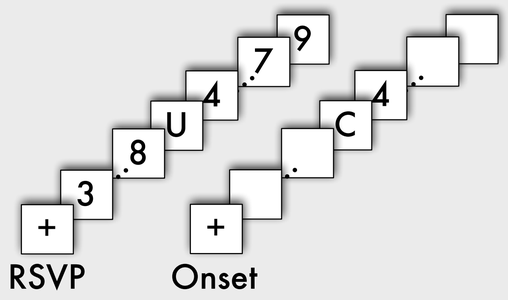
Target Discriminability and Attention

- Neurophysiology: selective attention can act very early in visual processing
- Behaviour: Target-distractor similarity directly impairs selection accuracy[1]
- How does target discriminability influence latency of attentional selection ?
- We manipulate discriminability to compare theory and EEG data

The Experiment

RSVP Condition

- Single letter target featurally similar to digit distractors
- Must be processed categorically to discriminate
- Attention should be slower and accuracy lower

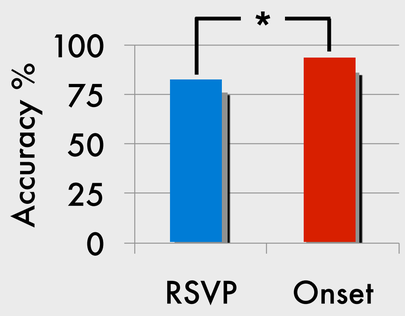


Onset Condition

- Single letter target only backward masked by digits
- Detectable simply by visual onset
- Attention should be quicker and accuracy higher

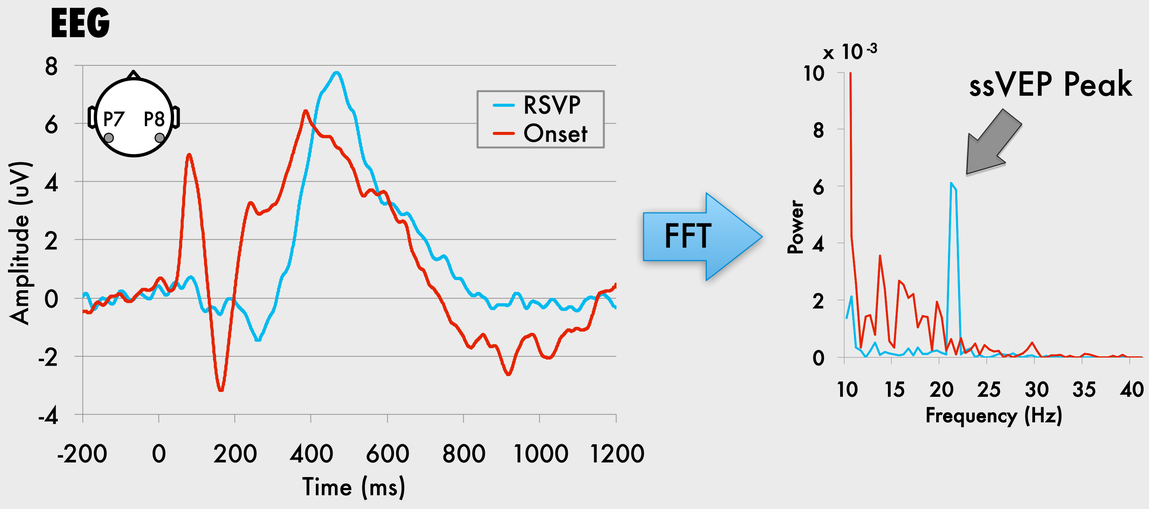
Experimental Results

Behavioural



- Onset targets make target detection easier
- Accuracy is significantly higher than RSVP
- $F(1,16) = 7.87$, $MSE < 0.01$, $p = 0.01$
- Is in line with previous findings[1]

EEG



Early Components

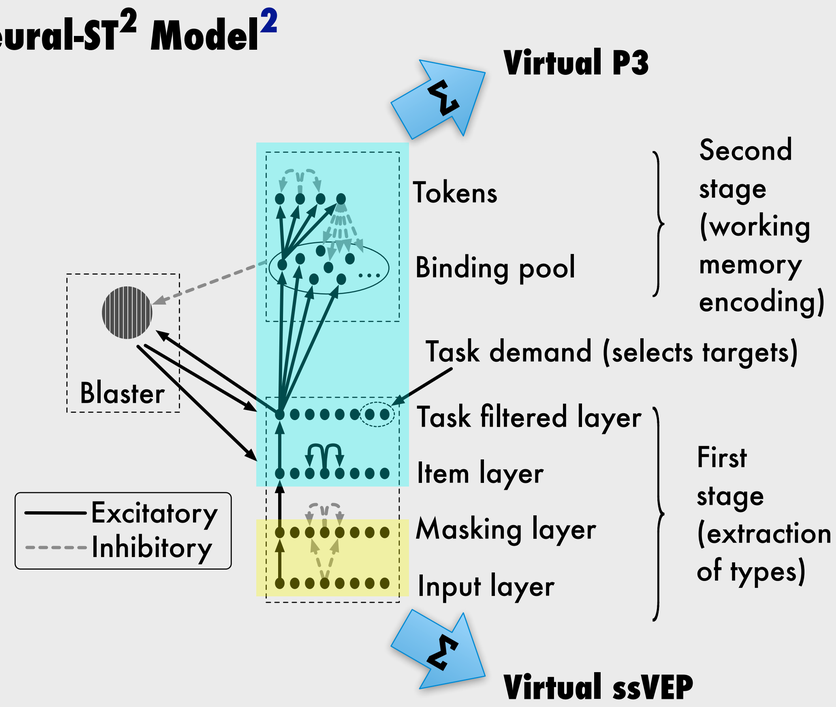
- RSVP condition evokes steady state VEP
- Onset targets evoke P1 and N1
- and significantly larger mean amplitude: $F(1,16)=91.93$, $MSE=0.479$, $p < 0.001$

P3

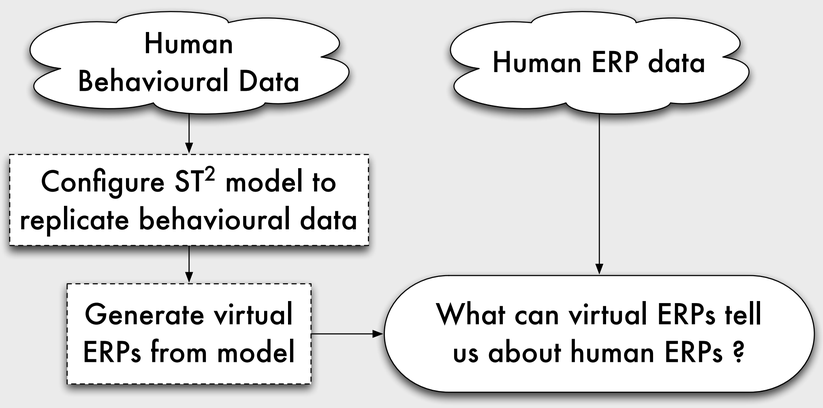
- Onset targets generate significantly earlier P3: $F(1,16) = 6.45$, $MSE = 5155.26$, $p = 0.02$
- But mean amplitude diff. not significant

Computational Modelling

The Neural-ST^2 Model[2]

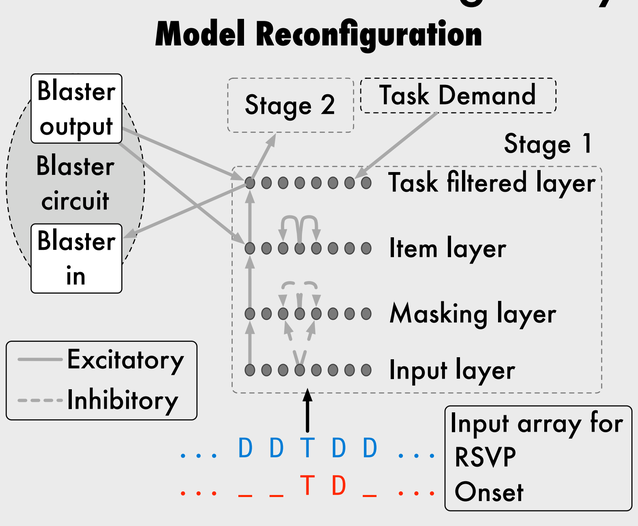


Virtual ERPs[3]

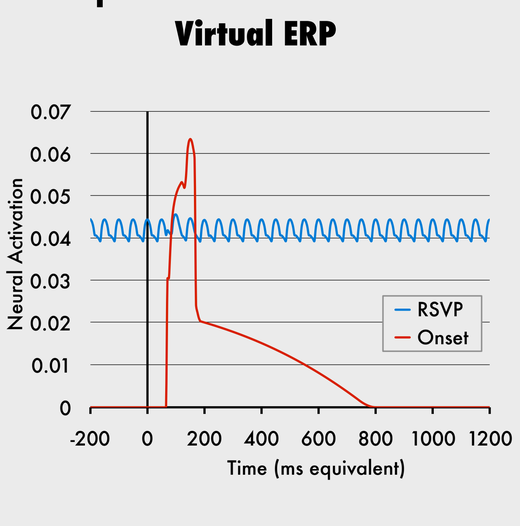


Simulating Early Components

Model Reconfiguration

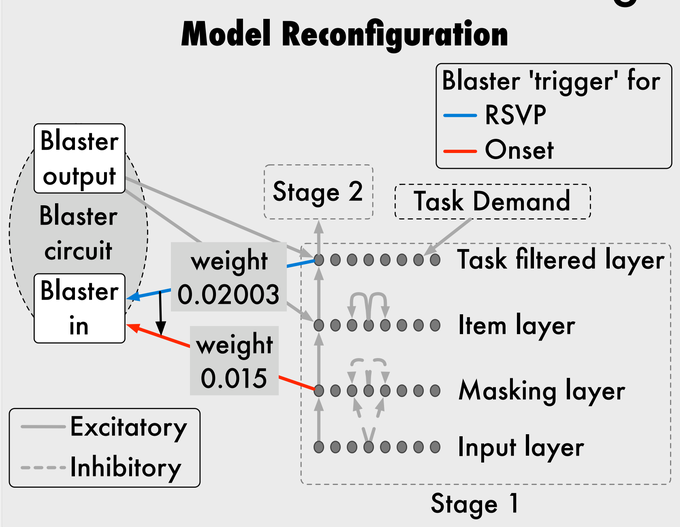


Virtual ERP

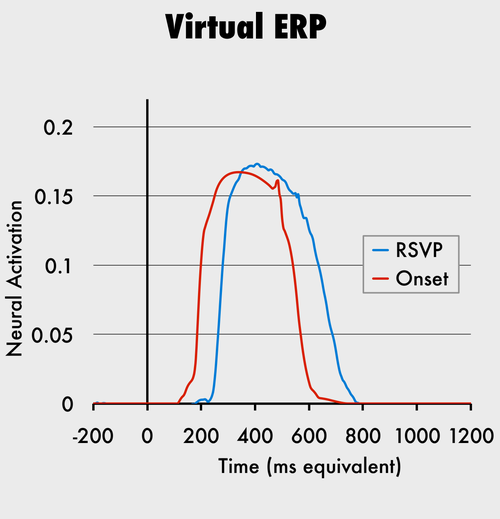


Simulating the P3

Model Reconfiguration



Virtual ERP



In Conclusion

- ERP patterns reflect differences in target-distractor discrimination
- ST^2 proposes that these differences arise from earlier triggering of attention
- There are key qualitative dissimilarities between RSVP and Onset presentation
- Direct comparisons of such EEG/MEG data should be cautiously interpreted

References

1. Visser, T.; Bischof, W. & Di Lollo, V. *Perception & Psychophysics*, 2004, 66, 1418-32
2. Bowman, H. & Wyble, B. *Psychological Review*, 2007, 114(1), 38-70
3. Craston, P.; Wyble, B.; Chennu, S. & Bowman, H. *Journal of Cognitive Neuroscience*, 2009, 21, 550-566

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