The relation between neural entrainment and speech intelligibility Jonas Vanthornhout¹ Lien Decruy¹ Jan Wouters¹ Jonathan Z. Simon^{2,3,4} Tom Francart¹

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BP filter a delta band filter (0.5 Hz to 4 Hz).

$$\hat{s}(t) = \sum \sum decoder(n, \tau) R(t + \tau, n)$$

The monotonicity is maximal with an 0-75 ms integration

correlation using only the early responses is significantly higher than the 0-250 ms integration window (tested using Zou's confidence interval). For the maximal attention condition, we found no significant difference. For the early responses, the movie condition shows more monotonic results compared to the maximal attention, we think is due to less variation in the attention level.

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3. Results

Experiment 3: effect of playing Tetris



- Reconstruction quality increases quasi-monotonically when subjects were attentively listening to speech sentences while watching a Tetris game (Spearman ho=0.7).
- ► When playing a Tetris game, the reconstruction quality did not increase with SNR (Spearman $\rho = -0.5$).
- ► These results do not correspond with the results from the previous conditions. However, playing Tetris introduced many motor and muscle artefacts, something which was not present in the previous conditions. Also the cognitive load increase when playing Tetris which decreases the entrainment of the auditory stimulus.

4. Conclusion

- 1. We found that reconstruction quality of the speech envelope increases with stimulus SNR when choosing an integration window of 0-75 ms and a pass band of 0.5-4 Hz. Our hypothesis is that the integration window minimises the affect of attention on the level of entrainment (Puvvada and Simon, 2015; O'Sullivan et al., 2014).
- . When subjects were watching a movie while listening to the speech stimuli, we found monotonically increasing reconstruction quality with stimulus SNR in the 0-75 ms integration window. Other integration windows did not show a monotonic increase as shown by the lower correlations
- 3. When subjects were playing Tetris while listening to the speech stimuli, we did not find this monotonic increase. We found the monotonic increase when the same subjects attentively listened to the speech stimuli. While this can be the result of failing to remove the effect of attention, it can also be due to artefacts.

Research question 1: The reconstruction quality increases as the SNR of the stimulus increases. **Research question 2:** When the attention of the subject was diverted to a movie or a Tetris game, we found a decrease of reconstruction quality at some SNRs.

Research question 3: By choosing an integration window from 0-75 ms we were able to reduce the effect of attention in the movie condition but not in the Tetris condition.

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Acknowledgements

Financial support for this project is provided by the KU Leuven Special Research Fund under grant OT/14/119. Research funded by a PhD grant of the Research Foundation Flanders (FWO). This project has received funding from the European Research Council (ERC) under the European Unions Horizon 2020 research and innovation programme (grant agreement No 637424), and from the YouReCa Junior Mobility Programme under grant JUMO/15/034 to Jonas Vanthornhout. The authors thank Lise Goris, Lauren Commers, Paulien Vangompel and Eline Verschueren for helping collecting data.

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