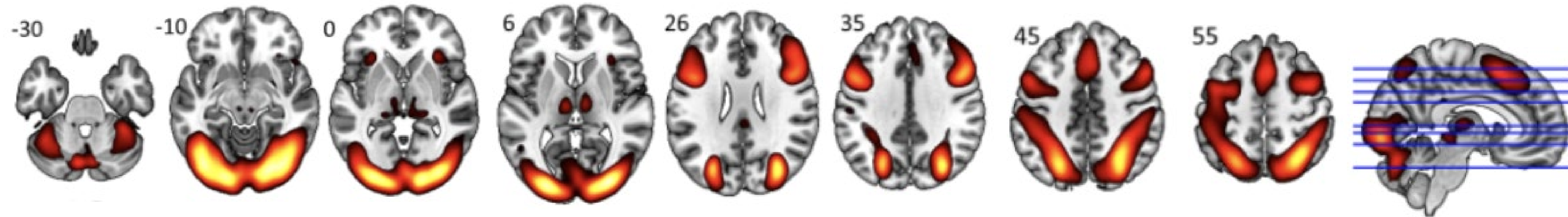


## Introduction

This study aims to characterize functions of networks of brain activity activated during task-based fMRI, as opposed to concluding brain region function through observations of brain activity during the lack of a stimulus. We aim to characterize the Volitional Attention to External Representations (EXT) Network [1]. We hypothesize the EXT network shows increased activity when individuals are required to maintain attention towards prolonged, salient visual stimuli and the EXT network shows suppression during tasks involving attention towards non-visual stimuli.

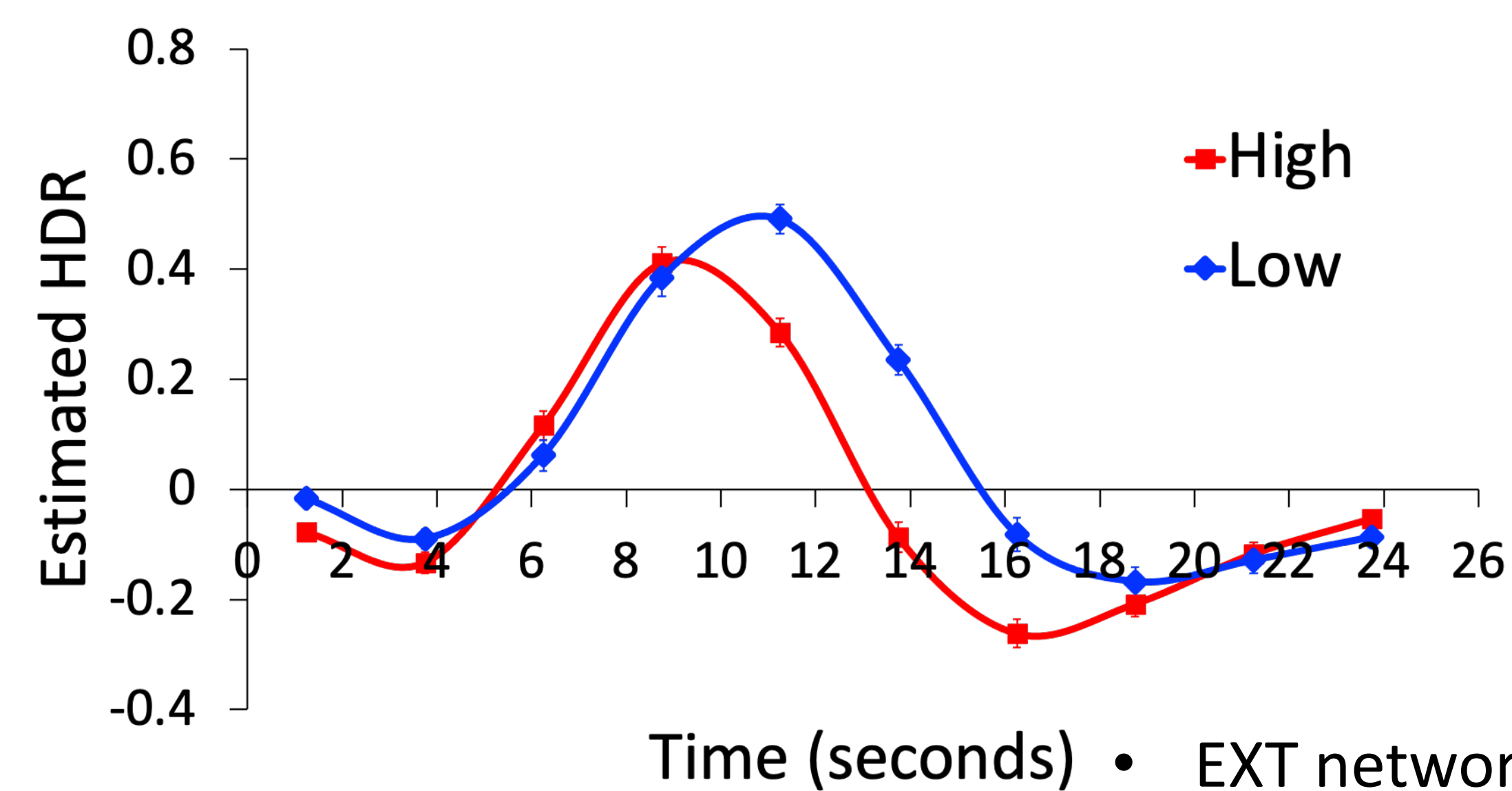
## Results

Recruitment of the EXT network is primarily characterized by activity in the occipital regions, superior parietal lobes, bilateral insula and paracingulate gyri, sensorimotor regions, and cerebellar regions [1].



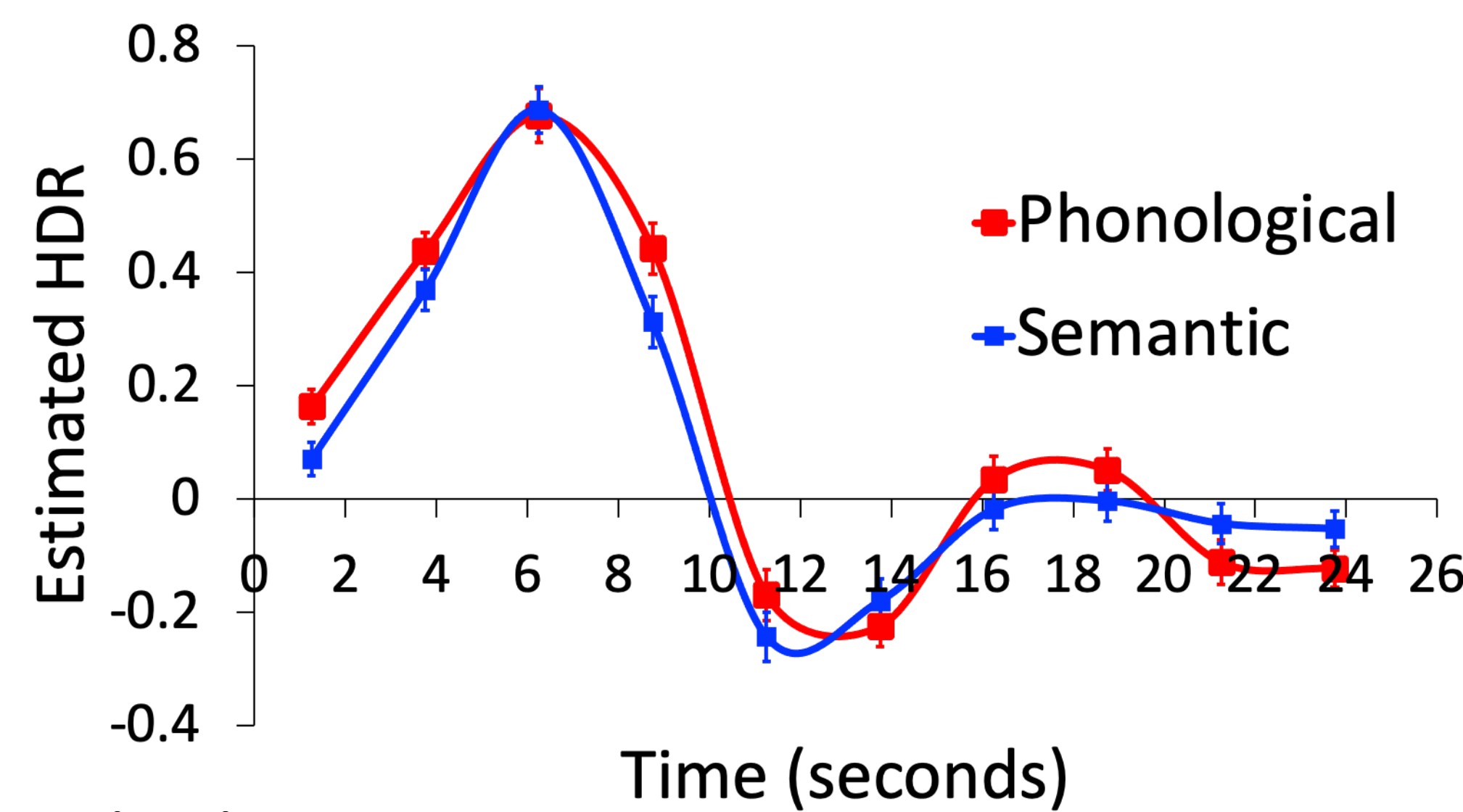
### Semantic Association Task

- Participants (n=27 schizophrenia, n=30 healthy controls) were required to select the word with the closest relationship to the prompt word in meaning.
- Words were ranged on semantic distance from Close (High) pairs to Distant (Low) pairs.

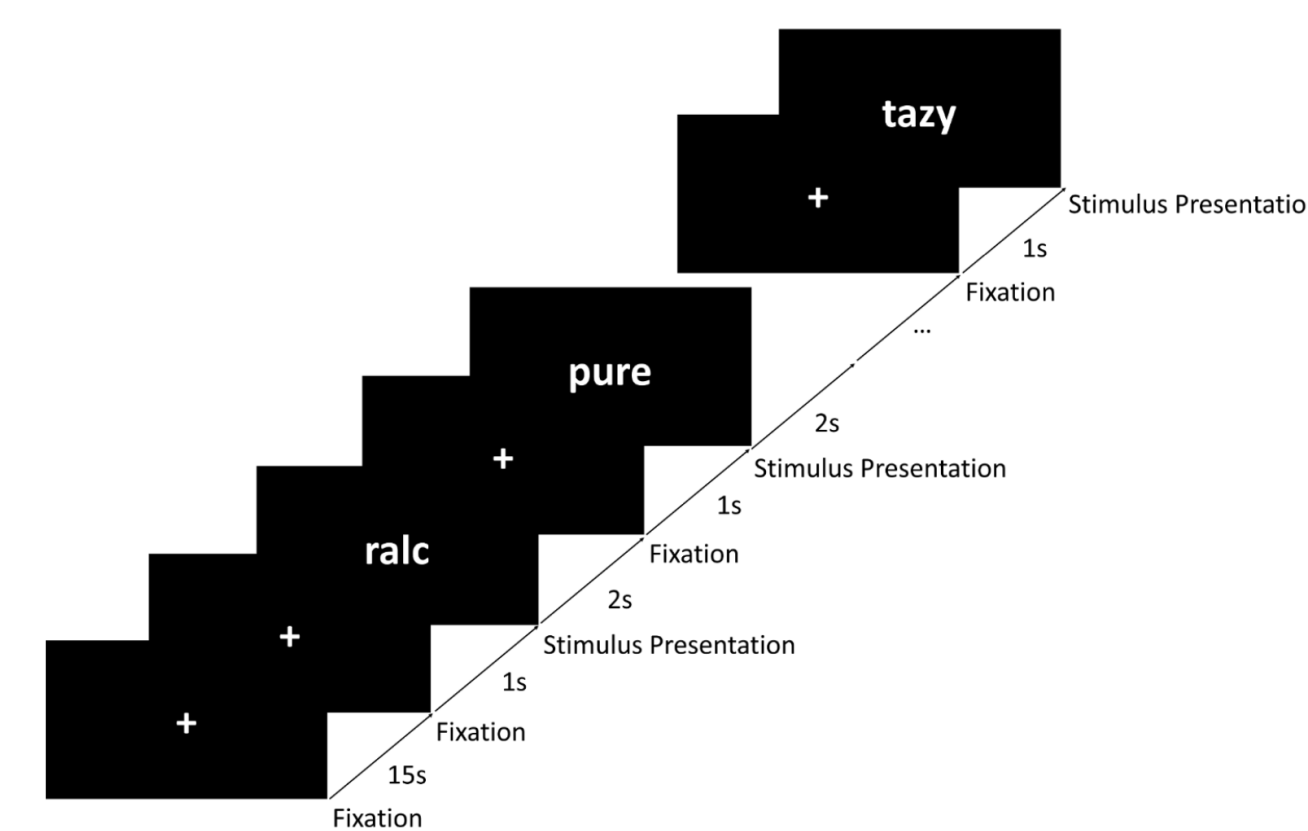
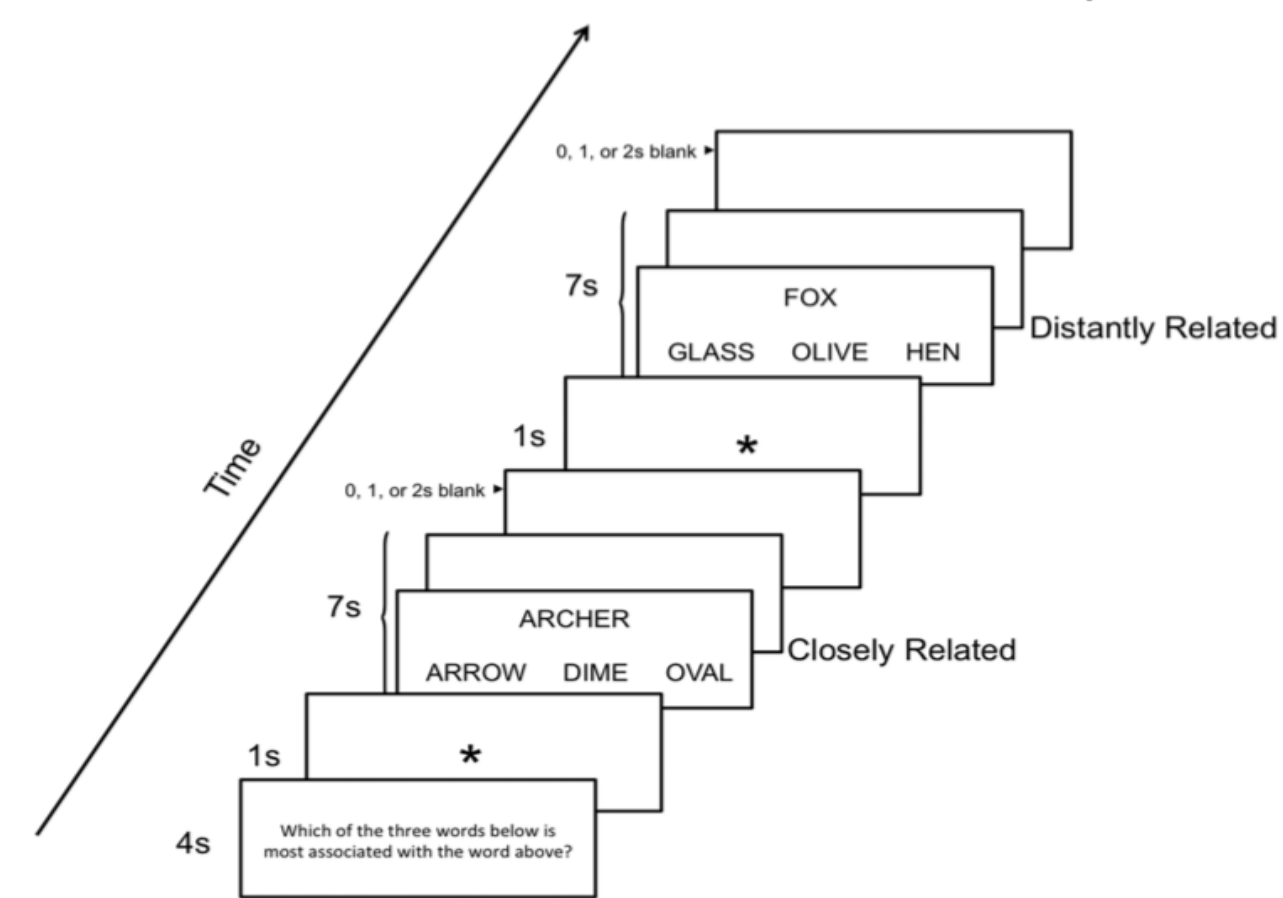


### Metrical Stress Task

- Participants (n=32 healthy controls, n=47 schizophrenia) were required to identify stress placement in the Phonological condition or identify the connotation as positive or negative in the Semantic condition.



- EXT network activation increased in correlation to difficulty of task
- This study merged data from SA and MS tasks
- Greater EXT activation in the MS task compared to the SA task.

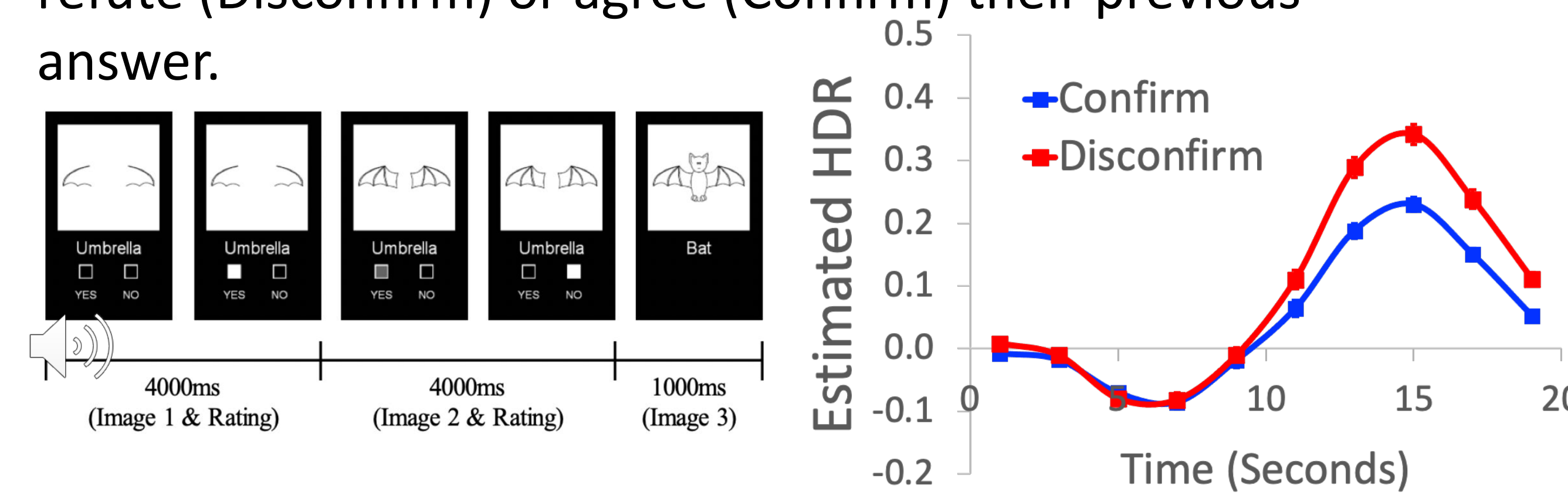


## Methods

- Previous studies extracted the various functional brain networks through constrained principal component analysis for fMRI (CPCA-fMRI) [2].
- Cognitive tasks which recruited the EXT network were compiled and analyzed, with 5 of them being presented here.
- Each task has the estimated hemodynamic response (HDR) plot and an interpretation of the role of the EXT network during each task.

### Evidence Integration Task [3]

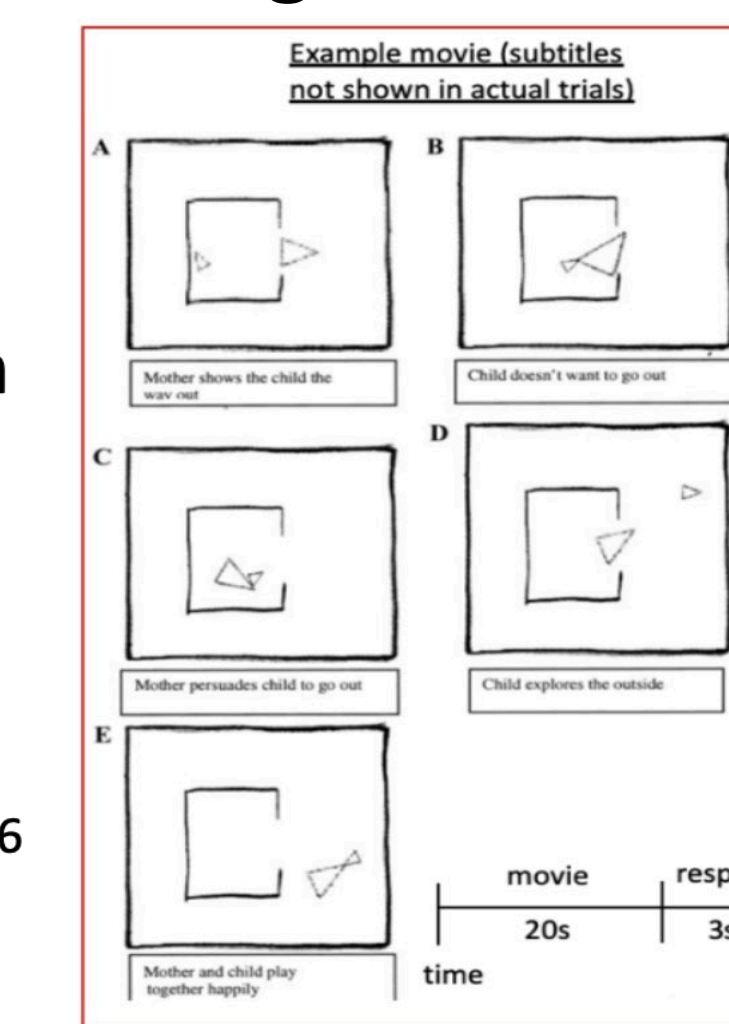
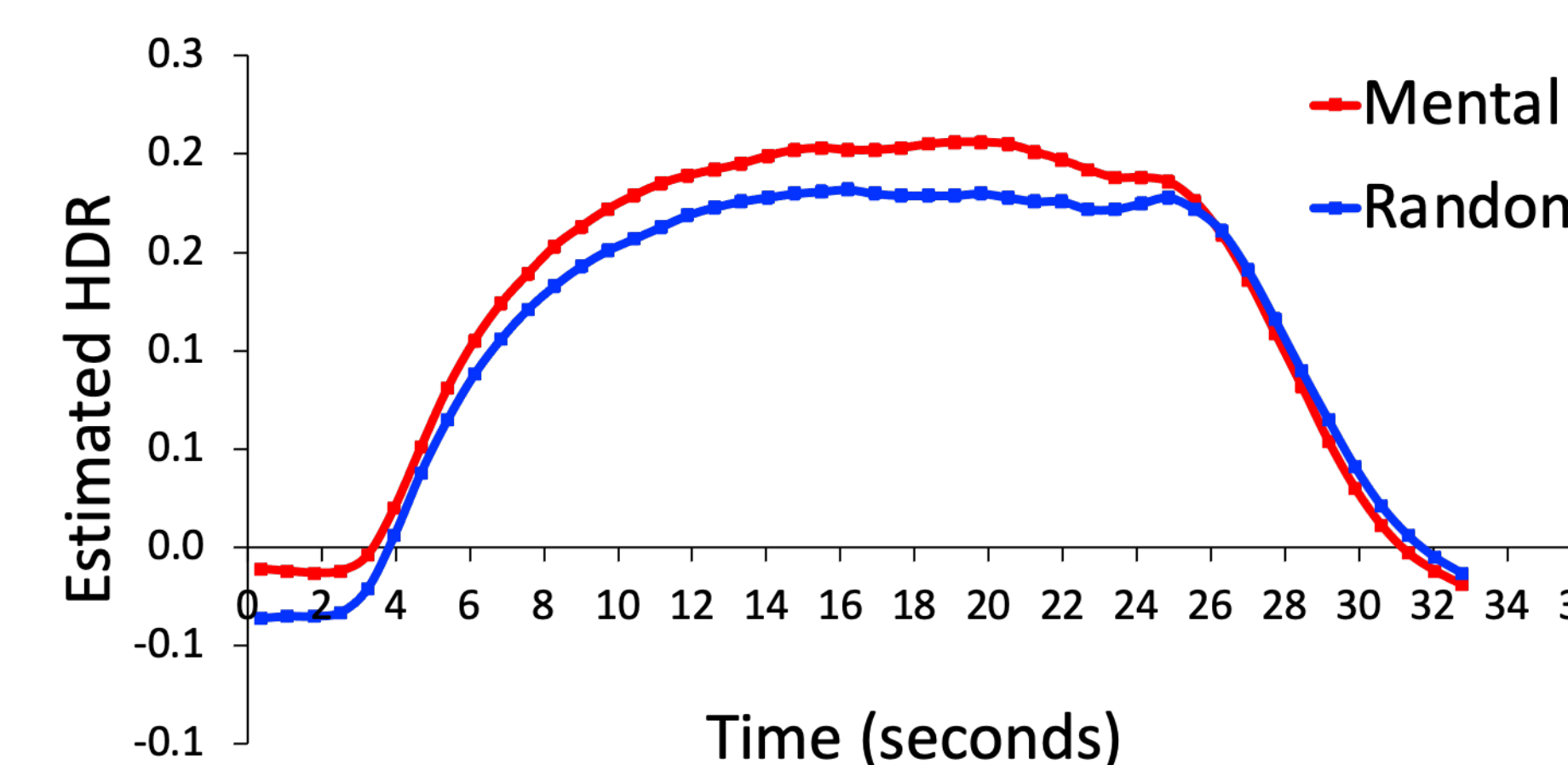
- Participants (n=41 healthy controls, n=70 schizophrenia) had to determine whether the prompt word accurately describes the partial line drawing presented. They were presented with a more detailed image and could either refute (Disconfirm) or agree (Confirm) their previous answer.



- EXT network showed greater activation during the disconfirm condition suggesting increased significance of visual evidence when participants disconfirm their answers.

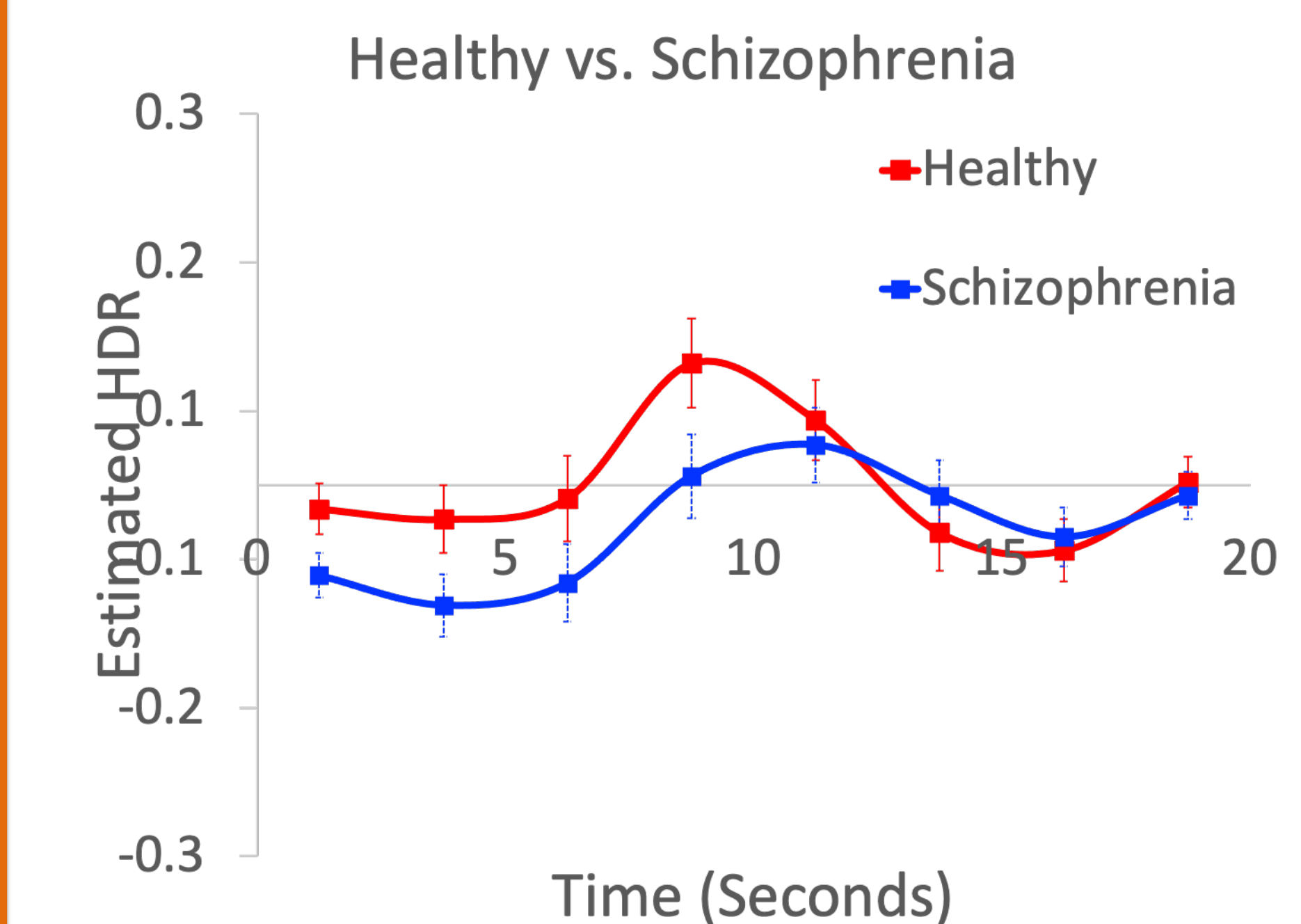
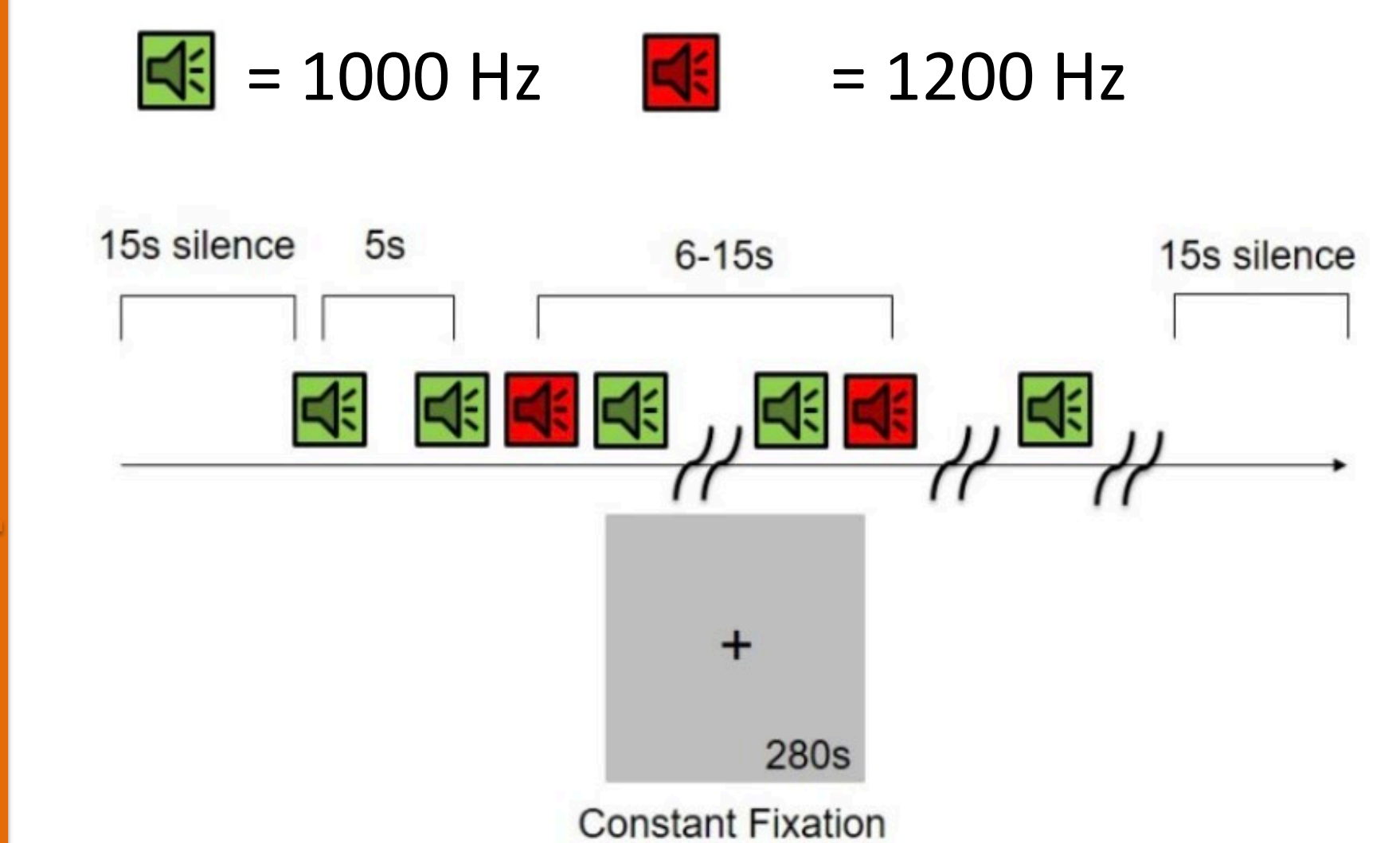
### Social Task

- Participants (n=500) were presented with video clips of shapes either showing interactions (Mental) or randomly moving (Random) and had to determine if there was a social interaction.
- Greater EXT activity in the Mental condition, likely because social interactions are deemed more significant compared to random movement.



### Auditory Oddball Task

- Participants (n=58 schizophrenia, n=50 healthy controls) were required to identify a salient, infrequent auditory stimuli within a series of standard stimuli by button press.
- The EXT network showed an overall low level of activity in both groups throughout the task, with only one peak activation.



## Conclusion

- Results suggest the EXT network is activated when significant visual stimuli is presented, with activation levels being directly correlated with the difficulty of the task, and EXT suppression occurs during tasks with non-visual stimuli.
- More tasks involving auditory stimuli involving a motor response is required to further investigate the correlation between the EXT network and auditory tasks.

## References:

[1] Percival, C. M., Zahid, H. B., Woodward, T. S. (2020). Task-Based Brain Networks Detectable with fMRI [fMRI image]. Github.com. [https://github.com/CNoS-Lab/Woodward\\_Atlas/tree/main/Network\\_Images](https://github.com/CNoS-Lab/Woodward_Atlas/tree/main/Network_Images)

[2] Sanford, N., Whitman, J. C., & Woodward, T. S. (2020). Task-merging for finer separation of functional brain networks in working memory. *Cortex*, 125, 246-271. doi:10.1016/j.cortex.2019.12.014

[3] Lavigne, K. M., Menon, M., & Woodward, T. S. (2020). Functional Brain Networks Underlying Evidence Integration and Delusions in Schizophrenia. *Schizophrenia Bulletin*. 46(1) 175-183. doi:10.1093/schbul/sbz032