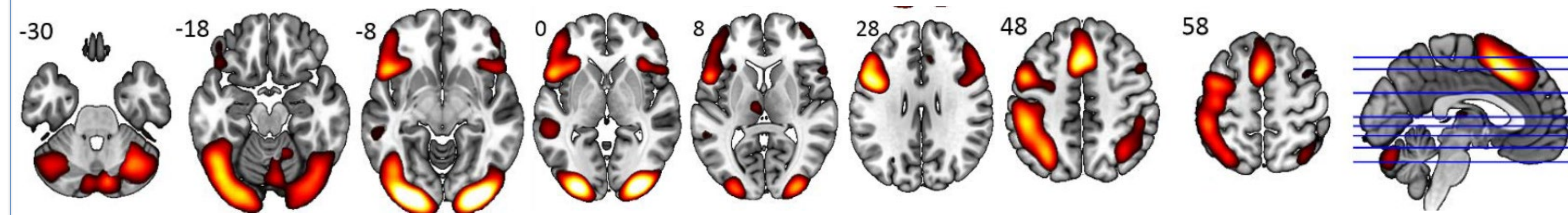


## INTRODUCTION

The CNoS lab has developed a novel statistical approach called fMRI-CPCA which it applied to discover 10 task-positive and 2 task-negative functional networks [1]. Although fMRI-CPCA has been successful in anatomically isolating functional networks, how exactly these networks relate to the cognitive processes that are involved in the tasks that evoke them is not yet clearly understood. The Maintaining network is one of the 12 functional networks that has emerged in several fMRI task-based studies. We aimed to characterize the functions of this network by analyzing 6 fMRI tasks that demonstrate BOLD activity classified as the Maintaining network. The purpose of looking at these tasks is to try to find a cognitive operation that is common to all of them, thereby discovering the function of the Maintaining network.

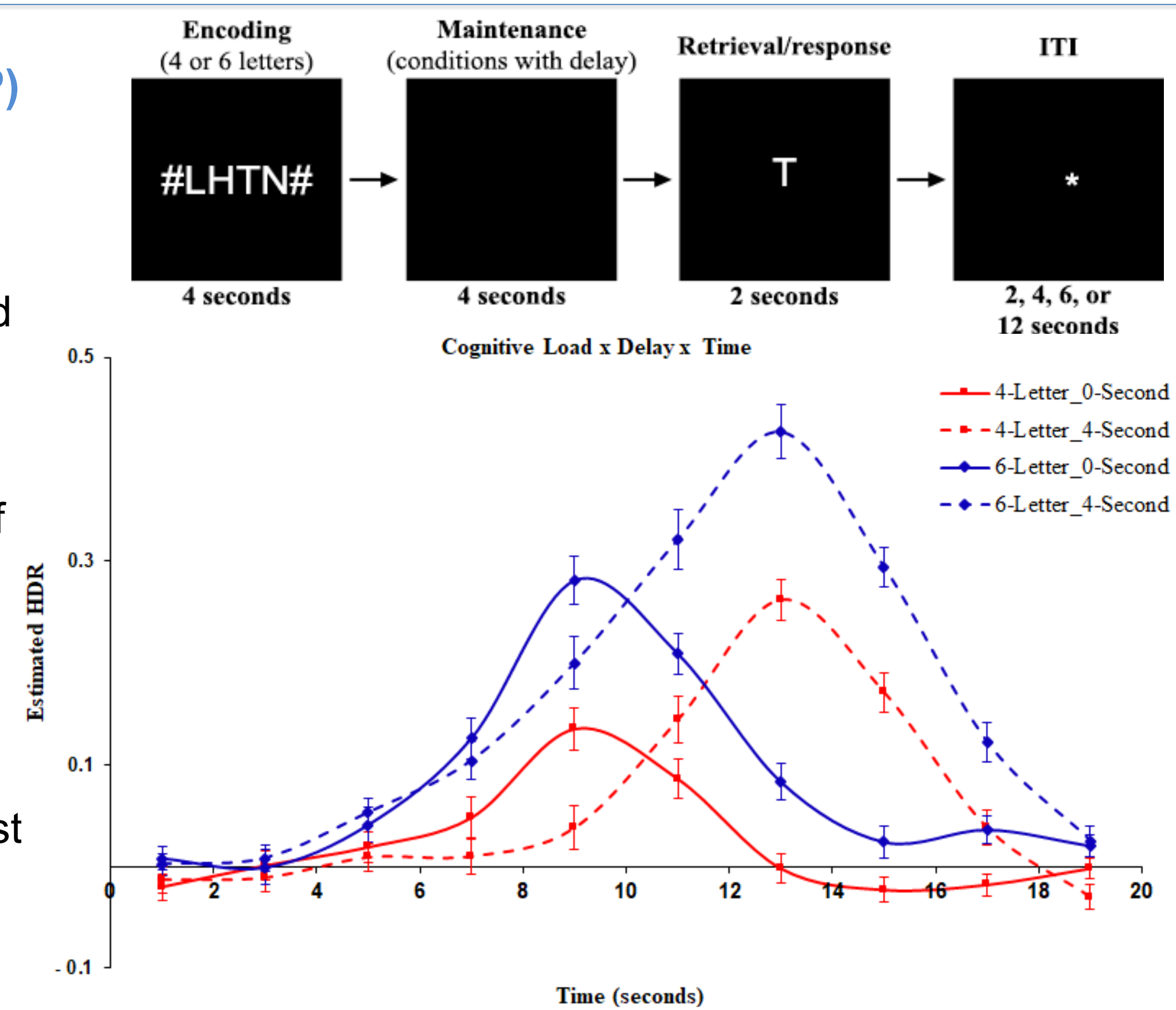
## RESULTS

Recruitment of the Maintaining network is mainly characterized by bilateral activation of paracingulate and superior frontal gyri, DLPFC, frontal poles, anterior insula, and supramarginal gyrus [2].



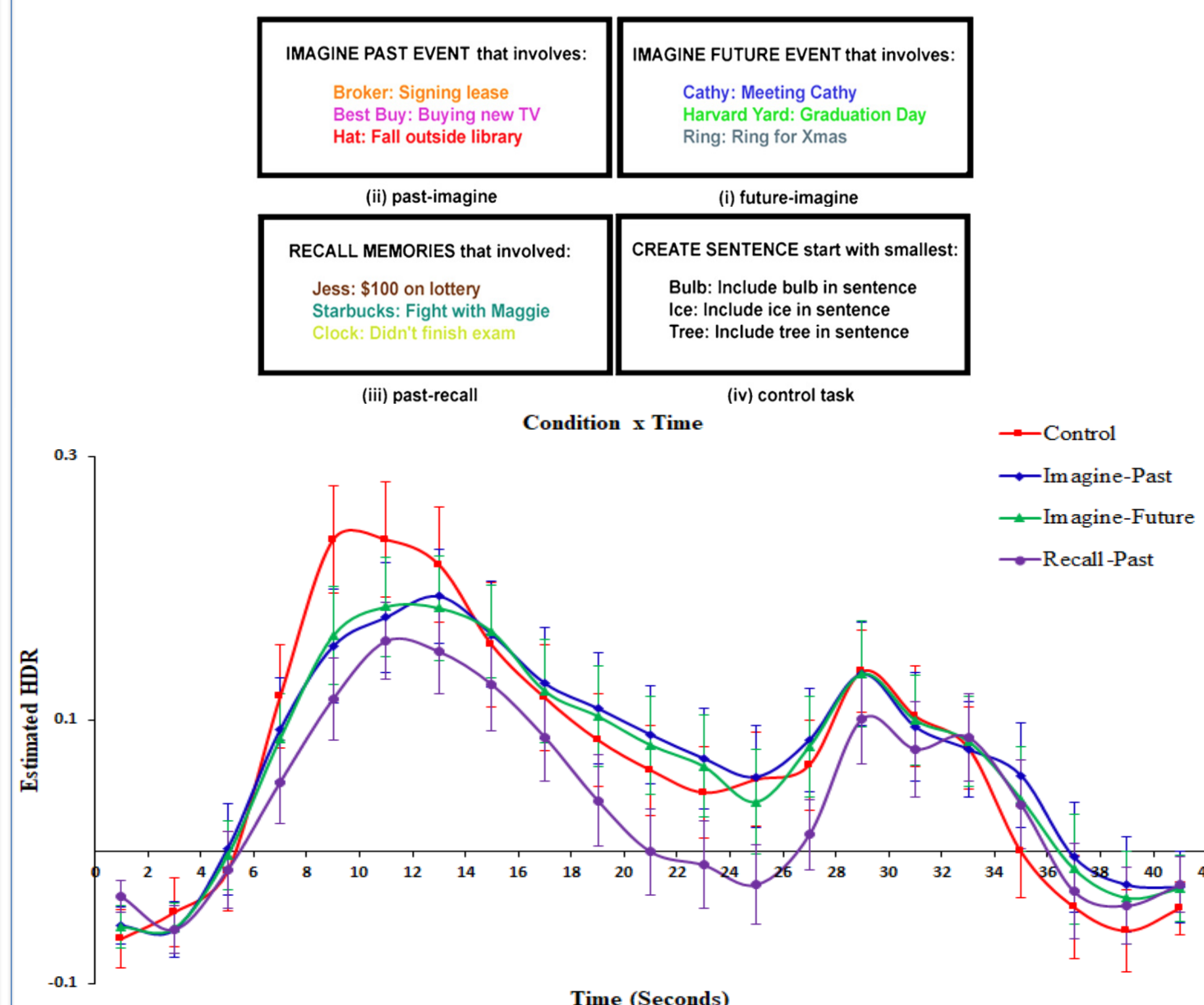
### Sternberg Item Recognition Task (SIRP)

- Participants (n=26 healthy controls, n=28 patients with schizophrenia) were presented a string of 4 or 6 uppercase consonants. After either a 0 or 4-second delay, a single probe letter was displayed and participants were asked to respond “yes” or “no” as to whether this probe letter was part of the string of letters shown earlier.
- Maintaining network seems to be involved in the rehearsal phase of working memory.
- Increasing the cognitive load and the delay period together elicited the highest activation of the Maintaining network activation.



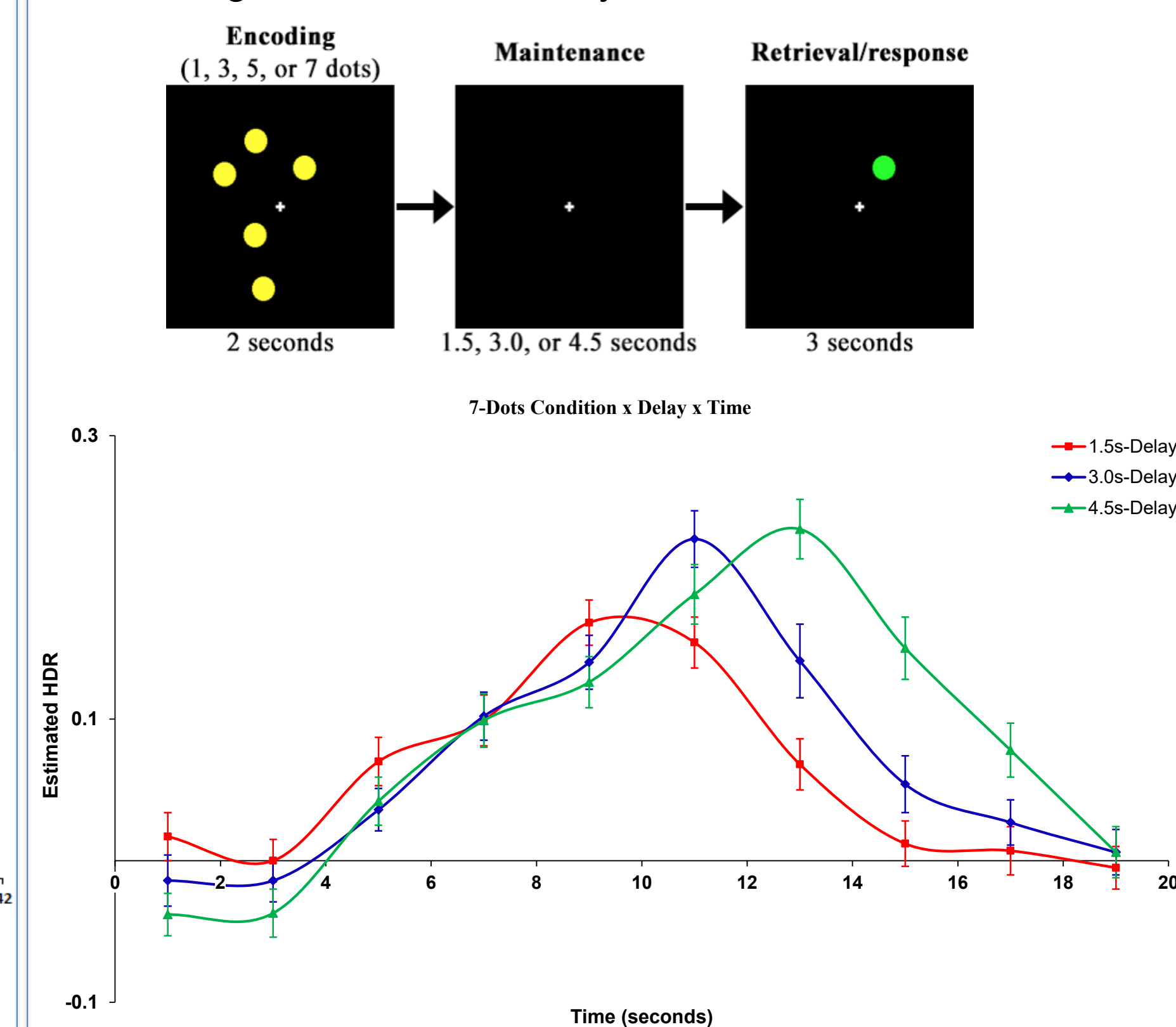
### Addis Task

- Participants (n=18) were asked to either imagine a past or future autobiographical event, recall a past autobiographical event, or complete a visuospatial-semantic control task.
- HDR peaks for the Maintaining network in the Imagine conditions differed from the Recall condition, suggesting that the activity of this network discriminates between novel recombination of episodic details and the simple recall of episodic details.



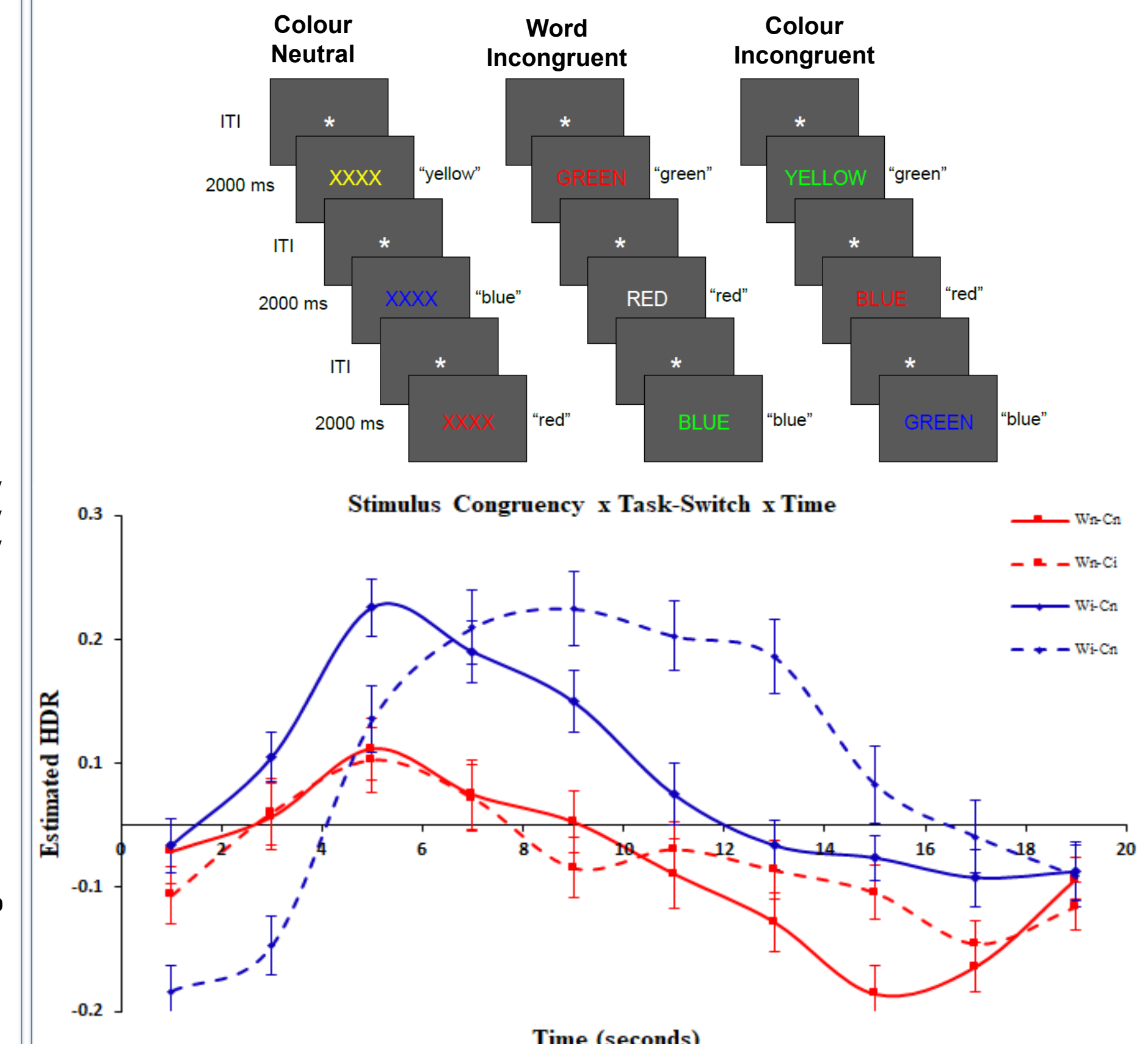
### Spatial Capacity Task (SCAP)

- Participants (n=44 healthy controls, n=44 patients with schizophrenia) were presented with a target array of 1, 3, 5, or 7 dots. After a 1.5, 3.0, or 4.5 second delay, they were asked whether the probe dot was in the same position as the target dots.
- Replicates the results seen in verbal memory tasks (i.e. SIRP): Maintaining network activation reflects the maintenance phase of the study and it is dependent on cognitive load and delay demands.



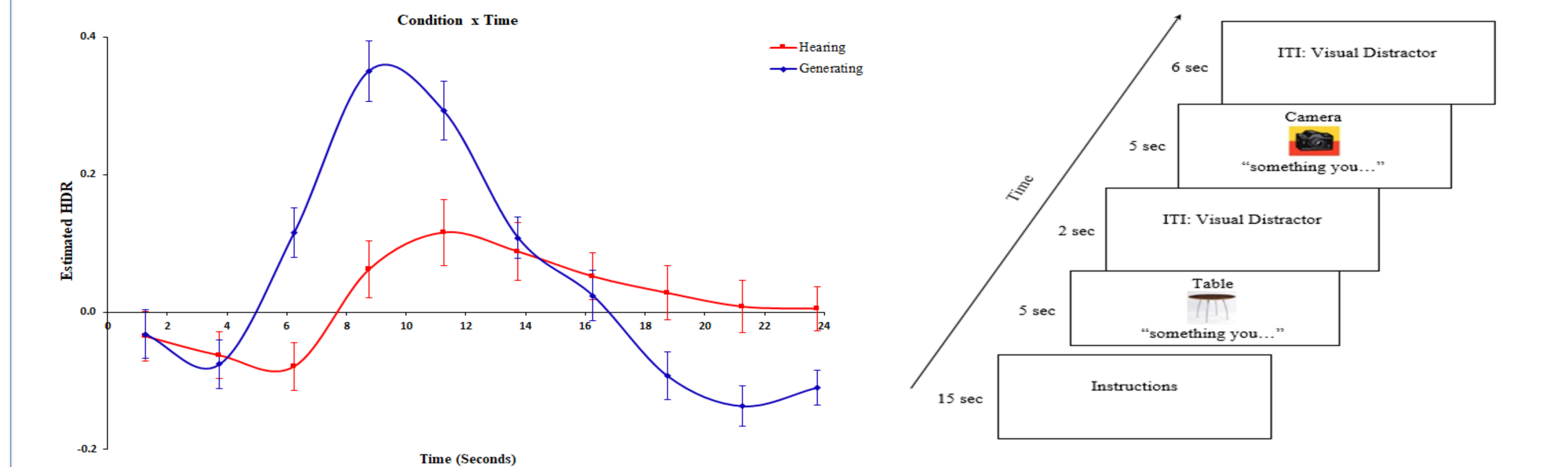
### Task Switch Inertia (TSI)

- Participants (n=54) read colour words presented in neutral (white font) or incongruent coloured fonts. This followed blocks of colour naming with neutral (letter X) or incongruent (incongruent colour word) conditions.
- Higher Maintaining network activation was observed in incongruent word blocks that followed neutral-colour-naming blocks, suggesting that inhibition demands require a greater Maintaining network activation.



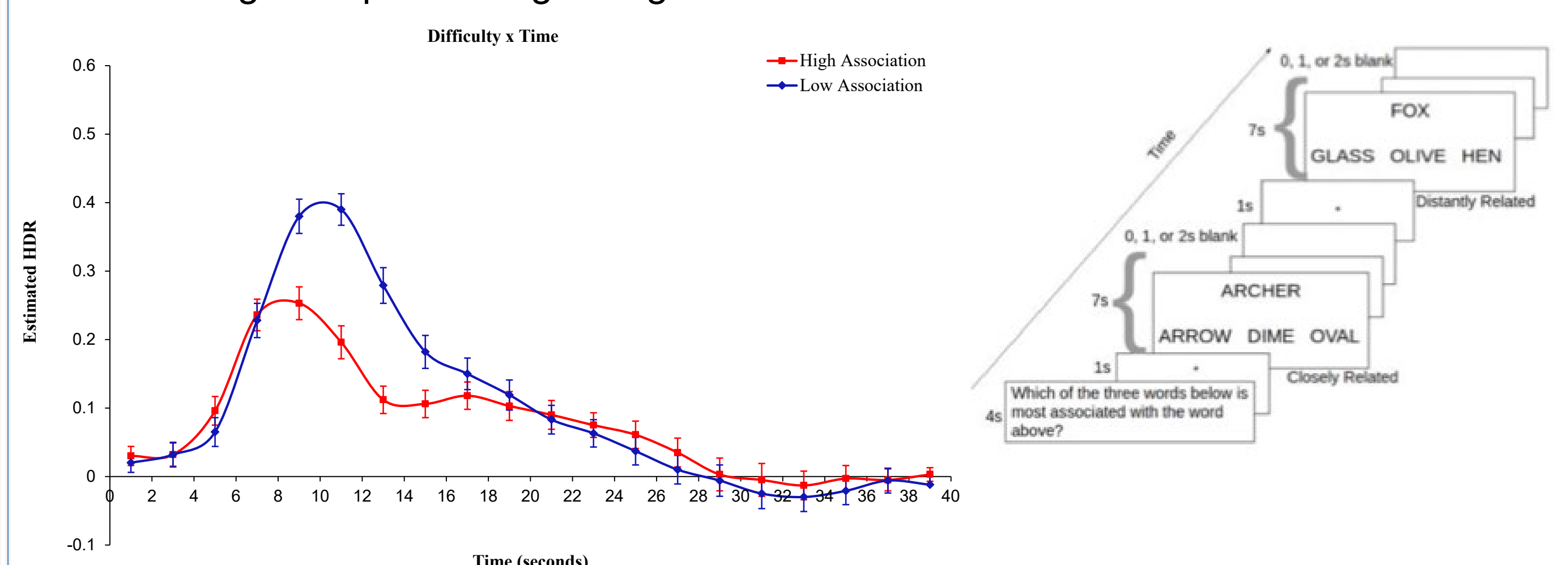
### Thought Generating Task (TGT)

- Participants (n=32 healthy controls, n=28 patients with schizophrenia) were presented with an object noun and its corresponding image for 5 seconds. They were instructed to either mentally generate or listen to the function of that object noun.
- Higher Maintaining activation was observed in the Generating condition relative to the Hearing condition, suggesting that the Maintaining network is involved in internally oriented cognition.



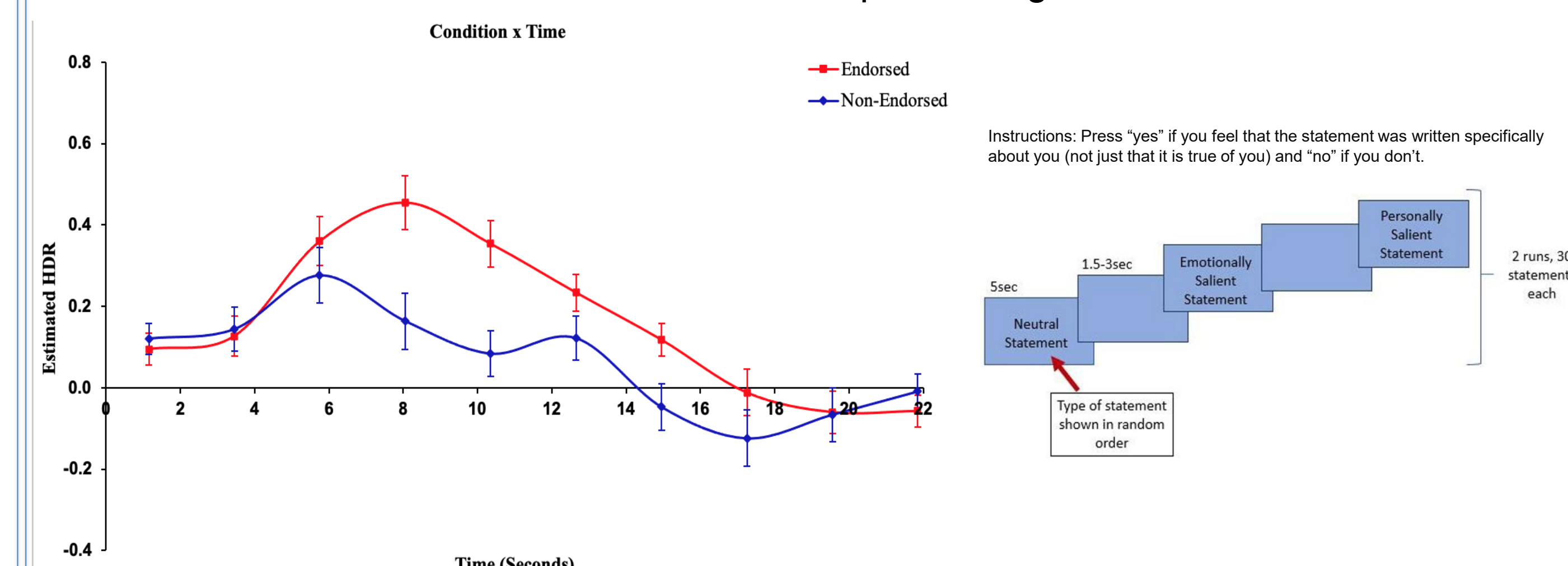
### Semantic Integration Task (SIT)

- Participants (n=24 healthy controls, n=21 patients with schizophrenia) were presented with a prompt word along with three potential options, and were asked to indicate which of the three options most related to the prompt word.
- Increased Maintaining network activation was observed in the conditions in which the association between the two words were low, suggesting that this network is involved in the cognitive processing of linguistic and semantic information.



### Delusions of Reference Task (DOR)

- Participants (n=42) were presented with neutral, emotionally-salient and personally statements, and were asked to respond with either a “yes” or “no” as to whether the statements were specifically about them or not.
- Increased Maintaining network activation was observed in the conditions where the participants thought that the statement is about them, suggesting that Maintaining network could be involved in self-referential processing.



## CONCLUSION

Overall, the role of the Maintaining network is most likely in underlying the integration of various frontal functions, volitional attention to internal mental representations, and conscious inner speech/language processing, while being non-specific in cognitive domain.

## REFERENCES

[1] Percival, C., Zahid, H., & Woodward, T. S. (2020). CNoS-Lab/Woodward\_Atlas: Woodward Atlas November 2020 Release. Zenodo. <https://doi.org/10.5281/zenodo.4274398>

[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. <https://doi.org/10.1016/j.cortex.2019.12.014>