

# Functional Brain Networks Underlying Deficiencies in Impulse Inhibition in Schizophrenia

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## Introduction

- Schizophrenia is a psychiatric disorder characterized by positive, negative, and cognitive symptoms (e.g., delusions, abnormal motor behaviours) [1]
- Impulsive behaviours have been associated with aggression in schizophrenia and is related to a large degree of psychiatric hospitalizations. However, the neural basis underlying these behaviours are not well understood [2]
- A probabilistic reasoning task, called the FISH task (Figure 1), and an evidence integration task, used to test the bias against disconfirmatory evidence (BADE) (Figure 2), are visual tasks that have been found to be strongly related to the presence of schizophrenia symptoms in schizophrenia patients [3,4]

## Objective

- This study aims to examine the functional brain networks underlying the two visual task experiments in healthy controls and schizophrenia patients to elucidate the commonly activated functional brain networks and their association with abnormal motor symptoms

## Methods

- Patients with schizophrenia (n=68) and healthy subjects (n=40) completed both the FISH and BADE tasks in the fMRI scanner

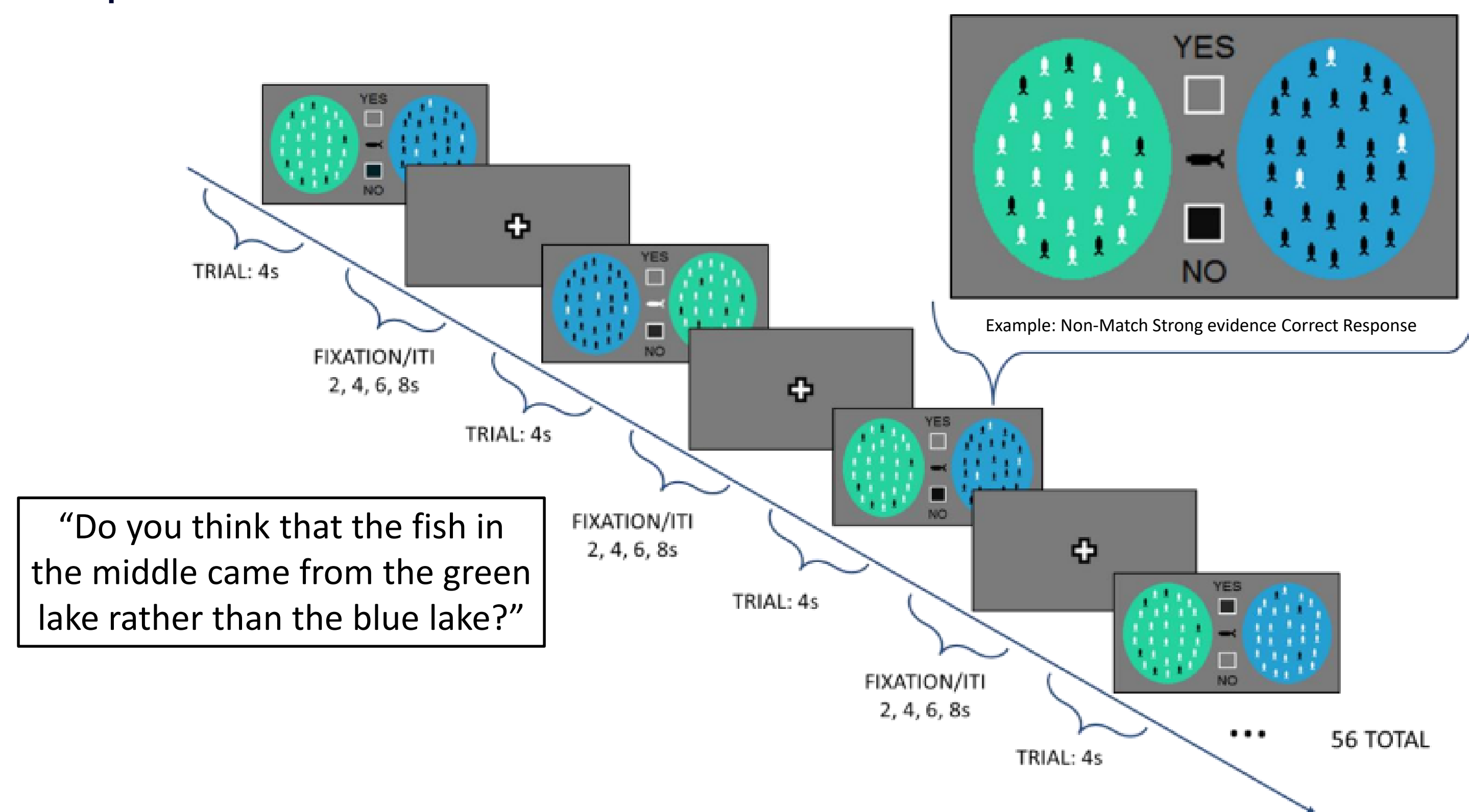


Figure 1. Overview of the FISH task trials. The participants were tasked with answering the question of whether the central fish came from the green lake ("Yes" or "No") with each stimulus being displayed for 4 seconds.

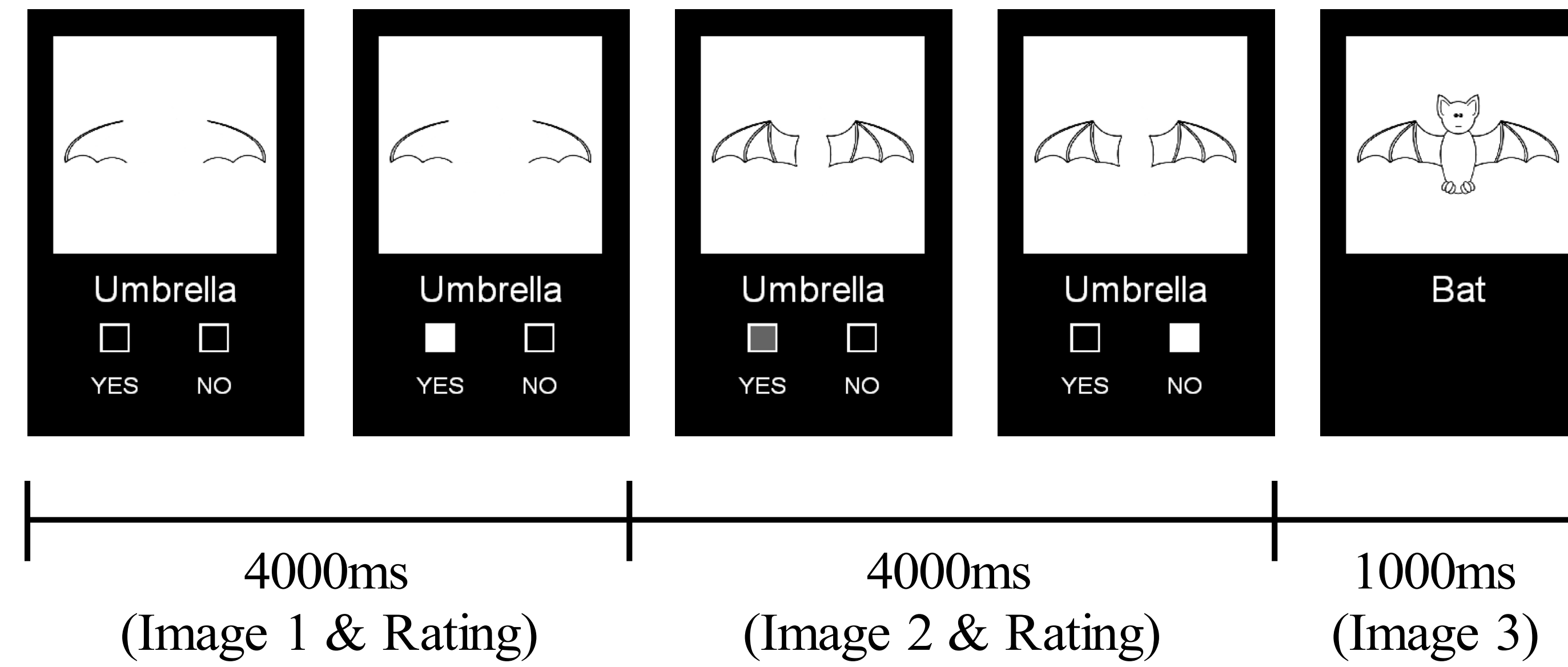


Figure 2. Overview of the BADE task. Participants were presented a partial line drawing and asked to answer "Yes" or "No" to whether they think the full picture will match the prompt word (4 seconds) followed by a second fuller partial line drawing which allowed participants to either change or keep their original response (4 seconds). Then the full picture was presented (1 second).

- Data was analyzed using Constrained Principal Component Analysis for fMRI (fMRI-CPCA) to identify the functional brain networks responding in each task and the task conditions [5]

## Results

- Three functional brain networks were extracted from the fMRI-CPCA analysis
- No group differences were observed between schizophrenia patients with and without delusions
- Group differences were observed between healthy and schizophrenia in the response network (Figure 3), demonstrated by hyperactivity for schizophrenia patients in the FISH task followed by reduced suppression in both tasks

## Discussion

- Hyperactivity and reduced suppression in the response network is concurrent with previous literature indicating this response may be related to deficiencies in impulse inhibition
- The presence of excess dopamine in schizophrenia leading to greater activation of the substantia nigra leads to inhibition of the globus pallidus, which ultimately reduces the inhibition of the thalamus [6]
- This leads to a greater motor output which may provide a biological basis for this deficiency in inhibiting movement
- Future investigations should investigate the differential activation of the thalamus and related structures with respect to the activation of the response network

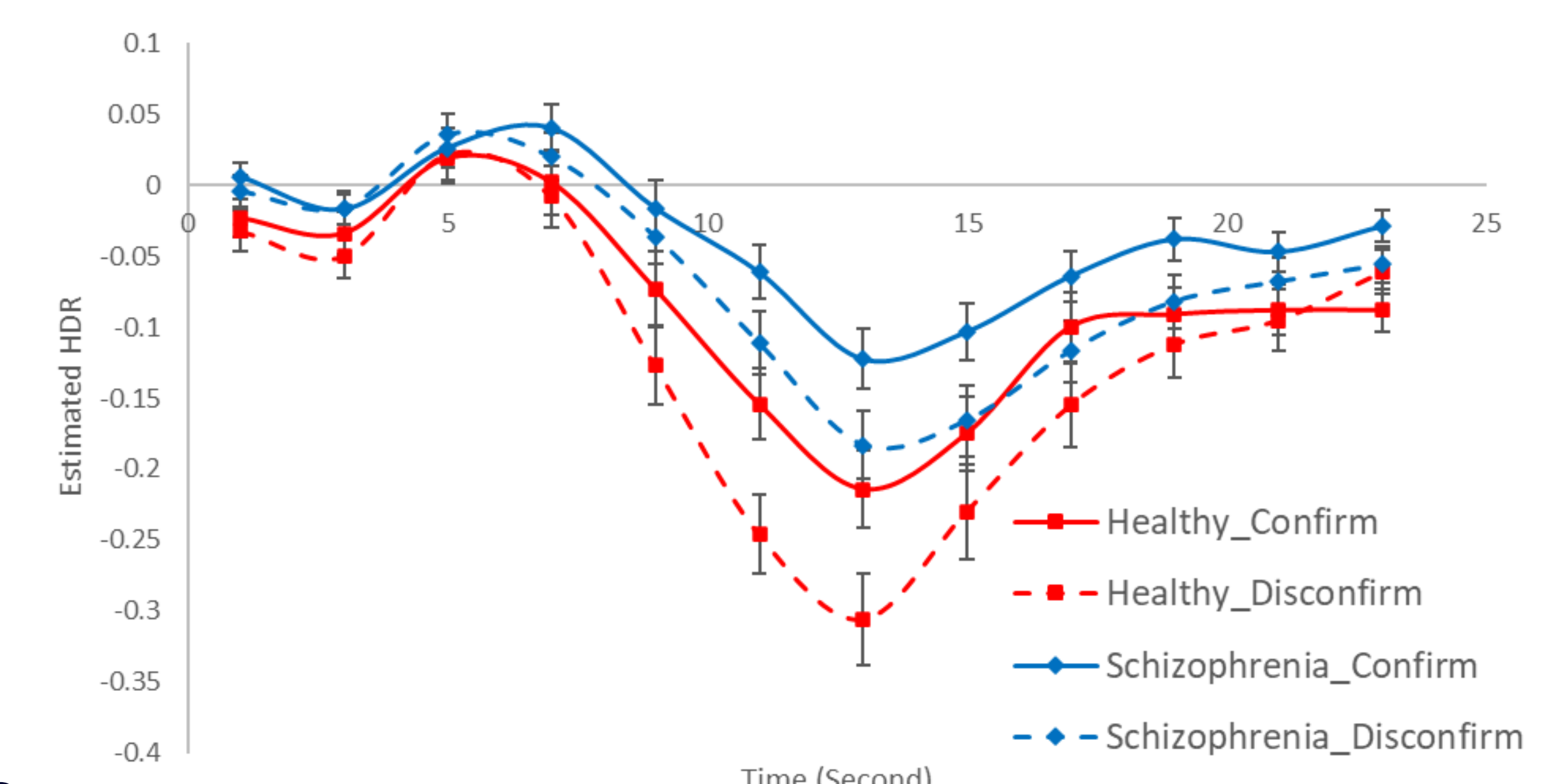
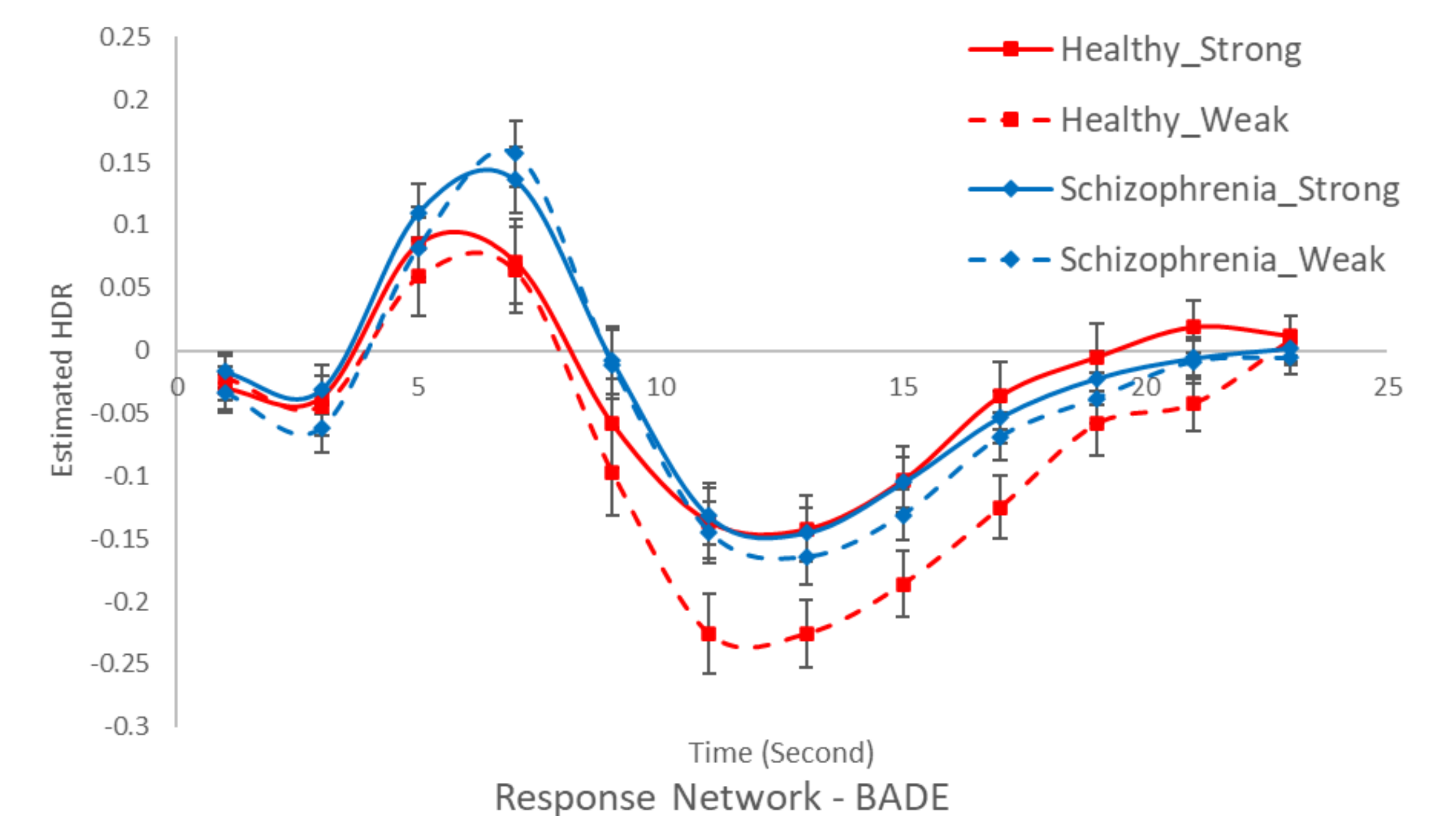
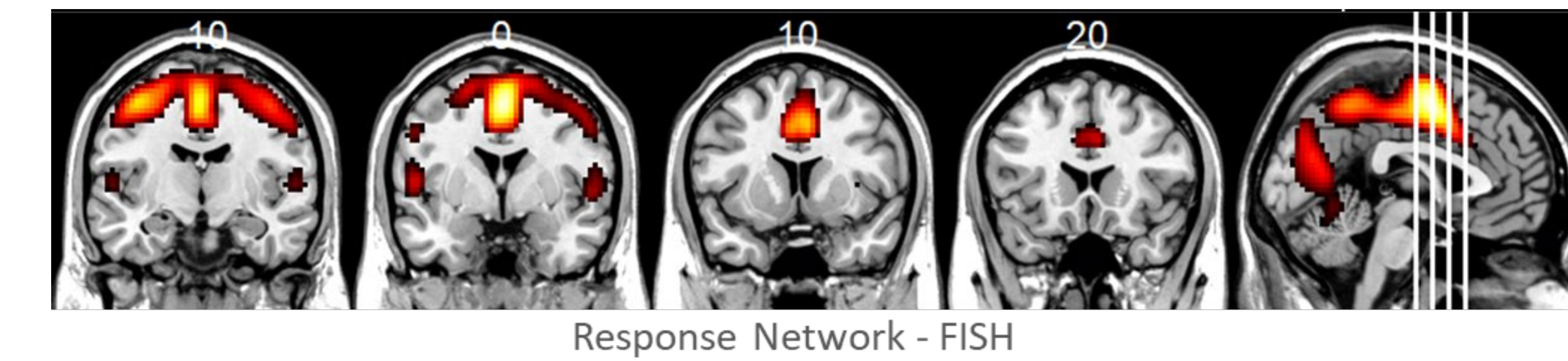


Figure 3. (Top): Dominant 10% of component loadings for Component 3 (Two-Handed Response Network). Red/yellow = positive loadings (Threshold = 0.18, Max = 0.29; Bottom Slices: 116, 126, 136, 146). Increased activation in the supplementary motor area, superior temporal gyrus, middle frontal gyrus, and thalamus. (Middle): Predictor weights plotted as a function of post-stimulus time for each group and strength condition for the FISH task. (Bottom): Predictor weights plotted as a function of post-stimulus time for each group and confirmatory condition for the BADE task

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