Does Inducing Disbelief in Free Will Alter Brain Correlates of Preconscious Motor Preparation?: A Replication Study

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Introduction

- **The readiness potential (RP)** is an ERP component characterized by slowly increasing negative voltage at fronto-central electrodes preceding voluntary movements.
- A study by Rigoni et al. (2011) found that inducing disbelief in free will causes a decrease in RP amplitude beginning 1200ms before button press in a typical Libet task.
- This result is surprising because high level beliefs appear to have influenced low level, non-conscious pre-motor processes.

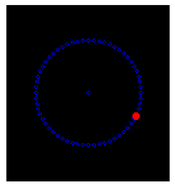
Goals of the present study:

1. Attempt to replicate Rigoni et al.'s (2011) results using an identical procedure.
2. Examine the relationship between *preexisting* beliefs about free will and RP amplitude.

Methods

Participants (n=30): right handed, 17 male, 13 female, 18-22 years old.

Stimuli: A 'clock' made of a ring of blue dots in which a red dot rotates around the ring every ~2550ms.



Procedure:

Belief Manipulation

Participants were randomly assigned to one of two groups. Each group read a different excerpt from Francis Crick's *The Astonishing Hypothesis* prior to the EEG experiment. The no-free-will group read a passage that argued against the existence of free will and the control group read a passage about conscious perception that made no statement about free will.

Task:

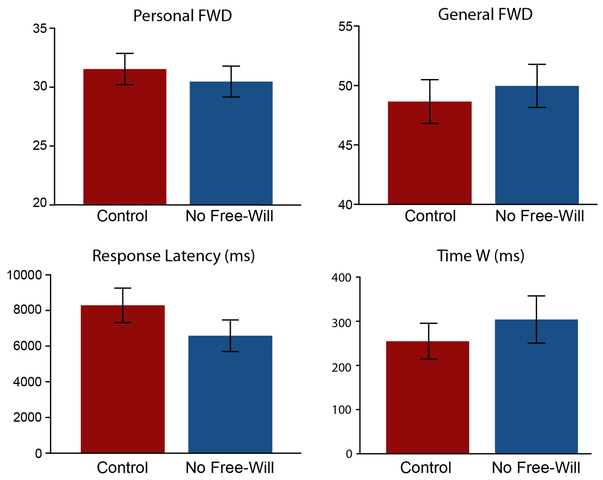
1. Participants were instructed to press a button whenever they felt like it while monitoring the time at which they felt the urge to act (via red dot's position on the clock).
2. After the button press, the clock stopped and participants reported the time at which they felt the urge to act (time "W") by clicking on the corresponding clock position.

Belief Measurement

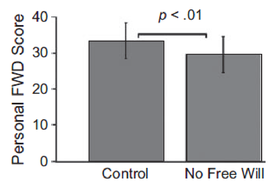
Participants completed the Personal and General subscales of the Free Will and Determinism Scale (FWD) which assays beliefs about free will.

Results

Behavioral Results



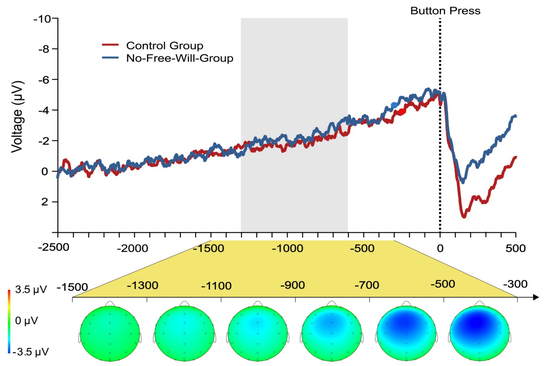
Rigoni et al. (2011)



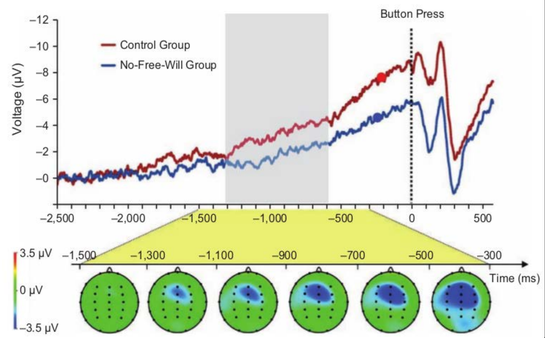
- Contrary to Rigoni et al. (2011), we found no significant difference between groups in FWD scores.
- We did find a trend towards faster response latencies in the no-free will group (p=0.06).

EEG Results

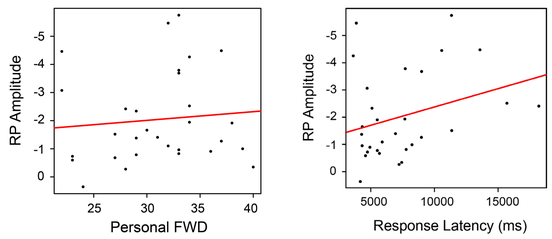
Current study



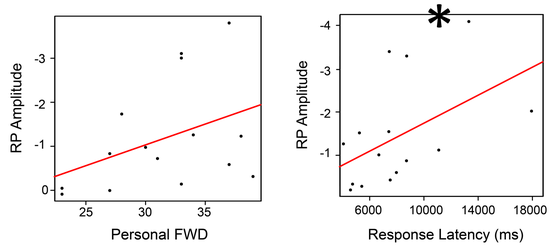
Rigoni et al. (2011)



All Subjects



Controls Only



- We found no differences in RP amplitude between the no-free-will and control groups.
- Correlations between RP amplitudes and FWD scores were not significant.
- We did find a significant correlation between response latency and RP amplitude in the control group.

Conclusions

- Contrary to Rigoni et al.'s (2011) results, participants who were exposed to anti-free will messages did not show reduced RP amplitudes in the Libet task. The FWD results suggested that the belief manipulation may have failed, potentially explaining the null ERP results.
- However, regardless of belief induction, we also found no correlation between FWD scores and RP amplitude. This finding suggests that free will beliefs were unlikely to be a key contributor to the RP amplitude differences observed in Rigoni et al. (2011).
- Interestingly, we observed a trend towards shorter response latencies in the no-free-will group, providing a possible alternate explanation for Rigoni et al.'s (2011) results.

Future Directions

- Further research is necessary to determine if the belief manipulation may be causing unintended changes in behavior which could then lead to changes in RP amplitude.
- The development of an improved methodology for manipulating beliefs in free will would be beneficial as this method has been shown to be inconsistent (Rigoni et al., 2013).

Selected References

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Acknowledgments

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