**Intentional Binding**

PSY310: Lab in Psychology

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**GitHub link:**

**Introduction**

Intentional binding is defined as coupling between intentional actions and their outcomes in a way that makes the latter feel closer in time than they actually are to form a subjective representation of the SoA. This temporal compression between the actions and outcomes provides an implied measure of SoA in how the brain binds events under a person’s control. In contrast to self-reported intentions, which are colored by motivational congruence, the intentional binding methodology offers an unbiased measurement of perceived action–outcome temporal distance (Haggard & Tsakiris, 2009). If the same individual is given a feeling of being responsible for an outcome, the perceived time between action and its consequence also tends to shorten, and this is how the agency can be indirectly measured (Moore & Obhi, 2012).

The aim of this experiment was to examine the concept of intentional binding by using interval estimates for voluntary motor activity in conditions that varied by expectations. The increased perceived interval between expected and unexpected frequencies of outcome events was the focus of the experiment, due to which the expected phenomenon of the brain perceiving the timing relating voluntary actions to an event was unraveled.

**Method**

An experiment was designed with the help of PsychoPy and was performed by a 20-year-old male studying at Ahmedabad University. In this experiment, one subject was executed across 396 trials, during which he was required to initiate a voluntary movement by pressing a button to produce an auditory stimulus. Two levels of expectation were manipulated: an “expected” condition, in which the participant was told that the button press would generate a tone in many trials, and an “unexpected to become expected” condition, in which the frequency is not known.

In each trial, the participant estimated how long he had waited for the auditory tone after he pressed a button, and the time interval was saved across conditions. The interval estimates derived from these two conditions were used to compute the extent of intentional binding, which represented how expectation might impact the participant’s feeling of control regarding the consequences of the actions performed.

**Results**

The data of the self-generated interval estimates of the participant elicited an intentional binding effect of -2.95192. This result shows a significant decrease in the perceived time difference between the press and the sound, i.e., the action and outcome in the expected condition as compared to the unexpected condition. This means that when the participant anticipated an outcome, the gap was perceived to be shorter, which should be an indication that they felt more in control.

**Discussion**

Consequently, employing intentional binding as an index of SoA has several advantages. First, it is a quantifiable measure, free from self-report bias, that has been cited in prior literature (Moore et al., 2013). Intentional binding succeeds in capturing the sense of agency without implying deliberative evaluation, therefore providing data that may reflect the subliminal evaluation better. Further, it enables the measurement of agency in a manner that is well-suited for experimental comparisons across different conditions.

Nevertheless, intentional binding can still be restricted as an index of SoA in certain ways. One is that it mainly measures the temporal factor of agency, thereby neglecting other cognitive and emotional elements of SoA (Wolpe et al., 2013). Moreover, the present study also demonstrated that intentional binding is not directly correlated to SoA: interval estimation involves various factors that are not related to SoA, such as instructions and personality traits.

**References**

* Haggard, P., & Tsakiris, M. (2009). The experience of agency: Feelings, judgments, and responsibility. *Current Directions in Psychological Science, 18*(4), 242-246.
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* Wolpe, N., Haggard, P., Siebner, H. R., & Rowe, J. B. (2013). Cue integration and the perception of action in intentional binding. *Experimental Brain Research, 229*(4), 467-474.