Intentional Binding Experiment

PSY310: Lab in Psychology

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GitHub Link:
https://github.com/SaanchiBhatt13/Psy310/tree/Intentional_Binding_Experiment

Introduction

The subjective experience of having influence over one's acts and results is known as the sense of agency, and it is essential to understanding moral responsibility and self-awareness. People can feel as though they are the authors of their acts due to this sense of agency, which affects how they interpret occurrences in their surroundings. The notion of intentional binding is closely related to it.

The psychological phenomenon known as "intentional binding" occurs when an intentional act (like pressing a key) and its sensory outcome (like a beep sound) are experienced as occurring closer together than they actually are. Simply put, it seems like there is a shorter gap between our acts and their results than there actually is. By fostering a sense of temporal closeness between an action and its result, this effect strengthens our sense of agency or our perception of control over our choices and their effects. To put it another way, this phenomenon happens when people perceive that the outcomes of their self-initiated actions occur sooner than those that are not. In essence, it shows how our brain interprets the relationship between timing and results, giving us a sense of control over our behavior.

Intentional binding is an implicit measure because it doesn't require participants to provide explicit self-reports regarding the agency. Instead, participants are asked about their perception of timing rather than their sense of control. Since intentional binding captures automatic cognitive processes without needing conscious thought on agency, it continues to be one of the most popular implicit measures for assessing agency despite the existence of explicit measures. This makes it worthwhile in research settings when evaluating subconscious processes is crucial or direct questioning may affect responses.

According to research, our intentional binding (IB) is greatly influenced by the strength of our intentions, with stronger intentions producing more significant temporal binding. This implies that our perception of a sense of agency depends on our awareness of our actions and their consequences. Additionally, binding is strengthened by strong intentions, which further solidify our identity as the "doer" of the action. Determining how people view their actions and the accountability attached to their outcomes requires an understanding of agency.

Method

The participant, female, age 20, is a third-year student at Ahmedabad University. She is a Psychology Major undergraduate student. Before the experiment began, she was informed about the aim and methodology of the study, and her consent was obtained. A 14.5" laptop screen and PsychoPy-2024.1.5 software were used to create the experimental setup.

Each trial began with a slide flashing a circle of dimension (0.2, 0.2) positioned (0, 0), orientation (0) anchored to the center with a foreground color- white. This white circle1 is flashed on the screen for 1 second, post which the circle1 is replaced with a circle2 (figure 1) of the same properties and a foreground color of green. This circle remains on the screen until the participant presses the space bar.

A beep sound follows in the gap after the space bar is pressed. A conditional Excel data file (figure 3) specifies the time of the sound ($delay), the sound frequency ($freq), the volume set to 1 (which can be manipulated from the device itself), and the duration set at 0.3 seconds.

Directly following the beep sound is a slide (figure 2) that has a line of instructions [text element - position (0, 0.3); font type: Arial; letter height: 0.05] and a text box [size (0.5, 0.5); position (0,0); anchor: center; font type: Arial; letter height: 0.05]. The participant is asked to enter the estimated delay duration between the action (pressing the space bar) and the response (beep sound) in the text box.

Then, the participant is supposed to click on the submit button [size (0.3, 0.1); position (0, -0.3); font type: Arvo; letter height: 0.05], and the trial gets recorded in an Excel data sheet. A total of 408 trials were conducted (34 reps, 12 conditions).

The data analysis was conducted using the parameters (delay, frequency, expectation, and textbox response), and the means of unexpected and expected trials were calculated. The difference between the two was obtained.

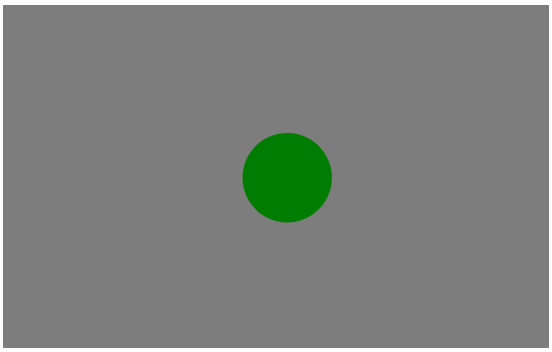

Figure 1:
Circle2 (green)

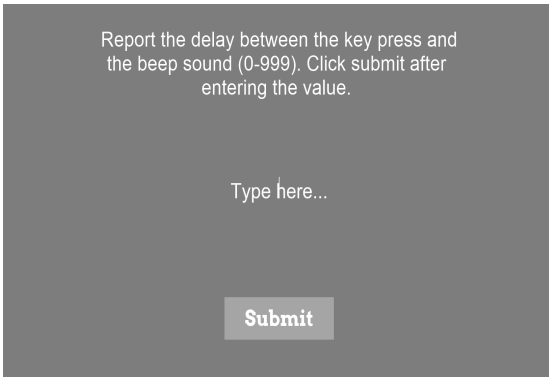

Figure 2:
Response Slide

delay	freq	condition
0.1	400	unexp
0.4	400	unexp
0.7	400	unexp
0.1	1000	exp
0.4	1000	exp
0.7	1000	exp
0.1	1000	exp
0.4	1000	exp
0.7	1000	exp
0.1	1000	exp
0.4	1000	exp
0.7	1000	exp

Figure 3:
Conditions File

Results

Mean of Expected Trials	**249.59**
Mean of Unexpected Trials	**330.76**
Difference in Interval Estimates	**81.17**

Discussion

The resultant findings exhibit a significant difference in the interval estimates of expected and unexpected trials. It would seem that the predictability of an outcome affects the temporal compression of our perception of delay. The delay is perceived as shorter in an anticipated (expected) trial and longer in an unexpected trial. This indicates that our sense of agency and the perception of time are closely tied to our expectations about actions and their consequences. That being said, we can conclude that a strong expectation regarding the outcome of an action can lead to stronger binding and enhance our sense of control over our actions, while unexpected outcomes can disrupt this temporal compression and result in longer perceived delays.

This process of intentional binding, however, is an implicit measure of the sense of agency of an individual, as the participant does not consciously contemplate or respond to the said phenomenon. Instead, they respond with an estimate of time. This perceived delay in time has implications for the sense of agency. At the same time, though this measurement method is widely used and very useful for scientific researchers in the field of measurement and study of the sense of agency as a cognitive phenomenon, the implicit measurement method has its fair share of advantages and disadvantages.

Since it functions outside of conscious awareness, one significant advantage is its capacity to mitigate social desirability bias, enabling more accurate evaluations. Intentional binding is especially helpful for studying populations with neuropsychiatric disorders because it is sensitive to even the most minor changes in agency perception. Additionally, it enhances the reliability of findings by providing objective data through reaction/estimation time tasks.

However, there are issues with intentional binding, such as a lack of solid psychometric validation, which can cause variability and make it more difficult to generalize the findings. Its validity as a stand-alone measure is questioned by issues with result interpretation and analysis and the findings of other explicit measures of agency not being correlated.

In conclusion, researchers can understand how humans perceive our sense of agency—basically, how much control we feel over our actions and their consequences—by examining intentional binding. This can benefit several disciplines, such as philosophy, neuroscience, and psychology. However, while intentional binding offers valuable insights into the sense of agency, researchers must navigate its limitations carefully.

Citations

1. Dewey, J. A., & Knoblich, G. (2014). Do implicit and explicit measures of the sense of agency measure the same thing?. *PloS one*, *9*(10), e110118. https://doi.org/10.1371/journal.pone.0110118

2. Moore, J. W., & Obhi, S. S. (2012). Intentional binding and the sense of agency: a review. *Consciousness and cognition*, *21*(1), 546–561. https://doi.org/10.1016/j.concog.2011.12.002