

Q1. What is your viewpoint on the role of unconscious processes in shaping our intentions and decisions, and how does this relate to our perception of free will?

Libet's Study helped us how conscious thoughts arise in a brain, and how it is affected by our free will. The study is given as follows:

Aim: Libet and colleagues undertook an iconic experiment to collect empirical evidence about the sequence of one's conscious intent to act compared to the onset of brain activity preceding that act. They also explored the role of conscious processes at the start of a spontaneous motor action.

Methodology: Participants sat in a chair and were instructed to bend their wrists randomly, ensuring it was entirely spontaneous. EEGs captured their brain waves. The reported moment (W) when the subject felt the urge or "intention to act" was compared with the detectable brain activity (readiness-potential, RP) leading up to a wholly voluntary motor action. The determination of W was based on participants' memory of a moving spot's 'clock position' when they first felt the urge to move. Both "self-driven voluntary actions" and "unexpected skin stimuli" were investigated.

Findings: Voluntary actions are preceded by a distinct brain electrical shift (the 'readiness potential', RP) initiating 550 ms before the activity. Subjects recognized the intention to act between 350-400 ms post RP start but 200 ms before the actual motor act. The study also ascertained that the realization of an urge to act was ahead of the real action awareness by roughly 100 ms. This was consistent across all test series and modes of recall.

Potential Errors: The accuracy of participants in recounting W might not be spot on. To mitigate this, errors were averaged and subtracted, but the results were still the same. There was a debate over whether the outcomes from a basic motor task could be extrapolated to all complex voluntary actions. However, applying such extrapolations is a standard scientific practice.

Final Thoughts: The study unequivocally showed that our conscious choices leading to an action aren't the starting point. Instead, the brain's subconscious activities initiate before our conscious realization of a forthcoming action. Thus, decisions and intentions are often preceded by unconscious neural activities.

Understanding Free Will:

Free Will Explained: Supporting the prevailing beliefs, the voluntary act being examined shouldn't be influenced by external drivers; it should originate internally.

Furthermore, participants should feel the desire to execute it, believing they can control the action's timing and nature.

W's Role in Control: The study's outcomes don't suggest our actions, which arise subconsciously, are beyond our control. It's imperative to note that the conscious will (W) emerges at approximately 150 ms before muscle movement, even though it's after the RP's onset. This 150 ms window provides sufficient time for conscious intent to influence the final action. Therefore, the conscious will can potentially halt or overrule the action, leading to no physical movement. Since this conscious intervention serves as a control, it might not necessarily have a subconscious precursor.

Q2. What are your opinions on the role of PFC in behaviour, and how does this influence our understanding in cognitive control processing?

In humans, the **prefrontal cortex (PFC)** occupies a significant portion of the brain. As such, it's plausible that it has a pivotal role in influencing our behaviours, thinking patterns, and various cognitive functions. Yet, until recently, the specifics of these roles remained largely undefined.

The '**Gateway Hypothesis**' offers insights into how the structural makeup of this brain region corresponds to a basic principle at the information processing level, subsequently influencing our overall cognition and behaviour.

This hypothesis is built upon four foundational ideas. First, our thoughts can sometimes be triggered by our sensory experiences, while at other times, they may arise without any sensory stimulus. Second, both actual experiences and mere imagination can stimulate certain core brain representations. Third, the brain possesses the capability to trace the origin of these activated representations. Lastly, the rostral PFC is integral to this mechanism.

When we encounter or merely visualize stimuli, an information processing mechanism evaluates it, guiding our subsequent actions. The rostral PFC plays a role in overseeing this system, thereby shaping our actions. Its initial impact is observed between primary sensory processing and contention scheduling, leading to behaviours being more dictated by sensory information rather than by self-generated thoughts from the SAS-level system.

Its subsequent impact is felt between contention scheduling and the stimulus-independent attending system. Here, thought activation leans less on sensory input and more on the interplay between SAS and contention scheduling. This is evident in

scenarios where no predefined behaviour is apparent, or the task becomes too straightforward, or multiple behavioural responses are possible, or in high-alert situations.

Thus, the SAS system ensures the efficient allocation of cognitive resources, avoiding potential overload the system might otherwise face.

In summary, the PFC regulates our actions by determining their reliance on external stimuli, deciding on the appropriate behavioural response, and playing a role in thought generation. These thoughts, in turn, influence our actions and behaviour.

Q3. What are your opinions on the role of mental phenomena in shaping brain function, and how does this perspective influence our understanding of the mind-brain relationship?

Traditionally, two opposing viewpoints stand out - **dualism** and **monism**. Dualism advocates for the separate existence of the mental and physical realms. It says that consciousness, or the mind doesn't interact with brain activities, and both can stand alone. This viewpoint opens doors to notions like paranormal occurrences and life beyond death. Conversely, monism contends that the conscious mind cannot exist separately from an active brain, firmly anchoring its belief in a singular realm.

As the fields of psychology and neuroscience have evolved, a blend of both theories has emerged. Research has identified that personal experiences, or consciousness, influence brain functions. This understanding establishes the concept of mind-brain interaction as scientifically credible, without undermining the depth and details of mental attributes. This theory proposes that conscious experiences, such as pain, impact the operations executed by the brain. These experiences emerge from the more advanced tiers of mental processing, while their neural parts operate at a foundational level. The higher-level processes guide and impact the low-level ones, emphasizing their mutual dependence. Through this lens, mental events play a pivotal role in shaping neural functions.

Regarding the nature of the mind-brain relationship, it's a hybrid of both monism and dualism. It is different from strict monism, because if one influences the other, they can't be identical. Regardless of whether this causal relationship is deterministic or non-deterministic, it challenges the monistic perspective that our thoughts and intentions don't influence our behaviours. This is embedded in the understanding that our beliefs, aspirations, and other personal experiences, all components of consciousness, influence neural activities. However, the theory doesn't align with pure dualism either. Dualism requires that the two domains remain non-reducible,

but here, they are interconnected. While they are distinct, they belong to a shared overarching structure, implying they aren't wholly autonomous.

In summary, conscious experiences exert an influential role on neural functions, and though they are distinct entities, their independence is an illusion.