

Memory of Former Beliefs May Affect the Single Belief Formation Process

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Abstract

Belief is an attitude toward a proposition. Current studies suggest that single belief formation is an active process. The key step in the belief formation process is information-seeking. Multiple sites of the brain play an important role in motivating individuals to seek information such as cortico-basal ganglia neural networks, neural systems for reward prediction errors, and orbitofrontal cortex. Based on previous studies, the information is processed by single neurons in higher areas of the brain. It can be assumed that some features of belief are encoded as information in memory. We hypothesize there can be a relationship between former beliefs and formation of new beliefs.

Keywords: Cognition, Representational theory of mind, Memory, Motivation, Information-seeking.

1. Introduction

There are three major views on belief: philosophical, psychological, and psychiatric. In philosophy, belief is defined as an attitude (A) of a subject (S) toward a proposition (P) that is canonically expressible in the form “S A that P”. Psychologically, human experiences this attitude toward different prepositions in everyday life. Psychiatrists have a pathological approach to false beliefs which pertain to a different reality defined as delusions [1]. Recently, a growing body of studies demonstrates belief formation process (see [3], for review).

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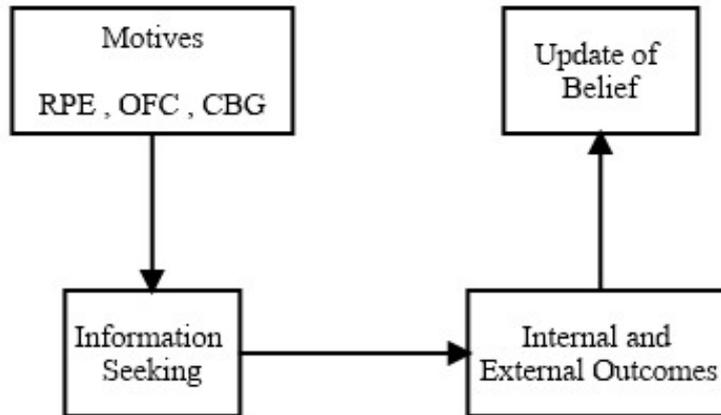


Figure 1: Theoretical Scheme for a Single Belief Formation Process.

Based on previous studies, it is suggested that the single belief formation process (SBFP) is an active process that needs the cooperation of different human brain parts. The key step in the SBFP is gathering needed information. There should be a motivation for information seeking. In order to find a motivating reason, it is suggested that individuals seek information providing internal or external rewards. Resolving uncertainty and producing positive emotions are the main internal rewards. Under uncertainty, cortico-basal ganglia (CBG) neural network including anterior cingulate cortex, dorsal striatum, and anterior and ventral pallidum become activated during individuals' information-seeking. The information itself can be equivalent to primary external rewards, e.g. food, water, etc. There are neural systems for information-related reward prediction errors (RPEs) as blood-oxygen-level-dependent signals in dopamine-rich midbrain regions and their prominent reward-related projection targets. Orbitofrontal cortex (OFC) plays an important role in valuing different kinds of rewards based on the situation. The OFC prioritize information seeking when human is curious and needs information. After receiving enough sensory perceptions, single neurons in higher brain areas begin processing, and eventually a belief is formed (Figure 1) [3]. There is also a psychological opinion suggesting that the violations of expectations trigger SBFP [2].

As mentioned, information in form of perceptions is processed by single neurons in higher brain areas at final stages of SBFP. It is our claim that some features of belief can be encoded as information in memory, although the property –explicit or implicit– of this encoded information is not well understood. According to the principles of brain plasticity in learning, memory gets updated through the life [4]. Although there is no well-defined model for the relationship between former beliefs and memory, in our view there can be a relation. Inconsistency of beliefs and the ability to reconsider them may be a clue for this relationship. To clarify this relationship, clinical studies on belief formation could be done in patients with memory disorders.

As mentioned before, there is an opinion that violations of expectations serve as the first step for information seeking motivation and starting a new SBFP. But, what is the expectation? Is it constructed based on a number of former beliefs? Is there any connection between former beliefs as a type of high-value memory and primers of the SBFP? Do former beliefs change the value of the information-seeking step in our mind? We hypothesize a theoretical interconnection between former beliefs and motives related to the SBFP (Figure 2).

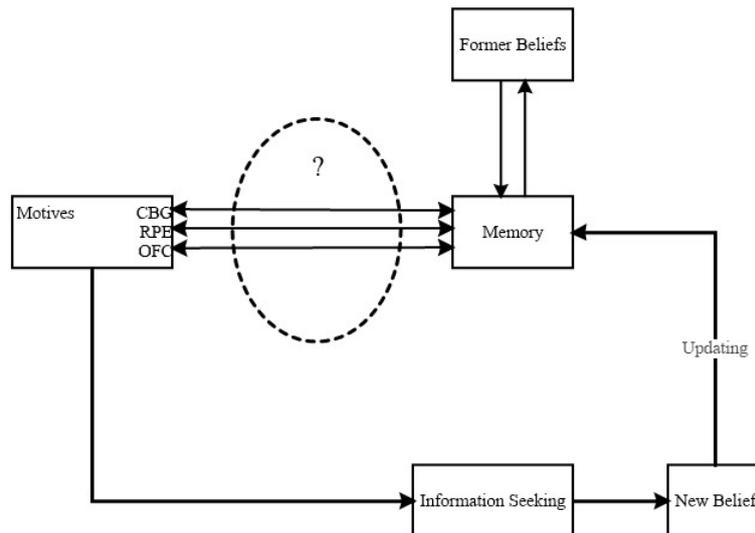


Figure 2: Suggested Theoretical Scheme for the Effect of Former Beliefs on a Single Belief Formation Process.

Further studies could be done to clarify if there are any interconnections between the motivation sites and memory of former beliefs in the brain. In the first step, it should be well understood that how former beliefs are represented as memory. In the next step, empirical studies could be done on probable neural networks that connect CBG, RPE, and OFC to the memory of former beliefs. We hope fulfilling these studies promotes our understanding of belief formation in the upcoming future.

References

- [1] H. F. Angel and R. J. Seitz. Process of believing as fundamental brain function: The concept of credition. *SFU Research Bulletin*, 3:1–20, 2016.
- [2] H. F. Angel and R. J. Seitz. Violations of expectations as matter for the believing process. *Frontiers in Psychology*, 8:772, 2017.
- [3] E. S. Bromberg-Martin and T. Sharot. The value of beliefs. *Neuron*, 106:561–565, 2020.
- [4] M. M. Merzenich and K. Sameshima. Cortical plasticity and memory. *Current Opinion in Neurobiology*, 3:187–196, 1993.