

【Grant-in-Aid for Transformative Research Areas (B)】

Section I



Title of Project : Understanding the relationship between the structure of qualia and the structure of information processing extracted from brain activity

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【Purpose of the Research Project】

Traditional neuroscience research has extensively investigated the relationship external stimuli (e.g., an apple in front of the eye) and the brain activity that occurs in response to the stimuli. Such studies have revealed a great deal about the mechanisms on how brains process information about external stimuli. On top of such information processing, however, our brains generate subjective conscious experience (e.g., "I see an apple!"). In this project, going beyond the traditional study on the relation between external stimuli and evoked brain activity, we aim to clarify the relationship between brain activity and consciousness.

Previous studies that aimed to study the relationship between brain activity and consciousness focused on the situations, where the same physical stimuli can be perceived differently across trials. For example, by showing a stimulus for a very brief duration, researchers tried to identify what are the differences between brain activities when participants report that they "saw" vs. "did not see" the stimuli. While it simplified the logic of the research paradigm, these studies grossly categorised our conscious percept into binary categories. Far from such poor categorisation, at any moment, our contents of consciousness, or qualia, seem vastly richer and complex. In fact, qualia have been claimed to be too rich to characterise and quantify with any traditional methods.

Here, we propose a novel paradigm. We claim that we can characterise an object through its relationships with all other objects, even if the object itself is difficult to characterise. Based on this logic, rather than trying to characterize a particular quale (e.g., "red") itself, we will try to characterize the relationships between the quale and other qualia in all possible ways.

【Content of the Research Project】

Building on the above idea, this project will establish a new research method to address the problem of how the contents of consciousness, or qualia, relates to brain activity. We will form three research groups (Fig. 1). Group A01 will characterize visual qualia by exploring the relationship between qualia and other qualia, which we call "qualia structure" using psychophysics and mathematical phenomenology. Group B01 will clarify the brain activity which underlies the qualia structure by using functional brain imaging. B01 will further clarify how the qualia structure can be changed by pharmacological manipulation of the brain activity. Group C01 will examine the information structure extracted from the brain activity using information theory. C01 will also evaluate the degree

of correspondence between the information structure and the qualia structure. Jointly, we will establish an unprecedented research method of consciousness that connects the visual qualia structure and the information structure extracted from brain activity.

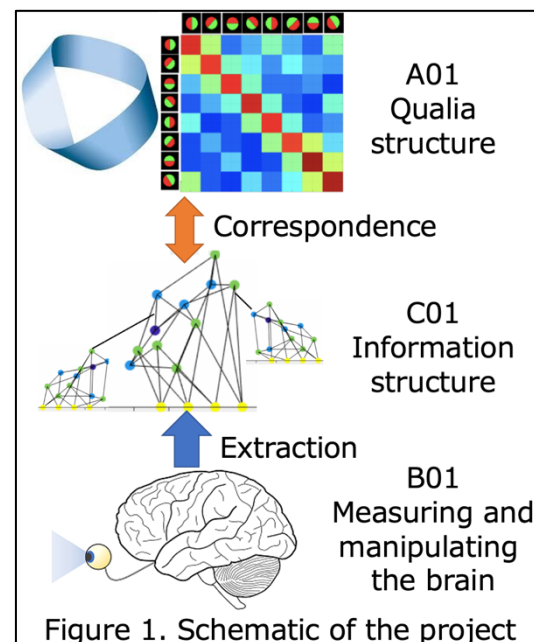


Figure 1. Schematic of the project

【Expected Research Achievements and Scientific Significance】

By characterizing the qualia structure, it may become possible to mathematically verify if I feel the red in the same way as you feel it. This logic may be applied, in principle, to animals, plants and man-made objects if established in the future.

【Key Words】

"Qualia" is quality, or contents, of consciousness. Not only visual consciousness, they can refer to audition, touch, taste and smell. They can also include thoughts and emotions. Everything that are subjectively experienced can qualify as qualia.

【Term of Project】 FY2020-2022

【Budget Allocation】 65,000 Thousand Yen

【Homepage Address and Other Contact Information】

<https://qualia-structure-en.labby.jp/>