Title of Project : Chronogenesis: how the mind generates time

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【Purpose of the Research Project】

We discriminate the present from the past and the future while we live our daily lives. Where does the awareness of time, which we term "mental time", come from? In our previous five-year project, "The Science of Mental Time", we achieved three major goals as follows.

1) We successfully drew a map of mental time

1. Map of time 2. Restore the lost memory 3. Evolution of episodic-like memory
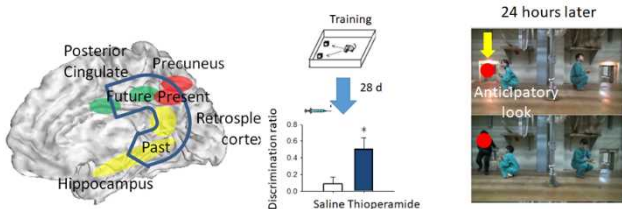
over the medial surface of the cerebral cortex.

2) We developed methods for manipulating mental time in lab animals, and initiated clinical applications

3) We clarified the ontogeny and the phylogeny of the episodic-like memory.

To make a further step forward, we "creates" an artificial neural network that achieves mental time functions, and use it as a control to be compared with the brain. Through the comparison, we address four critical question. 1) How does a sense of continuous "temporal flow" emerge? 2) How are rhythmic brain activities related with our awareness of time? 3) How do we "acquire" time through development and evolution? 4) How do we "lose" our time in neurological and mental diseases?

【Content of the Research Project】

This project consists of five sub-projects. Sub-project A01, located in the center of the five, "creates" an artificial neural network that outputs the order of two events when it receives multiple sentences sampled from a text corpus. The other four

sub-projects, characterized by key words such as "Flow" (B01), "Tick" (C01), "Acquire" (D01), and "Lose" (E01), address each of the four above-mentioned questions.
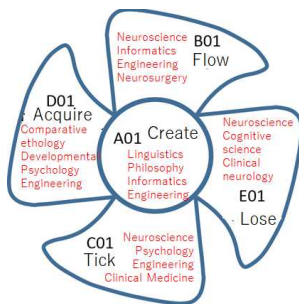
【Expected Research Achievements and Scientific Significance】

1. We develop an artificial neural network that achieve mental time functions,
2. clarify how the map of time emerges,
3. provide answers to questions in our daily life,
4. develop methods for prevention and amelioration of mental time dysfunctions,
5. clarify development and evolution of mental time.

Does a mental time function emerge in ANN?
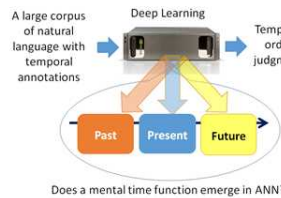
Five achievements are expected from our collaborative and interdisciplinary studies.

1) We will develop artificial neural networks that achieve our mental time functions.
2) We will clarify how the map of time functions and emerges.
3) We will provide solid scientific answers to naive questions like "Why do we feel nostalgic for the past?", and "Why does time fly when we have fun?".
4) We will develop new methods for evaluating and manipulating mental time, and initiate clinical applications for screening and ameliorating the symptoms of diseases with mental time dysfunctions like dementia.
5) We will clarify similarities and differences in the mental time functions between the human and the other species, and between adults and children.

【Key Words】

Mental time: an awareness of time as being past, present, and future, specifically evolved in humans. Mental time is constructed by the brain and does not therefore necessarily coincide with time in the physical world.

【Term of Project】   FY2018-2022

【Budget Allocation】   1,157,200 Thousand Yen

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