Title of Project : Acquisition of the independence of mind: Evolution and development of the mind liberated from the current external environments

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【Purpose and Background of the Research】

Humans can imagine time and place distant from here and now. They solve problems by manipulating mental images and simulate future events flexibly. Evidence in nonhuman animals for tools, culture, and language, etc. has led some researchers to propose this "ability to transcend time and space" as the ultimate defining feature of humans. We challenge this view.

I have demonstrated forms of higher-order mental functions such as metacognition, episodic memory retrieval, and causal inference in nonhuman primates, carnivores and birds. Central to such cognitive performances is the ability to "voluntarily manipulate mental representations, liberated from environmental stimuli."

We call this "the independence of mind" in our project: the critical mental function for "the ability to transcend time and space." Our goals include: (1) empirical study of phylogeny and ontogeny of "the independence of mind" by comparative and developmental analyses across species and human infants, and (2) investigation of understanding of social others derived from this critical function.

【Research Methods】

Testing human infants, nonhuman primates, rodents, companion animals, zoo animals, and birds, we will study: (A) functions that require active and flexible manipulation of mental representations, such as thoughts and inferences, (B) metacognition and mental time travel as components to realize (A), and (C) understanding others, social intelligence, and theory of mind as an application of the functions above. Below we present a few concrete experimental plans.

Mental rehearsal. Subjects solve simple puzzles, which are sometimes pre-exposed before they manipulate the devices. Subjects will solve the task more easily with pre-exposure if they can freely manipulate mental representations.

Preparatory behavior. Subjects perform memory tasks of varying difficulty. They may choose an option to obtain a hint before they actually solve the task. Will they adaptively choose this option in advance when they predict future difficulty?

Understanding others by projection. Can subjects translate their own experience of peeking into another room to infer that other people will the same, to gain advantage in a task simulating a treasure-hunting game?

The experimental procedures will be modified whenever necessary. We will start with a few species and gradually expand the tests to more.

【Expected Research Achievements and Scientific Significance】

Our intuitive and sophisticated experiments will demonstrate rudimentary "independence of mind" in multiple species.

The most important scientific significance lies in providing answers to the most essential question of what humans are, from comparative cognitive science, to renew conception of humans. The project also addresses neural correlates, and provides hints to understand and help socially handicapped people.

【Publications Relevant to the Project】

Fujita, K. (ed.) (2015). *Doubutsu tachi wa nani wo kangaete iru: doubutsu shinrigaku no chosen.* Gijutsu Hyoronsha, 303pp.

Takagi, S., Arahori, M., Chijiiwa, H., Tsuzuki, M., Hataji, Y., & Fujita, K. (2016). There's no ball without noise: cats' prediction of an object from noise. *Animal Cognition*, in press. (DOI 10.1007/s10071-016-1001-6)

【Term of Project】 FY2016-2020

【Budget Allocation】 142,900 Thousand Yen

【Homepage Address and Other Contact Information】

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