

【Grant-in-Aid for Scientific Research(S)】

Integrated Science and Innovative Science (Comprehensive fields)



Title of Project : Understanding and construction of developmental process from body-babbling to sociality acquisition

Minoru Asada

(Osaka University, Graduate school of Engineering, Professor)

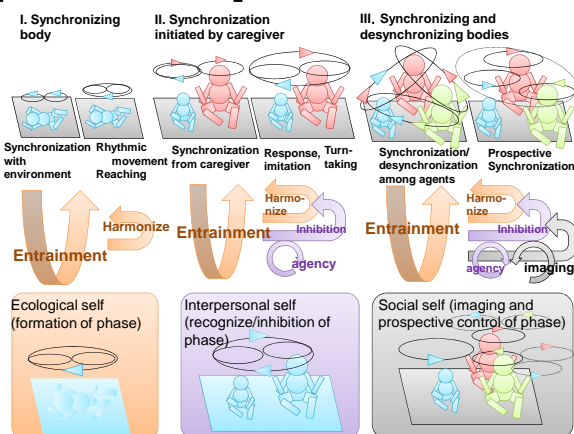
Research Area : Comprehensive fields

Keyword : Intelligent robot, Sensory behavior system, Sensation/Perception/Attention, Communication

【Purpose and Background of the Research】

We, the project leader's group, have been intensively promoting the study aiming at understanding human cognitive development process based on the design theory of humanoid robots with computational brain model, and achieved the excellent results in both individual development and the development between individuals. One of the big issues we have not attacked is how infants can acquire the representations of the self and others through the various kinds of experiences. In this project, we are going to attack this issue based on cognitive developmental robotics [1] through designing and working of humanoid robots and also infant behavior observations. We especially focus on the developmental process from body babbling to sociality acquisition. Applying the concept of synchronization/desynchronization, we reveal the developmental process of self/others representation, and realize make-believe play by seamlessly connecting them.

【Research Methods】



The first three years, we separate an acquisition process of self/others concepts into ecological, interpersonal, and social selves, and construct a computational model for each phase. (1) In the neonatal period, synthetic construction of body babbling, and synchronization/association between behavior and objects are realized (ecological self). (2) In

the infant period, based on scaffolding from a caregiver expected to synchronize with the infant (robot), inhibition of synchronization is introduced. As a result, turn-taking can be realized (interpersonal self). (3) In early childhood, active control of synchronization/desynchronization can be realized based on an interaction model among three agents (social self).

In parallel with the above, design and construction of infant robots and psychological experiments with real infants are used to verify the computational models. The last two years, these models are connected to emerge make-believe play as a result of the development.

【Expected Research Achievements and Scientific Significance】

This project enables us to understand the early process of self/others concept formation. As a result, this will impact the existing disciplines such as developmental psychology, cognitive science, and neuroscience, and accelerate the integration with these disciplines, that may lead the emergence of new science. On the other hand, the design theory for communication robots that infers the internal states of others will be given for artifacts symbiotic with senior people.

【Publications Relevant to the Project】

- [1] M. Asada et al., "Cognitive developmental robotics: a survey" IEEE Trans. on Autonomous Mental Development, Vol.1(1), pp. 12--34, 2009.
- [2] H. Sumioka et al. "Reproducing Interaction Contingency Toward Open-Ended Development of Social Actions: Case Study on Joint Attention". IEEE Trans. on Autonomous Mental Development, Vol.2(1), pp.40--50, 2010.

【Term of Project】 FY2010-2014

【Budget Allocation】 167,000 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.er.ams.eng.osaka-u.ac.jp/English/Welcome.html>