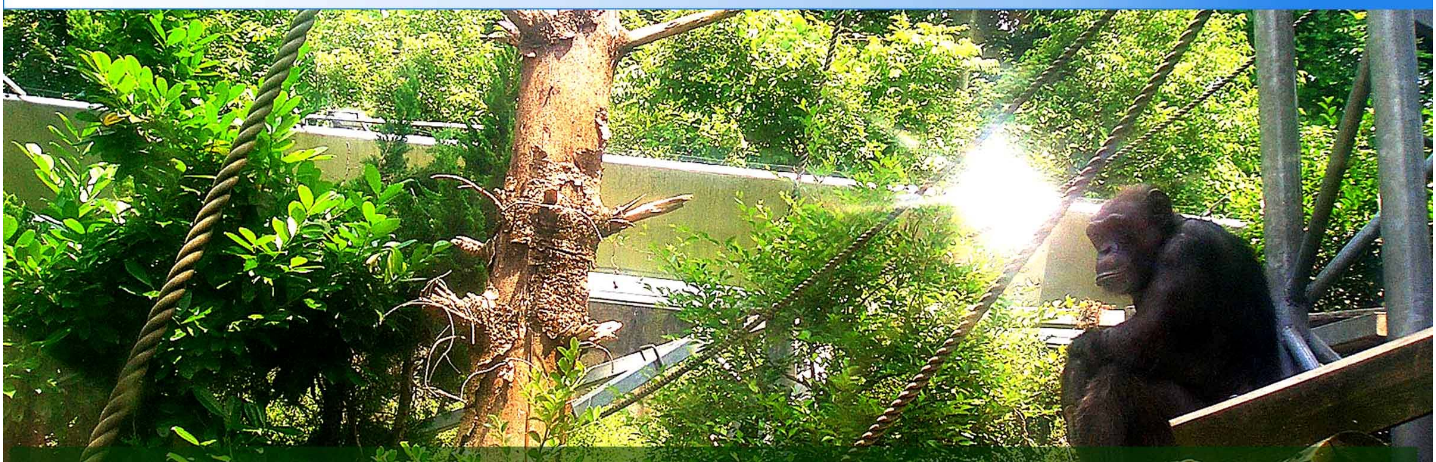
iCS^2 : 5

Primate Research Institute, Kyoto University, Symposium of Coopertaive Research Program 2009:

5th International Inuyama Comparative Social Cognition Symposium



Saturday, December 19 – Sunday, December 20, 2009
Large Conference Room, Primate Research Institute, Kyoto University
Inuyama, Aichi, Japan

Hosted by Primate Research Institute, Kyoto University and
Kyoto University Global COE Program: Revitalizing Education for Dynamic Hearts and Minds

Primate Research Institute, Kyoto University, Symposium of Coopertaive Research Program 2009:

5th International Inuyama Comparative Social Cognition Symposium (iCS^2:5)

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これまで 4 回にわたって，社会的認知の比較研究とその関連領域に関する共同利用研究会を開催してきました．はじめの 3 回は個別の大きなテーマを設定しての研究会でしたが，昨年度はより多くの方々による幅広い研究成果を発表していただき，議論を行うという形式をとりました．関連する領域とはいえ手法も対象も異なる研究者が一堂に会して議論と交流を深める本研究会は着実に学界にも認識される存在として成長しつつあります．そこで，今回も第 5 回という形で特に限定的なトピックを設定することなく，比較社会認知研究および関連する多様な研究領域から幅広く講演者を募り研究会を開催することとなりました．なお，今回は海外からも 5 名の研究者にご参加いただくことになり，第 1 回以来の英語による国際シンポジウムとなります.

Organizers (Kyoto University): Masaki Tomonaga, Misato Hayashi, Ikuma Adachi, Tomoko Matsui (Primate Research Institute), Shoji Itakura (Graduate School of Letters), Masayuki Tanaka (Wildlife Research Center), Masako Myowa (Graduate School of Education)

Collaborators: Kazuo Hiraki (University of Tokyo), Motoaki Sugiura (Tohoku University), Atsushi Sato (University of Toyama)

Hosted by Primate Research Institute, Kyoto University and Kyoto University Global COE Program: Revitalizing Education for Dynamic Hearts and Minds

Program

Saturday, December 19

12:00–13:00 Registration

13:00–13:05 Opening remarks

Session 1 (Chair: Masaki Tomonaga)

13:05–13:40 O1 Psychological reasoning in infancy
Hyun-joo Song (Yonsei University)

13:40–14:05 O2 Young children's social learning from a robot
Yusuke Moriguchi (Joetsu University of Education)

14:05–14:40 O3 The enemy of my enemy is my friend: Infants interpret social behaviors in context
Jane Kiley Hamlin (Yale University)

14:40–15:05 O4 Relative contributions of kinematical information and goal representation for perception of self-agency in humans and chimpanzees
Takaaki Kaneko, Masaki Tomonaga (Kyoto University)

15:05–15:30 O5 Chimpanzees' flexible helping upon request
Shinya Yamamoto (University of Tokyo)

15:30–16:55 Tea break and poster session

Session 2 (Chair: Ikuma Adachi)

16:55–17:30 O6 Social cognition in capuchin monkeys: Individual recognition from faces
Jennifer J. Pokorny (Yerkes National Primate Research Center)

17:30–18:15 O7 Mirroring other minds. New insights from neuroscience to understand monkey cognitive development
Pier Francesco Ferrari (University of Parma)

18:30 Banquet

Sunday, December 20

8:30–9:00 Registration

Session 3 (Chair: Tomoko Matsui)

9:00–9:35	O8	Language acquisition from a social cognitive perspective: How children learn word meanings with non-linguistic cues Harumi Kobayashi (Tokyo Denki University)
9:35–10:00	O9	Communicative behavior reflecting the perception of others' cognitive environment in infancy Hiromi Kusumoto (Kyushu University)
10:00–10:25	O10	Assessing cortical response to infant-directed speech in high-risk neonates Nozomi Naoi (JST; Kyoto University)
10:25–11:00	O11	Early word learning in young children Yuriko Oshima-Takane (McGill University)

11:00–11:10 Tea break

Session 4 (Chair: Ikuma Adachi)

11:10–11:35	O12	Object manipulation by a social rodent, degu (*Octodon degus*) Naoko Tokimoto (RIKEN BSI)
11:35–12:00	O13	Do capuchin monkeys (*Cebus apella*) understand emotional meanings in conspecifics expression? Yo Morimoto (Kyoto University)

12:00–13:15 Lunch and poster session

Session 5 (Chair: Masaki Tomonaga)

13:15–13:50 O14 Body scheme and social rule
Naotaka Fujii (RIKEN BSI)

13:50–14:15 O15 The comparative eye-tracking study in chimpanzees and humans
Fumihiro Kano, Masaki Tomonaga (Kyoto University)

14:15–14:40 O16 Human error processing interacts with social information: Evidence from ERP studies
Shun Itagaki (University of Tokyo)

14:40–15:05 O17 Autonomic reaction and neuronal response to facial expression and vocalization
Koji Kuraoka (Kyoto University)

15:05–15:40 O18 The behavioral hallmarks of face processing in man and monkey
Christoph D. Dahl (Max Planck Institute for Biological Cybernetics)

15:40–16:00 General discussion

16:00–16:10 Closing remarks

Poster session

P1 Cross-modal representations of familiar conspecifics in rhesus monkeys

Ikuma Adachi[1], Robert R. Hampton[2] (1 Primate Research Institute, Kyoto University; 2 Department of Psychology, Emory University)

P2 Visual search for emergent features in chimpanzees

Kazuhiro Goto[1], Masaki Tomonaga[2], & Tomoko Imura[2] (1 Kokoro Research Center, Kyoto University; 2 Primate Research Institute, Kyoto University)

P3 Scannig others' social cues in chimpanzees and humans

Yuko Hattori[1,2], Fumihiro Kano[1,2], Masaki Tomonaga[1] (1 Primate Research Institute, Kyoto University; 2 Japan Society for the Promotion of Science)

P4 The change of power in a chimpanzee: The investigation of relations between individuals

Mari Hirosawa[1], Naomi Suzuki[2], Ikuma Adachi[1] (1 Primate Research Institute, Kyoto University; 2 Faculty of Applied Biological Sciences, Gifu University)

P5 Double tactile sensations evoked by a single visual stimulus on a rubber hand

Motoyasu Honma[1], Shinichi Koyama[2], Yoshihisa Osada[1] (1 College of Contemporary Psychology, Rikkyo University; 2 Graduate School of Engineering, Chiba University)

P6 Effect of optic-flow on navigating virtual 3D-mazes

Tomoko Imura[1], Nobu Shirai[2] (1 Primate Research Institute, Kyoto University; 2 Department of Psychology, Niigata University)

P7 Social relationships and interactions in a captive group of brown capuchin monkeys

Yuta Ishiguro[1], Hiroe Kamanaru[2], Mitsunori Nagao[2], Hiroki Yamamoto, Masayuki Tanaka[1] (1 Wildlife Research Center of Kyoto University; 2 Kyoto City Zoo)

P8 Estimation of anxiety using eye movement at photograph appreciation

Tadanobu Kamijo[1], Maho Oki[2], Hideyuki Takahashi[3] (1 Graduate School of Engineering, Tamagawa University; 2 Graduate School of Humanities and Sciences ,Ochanomizu Univesity; 3 Tamagawa University Brain Science Institute)

P9 The correspondent link between action prediction and motor ability in early infancy

Yasuhiro Kanakogi, Shoji Itakura (Graduate School of Letters, Kyoto University)

P10 Inter-institutional transfer in captive chimpanzees: A case study of relationships among behavior, personality, and “Quality of Life”

Akitsugu Konno[1], Naruki Morimura[2,3], Masayuki Tanaka[2,4], Toshifumi Udono[3], Kaname Okahashi[4], Yuki Yamamoto[4], Masayuki Matsunaga[4], Fumio Ito[4], Mihi Inoue-Murayama[2], Toshikazu Hasegawa[1], Masaki Tomonaga[5] (1 Graduate School of Arts and Science, University of Tokyo; 2 Wildlife Research Center of Kyoto University; 3 The Chimpanzee Sanctuary Uto; 4 Kyoto City Zoo; 5 Primate Research Institute, Kyoto University)

P11 Online processing of speech prosody in children with autism spectrum disorders: An eye-tracking study

Yui Miura[1,2], Tomoko Matsui[1], Yoshikuni Tojo[3], Hiroo Osanai[4] (1 Primate Research Institute, Kyoto University; 2 Japan Society for the Promotion of Scicence; 3 Department of Education, Ibaraki University; 4 Musashino Higashi Education Center)

P12 EEG revealed two phases in visual self-recognition: Sharpening and facilitation

Makoto Miyakoshi, Noriaki Kanayama, Tetsuya Iidaka, Toshiharu Nakai, Hideki Ohira (Functional Brain Imaging Lab, Department of Gerontechnology, National Center for Geriatrics and Gerontology)

P13 Do monkeys recognize when others care about them?

Chizuko Murai (Brain Science Institute of Tamagawa)

P14 Bilingual advantage of conversational understanding: A comparison between English-Japanese bilingual children and Japanese monolingual children

Yuko Okumura[1], Michael Siegal[2,3], Shoji Itakura[1] (1 Graduate School of Letters, Kyoto University; 2 Department of Psychology, University of Trieste; 3 Department of Psychology, University of Sheffield)

P15 Brain development in chimpanzees: A longitudinal MRI study

Tomoko Sakai[1], Akichika Mikami[2], Daichi Hirai[3], Takeshi Nishimura[3], Juri Suzuki[3], Yuzuru Hamada[3], Masaki Tomonaga[3], Masayuki Tanaka[4], Takako Miyabe[3], Masato Nakatsukasa[1], Tetsuro Matsuzawa[3] (1 Graduate School of Science, Kyoto University; 2 Faculty of Human Well-Being, Chubu Gakuin University; 3 Primate Research Institute, Kyoto University; 4 Wildlife Research Center of Kyoto University)

P16 Manual laterality in object manipulation in substrate use by captive capuchin monkeys (*Cebus* sp.)

Yoshiaki Sato[1,2], Yui Fujimori[3], Misato Hayashi[1] (1 Primate Research Institute, Kyoto University; 2 Japan Society for the Promotion of Science; 3 Faculty of Applied Biological Sciences, Gifu University)

P17 Cerebral dominance for self information in handwritten shapes: An ERP study

Reiko Sawada[1,2], Yui Miura[1,2], Nobuo Masataka[1] (1 Primate Research Institute, Kyoto University; 2 Japan Society for the Promotion of Science)

P18 What we know about the left holding newborn side?

Céline Scola (Graduate School of Education, Kyoto University)

P19 Mother’s mind-mindedness could foster child’s mentalising abilities? False belief and emotion understanding

Ikuko Shinohara (Shiraume Gakuen College)

P20 Asymmetric perception of radial expansion/contraction in Japanese macaque (*Macaca fuscata*) infants

Nobu Shirai[1], Tomoko Imura[2], Yuko Hattori[2], Ikuma Adachi[2], Shigeru Ichihara[3], So Kanazawa[4], Masami K. Yamaguchi[5], Masaki Tomonaga[2] (1 Department of Psychology, Niigata University; 2 Primate Research Institute, Kyoto University; 3 Graduate School of Humanities, Tokyo Metropolitan University; 4 Graduate School of Integrated Arts and Social Sciences, Japan Women's University; 5 Department of Psychology, Chuo University)

P21 Group learning of a computer-based task in zoo chimpanzees

Masayuki Tanaka[1], Masayuki Matsunaga[2], Fumio Ito[2], Yuki Yamamoto[2], Sachiko Kunimoto[1] (1 Wildlife Research Center of Kyoto University; 2 Kyoto City Zoo)

P22 Why so difficult to discriminate human gaze directions for chimpanzees?

Masaki Tomonaga[1] and Takaaki Kaneko[1,2] (1 Primate Research Institute, Kyoto University; 2 Japan Society for the Promotion of Science)

P23 Motion judgment in infant macaque monkeys (*Macaca fuscata*)

Sota Watanabe[1,2], Masaki Tomonaga[3], & Kazuo Fujita[1] (1 Graduate School of Letters, Kyoto University; 2 Japan Society for the Promotion of Science; 3 Primate Research Institute, Kyoto University)

Abstracts

O1 Psychological reasoning in infancy

Hyun-joo Song
Department of Psychology, Yonsei University

A series of my experiments have revealed some evidence for infants' ability to reason about others' psychological processes. First, by 9.5 months, infants can reason about others' dispositions to do a particular action. Second, by 12 months, infants can use verbal information when inferring others' goals. Third, 14.5 months, infants understand that others can be misled by false perceptions. Fourth, by 18.5 months, infants can understand that others' false beliefs can be corrected by appropriate communications. These findings add to emerging evidence on infants' sensitivity to others' internal states.

O2 Young children's social learning from a robot

Yusuke Moriguchi
Graduate School of Education, Joetsu University of Education

It is generally assumed that young children learn new actions and language from another person. Recent research, however, has shown that children can learn new actions and skills from nonhuman agents. This study builds upon previous research and seeks to examine whether children could learn actions and words from a robot. In study 1, we examined whether children automatically imitated a robot's actions. The results revealed that children did not automatically imitate the robot's actions, but they did imitate when prompted to do so. Study 2 examined whether children can learn words from a robot. Children were shown a video in which either a woman (a human condition) or a mechanical robot (a robot condition) labeled novel objects. After viewing the video, children were asked to select the target objects that had been identified on the tape. The results revealed that children in the robot condition performed significantly above chance level although children tested with the human condition performed better than those tested with the robot condition. The results of two studies suggested that children have the potential to learn actions and words from a robot, but the way they learn from a robot is different from the way from a human. In the further research, we

will examine the neural basis of the learning from a robot.

O3 The enemy of my enemy is my friend: Infants interpret social behaviors in context

Jane Kiley Hamlin
Department of Psychology, Yale University

Recent research suggests that young infants prefer prosocial to antisocial individuals (Hamlin, Wynn, & Bloom, 2007). While a preference for those who help others is certainly adaptive, there are potentially situations in which unhelpful behavior is more appropriate (e.g. punishing others for their wrongdoing) or more socially diagnostic (e.g. "The enemy of my enemy is my friend" Aronson & Cope, 1968; Gawronski et al, 2005; Heider, 1958). This talk examines whether infants *always* prefer those who are prosocial, in contexts in which antisocial behavior could be seen as punishment, or in which an individual's antisocial behavior may be an indication that he or she shares a negative opinion toward a disfavored other.

O4 Relative contributions of kinematical information and goal representation for perception of self-agency in humans and chimpanzees

Takaaki Kaneko[1,2], Masaki Tomonaga[2]
1 Japan Society for the Promotion of Science; 2 Primate Research Institute, Kyoto University

Humans distinctly recognize an event which caused by the self from other events, namely the perception of self-agency which allow us to establish the concept of self as a being independent agent. Previous our study showed chimpanzees share similar cognitive function. In this study, we aimed to reveal species unique features of this cognitive function by comparing humans and chimpanzees. In particular, we investigated the relative contributions of kinematical information or goal representation as a cue for the self/other differentiation. It is known that chimpanzees and humans employ different strategies for a coding of other's action in a context of imitation, that is chimpanzees have difficulties in copying of other's motor action but they could do reproduce other's goals. These difference may reflect the difference in the perception of own voluntary action, however, none of study have addressed this matter before. Here we show that the chimpanzees have difficulty in discrimination of agency when goal representation was insufficient cue of the discrimination but the humans do not.

In our experiments, two of cursors were shown on the monitor and one of which were moved by the computer and the other could be controlled by the participants using the trackball device. The participants were required to detect the cursor which they could move and hit either target shown on the monitor. The time to detect the self cursor was increased as the percentage of a case in which the target the distracter cursor moved toward was accidentally correspond with the target the participant aimed to hit was increased, and this was only observed in chimpanzees but not in humans.

O5 Chimpanzees' flexible helping upon request

Shinya Yamamoto
Japan Society for the Promotion of Science; Graduate School of Arts and Sciences, University of Tokyo; Great Ape Research Institute, Hayashibara Biochemical Laboratories, Inc.

The evolution of altruism has been explained mainly from ultimate perspectives. However, it remains to be investigated from a proximate point of view how and in which situations such social propensity is achieved. We investigated chimpanzees' helping behavior in a tool-transfer paradigm, and discuss the similarities and differences in altruism between humans and chimpanzees. Previously it has been suggested that chimpanzees help human experimenters by retrieving an object which the experimenter is trying to reach. In the present study, we investigated the importance of communicative interactions between chimpanzees themselves and the influence of conspecific partner's request on chimpanzees' altruism. We presented two tool-use situations (a stick-use situation and a straw-use situation) in two adjacent booths, and supplied non-corresponding tools to paired chimpanzees in the two booths. For example, a chimpanzee in the stick-use situation was supplied with a straw, and the partner in the straw-use situation possessed a stick. Spontaneous tool transfer was observed between paired chimpanzees. The tool giving events occurred predominantly following recipients' request. Even without any hope of reciprocation from the partner, the chimpanzees continued to help the partner as long as the partner required. We also found that the giver chose an appropriate tool from a selection of seven objects for transfer to their partner to obtain an otherwise inaccessible food reward. These results indicate that chimpanzees altruistically help others upon request without pursuing personal benefits. It is also suggested that chimpanzees have an ability to understand others' request and needs. This is the first experimental study reporting chimpanzees' flexible helping behavior. Thus the implication for the differences between

chimpanzees and humans is that voluntary altruism with highly accurate understanding and knowledge of others' desires is a unique human trait.

O6 Social cognition in capuchin monkeys: Individual recognition from faces

Jennifer J. Pokorny
Yerkes National Primate Research Center, Emory University

Nonhuman primates live in socially complex groups that require recognition of individuals with whom they interact. Humans typically use faces to extract information such as the identity of an individual, whom we can then determine is either familiar or unfamiliar. We examined the ability of capuchin monkeys (*Cebus apella*) to discriminate and recognize conspecific faces using a computerized oddity task. We demonstrated that capuchins not only recognize familiar and unfamiliar conspecific faces, but that they can also identify familiar individuals depicted in the images. This was done by having subjects select the one in-group member as odd among three out-group members and vice versa. The monkeys correctly determined which faces were in-group versus out-group members, corresponding to their real-life experience. This indicates that capuchins recognize the identity of individuals whom they see in a picture and understand the representational nature of two-dimensional images.

O7 Mirroring other minds. New insights from neuroscience to understand monkey cognitive development

Pier Francesco Ferrari
Department of Evolutionary and Functional Biology; Department of Neuroscience, University of Parma

The discovery of the mirror neuron system in both monkeys and humans challenged the view that action and perception belong to different domains. This finding also had a large impact on several scientific disciplines and raised important questions about their possible functions in social cognition and development.

Here I will first describe the basic properties of mirror neurons in the ventral premotor cortex and the inferior parietal lobule in the macaque monkey and subsequently the mirror neuron system in humans. Secondly, I will present hypotheses about their possible functions in action

understanding and imitation, both during infancy and adulthood. Recent neurophysiological data on infant macaques suggest that they are provided at birth with a mirror mechanism probably serving communicative functions. The capacity to match own and others' behavior now documented in infancy (e.g. neonatal imitation) and so well developed in adulthood, probably reflects the need and ability of monkeys to stay in tune with each others and to synchronize behavioral activities. An empathic connection resulting from behavior matching may have important consequences on social relations and could be at the basis of the development of prosocial behaviors.

The foundations of complex forms of communication and imitation that are so well expressed by apes and humans can be tracked in macaques and probably rely on an action-perception core mechanism that is present at birth and subserves early intersubjective exchanges.

O8 Language acquisition from a social cognitive perspective: How children learn word meanings with non-linguistic cues

Harumi Kobayashi
Graduate School of Science and Engineering, Tokyo Denki University

Studying origins of language from an ontogenetic, developmental perspective is specially unique and advantageous. The reason is that we can observe at first hand how language appears and changes as time passes. It has been suggested that the most important ability of human children to acquire language is establishing joint attention with other people. Joint attention refers to specifying a certain part of the environment and paying attention to it with other people to share information and emotion about it. Joint attention entails basic structure of language that first specifies what one wants to talk (theme) and what one wants to talk about it (description). Children start activities of triadic interaction that involves child, adult, and object around nine to twelve months of age. The child confirms adult's line of regard and actively tries to establish joint attention about the interesting aspect of the environment. Emergence of ability of estimating others' intentions follows the emergence of joint attention at around eighteen months. Because their ability to use linguistic information is limited, they must be able to use non-linguistic social cues. Our laboratory has studied how young children recognize adults' referential intentions from non-linguistic cues such as gesture, eye gaze, and timing of utterances. We found that young children are sensitive to a variety of non-linguistic cues adults provide and use these cues to know word meanings.

O9 Communicative behavior reflecting the perception of others' cognitive environment in infancy

Hiromi Kusumoto
Graduate School of Human-Environment Studies, Kyushu University

Humans change their way of communication adapting to the addressees' conditions of perception, almost automatically, which is assumed to be on the basis of understanding of mutual cognitive environment (Sperber & Wilson, 1995). To clarify the developmental origin of this ability, we investigated whether infants properly modify their communicative behaviors reflecting the partner's cognitive environment. Previous researches have shown that infants produce more pointing gestures or vocalizations when the recipient's visual attention was on them than when it was not (e.g., Liszkowski, Carpenter, & Tomasello, 2007; Liszkowski, Albrecht, Carpenter, & Tomasello, 2008). However, it is still unclear to what extent infants change their modalities of communication flexibly in naturalistic settings. In the present research, 12 and 14-month-olds (N = 16) and their mothers participated and we set up a situation of mother-infant interaction. We inserted two conditions of test trials (where mother did not respond adequately to the infant's communicative action), into the baseline trials (where mother responded adequately). Results showed that infants vocalized more frequently in the test trials than in the baseline trials, and the frequency of pointing reduced significantly as trials proceeded in the unavailable condition but not in the other trials. These supported the view that 12- and 14-month-olds modify their communicative behaviors reflecting a recipient's cognitive environment and somehow understand the effectiveness of each modality of communication.

O10 Assessing cortical response to infant-directed speech in high-risk neonates

Nozomi Naoi
JST/ERATO; Graduate School of Education, Kyoto University

A number of behavioral studies suggest young infants are more likely to attend to infant-directed speech than to adult-directed speech. To evaluate the effects of prenatal and postnatal experience on neonates' speech processing, we examined cerebral responses to infant-directed speech in neonates in Neonatal Intensive Care Unit (NICU) using near-infrared spectroscopy (NIRS).

O11 Early word learning in young children

Yuriko Oshima-Takane
Department of Psychology, McGill University

A growing body of research has shown that young infants are able to use morphosyntactic information in input to categorize new words into grammatical categories such as nouns and verbs (Mintz, et al., 2002). Furthermore, recent research has demonstrated that children under 2 years of age are able to use morphosyntactic cues to map new words onto their referents after only minimal exposure to the word-event pairings without contextual or social support (Echols & Marti, 2004; Oshima-Takane et al., 2008). However, whether young children's representations of morphosyntactic information are abstract enough to guide early word learning is under debate (Dittmar, et al., 2008; Gertner et al., 2005; Gleitman, 1990; Tomasello, 2003). In this talk, I will examine this issue by presenting two types of habituation data. From one, I will show evidence that children under 2 years of age are able to use both noun and verb morphosyntactic cues in a word learning task in which the novel words have more than one possible interpretation (i.e. agents or actions) and when morphosyntactic cues are not consistent with perceptual cues. From the other, I will provide evidence for an early capability to generalize new verbs to previously unseen instances with a new agent. Based on these findings, I will argue that children's representations of both noun and verb morphosyntactic information are abstract enough to guide early word learning. However, children's cognitive resources such as memory, attention, etc. are still limited at early stages of language development (Dapretto & Bjork, 2000; Werker & Fennell, 2004). Hence, young children may fail to access their morphosyntactic knowledge when word learning tasks are too demanding and consume too much of their cognitive resources.

O12 Object manipulation by a social rodent, degu (*Octodon degus*)

Naoko Tokimoto
Labratory for Biolinguisutics, RIKEN Brain Science Institute

It is believed that tool-use is impossible without a cognitive module specific to it. Only a limited number of species, mostly primates and corvids, develop the skills. However, we found that a rodent, degus spontaneously constructed nesting cups by a procedure similar to that of primates. The degu is a highly social and curious animal native to Chile that demonstrates the manual dexterity and forelimb-eye coordination requisite for tool-use. To examine the object manipulation ability of the degus, we trained them to manipulate a rake-like tool with their forelimbs to retrieve a distant food reward.

To train and test the degus, we used a conditioning approach similar to one traditionally used for non-human primates. As a result, degus learned to use the rake as a tool after fifty-seven sessions on average. Furthermore, the trained degus adapted to tools of different sizes, shapes and colors, and they ignored fake-tools that did not work. These results showed that they understand the function of rake-like tools to get a food in a distance. Our findings suggested that the cognitive system necessary for the tool-use was gradually constructed in the environments in which it is indispensable. The tool-use should be recalibrated as the result of a combination of general cognitive faculties rather than a single higher cognitive function. We will discuss the complexity of the object manipulation of the degus.

O13 Do capuchin monkeys (*Cebus apella*) understand emotional meanings in conspecifics expression?

Yo Morimoto
Graduate School of Letters, Kyoto University

Primates are characterized by a variety of facial and vocal expressions and complex social interactions. In their social behaviors such as coalitions or postconflict affiliations, primates may use other's emotional expression to predict the individual's subsequent behavior. Among primates, apes have been shown to understand emotional meanings in others' expressions. In this study, we asked to what extent a New world monkey species, tufted capuchin monkeys (*Cebus apella*) understand other's emotion. In Experiment 1, we showed that capuchin monkeys in fact modify their behavior according to conspecifics' emotional expression. However, whether they did it by understanding emotional meanings or by other simpler processes is still unknown. In Experiment 2, we investigated whether capuchin monkeys identify an object which is responsible for other's expression. Subject monkeys witnessed a stimulus monkey reacting either positively or negatively toward one of two containers. The other container was not shown to the stimulus monkey. Then they were allowed to choose one of the two containers. They preferred the container that had evoked positive expression and avoided the container that had evoked negative expression on the stimulus monkey; that is, the subject monkeys changed their preference toward the containers depending on the partner's expression. The results are consistent with the view that the monkeys estimated emotional valence of

the relevant objects and suggest that representing other's emotion is not unique to humans and apes.

O14 Body scheme and social rule

Naotaka Fujii
Laboratory for Adaptive Intelligence, RIKEN Brain Science Institute

Human beings are social animal. We have developed extremely complex social systems compared to any other species on the earth. What is the most essential behavioral requirement in human being to be a social animal? That is an ability to follow rules that constrain our behavior. Although there are many studies aimed to reveal neural mechanism of rule dependent social behavior, we still don't know how the rules emerge in brain and in society, and how such rules are operated. Here, we tried to observe monkeys' social behavior and neural activity under restrain free social environment to learn mechanism of rule emergence and maintenance in brain. Through the observation of monkeys' social adaptive behavior under several different social settings, we would like to propose body scheme based social rule representation in monkeys. It could be modified subjectively depending on how monkey recognize context at the moment and applicable to any social environment regardless of contextual variation as a universal mechanism of rule representation. In that sense, parietal cortex seemed to be playing important role in representing social rule as an effective constraint on body scheme. We believe tool use that modulates body scheme might also work as a leverage to make us bring up from monkey's social brain to higher human level cognition, since it might allow us to have a concept of "mind" that linked the subject and the object of manipulation including the body itself.

O15 The comparative eye-tracking study in chimpanzees and humans

Fumihiro Kano[1,2], Masaki Tomonaga[1]
1 Primate Research Institute, Kyoto University; 2 Japan Society for the Promotion of Science

We will introduce the exciting and novel approach — the comparative eye-tracking study in chimpanzees and humans. The eye-tracking methodology enables us to compare the eye movements of two species directly (i.e. both qualitatively and quantitatively). First, we will discuss why we are interested in the eye movements of humans and the closest species to humans, chimpanzees. Second, we will show the methods of measuring and analyzing the eye movements of chimpanzees and humans. Third, we will show the accuracy of measurement and discuss how the direct comparisons between species were validated. Fourth, we will show a recent study which clarified how chimpanzees and humans look at faces. Both subjects of chimpanzees and humans viewed a set of scene photographs that contained whole bodies, faces, facial expressions, and so on. Both species showed highly similar patterns of scanning for faces. For example, both species actively search for faces when presented with whole-body photographs. In addition, both species scanned eyes and mouth in that order when presented with facial photographs. However, the differences between species were also identified. For example, humans more actively searched for the eyes, and chimpanzees more quickly scanned each facial feature, compared to each other. Finally, we discuss how the comparative eye-tracking study contributes to our understandings of chimpanzee/human mind.

O16 Human error processing interacts with social information: Evidence from ERP studies

Shun Itagaki
Graduate School of Arts and Sciences, University of Tokyo

The ability to monitor our own action and to evaluate external information is necessary for us to behave adaptively in socially complex world. We can investigate human cognitive functions by recording electroencephalogram (EEG), and take a glance at underlying neural processing. There exist event-related brain potential (ERP) components that deeply relate to such cognitive function, which are called error-related negativity (ERN) or feedback-related negativity (FRN). These components reflect general error processing originated from the anterior cingulate cortex activation.

In this presentation, I propose that human error processing is flexible according to the situation, focusing on how this function is modulated by social knowledge or context, on the basis of the ERN or FRN deflections.

At first, I will talk about methodology of ERP and representative example of previous studies briefly, introducing the key points of the ERN and FRN component. After that, recent some of the experimental data will be shared with you and discussed. Each experimental data indicated that error processing was modulated by the relationship between self and other, the congruency with social knowledge in gambling task, and the interaction with facial expressions in choice reaction task. It is concluded that the human error processing has flexibility interacted with social information.

O17 Autonomic reaction and neuronal response to facial expression and vocalization

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Facial expressions and vocalizations convey emotional information in primates. Although the receiver of facial expressions and vocalization cues can perceive the internal state of the sender, the emotional information can affect the mental state of the receiver. In this talk, I report autonomic physiological reactions and neuronal responses to facial expression and vocalizations. I measured skin temperature around the nasal region as an indicator of the emotional states of rhesus monkeys (*Macaca mulatta*). The nasal skin temperature is known to decrease in the state of negative emotion. I found the temperature decreased after presentation of specific facial expressions and vocalizations. I also recorded the neuronal responses in the monkey amygdala to facial expressions and vocalizations. The amygdala has been implicated in emotional processing. Many amygdala neurons showed different responses to different types of emotional expressions, and some neurons responded to both facial expressions and vocalizations conveying the same meanings. These data suggest that facial expression and vocalization of monkeys evoke emotional reactions in the receiver.

O18 The behavioral hallmarks of face processing in man and monkey

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The face is at the heart of social communication and identification of social status. In the life of primates the object class *face* receives greater attention than any other object class. Thus it should not come as a surprise that faces are processed differently than objects and that special neural correlates are dedicated to the processing of faces. The question to what extent faces are processed differently when compared with non-face objects has been a major focus of research in humans for the past several decades. Both the *behavioral hallmarks* of face perception (i.e. holistic processing and subordinate-level entry point) as well as the underlying neural mechanisms have been explored extensively in human studies. While the neural signal derived from single cell recordings has taught us much about the various aspects of face selectivity in the monkey brain, relatively little is known so far about the *behavioral* abilities with respect to face perception in the monkey.

Here, we employ critical experimental paradigms which were developed for research with humans in combination with eye tracking methods to investigate face processing abilities in monkeys (*Macaca mulatta* or rhesus macaque) and directly compare them with the abilities of human subjects. With this comparative approach we demonstrate that monkeys and humans employ similar face processing capabilities. Thus, the social importance of faces triggered the development of an extra-processing system for faces that evolved early during primate evolution.