

**SPIRITS**  
SUPPORTING PROGRAM FOR INTERACTION-BASED  
INITIATIVE TEAM STUDIES

Kyoto Univ. – National Taiwan Univ.  
International Symposium

「環境理解の社会認知生物学」

# Social Cognitive Biology on Representation of Environment

**July 31 (Sun.), 2016**

**9:30–18:00**

3rd Floor, Inamori Foundation Memorial Hall,  
Kyoto University (京都大学稲盛財団記念館 3F 大会議室  
中会議室)



【共催】  
京都大学心の先端研究ユニット  
京都大学こころの未来研究センター

**Kyoto University–National Taiwan University International  
Symposium  
"Social Cognitive Biology on Representation of Environment"**

9:30~18:00 July 31 (Sun.) 2016

3rd Floor, Inamori Foundation Memorial Hall, Kyoto University

**Sponsored by**

Kyoto University, National Taiwan University

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Unit for Advanced Studies of the Human Mind, Kyoto University

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Supporting Program for InteRaction-based Initiative Team Studies (SPIRITS),

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## ■ Programs

9:30~9:35 Jun Saiki (Kyoto University)

Opening Remarks

9:35~10:15 Tsung-Ren Huang (National Taiwan University)

Attention-modulated perception and learning of visual scenes

10:15~10:35 Yoshiyuki Ueda (Kyoto University)

Visual experience modulates perception, attention, and preferences

\*Coffee Break\*

10:50~11:30 Chien-Te Wu (National Taiwan University)

Do political colors matter in trust-based interaction?

11:30~11:50 Nobuhito Abe (Kyoto University)

Cognitive mechanisms in (dis)honesty: behavioral and neural evidence

\*Lunch & Poster session\*

13:50~14:30 Su-Ling Yeh (National Taiwan University)

Understanding the environment without awareness

14:30~15:10 Chien-Chung Chen (National Taiwan University)

The six dimensions of spatial configuration dependency in flanker effects

15:10~15:30 Satoru Saito (Kyoto University)

Verbal working memory and language environment

15:30~15:50 Yukiyasu Kamitani (Kyoto University)

Methods for neural mind reading

\*Coffee Break\*

16:05~16:45 Chun-I Yeh (National Taiwan University)

Processing of artificial and natural stimuli in macaque primary visual cortex

16:45~17:25 Keng-Chen Liang (National Taiwan University)

The social and cognitive neurobiology of processing environmental danger in rats

17:25~17:45 Yutaka Komura (Kyoto University)

Self-reflective codes in the deep brain

17:45~18:00 Jun Saiki (Kyoto University)

General Discussion & Closing Remarks

## Talk Session Abstracts

## **Attention-modulated perception and learning of visual scenes**

*Tsung-Ren Huang*

*Department of Psychology, National Taiwan University*

To efficiently process overwhelming information from viewing, human visual system can not only compute summary statistics of a scene (e.g., mean size of objects) but also learn statistical regularities in that scene. Such perception and learning of visual scenes show complex interactions—ensemble perception and statistical learning of scenes can either interfere with other or work in parallel; during perception and learning, stimuli in the visual periphery can be involuntarily processed or ignored; when processed, they can play a role of either distractors or context cues. In this talk, I will present experimental results and computational models regarding how visual attention accounts for various phenomena in perception, learning, and memory of visual scenes. Specifically, our experimental and simulation results suggest that scene understanding often follows a global-to-local, exploration-to-exploitation principle and local regularities in a scene, once learned, become more salient and attractive to spatial attention. More importantly, spatial attention can be voluntarily allocated to either local or global aspect of a scene to gate both ensemble perception and statistical learning of suprathreshold stimuli at that spatial scale. As a result, it is difficult to see attention-modulated ensemble perception and statistical learning to operate simultaneously at different spatial scales.

## **Visual Experience Modulates Perception, Attention, and Preferences**

*Yoshiyuki Ueda*

*Kokoro Research Center, Kyoto University*

Vision provides an overwhelming amount of information to us. Although we cannot recognize all of the details explicitly, recognized and non-recognized information, forms our cognition. In this study, results show that this effect is not due to higher-level processes such as thinking and reasoning, but rather perceptual processes. The first topic of this talk is cultural differences in visual search. Japanese and North American participants were asked to search for the longer or shorter line among shorter or longer lines. North Americans showed a reliable search asymmetry, in which participants easily found the longer line among shorter lines than vice versa. However, Japanese participants did not show this asymmetry. If cultural differences in searching ability are based exclusively on a differential engagement of strategic factors, such as analytic/holistic processing, it should be invariant across different kinds of stimuli. Interestingly, the direction of cultural differences in search asymmetry changed according to stimulus sets. This suggests that cultural differences are not due to strategic processing, but are based instead on the target detection process, which is developed by adapting to environmental factors. The second topic of this talk is preference formation. Based on findings that a preference for previously seen objects over new objects (the mere exposure effect), participants' preference was investigated after repeated exposure to multiple items. The results showed that participants displayed a greater preference for the average of items, indicating that individuals readily compute a statistical summary from the current environment automatically, and store it. Furthermore, this average preference was greater when participants focused less on the items during exposure than when they focused on the items. These results indicate that environmental summary is calculated and pooled more efficiently in an implicit manner, and its implicit storage influences the formation of average preferences. These two studies provide explanations concerning how individuals change their behavior depending on their visual environments and variety of individual differences yields.

## **Do political colors matter in trust-based interaction?**

*Chien-Te Wu*

*School of Occupational Therapy, College of Medicine, National Taiwan University*

Trust is a basic component that shapes a group in social animals and is known to vary with social contexts. Many studies have demonstrated the power of ascribed identity (e.g., ethnicity, gender) upon trust behaviors among human beings. However, few studies have investigated how acquired identity (e.g., political party) may influence one's trust to another person and the neural mechanisms underlying trust-related decision making. To address this issue, we enrolled 58 healthy adults who share different political identities, defined by their presidential choices in 2012 Taiwan presidential election (i.e., KMT vs. DPP supporters), to participate a repeated binary trust game experiment while undergoing fMRI scan. Each participant was informed that two types of partner (same and different political identity) were included in the present study. At the behavioral level, we found that political identity can modulate cooperative decisions and that this is reflected in higher frequency of trust decisions when participants were interacting with a partner having the same political identity. At the neural level, our fMRI analyses for the same political identity trials in which the participants' partner defected compared with trials in which the partner reciprocated showed significant hemodynamic signal change in the brain regions implicated in emotional processing, mentalizing, and self-regulatory control. These include the anterior insula, the temporoparietal junction, and the dorsolateral prefrontal cortex. However, participants exhibited greater activation in the striatum (reward learning) in response to different political identity trials in which the partner reciprocated compared with trials in which the partner defect. The current findings highlight the role of social identity in trust behaviors.

# **Cognitive mechanisms in (dis)honesty: behavioral and neural evidence**

*Nobuhito Abe*

*Kokoro Research Center, Kyoto University*

[abstract is not opened to the public]



## **Understanding the environment without awareness**

*Su-Ling Yeh*

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Can mental processing of the outside world be carried out without awareness, and what is the boundary condition of such unconscious processing? Thanks to the recent advance of experimental paradigms and brain imaging techniques, we have begun to uncover the mysteries of unconscious processing. In this talk, I will focus on studies using two paradigms for investigating unconscious processing: visual crowding and continuous flash suppression. Results from behavioral, ERP, and fMRI experiments revealed that unconscious processing of semantics does not require identification of word form, which argues against a simplistic hierarchical model in the sequence of orthography, phonology and semantics in reading. However, temporal integration of semantic information requires awareness of the stimuli. Further investigations using objects, gazes, faces, and scenes found that object boundary, intention, multisensory integration, and evaluative conditioning can nevertheless occur without awareness. Taken together, I will conclude the talk with my view of the role of consciousness on mental processing.

## **The six dimensions of spatial configuration dependency in flanker effects**

*Chien-Chung Chen*

*Department of Psychology, National Taiwan University*

The visual performance to a visual target can be changed by the presence of another visual stimulus (Flanker) nearby. Many theories have been proposed to explain the flanker effects. We used a dual-task paradigm, in which an observer is to detect a target superimposed on a pedestal and in the presence of flankers, to investigate the mechanisms underlying such flanker effects. The typical result is that, compared with the no-flanker conditions, the target threshold vs. pedestal contrast (TvC) functions shifted horizontally on log-log coordinates when the flanker appears. This result can be explained by a model in which the effect of the flankers is to modulate both the excitatory and the divisive inhibitory sensitivity of the target mechanism to both the target and the pedestal. The flanker effect depends on spatial configuration of stimuli, such as the relative distance, location, orientation, phase, and depth between the target and the flankers. Such spatial configuration dependence suggests that the flanker effect is close related to border ownership coding and contour and surface completion.

## **Verbal working memory and language environment**

*Satoru Saito*

*Graduate School of Education, Kyoto University*

Verbal working memory - the ability to hold verbal information temporarily - is an important element of higher cognition, playing a key role in reasoning, planning, comprehension and language acquisition. A wide range of research has explored the ways in which the language processing system and different types of linguistic knowledge contribute to this critical cognitive skill. Thus far, behavioural data from children, healthy adults, and neuropsychological patients have all made important contributions, as have more recent advances in computational modelling and neuroimaging. Building on the long tradition of working memory research, understanding the nature of verbal working memory and the degree to which it depends on the architecture of the language system continues to develop. In this research trajectory, our group has demonstrated the direct relationship between the language processing systems and verbal working memory through a paradigm for speech production, that is, through an experimental speech error induction technique (Saito & Baddeley, 2004; Nakayama & Saito, 2014). These studies suggest that the functioning of verbal working memory emerges from an interaction between speech perception and speech production systems, embedded within the large language network system (e.g., Ueno, Rogers, Saito, & Lambon Ralph, 2011). One of the implications from this language architecture view of verbal working memory is that the development of its functioning during childhood is underpinned by language experience through the exposure to the given language environment. This is certainly the case in shaping verbal working memory functioning for particular languages through the acquisition of the first language (Yuzawa & Saito, 2006) or through the foreign language learning (Sakuma & Saito, 2012). Recent data from our lab also have indicated that even adults' verbal working memory performance is strongly affected by the structure of the language environment not only in terms of phoneme sequence structures (Nakayama, Tanida, & Saito, 2015) but also in terms of suprasegmental / prosodic features of the language (Ueno, Saito, et al., 2014; Tanida, Ueno, Lambon Ralph, & Saito, 2015). A series of studies reported here confirms that verbal working memory is at least partly embedded within the architecture of the language system, which is gradually formed through the exposure to the given language environment.

## **Methods for neural mind-reading**

*Yukiyasu Kamitani*

*Graduate School of Informatics, Kyoto University*

*ATR Computational Neuroscience Laboratories*

Objective assessment of mental contents based on brain activity represents a major challenge in neuroscience. Despite its wide-spread use in human brain mapping, functional magnetic resonance imaging (fMRI) has been thought to lack the resolution to probe into putative neural representations of perceptual contents. As a consequence, the potential for reading out mental contents from human brain activity, or “brain decoding”, has not been fully explored. In this talk, I present our work on the decoding of fMRI signals based on machine learning-based analysis. I first show that visual features represented in ‘subvoxel’ neural structures could be decoded from population fMRI responses. Decoding of stimulus features is extended to “neural mind-reading”, in which a person's subjective state is predicted. We next discuss how a multivoxel pattern can represent more information than the sum of individual voxels, and how an effective set of voxels for decoding could be selected. A modular decoding approach is presented with an example of visual image reconstruction where arbitrary images could be accurately predicted from single-trial fMRI signals. Finally, I present our results on dream decoding in which semantic contents of visual dreams were predicted from brain activity during sleep. These results show that our machine learning-based approach provides an effective means to read out complex mental contents from brain activity while discovering information representation in multi-voxel patterns.

## **Processing of artificial and natural stimuli in macaque primary visual cortex.**

*Chun-I Yeh*

*Department of Psychology, National Taiwan University*

Using natural stimuli to study receptive field properties has become an important branch of visual research. In contrast with artificial stimuli that have simple and well characterized properties, natural stimuli frequently have very complex dynamics.

However, a systematic investigation of the contextual effect of the receptive field with both stimulus types has not yet been accomplished. Here we used both artificial and natural stimuli to study how spatial receptive-field properties may change with the characteristics of the visual stimulus ensembles (i.e. with or without spatial correlation). Artificial stimuli include both sparse noise and dense noise (binary checkerboard and subspace gratings), and natural stimulus is a movie clip with three different versions (original, original with 90-degree rotation, and randomized). A multi-electrode matrix (8x8 array, Neuronexus) was used to simultaneously record from multiple neurons in different layers of macaque monkey V1. Here we report some of the main findings in our simple cell population (modulation ratio  $f_1/f_0 > 1$ ). First, the contextual effect is significantly larger for neurons in the superficial layers 2/3 than for those in the input layer 4c of V1. Second, the spatial correlation in artificial images may contribute to the increase of the subregion number and the aspect ratio of the receptive field. Third, the orientation bias in natural images may contribute to the change of the preferred orientation axis of the receptive field. Overall, these results indicate that macaque monkey V1 is highly adaptive and dynamic: the receptive field of many V1 neurons may change accordingly with the statistics of the visual scene.

## **Cognitive and social neurobiology for processing environment danger in rats**

*Keng-Chen Liang*

*Department of Psychology, Neurobiology and Cognitive Science Center, National  
Taiwan University*

Environment bearing imminent threat to an organism elicits defensive reaction and forges robust memory. Organisms readily learn about the cue predicting danger as activating such memory allows better coping. Prevailing evidence on brain operation of fear memory has been focused on the amygdala. Yet our data suggest that fear memory can also be formed by a combinatorial process in which the hippocampus integrates aversive stimuli with contextual cues into a configural representation of frightening environment. In a series of experiments, we trained albino rats on a two-phase contextual fear conditioning task: They explored a context on the first day to form a representation and received on the second day a shock shortly after re-entry into the context to gain fear association. On the third day freezing was tested. This paradigm allows independent manipulation of context coding and context-shock association. Results indicate that drug suppression of the hippocampus shortly after either day of training impaired freezing in the test, suggesting involvement of the hippocampus not only in context representation but also in context-shock association. If the hippocampus indeed codes a configural memory of the frightening environment, the memory should be activated by any cue embedded in or linking to this configuration, which is respectively termed direct or mediated pattern completion. To test this, rats were trained on the task and tested for freezing in a novel context with a reminding cue of shock or what else linked to the context, to enable direct or mediated pattern completion. Results showed that the shock or mediated cues could retrieve fear memory in a novel context never associated with the shock; suppressing the hippocampus but not amygdala shortly after context-shock training abolished such pattern completion in the test. These results suggest that when encountering environment danger, the brain may form multiple copies of fear memory. Among them, the amygdala forges Pavlovian association as documented in the literature but the hippocampus integrates a configural representation of the event via a more cognitive type of learning.

Social interaction also contributes to detection of and reaction to the environmental danger as shown by the literature of observation learning, but its underlying neural mechanisms remains unclear. We have shown that a rat could learn avoidance behavior

by observing a conspecific's acquisition of a two-way active avoidance task. Further, witnessing a naïve model benefited the observer more than witnessing an expert model. Such findings imply that sensing the contingency between the model's reaction to the signal and its emotion changes, which was better explicated in the behavior of a naïve model, is crucial for observation learning. Our data indicate that rats indeed sensed the stress of a conspecific encountering shock and showed altruistic behavior of lever-press to relieve a companion from stress. To study neural mechanisms underlying observation learning, we first explored the neural correlates of reacting to others in danger. Rats received the above empathetic and altruistic tasks; ensemble unit activity was recorded by bundle electrodes indwelling in the anterior cingulate (ACC), insular (InC) and other cortices of a behaving rat. We found some ACC and InC units responding not only to one's own but also to other's pain; some of them shared excitatory responses to self and companion's pain, others had opposite responses: activated by its own pain but inhibited by other's pain or vice versa. In a prosocial task, certain ACC and InC units increased activity shortly prior to an altruistic act. The shared-response units in the empathetic task increased their ensemble activity when rats performed the altruistic act, and units related to prosocial behavior also increased their ensemble activity to other's pain, suggesting overlapped circuitry underlying the two behaviors. Given the involvement of medial frontal cortex and InC in human observation learning based on our preliminary data, the role of ACC and InC neurons in social learning of rodents should be better investigated in the future.

## **Self-reflective codes in the deep brain**

*A. Nikkuni, S. Fujimoto and Y. Komura (Kyoto University)*

*Kokoro Research Center, Kyoto University*

In everyday life, we do not only make decisions but also reflect our own decisions. How about animals? The authors found the behavioral correlates of reflective minds in the monkeys. In the decision wagering task, the monkeys chose the escape options with low risk and low return more frequently as decision difficulty increased. These monkeys' behaviors indicate the degree of confidence, which is a typical consequence of self-reflective mind.

For several years, the neural correlates of confidence have been discovered in the frontal and parietal cortices. We recorded single-unit activities from the monkeys performing the above decision wagering task, and found out the neural correlates of decision confidence in the pulvinar, a subcortical region. Moreover, reversible inactivation of the pulvinar had a specific effect on the wagering performances. These pulvinar responses and monkeys' behaviors under normal and inactivated states were explained well by a statistical model of self-reflection. We would like to discuss the relationships between cortical and subcortical signals of confidence or reflective mind.



## Poster Session Abstracts

## **Use of linguistic context is associated strongly with perspective taking**

*Mitsuhiko Ishikawa*

*Graduate School of Letters, Kyoto University*

The reasons that people with autism spectrum disorders(ASDs) have social difficulties have been a source of debate. One possibility is the idea of context blindness, which stipulates that the lack of spontaneous use of contextual information may be the core deficit of ASD. Here, we examined how autistic traits and the use of context influence social cognitions. Participants were 32 typically functioning adults whose autistic traits were measured to render an Autism Spectrum Quotient(AQ). All participants completed four cognitive tasks: the Embedded Figures Test, a linguistic context judgement task, a social context judgement task, and a Director(perspective-taking) task. The communication factor of the AQ predicted linguistic context use and perspective-taking ability. Linguistic context use explained variance in perspective-taking. However, the indirect effect from the communication factor to perspective-taking through the use of context was not significant. Use of linguistic context may be strongly and independently related to social ability.

## **The modulation of visual size perception by audition and its temporal property**

*Daiki Yamasaki*

*Graduate School of Letters, Kyoto University*

It is known that rapidly rising intensity sounds (looming sounds) can impact not only auditory processing but also crossmodal processing. In particular, the effects of looming sounds on the visual size perception have been well investigated. However, it is still unclear to what extent looming sounds affect the visual perception. In this experiment, we found that looming sounds affect the visual size perception, but the influence can be limited by the relationship of the audiovisual stimuli.

## **Olfactory effects on visual perception for pictures and words in binocular rivalry**

*Maiko Koumura*

*Graduate School of Letters, Kyoto University*

Zhou et al.,(2010) showed that olfactory information modulates visual perception in binocular rivalry. Olfactory stimuli prolong perception of congruent visual stimuli. However, little is known how olfaction affects visual processing in more details. We investigated how the effects of olfaction on binocular rivalry differ by the types of visual stimuli. In experiment 1, we examined whether the olfactory effects differ for visual stimuli of pictures or words (Chinese characters). The effect of olfaction was found for pictures, but not for words. In experiment 2, we used words (katakana) in colors that were either congruent or incongruent with its meaning. The effect of olfaction was found on colors, but not on words. These results suggest that the effects of olfaction differ by the types of visual stimuli, and the differences may be caused by the familiarity of visual stimuli or the strength of association between olfaction and visual objects.

## **Implicit and explicit processes of inhibiting desire for an extra-pair relationship**

*Ryuhei Ueda*

*Graduate School of Letters, Kyoto University*

Little is known about inhibiting factors of regulating the desire for extra-pair relationships. This study tested whether implicit, automatic attitude and explicit, deliberate control interactively regulate desire for extra-pair relationships. The male participants having a romantic partner performed (A) implicit association test (IAT), in which they were required to categorize ‘adultery’ or ‘single-minded’ love images as ‘good’ or ‘bad’, and (B) go/no-go task during functional magnetic resonance imaging (fMRI). Subsequently, they were engaged in date rating task where they rated how much they wanted to date unfamiliar females. The results demonstrated individuals with more negative attitude towards extra-pair relationships (measured with IAT) and higher prefrontal control (measured with go/no-go task) can regulate desire for extra-pair relationships with unfamiliar attractive females. Critically, we also found such individuals tended to keep longer romantic relationships with a particular partner in the real life. These results illuminate the implicit/explicit psychological processes of

amorous decision-making.

### **Does elaborate linguistic context influence to Japanese preschooler 's cognition of emotional information?**

*Yun-Hee Park*

*Graduate School of Letters, Kyoto University*

It is well known that adults' emotional recognition of facial expressions is modulated by contextual information linguistically provided with the face. The current study examined whether linguistic context influenced emotional recognition in Japanese 5-year-old preschoolers who had rich emotional knowledge and normal language ability. We presented preschoolers with three kinds of linguistic context about emotional situations (simple context, elaborate context, and ambiguous context) prior to presentation of a happy or a sad face, and recorded their emotional categorization of the faces. As a result, when preschoolers received elaborate linguistic context prior to seeing the facial expression their categorization scores were lower when the linguistic context and target emotions were incongruent. This result is consistent with previous findings with adults, and shows that preschoolers use contextual information rather than visual cues such as facial expression to reach a decision about the emotional state of another. We discuss the result from developmental, cognitive, and psychophysiological perspectives.

### **Effects of Detailed Illustrations on Science Learning**

*Yu-ying Lin*

*Graduate School of Letters, Kyoto University*

This study examined the influence of detailed illustrations on reading behaviors and learning outcomes. In Experiment 1, the subjective ratings of participants on learning interests showed a preference for detailed illustrations over simplified illustrations. In Experiment 2, participants read 8 human anatomy lessons: 4 lessons contained detailed illustrations and 4 lessons contained simplified illustrations. Participants completed a comprehension test and an evaluation questionnaire after reading each lesson. The results showed that detailed and simplified illustrations were equally effective in terms

of learning outcomes. Eye-tracking data indicated that the participants generally started viewing pictures earlier and spent more time on the detailed illustrations than they did on the simplified illustrations. The results suggest that detailed illustrations could influence reading behaviors, and may support learning differently compared with simplified illustrations.

**How attention biases recognition memory judgments: A signal-detection approach to Miyoshi and Ashida (2016)**

*Kiyofumi Miyoshi*

*Graduate School of Letters, Kyoto University*

Miyoshi and Ashida (2016) reported that invalid attentional cueing induced liberal bias in recognition memory judgments and increased the occurrence of false familiarity. The present study employed signal-detection models to provide a mathematically-structured explanation to this phenomenon. These models were originally used in Rahnev et al. (2011) to explain subjective bias in visual detection/identification with the assumption that inattention increases the trial-by-trial variability in perceptual signal distribution. Importantly, our recognition memory data were well explained in the same manner with these models, suggesting that inattention increases the noise in perceptual processing, which increases the variability in the level of processing fluency, resulting in the increased trial-by-trial variability in familiarity signal distribution. In this way, merely assuming the bottom-up attentional effect on perceptual processing can explain the occurrence of recognition bias and dejavu-like false memory.

**The influence of the representation of a person on a reading span test**

*Sho Ishiguro*

*Graduate School of Education, Kyoto University*

Working memory is thought to be an important memory function in everyday life. Although the capacity of working memory is severely limited, individuals can overcome the limitations under certain conditions. This study focused on working memory in a social situation, and tested the hypothesis that individuals overcome the limitations under a condition where they process information about a person. This

hypothesis was considered in terms of the effect of the context provided by a person. Thirty-two participants performed two conditions of a reading span test: a single condition in which participants processed information about a person within a set of sentences, and a multiple condition in which participants processed information about multiple persons within a set. Reading span scores were higher in the single condition than the multiple condition, supporting the hypothesis. The effect of context on working memory span, as well as an alternative explanation, is discussed.

### **Research and Development on the Acquisition Program of Learning Strategies in Application Learning**

*Hiroaki Ayabe*

*Graduate School of Education, Kyoto University*

This study investigated factors forming the academic achievement by examining students' characteristic and strategy use for learning, and comparing elementary school (n = 78) and junior high school (n = 45) students. Academic achievement test, IQ test and a questionnaire were administered. The results revealed that learning strategy use would not give a significant effect on academic achievement and that the positive effect of "commitment" could be observed in the elementary school students, however, not in junior high school students. Therefore, we devised a fostering program of mutual teaching with a poster to develop learning strategies skills, and was put into practice for junior high school students (n = 22). From the results, awareness of external resources such as posters and friends was so strengthened that elaboration strategies and emotional and motivational strategy were promoted. However, higher-order strategy required thinking (e.g. organization strategies, diagram utilization strategies) was not promoted.

### **The functional connectivity of the striatum during focused attention and open monitoring meditation**

*Masahiro Fujino*

*Graduate School of Education, Kyoto University*

Mindfulness meditation includes Focused Attention meditation (FA), entails the

voluntary focusing of attention on a chosen object, and Open Monitoring meditation (OM), involves nonreactive monitoring of the present experience. Although both meditations have the same purpose of preventing mind-wandering generated by the default mode network (DMN), they employ different methodologies. To clarify neural mechanisms of their methodologies, twelve meditators underwent fMRI during resting-state, FA and OM. Functional connectivity was assessed using the Seed-based analysis with the striatum. Compared to the resting state, during FA, correlations between the ventral striatum and the salience network regions were increased, and correlations between the ventral striatum and the DMN regions were decreased. By contrast, during OM, correlations between the putamen and the wider range of DMN regions were decreased. These results suggest that, while the ventral striatum may play a crucial role during FA, the putamen may play a crucial role during OM.

### **Does Unconscious Reward Undermine Intrinsic Motivation?**

*Kenshiro Ichimura*

*Graduate School of Education, Kyoto University*

Contrary to the common belief that monetary reward enhances human motivation, it is well understood that performance-based monetary reward can undermine an individual's intrinsic motivation. The purpose of the present study was to investigate whether this "undermining effect" is linked to unconscious monetary reward cues. Seventy-two participants performed a game-like task involving a stopwatch with conditions of no reward, subliminal reward, or supraliminal reward. Intrinsic motivation for the task was measured by the number of times they attempted the task during a free choice period (behavioral measure) and answers to a questionnaire scale (self-report measure). Results showed that even though self-reported intrinsic motivation was higher in the supraliminal reward group than the other two groups, behavioral intrinsic motivation was undermined in the supraliminal reward group and also in the subliminal reward group. These results indicated that undermining effect affected intrinsic motivation in unconscious reward processing.

## **The effect of verbal interference on learned categorical perception**

*Takashi Hiroi*

*Graduate School of Education, Kyoto University*

Categorical perception (CP) refers to the phenomenon whereby category knowledge affects perception and is demonstrated experimentally by superior discrimination of objects belonging to different categories compared to the same category. Recent findings suggest that CP for linguistic categories is stronger when stimuli are presented to the right visual field. Furthermore, verbal interference disrupts CP, suggesting CP is caused by verbal labels attached to categories. However, Holmes & Wolff (2012) also found the laterality effect in non-linguistic categories. The authors argued that CP reflects categorical processing and that verbal interference used in previous studies may tax not only linguistic, but also categorical processing. We investigated whether previous verbal interference selectively interferes with linguistic processing. We found that verbal interference disrupts CP for linguistic, but not non-linguistic, categories. These results suggest that previous verbal interference selectively disrupts linguistic processing, and that CP for linguistic categories is caused by their verbal labels.

## **Grapheme-color synesthesia and writing motion**

*Seiji Oshiro*

*Faculty of Integrated Human Studies, Kyoto University*

There are not many studies focused on writing motion of grapheme-color synesthetes. I am planning a research about synesthesia while synesthetes are writing. A Writing Slip is an error that a person writes some characters that is not intended when s/he writes one character repeatedly and rapidly. (Japanese character is easy to slip.) Using a writing slip I've done a pilot that I asked three synesthetes to write a hiragana repeatedly and rapidly in three pen-color conditions (neutral, congruent, the color that s/he perceives with another character). Though there is only a few data for now, the result is two of three participants slipped more times in incongruent condition than neutral condition.



## **Future-based attention affects monocular visual information**

*Takafumi Tsuji*

*Graduate School of Human and Environmental Studies, Kyoto University*

Visual information from the two eyes is integrated in V1. Thus, we are unaware of the eye from which visual information originates. But, according to a previous study, voluntary attention can modulate processing of monocular visual information (Peng, Yi & He, 2012). They show that attention towards a cue visible to one eye enhances attention towards another cue visible to the same eye. As an extension of this work, the current study demonstrates a similar modulatory effect in future-based attention. As subjects attended to a monocular gabor patch, we measured the suppression time of another gabor patch suppressed by CFS. These gabor patches were presented in either same or different directions and in the same or different eye. A longer suppression time was observed in the different-direction condition. We thus conclude that attention can modulate monocular future information.

## **Does it determine the strength of an illusory motion whether we can see the directions of stimuli during a saccade?**

*Munendo Fujimichi*

*Graduate School of Human and Environmental Studies, Kyoto University*

People perceive illusory motion when observing repeated patches of luminance gradation. A recent study showed that the magnitude of such illusory motion decreases when a saccade is made in a direction parallel with the directions of the illusory motion. However, the mechanism through which this suppression occurs is unclear. Prior studies suggest that illusory motion occurs when visual information is disrupted during a saccade, essentially ‘resetting’ visual information. Thus, we hypothesized that visibility of the directions of the repeated patches during saccades was associated with the magnitude of the perceived illusory motion. In the experiment, we flashed a vertical or horizontal illusory pattern during a participant’s horizontal saccade. Participants judged the illusory pattern direction. The results showed a nonsignificant relationship between the pattern direction and the discriminability. We conclude that visibility of the illusory figures’ direction during a saccade is not a critical factor in the magnitude of illusory motion.

## **Crossmodal correspondence between timbre and visual sizes**

*Hiroki Yoshida*

*Graduate School of Human and Environmental Studies, Kyoto University*

Crossmodal correspondence is the phenomenon that we feel the correspondence between the sensory features which are naturally considered to be independent of each other. For example, high/low-pitch sounds match small/big objects respectively. The previous studies have mainly examined on the features which are polar (e.g. big/small, high/low). The present study uses timbre, which is not a polar feature at least perceptually, and investigates crossmodal correspondence between timbre and visual sizes in two timbre conditions. The implicit association test was adopted in the experiments. Only a single stimulus was presented on each trial of blocks. One stimulus of both modalities was assigned to the same response key respectively, and the assignments changed on each blocks. The reaction times in one assignment were significantly faster than that of the other in both conditions. These results suggest that crossmodal correspondence also occurs in the features which are not polar at least perceptually.

## **Updating visual working memory in the averaging task**

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Working memory (WM) has been identified as a cognitive function of prime importance for everyday tasks. It enables the robust maintenance of information, as well as updating the stored information. Previous studies had primarily focused on its storage function, aiming to specify the WM strict capacity limits. On the other hand, how stored representations in WM interact with new input under this limited capacity has been investigated in the point of view of working memory updating. However less is known about its detailed process. The present study aims to examine how the stored information is affected by the input of new information. To this end, I developed the averaging task in which participants manipulated dynamically the stimuli presented sequentially. The result suggested that stored information isn't updated equally. About last two stimuli of sequence were more affective on updating than others.

## **Perception of color naturalness in different color vision types**

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Around 5% of males have red-green color deficiency, where one type of cone photoreceptor is missing or has a shifted absorption spectrum. While they usually have difficulty distinguishing between reddish and greenish colors, especially in an artificial, experimental condition, it is also known that they can often tell those colors apart in a natural environment, naming them “red” or “green”. Since previous studies on color deficiency focused mainly on how color deficient people perceive subtle differences of small color patches, this study aims to reveal how they perceive “color naturalness” in natural images. Here people with normal color vision or color deficiency observed natural images whose colors had been modulated along the red-green or blue-yellow axis, and then we used the maximum likelihood difference scaling (MLDS) method. We report here that color deficient people may perceive and distinguish color naturalness in a way that is different from normal people.

## **Dissociable Contributions of Frontal Lobe and Memory Functions to the Processing of Subjective Time in Older Adults**

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The time processing is important in episodic memories. However, evidence regarding the relationship between the time processing and other cognitive functions is scarce. The present study investigated how inter-individual variables of frontal-lobe and memory functions in healthy older adults predict their abilities of the prospective and retrospective time perception, and of the recency judgment. Results demonstrated that accuracies in the prospective time perception were correlated with scores of frontal-lobe functions, and that estimation of the duration in the retrospective time perception was predicted by variables of both frontal-lobe and memory functions. In the recency judgment, accuracies in short lags reflected variables in frontal-lobe functions, whereas those in long lags were correlated with variables in memory functions. These findings suggest that frontal-lobe functions could contribute to time-related processes in all domains, and that memory functions could be important in the retrospective time

perception and recency judgment when time lag is long.

### **Synchronization of features and response is necessary for value-driven attentional capture**

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Features that are associated with reward capture attention (value-driven attentional capture; VDAC). However, necessary conditions for the formation of the feature-reward association in VDAC remain unknown. In the current study, we manipulated the temporal relationship among feature, response, and reward in reward learning to reveal the necessary components of VDAC. We presented features associated with reward in a variety of locations in a flanker task to create color-reward association (training phase) and then examined VDAC in a subsequent visual search (test phase). First, features were presented in a task display, and we obtained a significant VDAC. In contrast, no VDAC was observed when features and reward were simultaneously presented in the feedback display. We next examined temporal relationship between feature and response. When features were presented before or after the task display requiring response (fixation display), VDAC disappeared. Taken together, synchronization between features and response is necessary for VDAC.

### **How The Effect of Saliency and Ensemble Information are used on Visual Search**

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The more salient point of the scene, the more it attracts visual attention (Itti & Koch, 2000). While saliency map is computed from local information, ensemble information is computed from spatially distributed objects. The questions are whether human can use ensemble information for optimal search and when and how such information affect human search process. The task was to count the point of Gabors (the black-white Gabor had 1 point and the colored Gabor had 2 or more points) and judge which side of the screen included just 20 points, during which their eye movements were recorded. In the beginning of trials, eye movements were captured to the salient side. After a few

saccades, their eyes moved to the correct side when the point difference was large. These results suggest that at first eye movements depend primarily on saliency, and ensemble information gradually affects them after a few saccades.

**Competing against a familiar friend: Interactive mechanism of the  
temporo-parietal junction with the reward-related regions during episodic  
encoding**

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Competition enhances learning under certain circumstances. However, little is known about how competition-related activations during episodic encoding are modulated by the personal relationships with opponents. The present fMRI study investigated this issue by measuring encoding-related activations during the competition with familiar friends and unfamiliar others. fMRI results demonstrated that activations in the right temporo-parietal junction (rTPJ) were greater during the competition with familiar friends than that with unfamiliar others, and the activations were correlated with the subjective ratings of motivation. In addition, striatum and amygdala activations related to the competition with familiar friends were correlated with the pleasantness ratings. Functional connectivity between the rTPJ and reward-related regions was higher in the competition with familiar friends than that with unfamiliar others. The interaction between the rTPJ involved in social motivation and the reward-related regions involved in social reward could contribute to the memory enhancement by competing with socially familiar opponents.

**Exploratory analysis of synesthetic colors distribution in the color space**

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This study investigated distribution of synesthetic colors in the color space to understand perceptual properties of synesthetic colors. This analysis requires a large amount of data for a single synesthete. We therefore collected large samples of data from five synesthetes. We obtained over 1000 synesthetic colors associated with

Japanese kanji characters for each of two synesthetes, and over 100 synesthetic colors for each of the other synesthetes. We then analyzed the distribution pattern of synesthetic colors in the color space by using techniques of spatial statistics. The spatial statistical analysis revealed that synesthetic colors are concentrated in multiple regions in the color space, that is, they form “synesthetic color clusters”. The synesthetic color clusters indicate that synesthetic colors are not selected randomly from the color space, but specific colors preferentially become synesthetic colors for each synesthete.

### **Visual short-term memory of gloss under variations in illumination**

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Retaining material properties such as gloss or roughness in memory is considered a difficult task because the appearance of a material dramatically varies depending on illumination. Since studies of visual short-term memory have usually used a simple image-based matching between study and test, little is known about how people retain visual properties where there are variations in illumination. To address this issue, we measured the precision of visual short-term memory of materials by using feature matching tasks. Results revealed that memory of gloss and roughness was fairly accurate even when study and test stimuli were presented under different illuminations. This suggests that under variations in illumination where image-based matching is prevented, people can still effectively extract and retain surface reflectance properties of objects in visual short-term memory.

### **Impaired recognition of faces encoded by emotional and semantic processes in patients with Parkinson disease**

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Cognitive declines in patients with Parkinson disease (PD) are often observed. Previous studies have reported that the PD patients are impaired in the processing of emotion-related information and semantic elaboration. However, little is known about how the effects of these processes on episodic memories are disturbed in PD. The

present study assessed face memories encoded by emotion-related and semantics-related processes in PD and age-matched normal controls (NC). Results demonstrated that NC showed the better remembering of faces encoded by emotion-related and semantics-related processes, whereas in PD, the enhancement of face memories encoded by these processes was not identified. The findings suggest that the impaired processes of emotion and semantic elaboration during encoding could cause the disturbed enhancement of face memories in PD, and that the impairments could be associated with the dysfunction in dopaminergic modulation of emotion-related regions and the fronto-striatal deficits.

### **Human Area Prostriata: a New Sensory Alarm Area ?**

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A recent monkey study found that the area prostriata, a small limbic region between the anterior calcarine fissure and hippocampal formation, was sensitive to visual motion in the far periphery. The present fMRI study explored a human counterpart of the monkey area prostriata. In a scanning run, moving bars were presented in the periphery with alternating static bars in a standard block-design paradigm. Throughout the run, the subjects were required to perform a rapid serial visual presentation task at the fovea. The peripheral motion stimuli evoked responses in visual cortical areas such as V5, and V6. Furthermore, we found a robust activation in a small limbic region located at the isthmus of the cingulate gyrus. In view of its anatomical location, this region may be the human homolog of the area prostriata. The possible roles of the human area prostriata will be discussed in relation to the human alarm system.

### **Visual Attention Inspired Close-up View and Distant View Classification**

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The images of distant view and close-up view indicate a photographers' attention which can be further utilized for user behavior analysis and scene evaluation. As images may compose arbitrary contexts, distant view and close-up view classification becomes

non-trivial. In this work, we found two cues can represent human visual attention, i.e. focus cue and scale cue. We model the focus cue in frequency domain using the Discrete Wavelet Transform, and employ signal distribution as the focus feature. For the scale cue, we model it by defining a spatial size and a conceptual size in the image using the Edge Box and Convolution Neural Network. By integrating these two models, a robust scheme is proposed for this non-trivial task. Experiments on a newly retrieved dataset, which has 2137 natural images, show the classification accuracy achieves up to 97.3%.

### **Implicit learning of variable spatial configurations**

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The visual environment consists of highly structured arrangement of objects, and individuals learn such regularities implicitly. Studies have shown that visual search performance is facilitated when the same spatial configurations are presented repeatedly (Chun & Jiang, 1998). They often employ repetition of fixed displays, but in the actual environment, people confront with the similar but non-identical scenes. In such situations, is implicit learning from the similar (but non-identical) scenes different from learning from the fixed scenes? The present study tested the hypothesis that exposure to the similar displays leads to flexible representation that transfers to the similar patterns in implicit learning. Throughout several experiments, we found that transfer to the similar pattern occurred when the pattern contains variability. This suggests that what we learn from variable scenes is different from what we learn from static scenes in terms of flexibility, and variability is of sufficient importance to generalize implicit learning.

### **Addressing Internet mediated home culture influence on acculturative stresses of international students**

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Acculturation is a process of cultural and psychological changes that result following meeting between cultures. Acculturative stress represents the burden that international students hold while living with the foreign culture. Recently, the development of the Internet brought closer international students with their connections of their home culture. We believe these connections could possess influence towards students' acculturation stress. To address the problem, a survey study was designed, with the use of Acculturative Stress Scale for International Students (ASSIS) as the main indicator of acculturation stress. Based on previous studies and pilot-tests, we made two predictions. Firstly, International students overall have a low level of acculturation due to online influence of their home culture. Secondly, parents and friends in the home culture can now possess influences directly to international students' process of acculturation aboard in fields like social value and Japanese friends made both on and off-line.

**Age-related difference in activations during the retrieval of memories learned  
from people belonging in the same and different generations**

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[abstract is not opened to the public]

**Examining the effects of language, individualism-collectivism, and physical environment on cross-cultural attention.**

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A robust amount of evidence shows that attentional differences exist between people in Euro-American and East-Asian cultures, (esp. between Japanese and Americans). While many believe these attentional differences stem from sociocultural biases towards collective and individualistic values, few have shown a direct correlation between attentional style and individual performance on an individualism-collectivism scale. Furthermore, there exist other potential cultural modulators of visual attention, such as language and the layout of one's everyday physical environment. To appraise each of these potential modulators, this study assesses various individual differences related to language, physical environment, and individualism-collectivism, and then measure how well these factors predict performance during two attention-related eye-tracking experiments. The first of which measures participants' eye-fixations towards the foreground and background of naturalistic scenes. The second measures local-global competition while participants identify either the local or global element of a Navon figure.