

Poster Symposium at the End of the Year 2013 on the Interdisciplinary Research of Perception and Cognition, Kyushu University

Cosponsored by Project for Interdisciplinary Research and Research Center for Applied Perceptual Science (ReCAPS), Kyushu University.

Program

Invited papers -----

1. Some Extensions to Nakajima and Ueda's Method of the "Acoustic Language Universal"
Willy WONG, Erin TSANG, Pascal van LIESHOUT
(University of Toronto)

The technique proposed by Nakajima and Ueda ("An Acoustic Language Universal") is a fascinating and powerful method yielding new insight into the perceptual information encoded in speech. This poster summarizes some recent work on my part to repeat, to explore and to extend this work. In particular, I will discuss an extension of this work to formant analysis as well to speech production through measurements carried out using a 3D electromagnetic articulograph device.

2. The structure of visual hallucinatory experiences induced by flickering light
Cordula BECKER*, Mark A. ELLIOTT**
(*Ludwig-Maximilians Universität, **National University of Ireland Galway)

It is a widespread assumption that conscious visual states are based on the interaction of spatially structured information in the environment with the visual nervous system. This stands in contradiction to the fact that visual hallucinations can be observed in a number of pathologies and that it is possible to generate visual hallucinations by temporally, but not spatially, defined electrical and optical stimulation. We show that complex colour and form hallucinations are evoked when subjects are presented with flickering light.

3. Beta rhythms of electroencephalography during voice perception in persons with/without autism spectrum disorders
Atsuko GUNJI, Hiroshige TAKEICHI, Tomoka KOBAYASHI, Kota SUZUKI, Hisako YAMAMOTO, Akira YASUMURA, Masumi INAGAKI

(National Center of Neurology and Psychiatry)

We investigated the event-related de-synchronization (ERD) of beta frequency band in the sensorimotor cortex during voice perception, which might reflect mirror neuron system activity related to vocalization (Tamura, Gunji et al., 2012). The ratio of beta power between conditions (voice/scrambled voice - nonvoice/scrambled nonvoice) was defined as an index to detect the voice-specific brain response. As a result, the ratio showed right hemispheric dominance in typically developing children/adults, but not in children with autism spectrum disorders, and therefore the neuropsychological evaluation of electroencephalography (EEG) might be useful as a clinical application to evaluate communication ability.

Contributed papers -----

4. Neural signature of attentional engagement in temporal judgment

Hiroshige TAKEICHI*, Yoshitaka NAKAJIMA**, Takako MITSUDO**, Shozo TOBIMATSU**

(*RIKEN, **Kyushu University)

The purpose of the present study was to reanalyze event-related magnetic fields (ERF) to clarify the time course of brain dynamism associated with temporal judgments. ERFs were measured while the participants were or were not making temporal judgments about stimuli which consisted of three tone bursts defining two neighboring time intervals. Bhattacharyya distance was calculated between the time course of the condition where the participant actively made temporal judgments and that of the condition where the participant passively listened to the stimulus. As a result, the Bhattacharyya distance started to increase at the beginning of the stimulus, and therefore can be considered as a neural signature of attentional engagement.

5. A study of music therapy for chronic schizophrenia patients in Japan

Masako ASANO*, Hiroe TSUKAHARA**, Miki TAKATO**, Youhei KOMATSU***, Motonori FUKUI****, Shiho SUGIHARA*****, Yuichi SAEKI*****, Yoshitaka NAKAJIMA***** ,

(*Health Sciences University of Hokkaido, **National Hospital Organization Ryukyuu Hospital, ***Nishikyushu University, ****National Hospital Organization Hizen Psychiatric Center, *****University of Hyogo, ***** Kyushu University)

Our purpose was to examine the effects of group music therapy sessions for chronic schizophrenic patients with randomized controlled trials. We conducted music therapy sessions for the experimental group in addition to standard treatment, and we treated the experimental group patients on a weekly basis for a session of about one hour a week over a 12-week period. No major change appeared in the control group, whereas changes in various directions appeared in the experimental group, and the directions of change seemed to depend on the subjects' relationship with music in everyday life.

6. Audio-visual peripheral localization disparity

Ryota MIYAUCHI*, Dae-Gee KANG**, Yukio IWAYA***, and Yôiti SUZUKI**

(*Japan Advanced Institute of Science and Technology, **Tohoku University, ***Tohoku Gakuin University)

We investigated how unisensory localizations of audition and vision were reflected in the comparison between spatial information obtained from different modality-specific coordinate systems. We measured the relative location of a sound to a flash and the unisensory perceived location of each sound and flash in a pointing task in the central and peripheral visual fields. We have demonstrated that the locations of auditory and visual events are perceived the same when an auditory event is simultaneously presented at about 50 temporal side of a visual event and the unisensory locations of audition and vision are appropriately reflected in remapping of different modality-specific locations into a unified audio-visual space.

7. Subjective evaluations for inaudibility of differences between original track and watermarked track based on cochlear delay characteristics

Ryota MIYAUCHI, Daiki HAMADA, Atushi HANIU, and Masashi UNOKI

(Japan Advanced Institute of Science and Technology)

To investigate inaudibility of a sound distortion caused by the embedded data based on cochlear delay characteristics, we conducted a subjective experiment. We conducted a paired-comparison test and ABX test using music tracks embedded data by the periodical phase modulation method, the direct spread spectrum method, and the cochlear delay method (our proposed method). The results revealed that the CD methods could be used to inaudibly embed the watermarks into original signals.

8. Cortical hemodynamic response patterns to normal and whispered speech

Gerard B. REMIJN*, Mitsuru KIKUCHI**, Yuko YOSHIMURA**, Kiyomi SHITAMICHI**, Sanae UENO**, Yoshio MINABE**

(*Kyushu University, **Kanazawa University)

In this study we used near-infrared spectroscopy to investigate the cortical hemodynamic response during the perception of normal and whispered speech in adult listeners (n=13). Results showed that oxygenated hemoglobin values during whispered speech were significantly higher over a right temporal region of interest (ROI) than over a left temporal ROI. No significant differences were found in oxygenated hemoglobin comparisons between normally-vocalized and whispered speech, although the right temporal ROI comparison bordered on significance with whisper inducing the higher value. Since the sound level of whisper is modest as compared to normal speech, increased attentional engagement and/or processing effort during whisper perception may have influenced the results.

9. Temporal dynamics of the knowledge-mediated visual disambiguation process

Tomokazu URAKAWA***, Naruhito HIRONAGA*, Katsuya OGATA*, Takahiro KIMURA* Yuko KUME*, Shozo TOBIMATSU*

(*Kyushu University, **Japan Society for the Promotion of Science)

The present study attempted to elucidate how fast the knowledge-mediated disambiguation (KMD) of an ambiguous image was implemented in the brain, with a focus on the early time range within 150 ms after the ambiguous image onset. We traced the visual response to a two-tone dalmation-type ambiguous image using a magnetoencephalography (MEG) and performed the Granger causality (GC) analysis. We found deactivation for the ambiguous image in the lateral occipital (LO) area at approximately 120 ms after the image onset when participants disambiguated the image with prior knowledge of its unambiguous version. The GC analysis revealed that the top-down processes among areas of the cuneus, LO, and precuneus existed within 150 ms, a time range at which the deactivation at the LO appeared. These results show an early phase of the KMD and suggest that the KMD begins to be implemented up to 150 ms after the ambiguous image onset in the brain.

10. A magnetoencephalographic study on pain-relief by vibrotactile stimulation

Koichi HAGIWARA, Mariko HAYAMIZU, Naruhito HIRONAGA, Katsuya OGATA,

Shozo TOBIMATSU
(Kyushu University)

We investigated whether the secondary somatosensory cortex (S2) and insula contribute to the gate control mechanism of pain modulation with vibrotactile stimuli. Somatosensory evoked magnetic fields were recorded during pain ($A\delta$) and tactile ($A\beta$) stimulations, with the former being delivered 60 ms earlier than the latter so that the interaction of the two occurs at the cortical level. Significant amplitude reduction was observed when compared to the sum of amplitudes recorded by stimulation of each sensory modality individually, suggesting that S2 and insula are important for the central gating mechanism.

11. Interactive evolutionary computation for human science

Hideyuki TAKAGI
(Kyushu University)

We introduce the four cases that interactive evolutionary computation (IEC) is used for human sciences, which is the reverse direction of most IEC research approaches, i.e. system optimization. These cases include (1) measuring emotional expression ranges of schizophrenic patients, (2) finding unknown auditory knowledge through IEC-based hearing-aid fitting and IEC-based cochlear implant fitting, (3) IEC based on physiological responses to guide human physiological responses to the target physiological conditions, and (4) modelling human awareness mechanism using IEC. We can understand that IEC can be a useful tool for human science through these cases.

12. Computational model-based analysis of musical expectancy

Satoshi MORIMOTO, Gerard B. REMIJN, Yoshitaka NAKAJIMA
(Kyushu University)

The computational mechanism underlying the generation of musical expectancy is still unclear. To address this issue, we conducted a belong/not-belong chord judgment experiment and estimated the computational model. Our results suggest that internal multiple patterns of chord progression are important to the generation of musical expectancy.

13. Cats can see the illusory motion in Rotating snakes

Takeharu SENO*, Rasmus BAATH**, Akiyoshi KITAOKA***

(*Kyushu University, **Lund University, ***Ritsumeikan University)

We examined whether cats see illusory motion in a static image using “Rotating snakes” (Kitaoka, 2003). We presented to eleven cats the illusion image as well as its control figure that consists of the same elements as the former but does not give illusory motion to human observers. We measured total contacting time, total watching time, visiting times, as well as hunting actions made by these cats responding to each image. The results suggested that cats can see the illusory motion in Rotating snakes.

14. No time stretching illusion when a tone is followed by a noise

Tsuyoshi KURODA*, Simon GRONDIN**

(*Kyushu University, **Laval University)

A sine tone is perceived as longer when it is preceded by a noise than when presented in isolation. This is called the time stretching illusion. We conducted an experiment where the method of constant stimuli was used and found that this illusion does not occur when a tone is followed by a noise.

15. The filled duration illusion with the method of adjustment when filled vs. empty comparison intervals are used

Emi HASUO*, Yoshitaka NAKAJIMA*, Takuya KISHIDA*, Erika TOMIMATSU*, Kazuo UEDA*, Simon GRONDIN**

(*Kyushu University, **Laval University)

The duration between the onset and the offset of a continuous sound (filled interval) is often perceived to be longer than the duration between two successive brief sounds (empty interval) of the same physical duration. We examined this phenomenon, sometimes called the filled duration illusion (FDI), with the method of adjustment, where the participants adjusted a comparison interval (filled or empty) to match a standard (filled or empty). Results showed that the FDI occurred clearly for some participants but not for others, and that the participants who showed clear FDI with one comparison type did not always show such large FDI with the other comparison type. It seemed that the FDI is not a stable phenomenon both across and within participants.

16. Speech development during the first 3 years of life

Yuko YAMASHITA*, Yoshitaka NAKAJIMA*, Kazuo UEDA*, Takeharu SENO*,

Yohko SHIMADA**, David HIRSH***

(*Kyushu University, **Doshisha University, ***Sydney University)

The purpose of this study was to explore developmental changes, in terms of spectral fluctuations with Japanese- and English-learning infants during the first 3 years of life. Cepstrum analysis was performed and the correlations between the power fluctuations of the critical-band outputs represented by factor analysis were observed. The present analysis identified four factors with infants and toddlers aged 3 months to 3 years.

17. Perceptual roles of power-fluctuation factors of speech sound revealed by cepstral liftering and zero-shifted factor analysis

Takuya KISHIDA, Yoshitaka NAKAJIMA, Kazuo UEDA, Gerard B. REMIJN, Takuya FUJIOKA

(Kyushu University)

The aim of this study was to investigate the perceptual roles of power fluctuations in critical-band filters in speech perception. Japanese speech sounds were resynthesized from four factors obtained in a factor analysis of power fluctuations of cepstrally liftered, so that spectrally smoothed, speech sounds, and mora identifications of the resynthesized sounds were measured. When the factor whose loading had a peak at about 1000 Hz was eliminated, the participants' performance was worse than when any other factor was eliminated.

18. Effects of frequency-band elimination on identification of noise-vocoded Japanese syllables

Shinya ISAJI, Kazuo UEDA, Yoshitaka NAKAJIMA

(Kyushu Univeristy)

Perceptual roles of frequency bands in noise-vocoded Japanese syllables were investigated. Eight male and two female participants identified 4-band noise-vocoded syllables in which frequency bands were systematically eliminated. Elimination of the lowest band resulted in by and large statistically significant decreases in amounts of information transmitted in voicing; the results suggested that temporal relationship between the lowest band and the other bands may contribute to the voiced vs. voiceless distinction.

19. Factor Analyses of Critical-Band Filtered Normal and Whispered Speech

Kiyoto NOGUCHI, Kazuo UEDA, Yoshitaka NAKAJIMA

(Kyushu University)

This investigation focuses on how we could determine an adequate number of factors that describe power fluctuations of critical-band filtered normal and whispered speech, based on newly recorded speech materials in which 10 speakers (5 males and 5 females) uttered 200 sentences both in normal and whispered voices. Both cepstral analyses, which could reduce interference on a spectrum caused by vocal fold vibration, and conventional analyses were performed. The cepstral analyses yielded common four factors both in normal and whispered speech with percentages of cumulative contributions more than 75%, whereas the conventional analyses yielded only three common factors in normal speech with percentages of cumulative contributions less than 39%.

20. A magnetoencephalographic study on brain responses to morphing human face into monkey face

Emi YAMADA, Katsuya OGATA, Mutsuhide TANAKA, Shozo TOBIMATSU

(Kyushu University)

21. An ERP study on subliminal priming effects using emotional faces

Mutsuhide TANAKA, Toshihiko MAEKAWA, Katsuya OGATA, Emi YAMADA,
Naomi TAKAMIYA, Shozo TOBIMATSU

(Kyushu University)

22. Co-activation of small hand muscles depends on the synergy of neighborhood contracting muscles but not M1 somatotopy

Katsuya OGATA, Hisato NAKAZONO, Tsuyoshi OKAMOTO, Shozo TOBIMATSU

(Kyushu University)

(Five Japanese papers follow.)