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Program

プログラム

Invited papers -----

招待講演

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 dominancy 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 -----

一般講演

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 Ryukyu 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. REMIEN, 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 University)

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)

脳磁図を用いたヒトからサルへのモルフィング画像に対する顔認知過程の研究

山田絵美, 緒方勝也, 田中睦英, 飛松省三
(九州大学)

「ヒト (100%) →ヒト (0%)」のモルフィング画像を用い、ヒトの顔とサルの顔に対する認知過程の違いを脳磁図 (MEG) で検討することを目的とした。9名を対象にモルフィング顔画像 (H9: ヒト 90%、H5: ヒト 50%、H1: ヒト 10%) 観察中の MEG を計測した。顔の倒立効果を検討するため、刺激の呈示は正立と倒立の2条件で行った。Matlabにより刺激画像の平均輝度、コントラスト、空間周波数を刺激間で一致させた。刺激呈示後、サルかヒトかを判断しボタン押しをしてもらった。その結果、全ての刺激で M170 が右紡錘状回の顔に特異的に反応されると言われる FFA (fusiform face area) 周辺で記録された。FFA での M170 の活動量は刺激間で差はなかったが、倒立顔と正立顔、ヒトとサルでは活性の分布が異なった。M170 の潜時は全ての倒立顔で延長し、ヒトの割合が減少すると潜時も延長した。

以上より、正立と倒立、ヒトとサルに対する顔認知処理の違いは、FFA の活動量よりも活性の分布が異なるためであることが示唆された。また、倒立顔とサルで潜時が延長するのは種の弁別を反映しているためであると考えられる。

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)

事象関連電位を用いた顔情動刺激のサブリミナル・プライミング効果の検討

田中睦英, 前川敏彦, 緒方勝也, 山田絵美, 高宮尚美, 飛松省三
(九州大学)

fMRI 研究ではサブリミナル・プライミング (SP) 視覚刺激が前頭前皮質の活動を抑制し、直後の課題遂行に影響することが報告されている。しかし顔情動刺激の SP 効果の脳内処理過程は不明な点が多い。そこで顔情動刺激による SP 効果が ERP に与える影響について検討した。対象は健常成人 10 名である。まず恐怖と中立表情から曖昧モルフィング画像を作成した。次に SP 刺激 (恐怖・中立表情) 17ms 呈示後、300ms 遅れて標的刺激 (中立・曖昧・恐怖表情) を 800ms 呈示した。標的刺激の表情を判定させ、課題遂行中の ERP を測定した。その結果、恐怖 SP 条件で、曖昧表情に対する心理評定が恐怖側に偏向した。ERP では曖昧表情に対する右前頭部 (F8) の P2 振幅と左後頭側頭部 (T5) の N170 振幅がわずかに増大する傾向を認めた。恐怖表情による SP 効果により恐怖刺激に対する予測的注意が喚起され、曖昧表情が恐怖に偏向した刺激として処理された可能性がある。

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)

小手筋の同時活性化に対する一次運動野の興奮性は隣接の随意運動する筋に依存する
緒方勝也, 中藺寿人, 岡本剛, 飛松省三
(九州大学)

小手筋の 1 つを収縮させると、他の筋が不随意に収縮する現象(同時活性化)がしばしば観察される。同時活性化に対し隣接する筋の随意運動による影響を検討するため、短母指外転筋 (APB)、小指外転筋 (ADM)収縮時に第一背側骨間筋 (FDI)の

MEP を評価した。健常被験者 7 名で右手 FDI の安静を保ちつつ随意的に APB あるいは ADM を弱収縮(最大収縮の約 10%)させた。安静時と APB・ADM 収縮下で左 M1 刺激による FDI の MEP を計測した。その結果、APB・ADM 収縮下で不随意に弱い FDI の同時活性化がみられ、MEP は増大した。同時活性化による FDI の筋活動量を条件間で同等に制御できた被験者でも、ADM 収縮で FDI の MEP がより増大した。よって同時活性化による M1 の興奮性に APB・ADM の部位間で差があることを認めた。手指開散の共同筋として ADM 収縮時に FDI がより活性化したと推測した。

23. 反復性経頭蓋交流電気刺激 (tACS) を用いた MEP のオンラインとオフライン効果：至適刺激条件の検討

中菌寿人, 緒方勝也, 飛松省三
(九州大学)

反復性 tACS の MEP に対するオンライン (ON) とオフライン (OFF) 効果の至適条件を検討することを目的とした。tACS (持続 90 秒、刺激強度 1mA) の刺激周波数 (5、10、20、40 Hz)、刺激部位 (左 M1-C4、左 M1-Pz)、試行間間隔 (3 分、5 分) を変え、刺激 20 秒後から MEP の ON 効果と終了後の OFF 効果の評価した。その結果、刺激部位 (n=5) は M1-Pz で周波数に関わらず ON 効果があり、OFF 効果もみられた。tACS によるフリッカー誘発は M1-Pz で M1-C4 より少なく、その程度も弱かった。10 Hz と 20 Hz の tACS を各 4 試行行った場合、3 分間隔 (n=4) で 20 Hz の tACS のみ ON 効果が大きく、OFF 効果もみられた。一方、5 分間隔 (n=6) では、ON 効果は小さく OFF 効果も少なかった。反復性の短時間 tACS の場合、電極配置は M1-Pz が適切である。試行間間隔 3 分では各試行間の相互作用が生じる可能性がある。

24. 色相と意味の関連における文化差：単語判断課題を用いた検討

徐冰, 光藤宏行
(九州大学)

本研究では、色相と単語の意味の関連が文化背景によって異なるかどうかを単語判断課題によって検討した。実験では、失敗と成功に関する単語を赤・緑・青の 3 色いずれかに設定し、実験参加者を日本人と中国人を対象として、判断にかかる反応時間を測定した。その結果、中国人の場合は失敗に関する単語に対しては赤が緑より速く判断されたが、日本人の場合は全ての条件で反応時間の差は小さく、この結果は (a) 文化背景によって色と意味の関連についての情報処理が異なるこ

と、さらに (b) この課題は言語処理との関わりで考える必要があることが分かった。

25. 色字共感覚と視覚的作業記憶

西由紀子, 光藤宏行
(九州大学)

本研究の目的は、知覚よりも高次な機能である視覚的作業記憶において、色字共感覚者の感じる共感覚色が保持されているのかを検討することであった。色字共感覚者を対象に、文字変化が共感覚色の変化を伴う条件と伴わない条件を設定し、変化検出課題を用いて記憶保持容量を測定した。その結果、文字変化が色の変化を伴う条件では保持容量が大きく、共感覚色は視覚的作業記憶に保持されていることが示唆される。

26. 残響が空隙転移錯覚に与える影響について

久保 翔平, REMIJN, Gerard B., 中島 祥好
(九州大学)

残響下で聴覚の体制化がどのように行われるかを調べるため、空隙転移錯覚とよばれる聴覚の錯覚現象を用いて残響による影響を調べた。本研究では、残響時間を任意に変え、長いグライド音・短いグライド音・空隙の 3 要素を組み合わせた複数の刺激パターンを実験参加者に提示し、どのように聞こえたかを回答させる現象観察実験を行った。実験結果から、残響下ではあらゆる刺激パターンにおいて、長い音よりも短い音の方が途切れて聞こえる傾向があることが示された。

27. ケプストラム分析を用いた音声の因子分析

藤岡拓也, 上田和夫, 中島祥好
(九州大学)

8 言語の音声を臨界帯域フィルターに通し、パワー変動の相関から因子分析を行うことにより、言語間に共通する 3 因子と 4 周波数帯域が導き出されていた。しかし、従来の分析方法では、話者の音声の基本周波数によって分析可能な因子数が影響を受けることが、イギリス英語と日本語とで確かめられたため（基本周波数が 260 Hz 以下ならば 3 因子、150 Hz 以下ならば 4 因子の分析が可能）、基本周波数の影響を取り除くことのできるケプストラム分析を組み込んで因子分析を行い、どのような因子が得られるのかを調べた。日本語、イギリス英語、アメ

リカ英語、フランス語について分析を行ったところ、これらの言語に共通する 4 因子が得られ、ほぼ共通する 4 帯域に音声を分割することができた。これらの帯域は、雑音駆動音声を知覚するために必要な 4 帯域と関係すると考えられる。