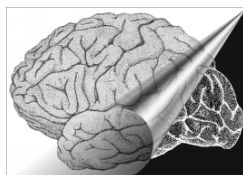


BME Department of Cognitive Science
Doctoral Students' Conference



24 June, 2011

Budapest, Műegyetem rkp. 3.
1st floor, Room 66 (Oktatói Klub).



M Ű E G Y E T E M 1 7 8 2

Program

- 10:00* **Stuart Anstis, János Geier, Mariann Hudák**
Afterimages from unseen patterns
- 10:20* **Orsolya Szalárdy, Tamás Bóhm, Alexandra Bendixen, István Winkler**
Effects of perceptual organization on processing pitch in the human auditory system
- 10:40* **Krisztina Nagy**
Sensory competition for faces
- 11:00* **Katalin Hohner**
Clinical aspects of bistable visual perception
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- 11:40* **Andor Csík**
The role of ostensive communication cues in dogs
- 12:00* **Eszter Szabó**
The role of pause length in perceiving emotions in mother-tongue and in foreign language speech.
- 12:20* **Forgács, B., Bohrn, I., Baudewig, J., Pléh, Cs., Jacobs, A. M.**
Neural Correlates of Combinatorial Semantic Processing of Literal and Figurative Noun Noun Compound Words
- luch brake
- 13:20* **Ágnes Szöllősi**
Day-time effects in the consolidation of autobiographical events
- 13:40* **Péter Pajkossy**
Trait worry, repetitive thinking styles and stimulus-independent processing
- 14:00* **Péter Simor**
The neurocognitive characterization of Nightmare Disorder
- 14:20* **Zsombor Várnagy**
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- 14:40* **Gábor Megellai**
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- 15:00* Closing

Afterimages from unseen patterns

Stuart Anstis, János Geier & Mariann Hudák

We present a brightness and colour aftereffect, in which a coherent pattern (e.g. a letter) is seen after viewing incoherently flickering squares. The display consists of 10x10 squares, flickering at 10 Hz. Subjects view this flickering display for 30 seconds. With fixation kept fixed throughout the movie and afterwards, a letter is seen when the movie ends. However, subjects cannot identify nor can detect any letter during the flickering of the display.

Stimuli: In the black and white version of the display, squares twinkle pseudo-randomly between black and white (taking the value of 0 or 255), producing coarsely pixelated dynamic random-dot noise. However, in a central region of the display, which is shaped like a capital letter, the ratio of black to white squares is 1:3, while for the remaining (background) squares, the ratio is 3:1. Therefore, only the probabilities are manipulated: the probability that the squares belonging to the letter take the value of 255 is 75% and the probability of value 0 is only 25% for these squares. In contrast, it is the other way around for squares belonging to the background. On average, the central region is approximately twice as bright as the background. However, the uneven dot density produced by these biased percentages is extremely noisy and is not visible within any single time frame, since it is due to chance; it only emerges as the average of a probability distribution over time. Each square subtends 1°.

The chromatic displays are prepared similarly to the BW ones: The R G and B channels take the value of 0 or 255 independently of each other. The letter is drawn so that the squares belonging to the character are more likely (75%) to take the value of 255 in the G channel, while the probability of 255 is less (25%) on the R and B channels. For the squares of the background, the case is the opposite. Interestingly, a black and white afterimage can be obtained from a coloured flickering display, by setting probabilities accordingly. The effect can be seen by all observers (n=15) who were presented with these displays, age ranging from 9 to 61. These coherently shaped afterimages elicited by a randomly flickering display imply that the visual system integrates brightness and colour through a larger period of time, and adapts to the average brightness and colour at each location in a larger time-window.

Effects of perceptual organization on processing pitch in the human auditory system

Orsolya Szalárdy^{1,2}, Tamás Bóhm^{1,3}, Alexandra Bendixen⁴, István Winkler^{1,5}

We tested whether sensitivity to feature deviance in the human auditory system depends on the actually experienced perceptual organization of the sound sequence. Sequences of regularly repeating ABA_ triplets were delivered to participants with a uniform 150 ms onset-to-onset interval, where ‘A’ and ‘B’ denote tones differing in frequency by 4 semitones [ST] and ‘_’ stands for a silent period equal to the common 75 ms tone duration. Occasionally, the second ‘A’ tone of the triplet was exchanged for a slightly (0.5 ST) or moderately (1.5 ST) lower tone (5%, each). In a pilot study, the parameters were set up so that a) most subjects experienced the sound sequence in equal proportion of the time as a single stream (integrated percept) or as two separate streams (A-A... and B---B...; segregated percept) and b) deviants did not significantly affect the perceived sound organization. Subjects continuously marked their perception of the sound sequences while EEG was recorded from their scalp. There was a difference in the ERP responses for the ‘B’ tones: the ‘B’ tones elicited higher-amplitude responses in the 80-200 ms post-stimulus interval while participants experienced the integrated compared with the segregated percept. We found that the amplitude of the N2 and P3a components elicited by moderate deviants differed as a function of the perceived sound organization. While experiencing the integrated percept, deviants elicited a larger N2 and a smaller P3a than those encountered while experiencing the segregated percept. These results suggest that the evaluation of the same auditory events is dependent on the perceived sound organization.

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Sensory competition for faces

Krisztina Nagy

The concurrent presentation of multiple stimuli in the visual field may trigger mutually suppressive interactions throughout the ventral visual stream. While several studies have been performed on sensory competition effects among non-face stimuli relatively little is known about the interactions in the human brain for multiple face stimuli. In the present study we assigned the neuronal background of the sensory competition in an event-related functional magnetic resonance imaging (fMRI) study using multiple face stimuli. We varied the ratio of faces and phase-noise images within a composite display with a constant number of peripheral stimuli, thereby manipulating the competitive interactions between faces. For contralaterally presented stimuli we observed strong competition effects in the fusiform face area (FFA) bilaterally and in the right lateral occipital area (LOC), but not in the occipital face area (OFA), suggesting different roles in competition. When we increased the spatial distance among pairs of faces the magnitude of suppressive interactions was reduced in the FFA. Surprisingly, the magnitude of competition depended on the visual hemifield of the stimuli: ipsilateral stimulation reduced the competition effects in the right FFA and LOC while it increased that in the FFA and LOC of the left hemisphere. This suggests a left hemifield dominance of sensory competition. Our results support the sensory competition theory of multiple stimulus processing of faces and suggests that this effect is the result of several cortical areas in both hemispheres.

Clinical aspects of bistable visual perception

Katalin Hohner

Bistable images put the perceptual system into an extreme situation where the characteristics and the neural background of perceptual awareness can easily be studied. Different types of stimuli are available to test bistable perception. The most frequently applied stimuli are the Necker cube, Schröder's staircase, the Lissajou figures and the red-green grid of binocular rivalry. Switching rate depends both on the type of stimulus, and on subject-dependent factors. It has been shown recently (Shanon et al., 2011) that binocular rivalry is sensitive to genetic factors, while the perception of the Necker cube is less determined genetically. The role of inheritance in bistable perception draws attention to specific subject groups, such as patients with different psychiatric disorders. I will review recent studies on bistable perception involving people suffering from schizophrenia, bipolar disorder, obsessive compulsive disorder and ADHD. In our experimental study, we tested patients suffering from anorexia nervosa in a classic binocular rivalry paradigm. Our aim was to find a subgroup of patients with rigid, non-adaptive alternation patterns. These patients are hypothesized to have a genetically determined developmental disorder. We also tested typically developing, age-matched subjects as a control group. A computational model (Braun et al, 2011) is employed to help data analysis.

The role of ostensive communication cues in dogs

Andor Csík

We would like to examine the role of ostensive communication cues in a learning task in dogs. According to the natural pedagogy theory these ostensive cues help the learner to acquire knowledge faster and in a more accurate form and to be able to generalize based on the knowledge gained. We tested these predictions with the help of a simple learning task where dogs had to learn how they can take a ball out of a box which that can only be opened on one side. We conducted a test condition (there was a presentation with ostensive cues to show the dogs how they could manage the task) and a baseline condition (there was no presentation). Our results partly support the hypothesis. We did not find any difference between the two conditions either in the speed or in the quality of the learning but we found that dogs generalize the acquired knowledge more often in the test condition than in the baseline condition.

The role of pause length in perceiving emotions in mother-tongue and in foreign language speech.

Eszter Szabó

The relationship between emotions and speech is analyzed from many aspects. Often speech signal is analyzed phonetically, and parameters like intensity, tempo, voice quality or fundamental frequency are measured (review: Johnstone & Scherer, 2000 or Scherer, 2003). In most of the research only one-to-two word long, or at longest, one-sentence long speech samples are analyzed, and the question of pause length or pause ratio is not relevant. However, some recent studies (Jovicic et al. 2004; Deppermann and Lucius-Hoene, 2005; Szabó, 2008;) showed the importance of these parameters in vocal emotion expression.

In the present research we asked how pause length influences listeners in ascribing emotional states to the speaker if nothing but the length of the pauses changes. We did this by taking emotionally neutral speech samples and manipulating the length of pauses. All of the pauses that were longer than 100 msec were elongated by 18 or 50% or abbreviated by 21 or 50%, so we now had five variants of each speech sample (with by 18 or 50% elongated pauses, with by 21 or 50% abbreviated pauses, and the original version). 50 subjects with a Hungarian and 37 subjects with a German mother tongue were to listen to these Hungarian speech samples. Their task was to rate on a 1-to-6 point scale how angry, sad, disgusted, happy, surprised, frightened, positive, and heated the speaker could have been. The data reveal that the length of silent pauses influences listeners in attributing emotional states to the speaker. In the Hungarian and the German speaking groups either, the same speech samples were perceived to be happier, more positive, furthermore less sad and less scared when pauses were shorter.

All in all, subjects with a German mother tongue rated the Hungarian speakers angrier, sadder, more surprised, more scared and more heated, than Hungarian subjects did. Our findings argue that pauses play a relevant role in emotion ascribing, and this might be a universal cue.

Neural Correlates of Combinatorial Semantic Processing of Literal and Figurative Noun Noun Compound Words

Forgács, B.¹, Bohrn, I.², Baudewig, J.^{2,3}, Pléh, Cs.¹, Jacobs, A. M.^{2,3,4}

The right hemisphere's special role in language comprehension is supported by a growing amount of evidence. Special interest surrounds right temporoparietal structures, apparently involved in the coarse semantic coding of concepts, what is important in combinatorial semantic processing, and the integration of individual lexical units into meaningful wholes. This role seems to be central in the processing of novel metaphoric expressions, but also of meaningful noun noun phrases. The current experiment aimed at clarifying the right hemisphere's involvement: four categories of German noun noun compound words (conventional and novel metaphors, closely and distantly related literal expressions) were presented to subjects in an event related fMRI experiment. The compounds were controlled for length, frequency, imageability, arousal, and emotional valence. According to the results, both literal and metaphorical familiar expressions, compared to unfamiliar metaphorical and literal expressions, increased BOLD signal reaction in right temporoparietal regions, while the opposite contrast revealed an increase in left inferior frontal areas. The results show that right temporoparietal areas are necessary in conceptual integration of elements of familiar compound words, whereas it contradicts the right hemisphere theory of metaphor processing, since novel metaphors (with great semantic distance) evoked left hemispheric morphosyntactic integration.

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Day-time effects in the consolidation of autobiographical events

Ágnes Szöllősi

In this explorative study we investigated the role of sleep in the consolidation of autobiographical memories. Participants ($n = 112$) were randomly assigned into three groups, that differed only in the task during the recording phase. Group 1 recorded events of the day before, right after waking up (morning group). Group 2 recorded events of the given day, right before going to bed at night (evening group). Group 3 recorded events of the day before, right after going to bed at night (control group). Each day, participants were first asked about the hours of sleep they had during the previous day. There was no significant difference between the groups in the amount of time the participants spent sleeping. For each recorded event participants specified a title. They were told that this title would be used 30 days later in a recall task. Participants then rated the personal importance and emotional quality on a 7-point scale. Rates of personal importance and emotional quality of recorded events didn't differ between the groups. Finally they gave a short description of the whole event. 30 days later the participants were tested in a free recall then in a cued recall task. In the cued recall phase (compared to the free recall phase) the morning group showed higher performance improvement, than the other two groups. In the second cycle of the analyses two independent raters classified the recorded events into two categories: general and specific events. According to our results: the control group recorded the fewest specific memories. Then we analysed the number of recalled specific events in the cued recall task. While the morning and the control group showed same performance, the evening group recalled fewer specific memories than both of the other two groups.

Trait worry refers to the tendency of excessively and frequently thinking about future threats. Because this process involves the abstract, verbal processing of emotionally valenced information, many theories suggest that worrying might be an avoidant emotion regulation style (e.g. Borkovec et al, 1998), which is maintained by cognitive control functions “monopolizing” processing resources for this abstract processing (Price & Mohlman, 2007). In accordance with this, in previous work (Pajkossy & Racsmany, 2010, 2011) we found that higher levels of trait worry were associated with better memory performance if the retrieval required self-initiated strategic search. Because this kind of retrieval process involves cognitive control, we interpreted our results as an evidence for efficient cognitive control associated with trait worry. However, the term cognitive control is broad, thus in my presentation I would like to present a somewhat new interpretation of our findings which might more precisely specify the cognitive processes required for excessive worrying. Beside this some pilot experimental work and also broader framework for future research will be presented. The starting point is that in our data sets the positive effect of trait worry emerge only after the statistical control of the opposite effect of trait anxiety (the propensity to experience the somatic and psychological signs of anxiety). Trait anxiety is highly correlated with trait worry but in contrast to it, trait anxiety is suggested to impair cognitive control because it shifts the balance between stimulus-driven and goal-driven attention to the favor of the former and this leads to less efficient processing (Attentional Control Theory, Eysenck, 2007). Thus the two constructs exert opposite effects on cognitive control and we suggest that this phenomenon might be caused by the fact that trait anxiety shifts the balance of the attentional system to stimulus-driven whereas trait worry to goal-driven processing. This dichotomy of stimulus-driven and goal-driven processing is also evident in a recent theory of cognitive control, the Gateway Hypothesis (Burgess, 2006). This account states that networks in the frontopolar part of our brain (Br 10 area) implement a shift between stimulus-independent (i.e. goal-driven) and stimulus-oriented (i.e. stimulus-driven) processing. To sum up, based on the Attentional Control Theory, the Gateway Hypothesis and our previous findings we suggest, that trait worry is associated with the tendency to stick on stimulus-independent processing (SIT). Specifically, we hypothesize that trait worry will be associated with superior performance in tasks requiring SIT (1), it will correlate with the ease of shifting to SIT (2) and with the difficulty of shifting away from SIT (3). Moreover, we also hypothesize that the predominance of SIT will be characteristic not only of trait worry but also of many related constructs associated with the repetitive processing of negatively valenced past or future events to which Watkins (2008) refers using the umbrella term “repetitive thinking” (e.g. rumination, post-event processing, obsessive thoughts). The testing of these hypotheses is in progress. Until yet, one pilot study using prospective memory task has been launched. In the task subjects had to carry out a simple task until a cue indicated that a previously encoded intention has to be executed. We manipulated whether this cue is processed with or without SIT and found that subjects with high levels of trait worry are better in the task requiring SIT. This preliminary result is in favor of our hypothesis but further research is clearly warranted to test our hypothesis regarding the relationship between stimulus-independent processing and repetitive thinking.

The neurocognitive characterization of Nightmare Disorder

Péter Simor

Nightmare Disorder (ND) is a sleep disorder characterized by frequent, emotionally negative and intense dream experiences that often – but not necessarily- end in abrupt awakenings. Recent research indicates that ND is not a mere symptom of waking psychopathology, but rather a special case for affective dysregulation during sleep. Inefficient regulation of emotional experiences may reflect impaired fronto-limbic emotional networks, known to manifest enhanced activation during REM sleep. Our aim was to examine if Nightmares Sufferers (NS) showed alterations in emotional as well as neutral information processing tasks, associated with prefrontal functioning. 35-35 NS and matched controls participated in our first study. First, we applied a neuropsychological battery comprising an Emotional GonoGO task, an Emotional Stroop task, and the verbal Category and Letter Fluency task. We controlled our measurements for sleep quality and daytime anxiety. According to our results NS showed significantly worse performance in these different tasks, reflected in a slower response pattern in the GonoGo and Stroop tasks, and in more perseveration errors in the Fluency task. While the effects of sleep quality and waking anxiety were in some cases associated with these alterations, these factors could not solely explain the difference between the two groups. In the second study, examining 17 NS and 18 controls we applied a Color-Word and an Emotional blocked design Stroop task in order to avoid the slow effects of interference. NS were significantly slower in the emotional Stroop task, but contrary to our expectations this group manifested slower reaction times not only after threatening but also after neutral words. In case of the Color-Word Stroop task, NS showed slower reaction times, but this difference was not significant. In the second study, sleep quality and daytime anxiety did not mediate the main effects. In sum, our results indicate altered information processing in NS, including inhibitory functions and suppression of task-irrelevant semantic representations. Nevertheless, the effect of impaired sleep quality in NS should be investigated more thoroughly, since altered sleep quality may modulate waking inhibitory functions, therefore in our third study we present the findings regarding the macrostructural sleep profile based on the data of 17 NS and matched controls. Our findings and future directions will be discussed within a neurocognitive framework aiming to model dreaming and emotional information processing.

The strength of prototype effect and autistic traits in the normal population

Zsombor Várnagy

The investigation consisted of two major tasks. Both were categorization tasks, one with visual categories and another with auditory categories. Both tasks included a training phase, and a subsequent test phase in which the subjects needed to recognize the members of the previously learnt categories. In the test phase there were members of the category, among them some with high typicality, some with medium and some with low typicality. There were also stimuli which were not the members of the category. The visual and the auditory task had the same structure. The only difference was that while in the visual task subject wasn't instructed to learn the category, in the auditory task they were. 25 subjects did the experiment. I measured the typicality effect with recognition accuracy, response time, in variables of visual scanning and variables of pupil dilation. Auxiliary variables from Wisconsin Card Sorting Test, Autism Quotient and Oxford-Liverpool Life Experiences Questionnaire were collected. Response accuracy proved to be the most sensitive variable showing typicality effect. Although typicality appears in response time as well, the effect size remains lower. The relation of Autism Quotient scores and the strength of typicality effect was one of the primary interests of the experiment. The two variables seem to be independent from each other.

Towards possible eye-movement correlates of cognitive instability in Wisconsin Card Sorting Test and Tower of Hanoi

Gábor Megellai

Executive function deficits have been found in children and adolescents with autism. The Tower of Hanoi and Wisconsin Card Sorting Test have provided clear evidence for the planning and mental flexibility functions are impaired in the autistic spectrum. Past studies have found different patterns of impairment on both of tests. The nature of the tests and the standard scoring makes it complicated to retrieve more accurate data from experiments, but using eye-tracker can allow more sophisticated analysis, showing saccadic components of cognitive processes. One of the main aims of the current experiment is to identify typical patterns of gaze direction on different tasks, which findings will serve as samples to identify short-term cognitive instability in autism. My experiment was conducted with the computerized versions of the tests on an eye-tracking device with normal, young-adult subjects. The results are based on intuitive measures and observation due to explorative character of experiment. Relationship between scan-path and different strategies is easily recognizable on distinct tasks.