AUDITORY AND VISUAL INFORMATION PROCESSING
IN THE HUMAN BRAIN
A symposium organized by the Finnish Graduate School of Psychology
October 8-9, 2008, Helsinki, Finland

This symposium is open to all doctoral students and post-docs. Register to the symposium no later than October 1, 2008, by sending via email your name, department and university to the coordinator of the Finnish Graduate School of Psychology, Ms. Pia Carpelan, e-mail: pideca@utu.fi

Students from the doctoral schools and programs belonging to the Nordic-Baltic Doctoral Network in Psychology may apply from the network reimbursement for their travel and accommodation costs up to 500 euros. See: http://nbnp.utu.fi/travel%20invoice.htm For further information, contact the new network coordinator Ms. Susanna Kharroubi, e-mail: ansukh@utu.fi

Program

Wednesday Oct. 8, 2008
Location: Auditorium 2 (basement floor), Department of Psychology, University of Helsinki,
Address: Siltavuorenpenger 20 C, Helsinki

10:00- Prof. Kimmo Alho, Department of Psychology, University of Helsinki, and
11:00 Advanced Magnetic Imaging Center, Helsinki University of Technology:
Auditory and visual attention networks in the human brain

11:15- Prof. Heikki Hämäläinen, Department of Psychology, University of Turku:
12:15 **Does aging involve hemispatial neglect?**

12:15 Lunch break (on your own)

13:15- Prof. Synnöve Carlson, Low Temperature Laboratory, Helsinki University of
14:15 Technology and Institute of Biomedicine/physiology, University of Helsinki:
Processing of auditory and visual information in the prefrontal cortex

14:30- Prof. István Winkler, Institute for Psychology, Hungarian Academy of Sciences,
15:30 and Doctoral School in Psychology (Cognitive Science), Budapest University of Technology and Economics:
Object representations as predictive models

15:45- Prof. Erich Schröger, Institute of Psychology I and Graduate Program "Function
16:45 of Attention in Cognition", Research Academy Leipzig, University of Leipzig:
Automatic deviance-detection and involuntary attention switching in audition and vision

16:45- **General Discussion**
17:30

Thursday Oct. 9, 2008
Location: Festival Hall (Juhlasali), Main Building, University of Helsinki
Address: Unioninkatu 34, Helsinki

10:00-18:00 **Professor Risto Näätänen's Footprint in Cognitive Brain Research**

In this symposium, ending in a lecture by Professor Risto Näätänen followed by unveiling of his portrait, Professor Näätänen's colleagues describe their scientific collaboration with him and the importance of his scientific achievements to their own research and to cognitive brain research in general.

The speakers will include:

Prof. Kimmo Alho, Department of Psychology, University of Helsinki
Prof. Synnöve Carlson, Low Temperature Laboratory, Helsinki University of Technology and Institute of Biomedicine/Physiology, University of Helsinki
Prof. Valéria Csépe, Institute for Psychology, Hungarian Academy of Sciences
Prof. Carles Escera, Department of Psychiatry and Clinical Psychobiology, University of Barcelona
Dr. Catherine Fischer, INSERM U821 and Neurological Hospital, Lyon
Dr. Marie-Hélène Giard, INSERM U821, Lyon
Prof. Heikki Hämäläinen, Department of Psychology, University of Turku
Dr. Minna Huotilainen, Cognitive Brain Research Unit, Department of Psychology, University of Helsinki
Prof. Risto Ilmoniemi, Laboratory of Biomedical Engineering, Helsinki University of Technology
Prof. Teija Kujala, Cognitive Brain Research Unit. Department of Psychology, University of Helsinki
Prof. Heikki Lyytinen, Department of Psychology, University of Jyväskylä
Dr. Petri Paavilainen, Department of Psychology, University of Helsinki
Dr. Eero Pekkonen, Department of Neurology, Hospital District of Helsinki and Uusimaa
Prof. Mikko Sams, Laboratory of Computational Engineering, Helsinki University of Technology
Prof. Erich Schröger, Institute of Psychology I, University of Leipzig
Dr. Mari Tervaniemi, Cognitive Brain Research Unit. Department of Psychology, University of Helsinki
Prof. István Winkler, Institute for Psychology, Hungarian Academy of Sciences

CREDITS

Participating doctoral student may gain 1 ECT credit, if accepted by their own university, by writing a short summary of each presentation on Oct. 8 and a short essay on the basis of talks on Oct. 9 and by sending them to either one of the organizers of this symposium:

Prof. Kimmo Alho, Dept. Psychology, PO Box 9, FI 00014 University of Helsinki
e-mail: kimmo.alho@helsinki.fi

Prof. Heikki Hämäläinen, Department of Psychology, FI 20014 University of Turku
e-mail: heikki.hamalainen@utu.fi

ABSTRACTS OF THE PRESENTATIONS ON OCT. 8, 2008

Auditory and visual attention networks in the human brain

Prof. Kimmo Alho
Department of Psychology, University of Helsinki, Helsinki, Finland, and
Advanced Magnetic Imaging Centre, Helsinki University of Technology, Espoo, Finland

Our functional magnetic resonance (fMRI) imaging results (Degerman, Rinne, Salmi, Salonen & Alho, 2006), combined with recordings of event-related brain potentials and magnetic fields (ERPs and ERFs, respectively; Degerman, Rinne, Särkkä, Salmi & Alho, 2008) indicate that selective attention to sounds at a certain location or with a certain pitch is associated with enhanced activity in a network of brain regions including auditory, parietal, and prefrontal cortical areas. In other fMRI studies, we found that overlapping frontal and parietal regions, together with thalamic and cerebelalr areas, are activated by switching auditory or visual attention between two locations (Salmi, Rinne, Degerman, Salonen & Alho, 2007) and during attention to bimodal, audio-visual stimulus combinations (Degerman, Rinne, Pekkola, Autti, Jääskeläinen, Sams & Alho, 2007). In the latter study, we also found enhanced activity in the posterior temporal cortex, especially in the left hemisphere, related to audio-visual integration. Left-hemisphere dominance in audiovisual integration is also suggested by our event-related brain potential (ERP) study on bimodal selective attention (Sams, Salminen, Ojanen & Alho, in preparation). Finally, our fMRI recent results suggest that partly overlapping networks of temporal, parietal and frontal brain regions are activated by voluntary, cue-guided (top-down) shifting of attention between two sound sources and by involuntary (bottom-up) attention to deviant sounds in an attended or unattended location (Salmi, Riinne, Koistinen, Salonen & Alho, in preparation).

Does aging involve hemispatial neglect?

Prof. Heikki Hämäläinen
Department of Psychology, University of Turku, Turku, Finland

Dichotic listening (DL) test shows a distinct REA (right ear advantage), i.e. preference to report consonant-vowel syllables delivered to the right ear, in right-handed young adults. REA is even stronger when attending voluntarily to the right ear stimuli (forced right), and is balanced out and even reversed to LEA (left ear advantage) when attending to the left ear stimuli (forced left). This top-down control in forced left condition develops in childhood and declines again with aging. Moreover, it is vulnerable to learning and plasticity effects demonstrated by, e.g., early blind and musically trained persons. Does this phenomenon reflect language-related or executive processes (or both) and their changes with age? In order to reveal the underlying mechanisms, different types of auditory and visual divided and selective attention tasks, in addition to the DL test, were applied to 50 young adults (age 19-35 years), and 41 senior citizens (age 65-85 years). The results indicate the existence of a general, age dependent attentional/perceptual laterality, which slightly resembles the symptoms of hemispatial neglect and/or extinction seen in patients following right parietal lobe lesions.

This study was supported by a grant from the Nordic Council to the Nordic Center of Excellence in Cognitive Control (grant # NCOE 40043), and University of Turku.

Processing of auditory and visual information in the prefrontal cortex.

Prof. Synnöve Carlson
Brain Research Unit, Low Temperature Laboratory, Helsinki University of Technology, Espoo, Finland, and Institute of Biomedicine/physiology, University of Helsinki, Helsinki, Finland

The prefrontal cortex (PFC) has a central role in the regulation of attention and working memory (WM). Most of our knowledge about the functional organization of the PFC comes from studies involving the visual system and much less is known about auditory WM. In this presentation, I will first show results from human brain imaging studies suggesting that mnemonic processing of visual and auditory information occurs in overlapping cortical areas. I will then present evidence from electrophysiological single cell studies in the primate PFC suggesting parallel processing of auditory and visual information in WM. - Successful performance of WM tasks requires an ability to focus on relevant information and to ignore irrelevant, distracting stimuli. Resistance to distraction has been considered a fundamental feature of PFC neuronal activity. Unexpected stimuli, however, often disrupt our work. In the second part of the talk I will show examples of effects of unexpected distracters on neuronal responses recorded in the PFC during a WM task that may explain why distraction impairs performance.

Object representations as predictive models

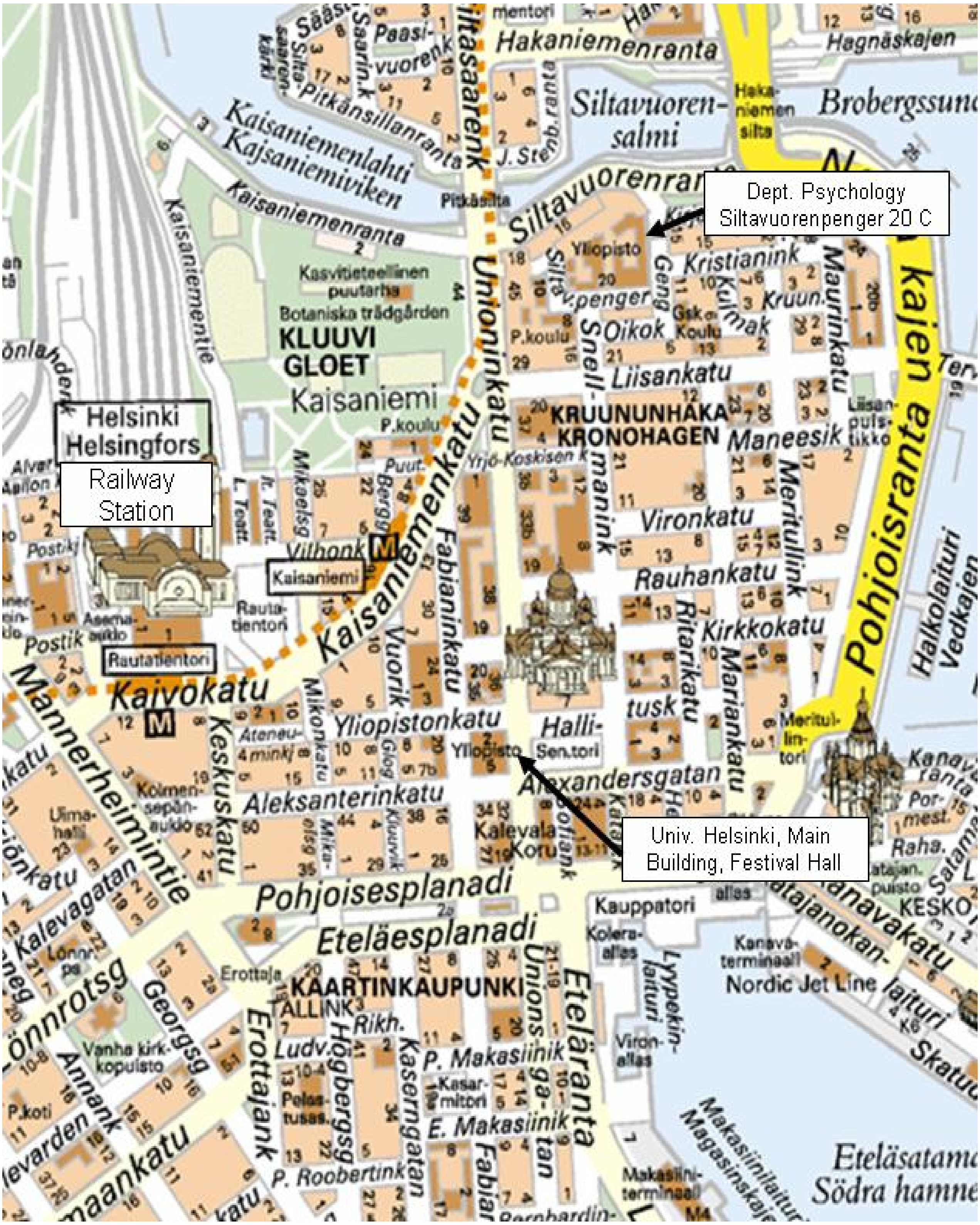
Prof. István Winkler
Department of General Psychology, Institute for Psychology
Hungarian Academy of Sciences, and Doctoral School in Psychology (Cognitive Science), Budapest University of Technology and Economics, Budapest, Hungary,

We perceive the world in terms of objects and events, entities that may be used in the symbolic operations of our conscious thinking. However the road from sensory input to awareness is a long and winding one. One issue that receives much interest in current science is how the brain forms meaningful units from the incoming information, determining what belongs to a single object or event. This question is especially critical in the auditory modality, because sounds originating from concurrently active sources mix together before reaching the ears and it has been shown that in many ecologically valid situations, the inverse problem (i.e., delineating the sources from the composite sound input) has no unique solution. Thus the auditory system is forced to constrain and guide the formation of object representations through processing principles honed by evolution and a lifetime of perceptual learning. A phenomenological description of the rules guiding the formation of perceptual objects has been presented by psychologists of the Gestalt school during the first part of the 20^{th} century. Recent research basing on behavioral and neurophysiological investigations and computational modeling is directed towards understanding how the brain utilizes these rules by maintaining a model of the auditory scene that represents the regular aspects of the acoustic environment. The paper will focus on the role of pre-attentive processes in building and constantly updating predictive regularity representations in the brain and how such generative models can underlie the parsing of the complex auditory input.

Automatic deviance-detection and involuntary attention switching in audition and vision

Prof. Erich Schröger
Institute of Psychology I, University of Leipzig, and the Graduate Program "Function of Attention in Cognition", Research Academy Leipzig, University of Leipzig Leipzig, Germany

First, a skeleton of a model linking the concepts of automatic deviance-detection and involuntary attention switching will be provided. Second, the tools suited to investigate the underlying processes will be introduced: MMN (sensorial and cognitive, memory-based deviance detection), P3a (involuntary attention switching), RON (re-orienting of attention). Third, various applications of these tools will be reviewed. For example, it will be shown that not only violations of concrete but also of abstract rules can be monitored by the automatic deviance-detection system and that such violations have consequences for involuntary attention switching. Another example is the influence of top-down-effects on these processes.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