Perspectives in Applied Cognition

Chairperson
Boris M. Velichkovsky
Department of Neurocognitive and Social Sciences, Kurchatov Research Centre, Moscow, Russian Federation
velich@applied-cognition.org

Discussant
Neil Charness
Department of Psychology, Florida State University, Tallahassee, Florida, USA
charness@psy.fsu.edu

Speakers
Matthias Rauterberg
Industrial Design Department, Eindhoven University of Technology, Einndhoven, The Netherlands
G.W.M.Rauterberg@tue.nl

José J. Cañas
Cognitive Ergonomics Group, Universidad de Granada, Granada, Spain
delagado@ugr.es

Sebastian Pannasch
Applied Cognitive Research Unit, Technische Universitaet Dresden, Dresden, Germany
sebastian.pannasch@tu-dresden.de

Thierry Baccino
Cognitions Humaine et Artificielle, Université Paris 8, St Denis, France
tbaccino@gmail.com

Joachim Paul Hasebrook
zeb-business.school, Steinbeis University Berlin, Berlin, Germany
JHasebrook@zeb-bs.de

"The proof of the pudding is in the eating". This symposium shows how results of cognitive studies could be "eaten" in practice. The goal of basic cognitive research is the elucidation of cognitive-affective processes and their functional architecture at different levels of biological and social organization. On the material from several domains, such as perception, attention, memory and communication, one can demonstrate that every scientifically established fact about cognitive organization has a number of practical consequences. Up to 10 new and emerging directions in development of cognitive technologies are currently known. The list starts with attention sensitive interfaces and ends with applications of recent studies on neuroimaging and molecular psychology. This symposium simultaneously refuses the old opinion on applied research as a kind of "second-hand" science. Real world applications often demand a deeper analysis and a broader synthesis with existing practices than this is common in established areas of basis research. Usually, there are also tighter requirements to the reliability of methods in applied context particularly related to human health and well-being. In other words, one needs better methods as well as more and not less "science" in applied cognitive research which will be demonstrated on several examples provided by the speakers of this symposium.

Embodied cognition: How to design from a phenomenological perspective?

Matthias Rauterberg

In this presentation, I will address three different concepts: cognitive science (in particular embodied cognition), phenomenology, and design. Each of them has their own scientific and historical roots. I will argue that the future of design - conscious and responsible design in particular - can only be based on a 'being in the world' perspective. Starting with the body as the prime reference in contact with our environment the notion of embodied cognition is essential. The design of interactive systems, which link the users with their environment, has to mediate between the users' body and the intended service. Phenomenology is an alternative position to establish the ontological foundation for interaction design and to overcome the restricted self-view of modern science. Thoroughness into this world is the basic assumption on which any (interaction) design starts from a first person view to preserve or if necessary to change our environment in a conscious and responsible manner. The idea of a third person view (also called 'God's eye view') is critiqued as a myth. Taking this position has a strong influence on the process and outcome of any design. I will try to resolve the old problem of direct access to nature versus access only through a conceptual layer by providing two main arguments:

(1.) humans are social creatures and have to communicate with each other; this communication can only be done through a representational layer; (2.) this representational layer is our only way to capture our environment, and this can only be done through a first person perspective.

The energetic metaphor of the mind functioning reconsidered

José J. Cañas

Cognitive Science and the disciplines that have formed it have been dominated by an assumption which is also common to all life sciences: human beings, their physical and mental functions, work thanks to the use of energy. This assumption is derived from the metaphor of the human of the human being as a machine driven by energy. Does anyone today would question that much of accidents and human errors that cause them are due to fatigue? And is it not true that fatigue could be explained by the depletion of some sort of mental or physiological energy? Perhaps, the most important example of the importance of this assumption is the enormous relevance that numerous Theories of Resources currently have. However, all the theories are only hypothesis. It may be a high time to reconsider the traditional assumption of the use of energy as the basis of human performance. The main reason to abandon this assumption is that it has little predictive value. Empirical data show that the physical laws of energy are not always followed by human mind and brain processes. For example, energy should be depleted over time, however, this is not always the case in human behavior and sometime we are forced to add some extra assumptions in order to explain the good task performance when it should worsened by a presumable lack of energy. In this presentation, some empirical evidence will be presented that challenge the energy metaphor of the human cognitive functioning as if it would be a machine driven by some kind of energy.

Mechanisms of human eye movements and their significance for applied cognitive research

Sebastian Pannasch

Human eye movements are essential for visual perception. During fixations, information is extracted from the environment and internally processed. Since highest visual acuity is limited to the small foveal region, fast saccadic movements are required to redirect the foveal region from one fixation point to another. Analyzing fixation durations and saccade amplitudes during everyday activities allows understanding what details of the environment receive attention. With a combined analysis of fixations and saccades it can be determined how such details were processed. I will discuss three recent findings. A direct relation seems to exist between patterns of eye movements and modes of attentional processing. Sudden events profoundly prolong the ongoing fixation. In the case of visual distractions, the strength of this fixation prolongation can be used as a probe to identify the current mode of processing. Furthermore, I will discuss how the knowledge about the mechanisms of eye movement control can be related to areas of application. Using the direction of the eye gaze in virtual environments can improve the quality of interaction. Therefore, it should be considered in the design of attention-centered interfaces. In driving, where responses to hazardous events are required, the analysis of eye movements can help to develop attention-sensitive assistance systems. Using gaze as input to control of communication interfaces can provide essential support for specific groups of patients (e.g. patients suffering from locked-in syndrome). The variety of possible applications makes it necessary to develop new forms of eye-tracking devices which are more flexible and less obtrusive.

Reading on screens: Constraints on the visual system

Thierry Baccino & Simone Benedetto

The mass digitization of books is changing the way information is created, disseminated and displayed and the question of interest for psychologists is to know what are the effects of digital devices on reading behaviors. The paper will present two potential sources of disruption in reading: 1) visual fatigue may be induced by backlit displays (television, computer screens, tablets, etc.), 2) comprehension may decrease with some modes of reading (Spritz mode) present on small displays. For visual fatigue, the paper will present two experiments in which participants performed a longitudinal study comparing prolonged reading with two last generation e-readers (LCD, E-ink) and paper book. Results from both objective (Blinks per second) and subjective (Visual Fatigue Scale) measures suggested that reading on the LCD (Kindle Fire HD) triggers higher visual fatigue with respect to both the E-ink (Kindle Paperwhite) and the paper book. The absence of differences between E-ink and paper suggests that, concerning visual fatigue, the E-ink is indeed very similar to the paper. For comprehension, we compared traditional reading (i.e. left-to-right, top-to-bottom) with a rapid serial visual presentation (RSVP) application (named Spritz) that is available on smartphones. This reading mode has received a lot of media attention. RSVP consists of displaying in sequential order one or more words at a time, thus minimizing saccades and eye blinks. According to Spritz's developers, the elimination of saccades should reduce visual fatigue and improve comprehension. In this study, we had people read on a computer screen a selected part of a book either with Spritz or in the traditional way. Results seem to contradict these claims. The fact that Spritz suppresses parafoveal processing and regressions (i.e. re-readings of words) negatively affected literal comprehension. Furthermore, the important reduction of eye blinks observed for Spritz might contribute to the increase of visual fatigue.

Why do (not enough) health care professionals work in hospitals? A cross-method analysis of employee retention and productivity in hospitals

Joachim P. Hasebrook & Jürgen Hinkelmann (University Hospital Münster, Germany)

Almost all European countries suffer from a dramatic shortage of health professionals, now and in the future. The European Commission estimates the gap in supply of human resources in public health domain by 2020 to be approximately 1,000,000 health workers. This means that almost 15% of the care for the EU population will not be covered. In order to optimize the organization of work for improved lifetime work perspectives, to provide a structured medical specialist training and life-long qualification possibilities for attractive careers, we recently launched the research project "FacharztPlus" in German university hospitals (medical specialist plus; see www.facharztplus.info). The first step of the project was to find reasons why medical specialists love or leave their work in hospitals. The analyses of the results of online employee surveys conducted by hospitals showed no specific reasons for leave or retention and were not sensitive to HR measures, such as improved absence planning or integration after parental leaves. Consequently, we tested a variety of questioning techniques including free and structured interviews, semantic differentials, Repertory Grids, and instruments from market research, such as Net Promoter Score (NPS). We compared the outcomes of the different techniques with regard to employee retention factors and HR measures. As a result of this project step, we developed a free survey package for hospitals which combines different psychometric techniques as well as hospital specific benchmarks. A special survey package has been launched in order to assess employee satisfaction and retention in all German university hospitals.