



S-237: Psychological foundations of cognitive technical systems

Berthold Färber, Heiner Deubel (chair)

The aim of the cluster of excellence "Cognition for Technical Systems" (CoTeSys) is to provide technical systems with cognitive capabilities such as perception, reasoning, learning, and planning in order to act and interact with humans in a natural way. Because this cannot be done without psychological input, several partners from psychology are engaged in the cluster to integrate basic psychological knowledge, advanced user interface ideas and evaluation procedures in the cluster. The symposium brings together experts from Psychology and Neurology contributing to the development of technical systems of the future on the basis of their specific expertise.

Enhancing automatic saliency computations by dynamic weighting of feature dimensions

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The dimension weighting account (DWA) explains performance differences for intertrial transitions of target-defining visual dimensions by assuming that pre-attentive computations of saliency are modulated by weighting of previously relevant feature dimensions. Here we investigate the pre-attentive nature of dimensional intertrial effects by varying strength of feature contrast and congruency of the stimulus-response mapping. Although both manipulations decrease performance, from a decision perspective the DWA predicts only the perceptual manipulation to affect the cost of cross-trial changes in dimensions. The results support this view, thus strengthening the assumption of the DWA that dynamic changes of dimensions affect pre-attentive salience computations.

Movement coordination in human-human interaction

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Coordinating one's own movements and actions with movements and actions of another person is an ability that is relevant in everyday social life as well as in professional work environments. The present contribution investigated human movement coordination in an interaction task with the intention to extract coordination rules that may be transferred to human-robot interaction. Movement parameters of two humans were recorded in a simple construction task using a six degree-of-freedom magnetic motion tracker. Results showed that participants dynamically coordinated the timing of their movements both in movement onsets and during execution. Results are discussed with respect to their relevance and applicability to human-robot interaction.

Recognition and prediction of pedestrian intentions from a moving vehicle

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Aim of the project is a system that is able to recognise action intentions and by means of that predict pedestrian behaviour, i.e. to be able to warn a driver of a possibly hazardous situation. A video experiment with naïve participants was conducted to get first hints about the parameters by which humans are able to recognise pedestrians' intentions. Further experiments and measurements (with

Lidar and infrared camera) help to decide which of the found parameters are necessary and which sufficient as well as finding the critical limits for the parametrisation in a model of pedestrian behaviour.

Handing over: Anticipation in joint action

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Successful joint action requires the seamless coordination between partners. Here we investigated how such coordination is achieved. We chose a handing-over task, which, despite its simplicity, requires agreement upon certain basic prerequisites and boundary conditions. Over the first three trials, the duration necessary to perform one handover decreased significantly due to a combination of reduced reaction and joint manipulation times. Thus, our preliminary results show that basic parameters of joint action are determined indirectly and adaptively while cooperating. The outcome of this implicit negotiation is used to anticipate the partner's next action and, thereby, to achieve higher efficacy.

Emotion in human-robot interaction: Recognition and display

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Given the importance of emotional aspects for natural human-robot interaction, we aim at providing cognitive systems with the ability to recognize and to display emotional states. In order to establish an emotion recognition system, we induced non-extreme emotions typical for interaction scenarios (e.g. over- versus underchallenge), which can be distinguished due to the underlying physiological signal patterns (ECG, SCR, BVP). Emotion display as another major concern is realized by the robot head EDDIE (23 degrees of freedom). User studies indicate that six basic emotions can reliably be recognized.

Modeling user stress in a cognitive architecture

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Cognitive architectures are powerful tools to test hypotheses about human-machine interaction efficiently. In order to create realistic user models, the architecture must be able to simulate the whole range of human behavior. To this end, we are extending the architecture ACT-R (Adaptive Control of Thought - Rational) to include both the formation and the effect of stress. The extension is based on appraisal theories developed in emotion psychology. By comparing empirical data of human drivers to those of a cognitive driver model, we are able to demonstrate how the ACT-R appraisal module enhances the realism of user models in technical settings.

Psychological foundations of cognitive technical systems

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S-238: Reading development in languages with transparent orthographies: From local models to universal theories

Timothy Papadopoulos, George Georgiou (chair)

The identification of early precursors to word reading and reading comprehension by and large, was and remains an Anglo-Saxon endeavor. Significant research, however, has been also conducted in many other languages, particularly of transparent orthographies, aiming to either validate these models or introduce new ones. The present symposium argues that the future of reading development and disability research lies extensively in its ability to build new universal theories that would integrate various stances into an overarching framework, providing more thorough explanations of reading development and relevant difficulties.

Examining the home literacy model of reading development in Greek

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The purpose of the present study was to examine the Home Literacy Model of reading development in an orthographically transparent language. Seventy Greek children were followed from kindergarten until grade 3 and were administered measures of general cognitive ability, phonological awareness, letter knowledge, rapid naming, vocabulary, reading fluency, and comprehension. The parents of the children responded also to a questionnaire on home literacy activities. The results indicated that the Home Literacy Model is overly simplistic and should be expanded to include relationships with RAN and letter knowledge.

Antecedents of reading in a transparent orthography (Finnish)

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This study examined various cognitive and social antecedents (kindergarten, Grades 1 and 2) of technical reading and reading comprehension in Grade 4. Also, the role of task-focused behavior was examined. In this Jyväskylä Entrance into Primary School Study (JEPS; Nurmi & Aunola, 1999-2007) around 207 children were followed from kindergarten (6-year olds) to Grade 4. The preliminary results showed that high levels of letter knowledge, visual attention, metacognitive awareness and mothers' education predicted grade 4 reading. In addition, teacher assessed task-focused behavior predicted both beginning reading and later reading comprehension even after controlling for earlier reading skills.