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Abstracts

effect called 'perceptual memory' (PM), which increases the likelihood to perceive the same again, and a repulsive effect called 'perceptual adaptation' (PA), which increases the likelihood to perceive something else. We combined functional magnetic resonance imaging and psychophysics in humans to test how the brain entertains these two processes without mutual interference. We found that although affecting our perception concurrently, PM and PA map into distinct cortical networks: a widespread network of higher-order visual and fronto-parietal areas was involved in PM, while PA was confined to early visual areas. Our data refute theoretical models that either explain PM and PA with a single mechanism or with two separate mechanisms that, however, co-localize to the same early sensory area. In turn we propose that the areal and hierarchical segregation may enable the brain to maintain the balance between stabilization and exploring new information. A Bayesian model which implements perceptual memory as changes in the prior and adaptation as changes in the sensory evidence reproduces the behavioral data.

SYMPOSIUM : SYNERGISTIC HUMAN COMPUTER INTERACTION (HCI)

- **Attentive Computing – Using Eye Gaze for Unintrusive Services**
  T Kieninger (Knowledge Management dept., DFKI GmbH, Germany;
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In the recent years, eyetracking devices have made tremendous improvements wrt. their accuracy, the comfort of use and also the costs. These trends open up new possibilities apart from their classical application domains in e.g. customer analysis where only little number of devices are used for one-time experiments. The DFKI has investigated to what degree eye trackers can improve our daily lives, assuming that with raising sales figures these devices might soon become affordable to everyone. Under the label "Text 2.0" we developed a framework that observes the user when reading text on a computer screen using a desktop eye tracker. It not only recognizes which textline or word a user currently looks at, but also if he is skimming over a text, or getting stuck at some word. These mechanisms have led to a series of applications and proactive services ranging from entertainment to education. In parallel, we worked with mobile eye trackers which permit services apart from monitor screens. By analyzing the provided scene image together with eye fixations and optional movement sensors we built several prototypes that anticipate when the user shows interest to some object. Sample applications are the "MuseumGuide2.0" or an automatic "Visual Diary".

- **Perceptual and Adaptive Learning Technologies in Education and Training**
  P Kellman (University of California, Los Angeles, CA, United States;
  e-mail: kellman@cognet.ucla.edu)

Recent in perceptual learning offers remarkable potential to improve almost any kind of education or training. I will discuss recent innovations in perceptual learning and adaptive learning technologies. Whereas learning in educational settings most often emphasizes declarative and procedural knowledge, studies of expertise point to crucial components of learning that involve improvements in the extraction of information. I will describe research that uses perceptual learning modules (PLMs) in computer-based learning technology to address challenges in learning in mathematics, science, medicine, and aviation, In the second part of the talk, I discuss the novel ARTS (adaptive response-time based sequencing) system, an adaptive learning system that markedly improves interactive learning by using both accuracy and speed data, and concurrently implementing a number of laws of learning and mastery. PLMs and the ARTS system, separately and in combination, have remarkable potential to enhance efficiency, durability, mastery, and objective assessment of learning in a wide range of educational and training domains.

- **Perception, Image Processing and Fingerprint-Matching Expertise**
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Fingerprint evidence plays an important role in forensic science. Little is known about the perceptual aspects of expert fingerprint analysis, or the differences between performances of fingerprint experts

and novices. We examined fingerprint identification performance among experts, novices, and novices with a short training intervention. Expert performance far exceeded both groups of novices. We predict the performance accuracy by using quantitative image measures borrowed from computer vision. We found that novices primarily used basic variables known to affect visual perception such as brightness and clarity of, mostly, the tenprints while the experts used domain-specific, configural features such as core and delta of the latents, ratio of areas and relative image characteristics of the latent-tenprint pair. Ultimately, it may be possible to evaluate a fingerprint comparison in terms of the quality of visual information available in order to predict likely error rates in fingerprint pair comparisons. Such a metric would have great value in both adding confidence to judgments when print comparisons are uncomplicated in terms of having high quality visual information, and it would allow appropriate caution in cases that are, from an objective standpoint of the quality of visual information, more problematic.

- **On Interactions Between Vision and Language**
  M Spivey (Cognitive and Information Sciences, University of California, Merced, CA, United States; e-mail: spivey@ucmerced.edu)

A number of studies have been showing that visual input can influence linguistic processing in real time. This tells us that the visual system can sometimes tell the language system what to do. Additional studies have been finding that linguistic input can influence visual processing in real time as well. Thus, it appears that the language system can sometimes tell the visual system what to do. The evidence points to an interactive (and decidedly non-modular) account for how perceptual and cognitive subsystems process their information. While it is clearly the case that there are brain areas that are mostly specialized for certain perceptual modalities, it is also the case that those specialized brain areas are able to process some information from outside of their specialized domain. With multiple heterogeneous perceptual subsystems sharing information back and forth in cascade, it may be that a dynamical systems approach to cognition in general, and to visual perception in particular, is required.

- **Validating a virtual head to measure the subjective cone of gaze**
  H Hecht (Psychology, Mainz University, Germany; e-mail: hecht@uni-mainz.de)

Gaze direction is an important cue that regulates social interactions. Although humans are very accurate in determining gaze directions in general, they have a surprisingly liberal criterion for the presence of mutual gaze. We first established a psychophysical task to measure the cone of gaze, which requires observers to adjust the eyes of a virtual head to the margins of the area of mutual gaze. Then we examined differences between 2D, 3D, and genuine real life gaze. Finally, the tolerance for image distortions when the virtual head is not viewed from the proper vantage point was investigated. Gaze direction was remarkably robust toward loss in detail and distortion. Important lessons for the design of eye-contact in virtual environments can be derived from these findings.

TALKS : 3D VISION, DEPTH AND STEREO

- **The role of monocular regions in the perception of stereoscopic surfaces**
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Binocular viewing of 3D scenes produces portions of the background that are only visible to one eye because of occlusion and interocular separation. Here we investigate the effect of monocular regions on perceived slant. It is well-known that horizontal stereoscopic slant is under-estimated for isolated surfaces. The addition of monocular regions significantly increases perceived slant [Gillam & Blackburn, 1998, Perception, 27, 1267-1286] however, the underlying mechanisms are unknown. Two probes equidistant from a slanted surface appear offset in depth as a result of the underestimated slant. We predicted that this bias would be reduced when monocular regions were present, as they increase perceived slant. The PSE was measured for two probes in front of slanted random-textured surfaces, with and without monocular regions. Bias was present for isolated surfaces with stereoscopic slants of +/-21 and 36 deg, with a larger bias for the latter. Surprisingly, the bias was not reduced by adding monocular regions. This contradicts the finding that monocular regions increase perceived slant and also that increasing stereoscopic slant by contrast does reduce bias [Gillam et al, 2011, Journal of Vision, 11(6):5, 1–14]. We discuss possible explanations in the context of physiological results from cells selective for depth edges.