wood) and two complexity levels (high and low) to test the influence of exposure frequency (F_0=novel stimuli, F_2=stimuli exposed twice, F_{10}=stimuli exposed ten times) under two sensory modalities (haptics only and haptics & vision). Participants' "need for touch" [Peck and Childers, 2003 *Journal of Consumer Research* **30**(3) 430-442] was also measured. Effects of exposure frequency were found for highly complex stimuli with significantly increasing liking from F_0 to F_2, and F_{10}, but only for the stone category. Analysis of the 'need for touch' data showed effects in participants with high need for touch, which suggests different sensitivity or saturation levels of MEE. This might also reflect the effects of expertise on the haptic evaluation of objects. It seems that haptic and cross-modal MEEs are influenced by factors similar to those in the visual domain.

◆ **Studying force perception in a visual–haptic coupling framework for chemistry simulation**

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Haptic devices have found room for applications in simulations of physical systems, as can be found in literature [Laycock and Day, 2007 *Computer Graphics Forum* **26**(1) 50-65]. In this work, a study of how force perception may be influenced by visual cues is performed. The case study was a chemistry simulation tool, showing a 3D model of a molecule and modelling an electric charge moving around it; the user can feel the force of the interaction. Through a set of tests, visual elements have been *incrementally* added, in order to make users catch more precisely the force information (intensity, direction) conveyed with the haptic device. Users were adult persons of both sex, aged between 20 and 50. With only haptics, users could perceive the feeling of being attracted or repulsed; moreover, users claimed a significant spatial disorientation. Addition of *visual cues* improved perception: molecule representation was decorated with colors depending on electrostatic potential values. A logarithmic color-scale associated to values interval was adopted, as from Weber–Fechner theory. The introduction of a graphical arrow (vector) indicating force direction makes users able to correctly perceive all the information about the felt forces. Also users orientation has been improved with the addition of visual cues.

◆ **Do the Gestalt principles of proximity and similarity apply in serial haptic search?**

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This study aims to investigate whether the Gestalt principles of perceptual organization also apply in the haptic modality. In the current experiment we focus on two of these principles: grouping by proximity and grouping by similarity. To do so, participants performed a haptic search task in which they scanned two columns of ten items with both index fingers. In one of the columns a target was present, the other column consisted of distractors only. The participants' task was to detect the target. We hypothesized that search times are faster when the two columns of items can be grouped. We therefore varied the distance between the two columns to test the principle of proximity. Moreover, we varied the type of items in the distractor column (same or different to the distractors in the target column) to test the principle of similarity. We did not find an effect for distance between the columns. However, we did find faster search times when the items in the two columns were the same. These results indicate that in the current experiment the principle of proximity may not apply, but the principle of similarity does.
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◆ **Hand movements during haptic object exploration**

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The aim of this experiment was to find a link between hand movements and specific types of information acquired during haptic exploration of 2D objects. A set of 18 objects of different shape, size, texture, orientation, and material were created on A4-sized cards. The objects were either fixed or could move with respect to the card. On each trial, two of these objects were presented to a blindfolded subject who was asked to determine whether or not there was a difference between them in terms of either coldness, elasticity, hardness, movement, shape, shape orientation, size, texture, or texture orientation. Index finger and thumb movements were recorded. An algorithm was designed to derive the type of desired information from these recordings using simple statistical measures such as standard deviation or kurtosis of movement direction, speed distribution, or average speed. Correctness of the algorithm's prediction varied with the type of information and the subject. Coldness, shape, and texture orientation could be

well identified, with prediction correctness well above chance level. This shows that prototypical hand movements can be identified and related to statistical measures.
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POSTER SESSION: IMAGING

◆ **Vision cortex stimulation by an artificial vision neural network**

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The aim of this project is to restore some vision to the visually impaired, via non-invasive digital stimulation. Combining neuroscience with innovative engineering technologies, our ultimate goal is to improve the quality of life for patients with serious vision problems. Our approach is to transmit processed information to the vision cortex, via the transcranial magnetic stimulation (TMS) technique which is a non-invasive method to excite the elementary unit of the nervous system. The back-feed of the vision neural system is done through a complicated artificial vision neural network (AVNN) of interconnected cells generating images that help the vision impaired to recognize objects. This artificial neural network will adapt the information to a form suitable to be sent by the array of electrodes wirelessly to the brain. A neuron to neuron communication is applied. Neural network has the advantage of learning, ie to adapt to new situations even if these situations are not learned with the network during the training phase. The function and the structure of the AVNN are similar to the neurons of the vision system, which can be replaced by a well learned network. This network is fed by the 3D image provided by a digital stereo vision system.

◆ **Restoring plasticity in the human amblyopic cortex: effect of Theta bursts**

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Recently, Thompson et al (2008 *Current Biology* **18** 1067-1071) showed that repetitive transcranial magnetic stimulation (rTMS) improved contrast sensitivity in adult with amblyopia. Their protocol involved either delivering 600 pulses with 85% of the maximum machine output (MSO) intensity at a frequency of 1 Hz during 10 min or 900 pulses with 69% MSO at 10 Hz during 15 min. The purpose of the present study was to improve the efficiency of rTMS using Theta burst sequences (TBS). 600 pulses at 41% MSO intensity was delivered at 50 Hz as bursts of 3 pulses repeated 5 times a second for 40 s on the visual cortex of four amblyopic participants. Contrast sensitivity was measured before and after TBS using high (SFh) and low (SFl) spatial frequency stimuli. No effect was observed on the contrast sensitivity of the fellow eye either at SFl or at SFh, or for the contrast sensitivity of the amblyopic eye at SFl right after TBS stimulation or 30 min after. However there was a significant improvement on the contrast sensitivity of the amblyopic eye at SFh started 30 min after TBS stimulation ($T=5.66$, $p<0.05$). The effect lasted at least 24 hours ($T=3.66$, $p<0.05$).
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◆ **Combining TMS and EEG: A touchstone for artifact removal**

66 S Marchesotti, G Plomp, M H Herzog (Laboratory of Psychophysics, Brain Mind Institute, École Polytechnique Fédérale de Lausanne (EPFL), Switzerland; e-mail: silvia.marchesotti@epfl.ch)

To understand how single pulse TMS affects brain dynamics, we combined TMS with EEG. However, removing TMS artifacts from the EEG is tricky. Here, we tested whether PCA can be used to remove the TMS artifact within the short time window of 50 ms after the pulse. We applied single pulse TMS to one observer and recorded EEG with 32 channels. We then analyzed the data using PCA and found that based on time-courses and amplitudes, three principal components were clearly caused by TMS. From these components we created a dataset to model the TMS artifact. To evaluate how well this artifact could be removed from an EEG signal, we added the model dataset to EEG data of a visual evoked potential paradigm (no TMS). We ran PCA over this ‘contaminated’ dataset and removed the first three components. Ideally, the cleaned data should show the same evoked activity as the original data. However, this was clearly not the case. Although a positive outcome of this simple test would not provide a sufficient proof of quality of an artifact removal method, our negative outcome puts in question the use of PCA to remove the TMS artifact within the 50 ms period after the pulse application.