The Cajal Centenary Conference on the Cerebral Cortex

25th-29th April, 2006
Barcelona, Spain

The year 2006 will be 100 years after the famous **Santiago Ramón y Cajal** and **Camillo Golgi** were awarded the Nobel prize in medicine or physiology for their ground breaking discoveries of the detailed anatomical structure of the brain. Cajal's work in particular has profoundly influenced all of Brain Research.
The Cosmociaxa Museum, the Spanish Science Council and the International Brain Research Organization and the Ministerio de Cultura are collaborating to organize two major events.

Neuroscapes2006
In honor of the artistic genius that Cajal brought forth in his drawings of the microarchitecture of the brain (http://www.neuroart2006.com).

The Cajal Centenary Conference
Immediately following the opening of the Neuroscapes2006 exhibition, about 300 scientists will gather to celebrate Cajal's century of influencing brain research by presenting a series of lectures and posters. The following speakers are invited and we will be honored if you would accept to speak at the meeting. The meeting is also open to participation by researchers and students and we are planning for about 300 participants. The meeting is also open to participation by researchers and students.

Both events, which will take place from the 25th-29th April 2006 at the Cosmocaixa Science Museum in Barcelona, one of the most visionary science museums in the world.

We wish to thank the following for their contribution to the success of this conference: European Office of Aerospace Research and Development, Air Force Office of Scientific Research, United States Air Force Research Laboratory (**www.london.af.mil**).

Conference Information
Neuroscapes2006

The "virtual arm" illusion: internalization of a virtual body by multisensory correlations

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Daily experience suggests that the self-representation of our body image is highly stable. However, there is evidence demonstrating that indeed our body image is malleable. In the "rubber arm illusion" (Bovitnick and Cohen, Nature 391:756, 1998) synchronous but irregular tactile stimulation of the hand of a rubber arm and the subject´s own out-of-sight hand results in projection of ownership towards the rubber hand. Here we have explored whether this illusion can be evoked with a 3D virtual arm generated in a virtual reality system. A right virtual arm with origin at the level of the subject´s right shoulder was displayed pointing straight ahead at shoulder level. This was displayed on a single screen (approximately 2×1.5m) with passive stereo and head-tracking, so that when the subject moved his or her body the arm would appropriately move with it, as if it were really attached to the subject's body. The arm was male in appearance and typically about 30cm longer than the subject's real arm. There were 3 main conditions, in each case the subject was standing. (i) The virtual arm was displayed and there was no other stimulus (except for the match between proprioception and visual changes as a result of body movements). The subject's real arm was held loosely at the side. (ii) A simulation of the original rubber arm experiments. In this case the experimenter held a 'wand' which was also tracked and represented in the virtual reality by a small sphere. The subject's real hand rested on a table to the subject's right, hidden behind a screen. The experimenter tapped the back of the subject's real hand with the wand at short irregular intervals while the sphere was seen synchronously to strike the back of the displayed virtual hand. (iii) An electrode was taped to the back of the subject's right hand, which delivered just noticeable electric shocks. In synchrony with each shock, a small patch on the back of the virtual hand turned from skin colour to red. In addition, a virtual cable ran back from the back of the virtual hand to the table top where the electric shock device rested. This also changed colour in synchrony with the shocks. The subject's true right arm was loosely at the side. All conditions were programmed to last approximately 7 minutes. The experimental design was between-groups – 10 completed condition (i), 15 condition (ii), and 13 condition (iii). A questionnaire similar to that given by Botnivick and Cohen was administered and also there was a debriefing interview. The questionnaire results showed that on two questions condition (ii) resulted in higher scores than conditions (i) and (iii): 'I had the sensation to have more than one right arm' ($P=0.09$) and 'It seemed (visually) as though the virtual arm was displaced towards my real arm' ($P=0.005$). The debriefing interview revealed that for all conditions the most common sensation was that the person's right arm felt tired after the experience (even though it was resting on the table or down by the side) – an observation consistent with the position of the virtual arm pointing out to the front for several minutes. It seems as though there was a degree of incorporation of the virtual arm, but not to the extent that this was captured by the

questionnaire responses. This experiment points to the possibility of using virtual reality as a useful tool to analyze multisensory processes that converge to generate body image.
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