Doctoral position financed by the Excellence Cluster (IDEX) of the University of Strasbourg

Topic: Tactile exploration of complex object properties with and without visual input

Host Laboratory: **ICube** - UMR 7357 CNRS-UdS, Strasbourg, FRANCE

Project summary (keywords are highlighted in bold): Interaction of the human body with mechanical devices relies on the **multisensory integration** of visual and tactile signals by the human brain. Only very little is known about the functional characteristics of sensory processes involving both vision and touch (sensory coordination), or about the mechanisms which allow to compensate for the lack of one by using the other (functional plasticity). Also, there are up to date no comprehensive data on the difference between tactile information processing through direct contact with the physical object space (exploration with the fingers of the two hands) and indirect tactile processing, where the physical object space is explored by means of an intermediate tool. This project will use **psychophysical experiments** to investigate these aspects of tactile information processing, with and without visual input, and with or without direct haptic contact. The aim is to generate groundbreaking fundamental knowledge relative to how **visual and tactile signals** interact, how one sense may allow compensating for lack of the other, and how sensory coordination and functional plasticity (vision-touch) produce successful perceptual judgments for motor control and action under conditions with and without direct body contact. Tactile information processing for perceptual judgments will be measured in relation to the relevant geometric and **mechanical object properties**. Measurements will be taken under conditions of "direct sensing", where observers are able to manipulate the physical object space with the fingers of their two hands, and under conditions of "remote sensing", where observers have to use a mechanical tool to manipulate and explore the physical object space, either with vision or without. The performances of observers with functionally intact visual systems, tested under conditions of direct and indirect tactile sensing with 1) full natural, **active vision**, 2) blindfolded, or 3) visual input from a computer screen prior to testing, will be determined. These results will be compared to those of congenitally blind patients tested under conditions of direct and indirect tactile sensing. Congenitally blind patients constitute an ideal comparison group here because their visual systems have never received any direct stimulus input (absence of direct visual experience), bearing in mind that internal "visual", or image-like, representations are nonetheless possible in such patients on the basis of neural plasticity (indirect visual experience). The behavioral data will be exploited for **computational/biomechanical modeling**, with immediate implications for technological research, bearing in mind that the characterization of human gestures in situations with indirect and/or partial sensory input for sensory coordination in interaction with mechanical devices is a critical aspect of research and development for image-guided surgery assisted by robots.

Skills required: **The ideal candidate for this post (3-year contract) will preferably have a Master Degree in Psychology with an excellent study track record.** Candidates from Neuroscience, Experimental Physics, or Computational Engineering are also encouraged to apply. The research topic is situated at the intersections between psychology, the behavioral neurosciences, computational modeling and medical robotics. A strong motivation for interdisciplinary research, which is particularly demanding, is required. **The successful candidate will benefit from housing facilities and financial aids for conference travel through the Collège Doctoral Européen of Strasbourg University.**

Contact: Please send your CV (2 pages max.) and a short motivation letter (by e-mail) to Dr. Birgitta DRESP-LANGLEY: birgitta.dresp@icube.unistra.fr