

Very recently, the disc arthroplasty, as opposed to spinal fusion, has gained momentum for the treatment of certain classes of spinal disorders. The main impetus for the design and development of the artificial discs has come from our 30+ years of experience/knowledge in the area of other joint replacements, like the total hip arthroplasty. However, the mechanical requirements of the artificial discs are quite different from those of total hip replacements, for example. The state-of-the-art knowledge from the total joint replacement is compared with the potential requirements for the design and development of spinal artificial discs. Wherever feasible, examples are provided to illustrate the comparisons and justify additional research that may be essential for the development of an "optimal" artificial discs.

### **S03-1 New Aspects of Human Typology in an Industrialized Environment**

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In preindustrial times, attempts to typify human beings were a means to structure the great variety of physical and psychological traits and their combinations. In modern industrialized societies any human typology is considered to be vague, difficult to reproduce and often loaded with prejudices.

Our scientific attempts to adapt the modern technical environment to the broad variety of human traits often neglect these requirements from the human side. The concept of an "average man" or the consideration of merely simple correlations do not fulfil these requirements. The field of personal protective equipment is a good example for this. On the one hand we need a wide variation of shapes of protective masks to adapt to the multitude of physical traits of the human face. Then again only a very limited number of different masks is acceptable from the logistic point of view. In this situation the concept of specific typology could be a solution to cover the relevant physical traits and their combinations.

### **S03-2 Basic Research of Human's Sensory Characteristics of Exerted Force by Hand in Japanese**

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Joysticks and similar multi directional controls operated by hand are increasingly applied in the industrial vehicles and machines. To design control equipments that feel easy-to-use and more suitable, it is necessary to study human's sensory characteristics of exerted force by hand. However, there are few

researches about the characteristics of exerted force (active sense) though many researches about the tactile sense (passive sense).

Therefore, we have studied the human's sensory characteristic of exerted force at an actual operating position. In this research, we focused on the following:

- 1) The verification of the Weber's law: The ratio of the minimum value of exerted force to the prior exerted (load) force (initial exerted force to same direction).
- 2) The verification of Weber-Fechner's law: The difference between absolute value of the exerted force and perception of the subjective force.

We made the joystick controls contains the six axes force/torque transducer to measure absolute force exerted by hand. This joystick is fixed type (no movement) to clarify the characteristics of force only. EMG and ECG were measured simultaneously.

In the presentation, we will show the results of these basic experiments and try to examine the correlation between perception of the subjective force and EMG.

### **S03-3 A Comparison of Characteristics of Brain Activity of Prefrontal Region and Behavior whilst Driving between the Young Adult and the Elderly**

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The purpose of this study is to investigate the difference of brain activity characteristics of frontal region between young adults and elderly during driving. The procedure of the experiment was explained to the subjects and informed consent was obtained from them. Eleven male young adults (20-22yrs), four male (65-71yrs) and five female elderly (65-80 yrs) volunteered as subjects for the experiments. 1,500 YEN per hour was paid to the subjects for their efforts.

Non-invasive measurement of regional cerebral blood flow was estimated by measuring deoxygenated hemoglobin, oxygenated hemoglobin, and total hemoglobin of both sides of prefrontal region using the near-infrared spectroscopy (NIRS) and the time resolved spectroscopy (TRS). The distance between the experiment car and the car in front, speed, and braking were recorded and the behavior of the drivers were obtained using the CCD camera and video recorder.

Temperature and relative humidity in the