Project VR-GO - Ergonomics in virtual environment

Motivation and objectives

The objectives are to perform manual handling tasks in both real and virtual environment. More specifically, the effects of virtual environment compared with a real similar setup will be analyzed in terms of changes in the movement pattern (movement and muscle coordination) by means of kinetic, kinematics and multi-channel surface electromyography (SEMG) recordings.

Dates: June the 25th – July the 4th 2012

Protocol:

To perform/simulate the same motor task in real and virtual environment

Participants: 10-12 healthy subjects without known neuromuscular disorders, without pain and without previous experience in VR (if possible). Two subjects per day, that leaves approx. 4 days to set the experiment up.

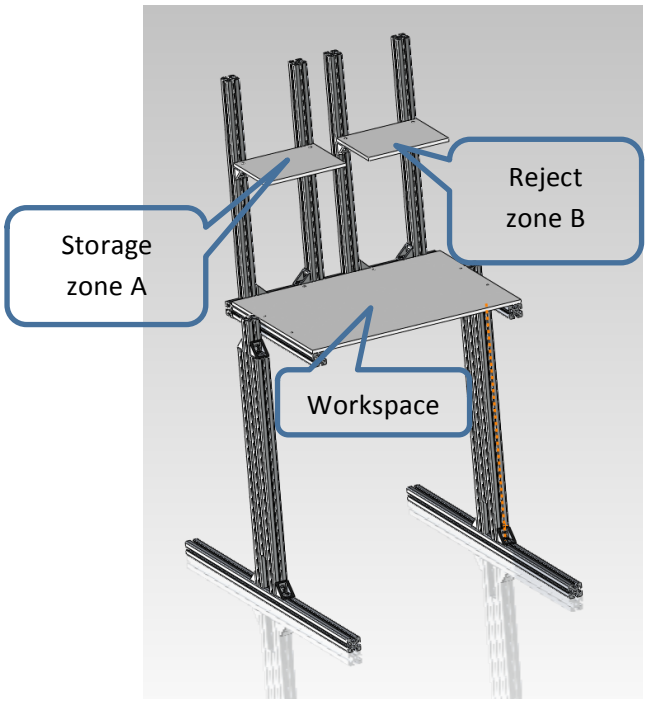

Figure 1 : Workplane

We will record repetitive measures:

- Real Environment & Virtual Environment (with/without haptic device for kinematics validation)
    - Subjects will manipulate the objects drawn below consisting of objects called fitters (fitting with the holes set on the workspace, see figure 1 (above)) and non-fitters (non-matching). All objects are taken from zone A. Non fitters are stocked on Zone B.

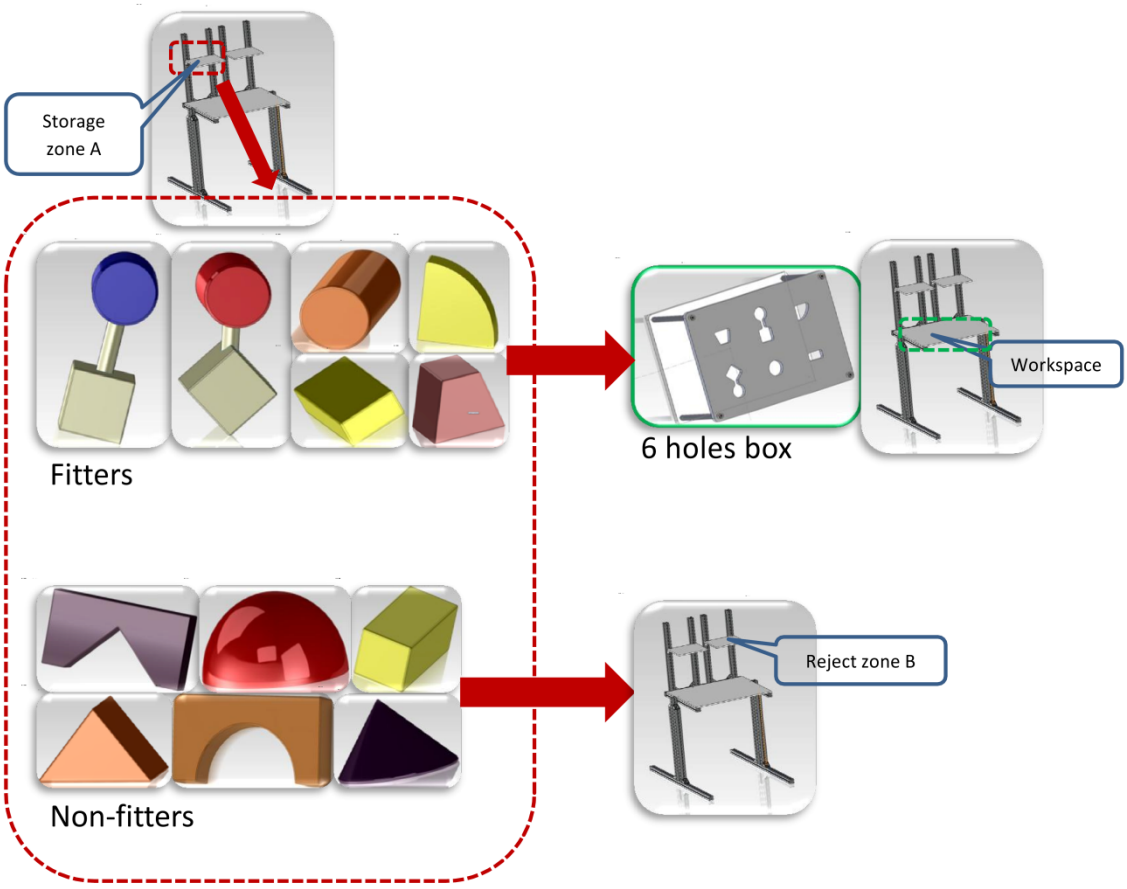

Figure 2: 6 holes complexity synoptic

- We will change the complexity of the task from 3 to 6 holes as shown on figure 2 (above; level of complexity).
- The manipulated objects should have the same weight (wood).
- The tasks are performed at two speed:
    - As fast as possible
    - Time-paced (piece rate)

Recordings:

- Kinetic:

Output forces of the haptic device when force feedback is active.

- Kinematics:

ART full body capture, 3D object trajectories.

- Bipolar and High density surface electromyography (SEMG):

Bipolar EMGs from the middle and lower trapezius,serratus anterior and deltoideus anterior muscles will be recorded with bipolar surface electrodes (Neuroline 720, Ambu, Denmark). Electrodes will be aligned on the selected muscles along the muscle fibers after skin preparation with ethanol.

SEMGs from the upper-middle trapezius will be detected with a semi-disposable adhesive grid of 64 electrodes (LISiN-Spes Medica, Italy, model ELSCH064). The grid consists of 13 rows and 5 columns of electrodes (2-mm diameter, 8-mm inter-electrode distance in both directions) with a missing electrode at the upper right corner serving as the origin of the coordinate system to define electrode location. The silver–silver chloride electrode surfaces in the grid are separated from the skin by a small cavity (~1-mm thick) filled with electrolyte gel. The EMG signals are bipolarly amplified 5000 times (128-channel surface EMG amplifier, SEA64, LISiN-OT Bioelectronica, Torino, Italy; 3-dB bandwidth, 10– 500 Hz), sampled at 2048 Hz, and A/D converted in 12 bits.

- RPE (rate of perceived exertion)

Trigger: TTL high (the trigger input is a level trigger input so the trigger input should be kept high in the whole duration of the recording)

Application specifications :