

POLYTECHNIC OF TORINO  
FACULTY OF ARCHITECTURE 2  
Degree in Architecture  
***Honors theses***

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**Devices for drawing and designing tasks in the virtual environment.**

**Human – Computer Interaction issues**

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In the information era, the computer represents the most fundamental of all media and has modified the interaction between humans and their environment. Just like in other areas before, nowadays computers play an important role in the design field as well. As a creative tool, it has modified the design process.

The design and modelling software products available on the market today are powerful instruments, which can give the designer very realistic graphical results. The introduction of virtual reality (VR) as a technology based on 3D environment simulation, as well as the evolution of 3D graphics, has brought a very consistent contribution to the advancement of the design field. Through VR and proper instruments, the designer is able to feel completely immersed into the model he's working on, such as a building or an object.

Using proper softwares, the designer is able to accomplish only some of the phases of the design process, such as the technical drawing, the 3D modelling, the graphical return and sometimes the presentation. All these tasks are mainly performed with the mouse and keyboard. The mouse is used to accomplish the majority of the design tasks, from the 2D models creation to the 3D ones. On the other hand, a device such as the mouse is not able to supply the traditional tools during the conceptual phase of a project and it seems inadequate during the 3D modelling tasks. The display is a very important device for the visual feedback of the computer - either 2D or 3D - simulated model, but it's a bi-dimensional surface.

The first goal of my research is to analyse different devices available on the market, that could be useful during the design process, and which could channel the entire process into one tool: the computer.

My stay in San Francisco, U.S.A., was the starting point of my work. Meeting Douglas Engelbart, the mouse inventor, and visiting the Stanford Center for Design Research laboratories, helped me understand how computers and their components have been naturally integrated in the design process, which has not been the case yet in Italy.

My research is focused on the analysis of 15 different input and output hardware devices for the design, in terms of features, respective typology, sensory feedback and the design tasks they could accomplish.

First of all, I've analysed the hardware devices that can either supply the mouse as a design tool or perform those design tasks when the mouse is not able to: different digital pens, pen tablet displays and touchscreens. Secondly, I gave my attention to the VR main devices: head mounted displays for the stereoscopic visualization and the dataglove for the virtual manipulation. Then I focused on the successors of these two devices: autostereoscopic and periferic displays and the haptic interfaces. And finally I reviewed special devices that don't belong to a specific category.



Two examples of the analyzed devices: Logitech *Io2 Pen*, Sharp *LL151 3D*



More example of the analyzed devices: SenseAble *Phantom Omni*, IO2 Technology *HelioDisplay*

The second goal of my research is the bimanual interaction and the experimentation with a 3D input interface, designed to perform the manipulation of both virtual scenes and objects and to be used in cooperation with the mouse: the 3Dconnexion, a Logitech Company, Spaceball5000.

The Spaceball5000, made of a 6 DOF sphere and 12 shortcut buttons, is so designed that the virtual modelling activity is to be performed by using both hands, recreating a natural way of working for humans. As a matter of fact, man usually accomplishes the majority of his activities using both hands. In cooperation with the mouse, this device makes the designer able to perform translations and rotations on all three Cartesian axes and to manipulate the scene or the virtual object in a very immersive way.

In order to collect consistent results, I've decided to make the experimentation in several fields: the Architecture Faculty of Politecnico of Turin, an architecture studio and the PininfarinaExtra design company.

In all the cases the use of the 6 DOF sphere has improved the participant's productivity, in terms of both the direct manipulation within the 3D scene and the perception of it.

Based on the outcome, it can be affirmed that the introduction of a device, which implements the mouse functionalities and increases the degrees of freedom, which in turn can improve the 3D environment manipulation, turned out to be a necessity expressed by each participant involved.

In conclusion, the introduction of some of the analyzed devices during the design process could make the designers less constrained to choose the right tool in order to accomplish a specific design task, closing the gaps and overcoming the difficulties brought by traditional systems.



The experimentation with 3Dconnexion Speceball5000

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