How to keep Senses for the Real in a Collaborative Virtual Environment?

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In technical education, especially in vocational training for skilled workers of the electrical, mechanical and informational domains, we face the situation, that physical phenomena can be studied quite successfully by experimenting with their virtual representation. This is due to the fact, that simulations in virtual environments have the advantages of low equipment costs, experimentation in a safe and reproducible way, allow different foci and levels of detail and encourage for action oriented learning. On the other hand, there are important aspects missing. The unpredictable infinity of cause-reaction or even non-causal behavior of reality and the sensual inspiration of physical contact with the surrounding objects and persons. But this other side of the learning process: building causal and formal mental models from the richness of real phenomena is left out in CVEs.

In this paper I will present results of a European Project (DERIVE-Distributed Real and Virtual Learning Environment) in which we try to unify both worlds, the virtual and the real, for vocational collaborative learning in mechatronics (electrical-electronic-informational engineering). With our concept of HYPERTUBES, we introduce a mechanism for a close coupling of real phenomena and their virtual representation in the area of pneumatics, hydraulics, electrics and informatics. This mechanism will allow a completely new type of collaborative learning in mixed realities.

HYPERTUBES are an extension of our concept of Complex Objects. Complex objects, somehow associated with complex numbers, are objects with a real part and several imaginary (virtual) ones (Fig. 1). Manipulating the real part automatically generates and changes the virtual counterparts correspondingly. With a certain interface-technology we successfully applied this concept for circuit design in pneumatics and evaluated it at several European vocational schools (Fig. 2-3). Whereas this concept couples reality to the virtual world, HYPERTUBES now constitute a connection in the other direction. They generate the relevant physical phenomena by a hidden electro-mechanical mechanism that is driven by a computer control program knowing the virtual context (Fig. 4-5). This concept will allow a collaborative modeling, where parts of the system are within reality at one place, others being at a different location in virtuality.

We will discuss perspectives of this new collaborative real and virtual environment for learning and work situations.

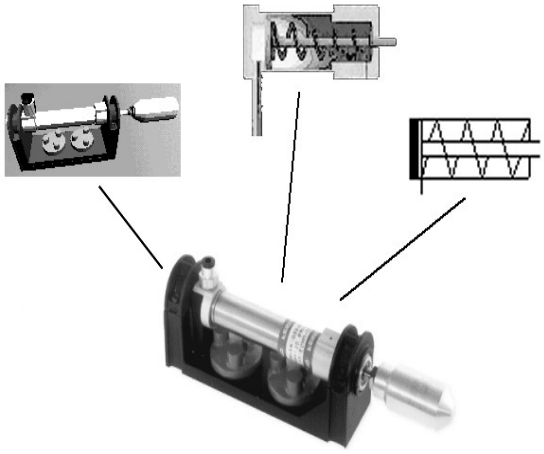

Fig. 1: Complex pneumatic Object

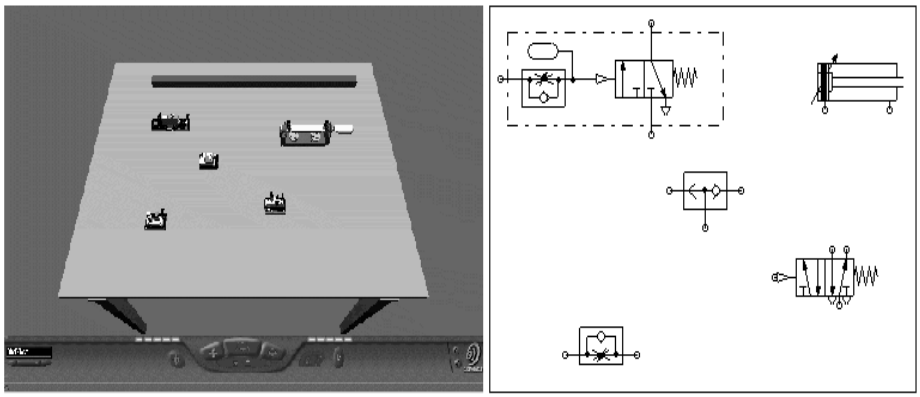

Fig. 2: Synchronous Modeling in different Worlds

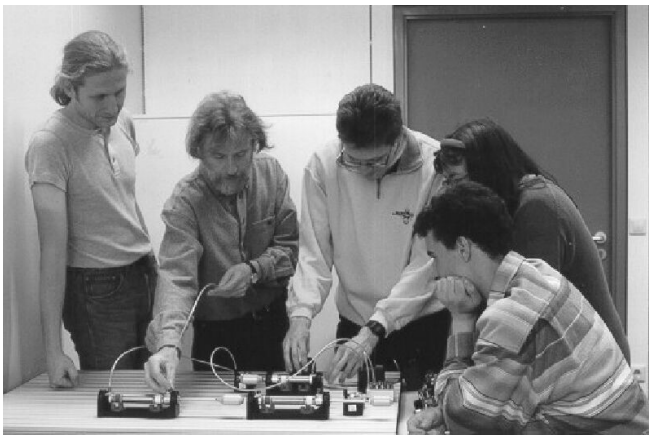

Fig. 3: Collaborative Learning in Reality

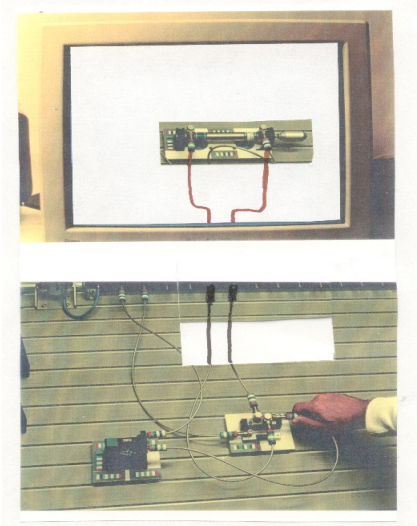

Fig. 4: HYPERTUBES

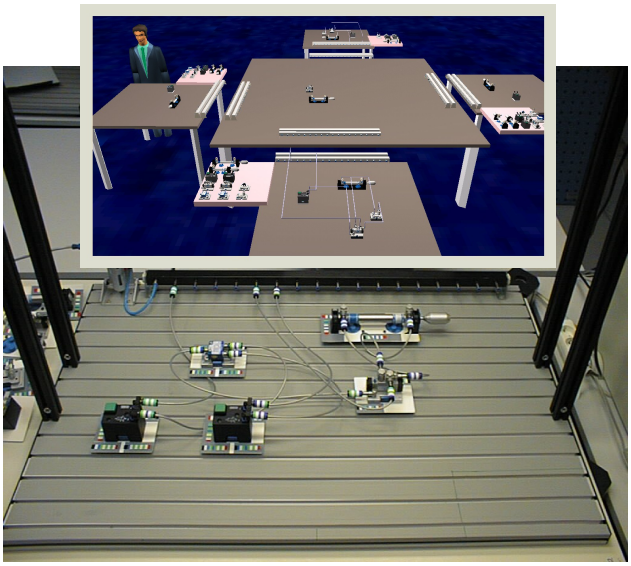

Fig. 5: Distributed collaborative real and virtual Learning Environment

For further details see
http://www.brevie.uni-bremen.de
http://www.derive.uni-bremen.de