

HOW USEFUL ARE VIRTUAL WORLDS?

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The context set by the chair of a 1994 IFIP Issue Panel Session. My position statement follows.

Virtual worlds are highly interactive environments for experiencing and manipulating three-dimensional synthetic scenes. Such kinds of environments are referred to as real-time interactive graphics with three-dimensional models, when combined with a display technology, possibly including binaural sound, that gives the user immersion in the model world and direct manipulation. A virtual environment, thus, is not simply an improvement of conventional display techniques, but it is a new media of communication with novel kinds of challenges for computer and communication technology.

While the initial development of this technology was pushed through military and space research and its commercial use by entertainment industry, a wide field of application is now developing in science and industry, medicine, art, and architecture. Some examples for the use of virtual environments are interactive exploration models such as the "virtual wind tunnel" of NASA Ames, the "walkthrough environment" of the University of North Carolina, or the "responsive environments" of GMD Bonn, Germany. New applications are also discussed in telepresence and robotics, and in the design disciplines as urban planning and architectural modeling. Projects like "Virtual Sho - Invisible Site" of the performance artist George Coates or "Home of the Brain" of Monika Fleischmann and Wolfgang Strauss (Prix Ars Electronica 1992) have prepared the grounds for Virtual Reality technology in art and performance. Along with sophisticated techniques for natural visualization and rapidly increasing computer power, virtual environments are becoming highly attractive for design and simulation. For example, the sensual experience of an office room or a building prior to its physical realization could help a designer to obtain a realistic impression of a construction while it is evolving and to give free way to imagination and creativity at the same time. The user should be able to move through the model, interact with objects in the model, and change the model interactively, e.g., by grasping and moving objects. As simulation of physical laws in virtual environments is progressing, such direct manipulation has become most attractive for virtual design. It is one of the aims, eventually, that a designer could be able to explore, and interact with, a manipulable environment without wasting physical matter and with the ability to readily change the immaterial model. While there is no doubt about the fact that virtual worlds have begun to prove useful, there is still much work to be done. A list of the most pressing needs includes the development of software for design of and interaction with virtual worlds. The growing prominence of Virtual Reality for entertainment industry greatly promotes the amounts of efforts and money spent on the solution of technical problems. But there are

as many problems to be solved with respect to the human user. The conditions, circumstances, and influences surrounding and affecting a participant user in a virtual world may greatly differ from natural experience. Issues of research necessary reach from perceptive features like vision, audition, and haptics to the understanding of sensory-motor adaptation and aftereffects associated with virtual environments such as motion sickness. On the other hand, virtual reality allows to expand sensory experiences to include a "real" grasp of information otherwise concealed to human senses, that is, human perception could be extended within and across sense modalities.

So, when addressing the question how useful virtual worlds are, we need to discuss possible benefits and as well as possible dangers which could be likely impacts of virtual world technology.

- Can virtual worlds help to better humanity?
- Can they save us money in achieving projects that would be unaffordable in *real reality*?
- Can they make *cold technology* better adapted to human expectations and needs?
- Can virtual worlds help to establish alternate forms of social life, e.g., for the handicapped?
- Are the prospects of realistic simulations overestimated (much overhead - little payoff)?
- Will experiences in virtual worlds be likely to interfere with experiences in real world?
- Could military action, put in effect through a virtual environment, become a matter of game and scoring, and detached from the regard of real effect?
- Will users be able to cope with the immersive (and possibly drug-like) aspects of virtual worlds?

These issues need to be addressed, along with current research and development, and preferably by those involved in the process of furthering this new, and apparently "hot," communication technology.

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William Bricken

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Any technology which has the audacity to call itself a variety of reality must also propose a paradigm shift. In essence, a paradigm shift expands the potential of an entire discipline. Virtual Reality (VR) expands every aspect of Computer Science, creating a new discipline: Computer Humanities.

I have coordinated, recorded and studied the initial VR experiences of over a thousand people in dozens of virtual worlds. A typical research result: mean enjoyment, rated on a scale from 1 (yuk!) to 10 (wow!), is 9.3 (N = 280). VR taps a positive emotional core. People enjoy it, people write about it, people stand hours in line for five minutes of it, people want it, and people will buy it. Consider the comments: empowering, the feeling of freedom, dreaming while awake, vast potential in every direction.

And just what is the paradigm shift? Computers are not only symbol processors, they are *reality generators*. VR is the body of techniques that apply computation to the generation of cognitively valid realities. Interface is defined by physiology; interaction, by natural behavior. Psychology defines the Physics of VR.

The Copernican revolution introduced a physics that differed fundamentally from appearance. VR introduces a metaphysics that differs fundamentally from the material. We now must decide which side of the monitor we wish to stand on.

VR is not a simulation of physical reality. Its characteristics are fundamentally unique and counter-intuitive:

- * VR is constructed, not given. It begins as Void, not as a subject/object dichotomy. It is completely representational, but not a priori rational, empirical, or verifiable. VR calls for a philosophy of immaterial realism, for realism about information.
- * VR encapsulates the participant (formerly the user) inside information, placing computation at the closure of our senses.
- * Unifying analytic symbolism with audiovisual imagery generates a feeling of wholeness. Computation becomes emotional, reason loses its crown. The material no longer dominates the senses.
- * Bits are cheap. The currency of VR is organization, not possession, not accumulation, not territory.

* Shared perspective in multiparticipant environments is to be negotiated rather than assumed. Divergent interpretations are the norm. VR allows mutually inconsistent environments to coexist without degradation.

The utility of VR is that it has provided a conceptual vocabulary for understanding the relationship between humans and information. Our VR skills and techniques are in their infancy, we are currently misinterpreting 90% of the meaning of cyberspace. Several issues arise out of our confusion:

* Multiple concurrent realities: VR permits comparison of realities, it is the first scientific instrument of metaphysics. What is the role of physical theory in the information age? What is the scientific method, the empirical standard, of digital environments? How graciously will physical reality admit competition?

* Fluid self: What are the cognitive effects of programmable virtual bodies, of transportable perspectives, of synesthetic sensation, of masslessness, of negotiable communalities, of complete empowerment?

* Cybersocialization: What are the ethics and politics of VR? What will interaction without material impact be like? Who has the right to limit access to the immaterial? How will people respond to explicitly penetrating world views?

* "I'm sorry Dave, I can't let you do that." : The VR programmer is no longer responsible for every token, no longer the symbolic god. What are the rights of autonomous computational entities? Will there be a Virtual Environmental Protection Agency?

* Intoxication: It's hard to get haughty about non-physical highs. Are there sensory channels to ecstasy? Is living in VR necessarily pathological?

* Computation: To formalize VR, we must shift from a symbolic calculus to a spatial calculus and build the participant into the axioms. Perspective is the primary operator. It is but a quirk of typography that we have ignored the experiential semantics of computational languages. The foundation of Virtual Reality is not the bit, it is the Void.