Virtual Reality and its Many Different Definitions

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Abstract

Virtual Reality [VR] has many different definitions depending on the context in which it is being used. This literature review will show three different aspects of Virtual Reality and how it is being utilized in educational training.

The first area of research is the role of VR in higher education. With the number of adult students on the rise for universities, the demand for distance learning is great. The technology of the Internet has eliminated the requirements for students to gather in one place for learning and opened the door to unlimited possibilities.

The second area is the exploration of individuals using desktop reality in gaming. Desktop Virtual Reality [DVR] gaming is not a new process. This research explores its effectiveness utilizing a Web-based training environment in the classroom using gaming.

Lastly, this paper will show the value of a new, high-tech surface computing system, which is a natural user interface that allows people to interact with digital content the same way they have interacted with everyday items such as photos, paintbrushes, and music with their hands or with gestures—by putting real-world objects on the surface.

The Role of VR in Higher Education

This literature review builds upon research on the integration of Virtual Reality [VR] and three-dimensional [3D] computer modeling on learning and teaching. The review discusses the values and challenges of integrating visualization technologies into the teaching environment and investigates perceptions, opinions, and concerns with respect to these technologies.

Students are entering higher education increasingly computer-literate, with high expectations that they will be introduced to appropriate technologies for their subject disciplines. Academic schools are challenged by these new technologies and require appropriate strategies for their effective integration and adoption. These strategies need to be given greater awareness and understanding of innovation within the academic curriculum [1].

In the mid-1960s, Ivan Sutherland's thesis, "Sketchpad: A Man-machine Graphical Communications System," was introduced as a highly precise computerized drawing system. With Sutherland's computerized drawing system, this graphical tool made today's computer-aided drafting [CAD] systems possible. Since that time, the impact of computers in education has resulted in much research and application [2].

A. H. Bridges identified three basic elements involved in computing:

- the technology of computing;
- the application of computing in architecture and other built environment subjects; and
- the use of computing as a teaching resource [2].

The initial inclusion of computer-related subjects as stand-alone modules in the structure of academic programs can offer a way for students and staff to become familiar and confident with computer applications, which would result in further appropriate integration into other subject areas [3].

Since many tasks in our everyday lives depend on our ability to recognize the three-dimensionality of the environment around us, from conceptual design to the final product itself, it is important to be able to appreciate the built environment in this manner as well [4].

With the use of 2D CAD being integrated into built environment curriculum, 3D modeling and especially VR have not found extensive and frequent use in built environment education. Yet, it is argued that 3D virtual environments can provide a rich, interactive, and engaging educational context that supports experimental learning [5].

R. Ellis explains that information technology has the potential to enhance the quality of the educational experience for all students, and ongoing work on the development of a virtual construction site project has received favorable reactions from those students introduced to new technologies [6].

As D. Bouchlaghem explains, “the process of design and visualization should be iterative, with changes made as a result of insights gained through visualization propagated into the next version of the design,” and this “collaborative building design requires a shared understanding to be reached between all parties involved” [7].

As pointed out by Messner and Horman, “observing and experimenting with the building construction process” is very important, but “it is difficult to provide this opportunity to the students in an educational setting.” With 3D, 4D, and VR visualizations, “students can experiment with different ‘what-if’ scenarios and actively discover unique solutions to construction planning challenges” [8].

Researcher F. Mantovani indicates “the point is no more to establish whether VR is useful or not for education; the focus is instead on understanding how to design and use VR to support the learning process” [9].

With selected desktop VR and semi-immersive VR technologies as appropriate types of VR to be used by students, the approach of developing links with software companies and built environment professional practices offers real-world case studies and applications of VR that illustrates how VR technology can be applied.

Technology has the ability to assist in the teaching process, enabling students to view and interact with the concepts they are working on in 3D immersive environments, and there are applications for all built environment subject areas as shown below in Figure 1 [10].

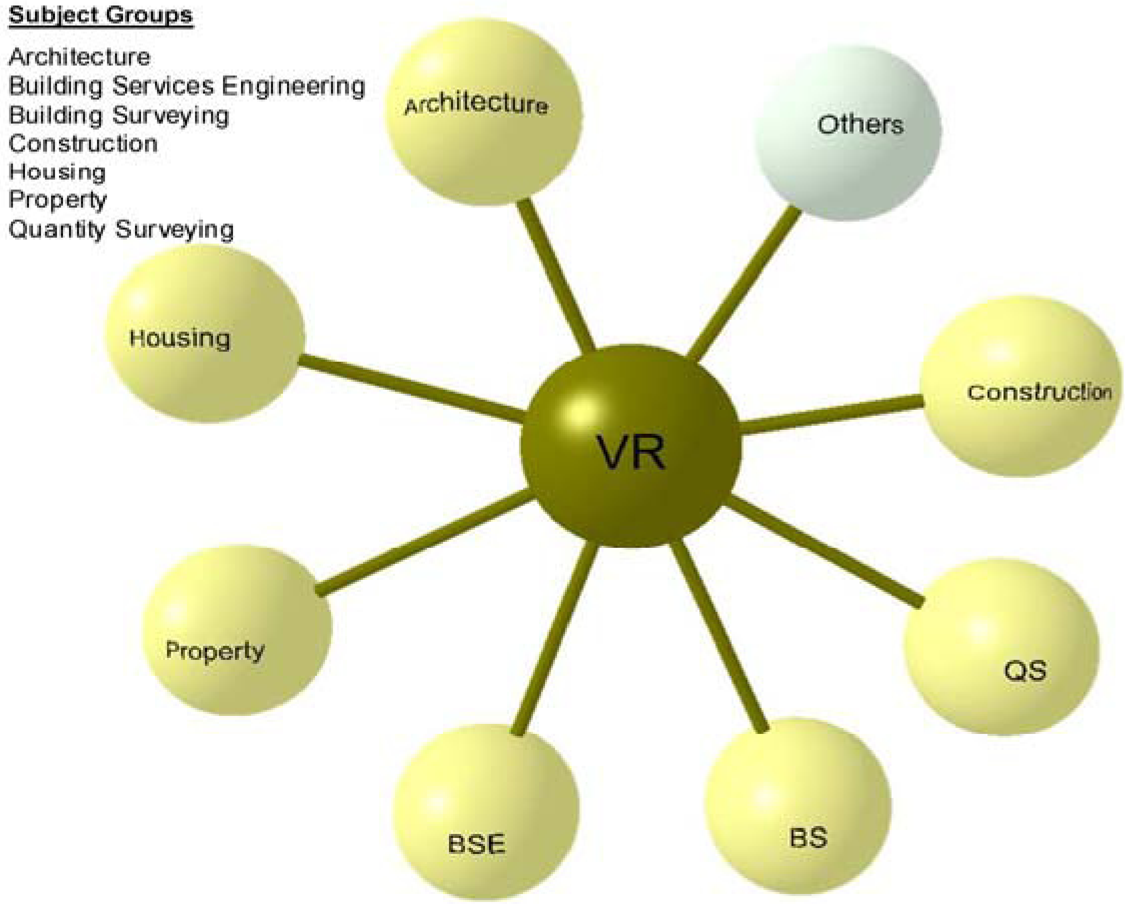

Figure 1. VR and built environment subject areas [10]

Floyd Ausburn and Lynna Ausburn suggest some simple steps to introduce VR:

- acquaint new users with the basic characteristics of VR;
- discuss benefits, strengths, limitations, and problems with VR in teaching and learning;
- provide an overview of the types of VR systems;
- use the VR systems in industries and share the outcomes with each other;
- discuss how one might apply VR in their own programs;
- include VR in curriculum development;
- explore VR technologies and how to use them effectively; and
- assist them in hands-on developments [11].

The user employs a mouse to move and explore within an on-screen virtual environment as if actually moving within a place in the real world. Movements can include rotating the panoramic image to simulate physical movements of the body and head, and zooming in and out to simulate movements toward and away from objects or parts of the scene. Embedded individual virtual objects can be "picked up," rotated, and examined as the user chooses, and clickable "hot spots" can also be used to navigate at will [12]. An example is shown in Figure 2 below:

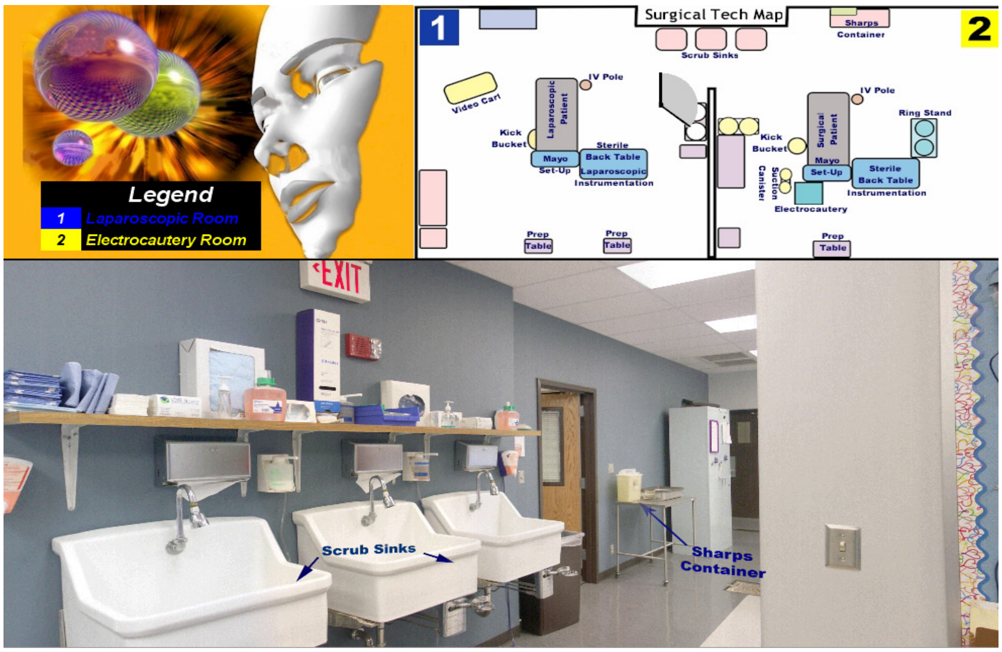

Figure 2. Desktop Operating Room VR

VR technologies allow users to occupy, navigate, manipulate, and control realistic computer-generated environments. These virtual environments [VEs] can immerse users/learners in a bounded graphical space and give them a strong feeling that they have actually *been* somewhere [13].

Desktop VR creates and delivers VEs in the form of on-screen "movies" that users can "enter" and explore interactively by moving a mouse or other navigation device. The user determines what movements to make and when to make them, exploring the imagery on the computer screen in real time as if actually moving within a place in the physical world. Movements can include panning and rotating the scene to simulate physical movements of the head and body, zooming in and out to simulate movements toward and away from objects or parts of the scene, and clicking on "hot spots" to navigate to additional embedded scenes and objects [13].

Based on the VR studies, three factors appear to be critical to successful VE implementation: the ability to teach VR users to understand that a VE is a complete "world" to be carefully and systematically explored, a clear explanation of the learning purpose and tasks before entering the VE "world," and adequate training and practice time in manipulating and navigating a VR program before immersion and interaction with a learning task. [13].

Desktop Virtual Reality [DVR] Gaming

The second area is the exploration of individuals using desktop Virtual Reality in gaming. Desktop Virtual Reality [DVR] gaming is not a new process. Kesper Juul describes gaming as a rule-based formal system with a variable and quantifiable outcome [14]. For years, gaming has been used in the field of healthcare. Many applications for gaming can be found in physical therapy, recreational therapy, medical training, and 3D visualization of medical information. The education areas using gaming are endless. In most cases, educational worlds are sponsored by academic institutions or nonprofit organizations. Educational worlds come in a wide variety of forms, including 3D re-creations of museum and gallery spaces, computer programming tutorials, virtual libraries, and meeting spaces for online university courses [15].

Military training has long been associated with gaming. America's Army has been using VR as a tool to recruit potential soldiers as well as to train current soldiers [15]. There is no limit to how gaming has been used in the field of education and training.

Surface Computing System

Lastly, this literature review points out the value of a new, high-tech surface computing system, which is a natural user interface that allows people to interact with digital content the same way they have interacted with everyday items such as photos, paintbrushes, and music with their hands or with gestures—by putting real-world objects on the surface.

In May of 2007, Microsoft introduced Surface computing, a new way of working with computers that moves beyond the traditional mouse-and-keyboard experience. Surface computing opens up a whole new category of products for users to interact with [16].

Microsoft Surface™

Microsoft has quietly been developing the first completely new computing platform since the PC, a project that was given the internal code name Milan. The product behind the Milan project is called the Microsoft Surface™. Surface does not have cables, external USB ports for plugging in peripherals, a keyboard, a mouse, or a trackball—no obvious point of interaction except its screen [17].

Microsoft Surface™, the first commercially available surface computer from Microsoft Corporation, turns an ordinary tabletop into a vibrant, interactive surface. The product provides effortless interaction with digital content through natural gestures, touch, and physical objects. Surface is a 30-inch display in a table-like form factor that is easy for individuals or small groups to interact with in a way that feels familiar, just like in the real world. In essence, it is a surface that comes to life for exploring, learning, sharing, creating, buying, and much more. Soon to be available in restaurants, hotels, retail establishments, and public entertainment venues, this experience will transform the way people shop, dine, entertain, and live [18].

One can take out a digital camera and place it on the Surface. Instantly, digital pictures spill out onto the tabletop. As one touches it and drags each picture, it follows the fingers around the screen. Using two fingers, one can pull the corners of a photo and stretch it to a new size. By putting a cell phone on the surface and dragging several photos to it, the pictures upload to the phone. The fingers act as a magic trick. One can drag and drop virtual content to physical objects [17].

At a high level, Surface uses cameras to sense objects, hand gestures, and touch. This user input is then processed and the result is displayed on the surface using rear projection as shown in Figure 3 below [18]:

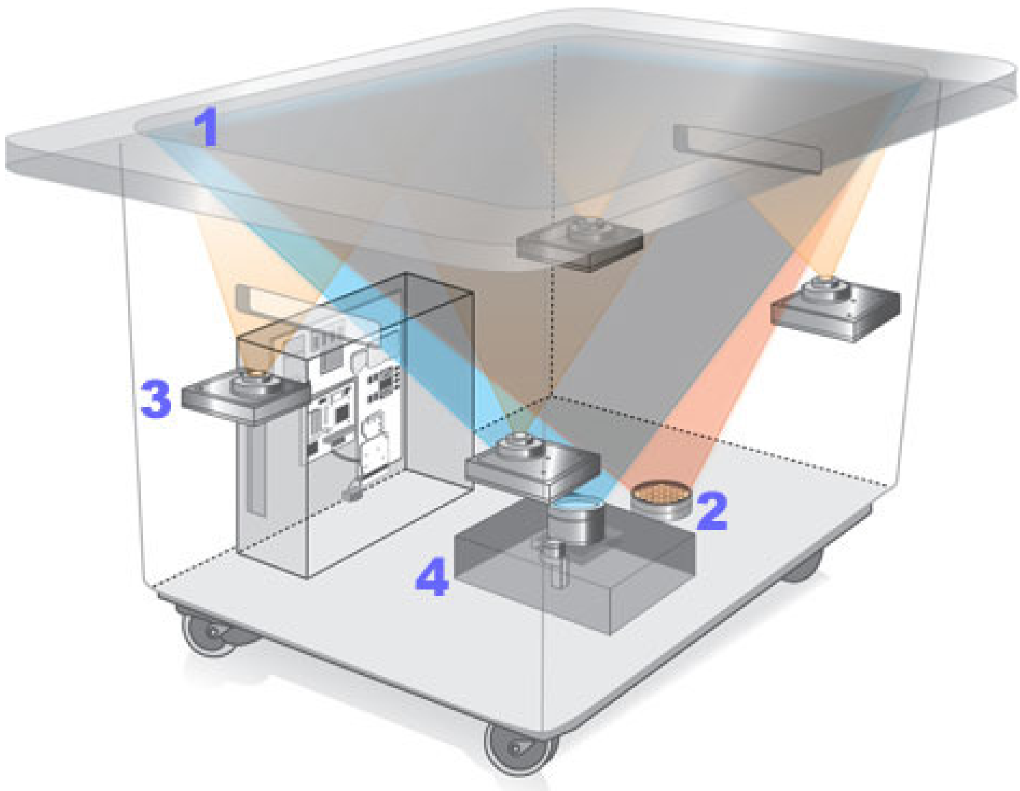

Figure 3. Microsoft Surface™
Diagram by Intoaroute - Touch Screen Salesbot

After you see the Surface in action, it does not take long to figure out just how attractive such a machine must be to the retail and service industries. It is easy to dismiss the concept as pure novelty and, at first, it may well be. But ask yourself: When was the last time you made a bank withdrawal from a human teller? The Surface machine is networked and infinitely flexible. You could use it to order food in a restaurant. While you wait, you could play games, surf the Internet, and then eat off the surface. And once you have gotten used to ordering dinner through a tabletop at your favorite restaurant, you may want to use it to call up recipes on your kitchen counter [17].

What Are The Four Key Attributes of Surface Computing?

Surface computing has four key attributes:

1. Direct interaction – Users can actually "grab" digital information with their hands and interact with content by touch and gesture, without the use of a mouse or keyboard.

2. Multi-touch contact – Surface computing recognizes many points of contact simultaneously—not just from one finger, as with a typical touch screen, but up to dozens and dozens of items at once.

3. Multi-user experience – The horizontal form factor makes it easy for several people to gather around surface computers together, providing a collaborative, face-to-face computing experience.

4. Object recognition – Users can place physical objects on the surface to trigger different types of digital responses, including the transfer of digital content [18].

The Human Touch

Microsoft Surface™ puts people in control of their experiences with technology, making everyday tasks entertaining, enjoyable, and efficient. Imagine quickly browsing through music and dragging favorite songs onto a personal playlist by moving a finger across the screen. Imagine creating and sending a personal postcard of vacation pictures instantly to friends and family while still wearing flip-flops.

Surface also features the ability to recognize physical objects that have identification tags similar to bar codes. This means that when a customer simply sets a wine glass on the surface of a table, a restaurant could provide him or her with information about the wine he or she is ordering, pictures of the vineyard it came from, and suggested food pairings tailored to that evening's menu. Microsoft Surface™ Computing brings to life a whole new way to interact with information that engages the senses, improves collaboration, and empowers consumers [16].

Conclusion

How VR, gaming, and surface computing will change our lives as instructors is unclear at this point. However, for certain, changes are coming. We must embrace the new technologies and be open to changing our ways.

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Biography

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