DOING IT DIRECTLY
THE EXPERIENTIAL DESIGN OF CYBERSPACES*
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ABSTRACT

Cyberspace is a new computer-based medium that enables groups of people to play the roles of characters in simulations of three dimensional worlds. This paper describes a theatrical approach to design in cyberspace, in which the designer, called a spacemaker, plays the role of a magician in an evolving space. In most computer-aided design systems, the designer is regarded as a third person observer of a static three dimensional model. In the approach described here, the spacemaker is considered to be a direct participant in a virtual reality.

1.INTRODUCTION

As Marshall McLuhan pointed out more than twentyfive years ago, the content of any medium is another medium. The content of print, for example, is the written word (whose content, in turn, is speech) and the content of a movie is a novel or a play or an opera." Currently there is much excitement about a new medium, called cyberspace, that is potentially the most encompassing medium ever devised. Since the content of a cyberspace is a digital simulation, cyberspace can be used to "carry" any medium whose sensorial effects can be simulated: which is to say, in principle, cyberspace can carry any medium.

The problem for cyberspace, today, is that no industry exists to support it, and an industry cannot take off without an infrastructure and a marketplace. The situation might be compared to the early days of cinema, circa 1900, when cameras and projectors had been developed but movies were still the stuff of sideshows. Antoine and Louis Lumière began showing movies for a profit in 1896, in a public auditorium in Paris, but for years cinema "… hovered between life and death in the nether world of the fairground, the second-class music hall, the beer garden, the penny arcades and the church social"." Yet, by 1905 John P. Harris was able to make a thousand dollars a week showing The Great Train Robbery in a converted Pittsburgh store that he called a "nickelodeon" (since tickets cost five cents each). By 1909, 8,000 nickelodeons had opened throughout the United States, and cinema had become, in less than two decades, a major industry and a new form of art.

In another paper[21], I describe a possible infrastructure for cyberspace, a "playhouse" where people go to play roles in simulated realities. The underlying notion is that cyberspace can be regarded as a form of theater in which the audience participates directly — that is, bodily — in simulations of three dimensional worlds. Theater is conceived broadly as an art and craft that enables people to invent, communicate, and comprehend realities by 'acting them out' (a view that has also been expressed by Brenda Laurel[10]). Acting, under this broad conception, "… is not just a form of expression, but a fundamental way of knowing. To act is to become someone else, in another set of circumstances, and thereby to know and experience a different reality. By giving his body over to a character, an actor enters a character's reality, and be can be said to embody (that is, provide a body for) the character. The character lives through the actor but so, too, does the actor live through the character. An actor in cyberspace is no different, except that the body she gives to her character is not her physical body, but rather her virtual one. She embodies the character but she, personally, is embodied by cyberspace "[21].

A spacemaker is a creative artist who makes cyberspaces, just as a filmmaker creates films, an architect designs buildings, or a novelist writes books. A cyberspace is a simulation of a reality, and if it is made well it can become, itself, a reality for the people playing roles in it. The spacemaker's goal is not to simulate reality, but to make simulations seem real, in order to create new realities. In some ways a cyberspace is like a physical space, except it is filled with virtual stuff rather than real stuff. But a cyberspace is not just stuff. It is also the pattern of activity of the stuff, and the characters who set the stuff in motion, and the human patrons who control the characters. Whereas architects create physical environments for human habitation, spacemakers create virtual environments which can seem real to the humans who play roles in them. The architect has only limited control of the physical world, but the spacemaker can bend and shape a simulation to create any conceivable kind of virtual world. A spacemaker, in other words, deals in illusion, and is more like a magician than an architect.

In this paper I consider an approach to the design of cyberspaces, and to design in general, that is in keeping with the notion of cyberspace as a theatrical medium. Under this approach, the spacemaker plays the role of a magician within an evolving cyberspace, and the space is not so much designed as grown.

2. HISTORY

The essential notion of cyberspace is not new, though the field only began to crystalize shortly after the publication of Neuromancer in 1986, when William Gibson applied the term "cyberspace" to "consensual hallucinations" that are induced by a vast "matrix" of interactive simulations 6, Ivan Sutherland constructed head-mounted three dimensional displays in the sixties 18,19, and since then many visionaries have explored ways to embody humans in realities that emerge from computer-based simulations. 4,14,9,2,5,13,20 A few companies have even made a business of it, mostly for the training of vehicle operators.

Until recently, only a small, highly specialized group of customers could afford the technology needed to sustain an illusion of embodiment in a computer-generated reality. The core technology is computer graphics, since it is easiest to believe a simulation is real if you can see it, and until recently the cost of the necessary three dimensional graphics technology has locked out all but a select few. The problem is that images of simulations must be constructed on the fly, one moment and one frame at a time, and that takes time. To sustain a convincing illusion, a rendering engine should generate thirty frames a second (video rate) or more, though experiments in Autodesk's research lab indicate that interesting realities can be sustained with as few as six frames per second. Today, even (top-of-the-line) personal computers are powerful enough to generate realistic, first person views of simulated environments, as amply demonstrated by simulation games such as Jetfighter 3, Tank Platoon 17, and Their Finest Hour 7 (and others from a number of developers and for all types of personal computers). Fast and inexpensive 3D graphics coprocessors will soon be available from numerous manufacturers, so personal computers can be dedicated exclusively to the job of simulating worlds while the fast coprocessors handle the job of displaying them. The core technology of cyberspace, in other words, will soon be available to everyone who owns a personal computer, which means that embodiment in imaginary worlds could soon become a common experience.

3. PARADIGM SHIFT

With the advent of cyberspace the interface designer has a new and exciting set of problems to solve. Rapid advancements in three dimensional graphics and sound technology, together with the general trend toward ever faster and less expensive coprocessors, will soon bring simulations of three dimensional worlds to mass markets. With this new capability comes the opportunity for a fundamental shift in user viewpoint, from third person to first person.

Under the old paradigm, the designer devises ways to help a user interact with representations of ideas and realities. On one side, in the computer, there is a representation of something while on the other side, in the physical world, there is a user of the representation. Under the new paradigm, there is no "user", but rather a being who directly experiences and acts within a simulation of a reality. Under the old paradigm, one directly experiences the various physical instruments through which a representation of something can be sensed and manipulated. That is, one experiences the instruments and not the thing, nor even the representation of the thing. Under the new paradigm, one experiences the representation directly, as if one were within it.

This paradigm shift, which John Walker has described as breaking "through the looking glass" 20, is much deeper experientially, than a simple swap of viewpoints. Entering cyberspace is not merely a matter of jumping from outside-looking-in to inside-looking-out. When you enter cyberspace you jump from outside-looking-in to inside-looking-further in. Cyberspace can be used to model and comprehend physical phenomena, but, more profoundly, it can be used to leave the physical world altogether, to take up residence in metaphysical worlds that feel, for all intents and purposes, as if they were real.

The new way of looking at the relationship between humans and computers is a reflection of a much wider paradigm shift, in the scientific community at large, which places a new emphasis on the human body as the wellspring of rationality (rather than the external, physical world). For a fascinating account of this new view, see Mark Johnson's book, The Body in the Mind.[8]

The first challenge, under the new paradigm, is to devise a technology that will give humans the feeling they are fully present in a virtual reality. You can imagine you are in a space but you can really be there (that is, experientially) only if your body is there, or if you deeply believe, with your whole being, that your body is there. Anything else is an intellectual exercise; worthwhile, perhaps, but less meaningful than bodily experience.

4. SPACEMAKER AS MAGICIAN

As mentioned in the introduction, the focus of this paper is on the spacemaker as magician, that is, on one possible role the spacemaker might play within a cyberspace. The spacemaker might play other roles, like architect, but in the end the spacemaker will need "supernatural" powers to construct virtual worlds. Like a true magician in the physical world, a magician in a cyberspace can override "natural" laws. In a cyberspace, a natural law is one that constrains the behavior of all objects in the virtual world except those inhabited or controlled by magicians. Since the powers of a magician are defined with respect to the natural laws of individual spaces, it is not possible to examine the role of a magician without positing the nature of the virtual space, or type of virtual space, in which the role will be enacted.

One important type of cyberspace might be termed terrestrial, to emphasize that the natural laws of such spaces are analogous to the natural laws of physical space, as ordinarily perceived and comprehended by humans on earth. In a terrestrial space, for example, such factors as scale, gravity, and atmosphere (and hence sky color), are all in accord with human terrestrial experience. Terrestrial spaces are important, under the theatrical paradigm, because they are analogous to the types of spaces in which humans evolved. While we can adapt to other types of environments, earth is home, the place where we can most naturally be ourselves. Earth, and human experience on earth, must therefore be the first and foremost concern of any technology that purports to embody humans in virtual spaces. Before we can feel at home anywhere in cyberspace, we must first learn how to feel at home in terrestrial cyberspaces.

The initial problem, then, is to imagine how a spacemaker might play the role of a magician on a virtual earth. Of course ordinary characters would all be subject to terrestrial laws, and could not, for example, walk through walls or over water. Magicians, however, should be able to do all manner of metavirtual things, like change the scale or shape of their bodies, levitate, manouvre freely in space like bees, pass through solid walls, disappear, reappear, hyperjump, and modify virtual objects or conjure up new ones. They might even modify the terrestrial laws themselves, and thus the very fabric of terrestrial space.

5.EXPERIENTIAL DESIGN

Construction in the real world is often a difficult, lengthy, and expensive process for which detailed plans must be carefully designed. But in cyberspace, where physical constraints do not apply, a magician is simultaneously designer, builder, and inhabitant, so there is no need for a formal planning step. A magician can simply do the job directly, conjuring up objects, or getting rid of them, in order to get on with life in the space.

This direct, experiential approach to design is similar to the "spontaneous" or "vernacular" architecture 16 which Christopher Alexander refers to as "the timeless way of building", through which order emerges out of "nothing but ourselves".1 An architecture that eschews formal planning might seem frivolous to modern sensibilities, yet "formal" architecture is a recent European invention that can rarely match the unified and graceful architecture of the "untutored builders in space and time [who] demonstrate an admirable talent for fitting their buildings into the natural surroundings".16 As Richard Neutra put it,

"Shaping man's surroundings entails a lot more than spatial, structural, mechanical, and other technical considerations … Our organic well-being is dependent on a wholesome, salubrious environment. Therefore exacting attention has to be paid to our intricate sensory world. This is primary if our surroundings are to stimulate our abundant perceptual, intellectual, and spiritual capacities, while at the same time accommodating our physiological nature and functional needs in a durable fashion.[11]

6. PROPERTY IN CYBERSPACE

It is important to emphasize that the spacemaker plays the role of a magician who not only builds a cyberspace, but who also lives in it as it is being built. Also, a cyberspace is fundamentally a cybernetic simulation that embodies one or more players 21, So the magician will not necessarily, or even usually, be alone in the evolving space. The magician may have supernatural powers, but this does not mean the magician will be free to do anything at all. Importantly, the magician must respect the private property of other characters, and the public property of the society, or societies, that share the space. Of course, if a magician creates a space from scratch, then the space will belong entirely to the magician, at least until she opens the space to other patrons, either for some public purpose or for private ownership.

Since the spacemaker as magician has supernatural powers and could do extensive damage to the private property of other patrons, consideration must be given to the question of just who is privileged to act in the role of magician. There can be no universal answer to this question, as each society will have its own laws regarding ownership. A society of athletes who patronize a sporting house,21 for example, may decide (or agree as a requirement of membership) that virtual playing fields are strictly public property, and that no patron can assume the role of magician. In other kinds of organizations, like an architectural firm or a game development company, every designer may have magical abilities, though levels of mastery and / or authority may separate magicians into different groups.

7.VIEWPOINT

In cyberspace, under the theatrical paradigm, patrons always have virtual bodies, and always play the roles of virtual beings called characters. There is never an exception to this principle. If you are "jacked into cyberspace, you are somehow connected to a virtual body (a puppet) that you control through movements of your physical body. Usually the puppet will be a model of a human body, if only a blocky envelope or skeleton, but the puppet could be any kind of virtual object that might serve as a body for a character in virtual world. A tree, say.

To keep things simple for the moment, imagine that magicians' puppets (i.e., their virtual bodies) are simple stick figures, but with well-defined heads, eyes, ears, torsos, and hands. A spacemaker can control a magician (that is, the magician's body) from two fundamental points of view: either 1) intrinsically, through the magician's eyes, or 2) extrinsically, from a point of view outside the magicians' body. Under the theatrical paradigm, there is no such thing as a point of consciousness apart from a body in a virtual space, so the magician must use an optical device, like a camera, to get an extrinsic view of a space.

Generally, the term camera is used to refer to any kind of optical device, in a virtual space, that can give a character an extrinsic view of the space. To preserve the patron's sense that he always looks through his own (that is, his character's) eyes, the image from a camera is always presented in a layer of information that is overlayed (as in a heads-up display) over the patron's view of cyberspace. This permits the patron to turn his head in any direction without any confusion about the spatial orientation of virtual cameras. Intrinsic and extrinsic images, in other words, are always projected to different viewing layers or regions in the patron's visual field.

8. BEYOND THE OFFICE OF THEFUTURE

It might seem that role playing has little application apart from traditional theater, but actually role playing is a pervasive aspect of modern professional life. As one very brief example of how the theatrical paradigm might be applied, consider the following scenario involving an architect and his first encounter with a set of prospective clients.

Imagine that you are a male physician in the year 1995, and that cyberspace playhouses are becoming common. You have finally had enough of living in places designed by other people and have decided to construct your own home. After a lot of dreaming, doodling, and serious talking, you and your wife visit a local architect who designs houses in cyberspace. You arrive with some simple sketches and a lot of hazy ideas, and you try as best you can to describe your dream house.

The architect takes it all in knowingly and then says "OK, let's see if we can find something close to what you have in mind". Rising from his desk, he walks to a sliding door and opens it, revealing a closet full of cyberspace apparel. Then, as he pulls two jackets from the rack, he asks whether either of you have ever been in cyberspace before. You say, "Sure, we work out regularly at The Sporting House", a local sports playhouse. He says "Great, then I'll spare you my usual song and dance about the wonders of virtual reality," Handing you each a jacket, a helmet, and a pair of gloves, he adds "I assume you know how to hook these up", and then asks you to have a seat as he gestures towards a long sofa against one wall of his rather large office. Following his instructions, you put on the jacket, gloves, and helmet, leaving the visor up. As you connect the gloves to the jacket and the jacket to the helmet, you look around the room and realize, after noticing the jacks hanging from the ceiling, that the architect's entire office is a well disguised cyberspace stage. Just beneath the surface of this plush, traditional office, with its soft thick carpet and its rich redwood walls, there lies a tangled web of wires, cables, pulleys, motors, connectors, adapters, cameras, boards, panels, monitors, switches, computers, and a hundred other devices that work together to create and sustain a shared

illusion: you cannot see them, but you know they are there, the nerves and tissue of cyberspace.

Three cyberspace jacks hang from the ceiling above the sofa. One jack hangs directly over the center of the sofa while the other two hang over either end. Each jack is about twice the size of a stereo plug and is connected to an umbilical cable, a bundle of video, audio, and digital cables wrapped in a rubber sheath. Each umbilical runs up into the ceiling and through a system of pulleys and take-up reels to a cyberspace engine, one for each of three patrons who might sit on the sofa at the same time. A fourth deck is connected to a jack that hangs over the architect's desk chair.

You walk across the room and reach for the jack hanging over the right end of the sofa. As you sit down, your wife takes a seat on your left. The architect has also donned cyberspace gear and is moving toward his chair as you insert your jack into the connector on the top and back of your helmet. You secure the jack by twisting it slightly to the right within the connector and then flip down your visor. Immediately your surroundings take on the surreal quality of cyberspace, and it is evident you have entered a three dimensional replica of the office. From your experience at the sports playhouse you realize that you have inhabited a virtual body and that it is sitting on a virtual sofa in roughly the same way as your physical body.

Your virtual body is crude and incomplete, amounting to little more than a blobby stick figure with a head, torso, hands, and an inoperable lower body that apparently serves no purpose other than to give you a greater sense of wholeness. Your arms have no visual representation at all, since you are wearing no trackers on your elbows and shoulders (which means there is no way to infer precisely how your physical arms are oriented). Yet, because your virtual hands move in correspondence with your physical hands, you feel as though you have virtual arms even though you cannot see them. You happen to glance to your left just as your wife jacks in and an androgynous figure, an apparent clone of your virtual body, suddenly joins you on the virtual sofa. In front of you is a replica of the architect's desk, with an empty chair. All of a sudden you hear a loud zipping sound, as if a giant had just unzipped an enormous coat, and a third character materializes, filling the empty chair. There is no mistaking who this is, as the character's head is wrapped in a video image of the architect's smiling face. This startles you, as you never encountered anything like it at your sports playhouse, where virtual bodies are simple stick figures. The face is frozen, but dramatic nonetheless, and you marvel at the rapid improvements in cyberspace technology.

The architect says, "Well, looks like we're all here. From now on, just call me Merlin." At this point he explains that the three of you are about to hyperjump to a "space shuttle" parked in front of his virtual office. Then, placing his left hand over his mouth (a gesture that activates a voice keyword recognizer connected to a microphone in his ear), he says "HYPERJUMP … HOMELAND … CONVERTIBLE … BACK SEAT", whereupon you and your wife are suddenly placed in the roles of characters sitting in a vehicle that looks, from your point of view in the back seat, like a convertible with its top down. The architect's character, Merlin, is in the driver's seat, and as he starts the engine and hits the accelerator, the shuttle quickly gathers speed and starts to climb into the air. Merlin banks the shuttle to the left, toward a prominent hill in the virtual landscape, and informs you that he is heading for a neighborhood full of Elizabethan style homes, on the other side of the hill, that he thinks may be similar to the house you described to him.

Inspecting the landscape as you fly over it, you notice that detailed features seem to "pop" into view as you approach them. Houses more than two or three city blocks away are devoid of visual texture or refinement, while features like roof tiles, fence slats, lawn chairs, and garden hoses are readily apparent in the yards and houses directly beneath you. You also

notice that no two houses them to be quite alike, though similar styles of houses are grouped into neighborhoods. Also, as you approach the hill it becomes obvious that the higher elevations are occupied by bigger and more expensive homes.

Finally, Merlin flys the shuttle over the top of the hill and descends towards a neighborhood of houses that do, indeed, look like what you had in mind. After slowly passing several prospects, your wife spots a house that she finds especially intriguing, and she asks Merlin to take you in closer, Merlin lands the shuttle in the house's driveway and says, "Let's have a look."

9. FEASIBILITY

The previous scenario might be dismissed as too fanciful to be of any practical significance were it not that everything described is possible today — without any fundamental technical innovations. There are problems to be overcome, to be sure, and the artistic challenge is immense, but all the hardware one might need to build a cyberspace playhouse is readily available "off the shelf". New software techniques will almost certainly be developed specifically for cyberspace, particularly in areas related to parallel programming, but it is clear, from research conducted at Autodesk and several other places, that interesting virtual worlds can be programmed without recourse to elaborate new techniques. The theatrical paradigm, today, is like the desktop paradigm in 1980. A few people recognized the potential of the desktop, and knew that there was no technical reason why it should not emerge as a dominant paradigm, but it was several more years before desktop publishing could be called an industry (or even named). Indeed, in 1980 few ideas were more fanciful than the notion that mice, iconic user interfaces, and laser printers would soon revolutionize office affairs.

10. CONCLUSION

In this paper and its companion,21 I have put forward a conception of cyberspace as a form of theater, and have proposed a new kind of gathering place, a cyberspace playhouse, where people can go to play roles in simulations of three dimensional worlds. There is still a great deal to ponder and develop, but the outline of a paradigm for cyberspace is beginning to form. In summary, a few (tentative) tenets of this paradigm are the following:

1. Embodiment is central to human rationality, as well as to human experience.

2. Cyberspace is the theatrical medium.

3. Virtual reality is a set of perceived relationships that emerge from a medium.

4. Cyberspace is a technology, a business, a market, an industry, and a virtual phenomenon.

5. Theater is the art and craft of making simulations seem real, and so is spacemaking.

6. The first ingredient of theater is a gathering place (or medium) for a group of people.

7. Patrons play the roles of characters in cybernetic simulations, from which virtual realities emerge.

8. Patrons always have virtual bodies.

9. Patrons always view virtual spaces from the point of view of their virtual eyes within their virtual bodies. The only way to get a view of the virtual world from outside the virtual body is

with an artificial optical aid, like a camera (there is no such thing as a point of consciousness, apart from a body, in cyberspace).

10. Spaces are human habitats, which means they should be a delight to human sensibilities: they should never confuse, disorient, or frustrate their inhabitants (unless designed to do so, as in a game).

At this juncture it is hard to see exactly what impact cyberspace will have on the human condition, but the promise could hardly be greater if humans had stumbled upon a way of access to a new physical universe. Indeed, in cyberspace there can be as many universes as humans have the time and imagination to conceive.

Anmerkungen

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