Virtual Reality as Mass Medium

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Abstract

It is the thesis of this paper that VR is the next revolution in mass communications. There are a number of well-known technological obstacles to the realization of this: bandwidth, cost, processing power, and so on. However, there are other non-obvious, "human" problems facing developers and users of VR technology which are not strictly technical and which will determine its success, acceptance, and usability: conventions of representation, powerful interface metaphors, paradigms of interactivity, protocols for group use, and environments for making and reappropriating tools. We conceive of these various issues in terms of frameworks, access, and connectivity, and illustrate them with examples from other media and from popular culture.

Virtual Reality as Mass Medium

Introduction Virtual reality has definitely captured the popular imagination, but is it trivial trend or total transformation? We believe that VR will be as ubiquitous and important a technology as television and Nintendo, it will be cheap, easy, fun, and an important part of people's lives, and it will transform the way people work and play. However, some thought must be given to how we make, use, and envision this technology which is changing all of our lives, because none of this is going to happen if we limit ourselves to thinking of VR as an imaging technology. We need to understand it as the next revolution in mass communications.

The reader may be confused at this point as to why we are talking about VR as a *mass* medium. Mass communication is historically associated with *broadcast* media, such as newspapers, radio, and television. However, when we say mass media, we mean massively *interactive* media, telephones and email being the two most prominent examples. In our conception, what is important about mass media is that they shape, and are shaped by, popular culture, and have the potential to create new forms of social interaction by connecting large numbers of people. Such media facilitate the creation of new social institutions and forms of culture.

VR promises to be the dominant mass communications medium of the next century. In our century, telephones, radio, television, and computer networks have all contributed to bringing people together. In the next century, media will not be *what* bring people together—they will be *where* people come together. We now live in front of TV; we will soon live *in* VR.

VR, as we conceive it, is the latest attempt to subsume all previous media. It is not clear to what degree it will be a full-sensory environment, nor is it clear how many of our social interactions we will want to carry out within it. However, we do see it as revolutionary because it will be the first medium to combine powerful forms of personal interactivity with mass distribution and access.

VR is a technology of the imagination. Imagination is the prototype of an imaging technology. Within the imagination we manipulate, transform, and process images and other cognitive forms. But we have difficulty sharing the artifacts of our imaginations with other people. In fact, the entire history of media technology can be seen as an attempt to externalize the human imagination: to give it form and to structure it in durable, reproducible, and manipulable representations which we can share with others. But just as the imagination gains its power through being structured, shared and communicated, so too, VR needs powerful frameworks for the communication and manipulation of digital media.

If we look at the prototypical medium—language—we see it provides the structure for imagination. However, saying this is rife with potential misunderstandings and logical errors. Imagination does not *precede* or *give rise to* language—language and imagination come into existence at

the same time. They define each other. They cannot exist without each other. So too with all subsequent media. *The invention of each new medium is concurrent with the invention of a new form of imagination.* If media give the imagination form and makes it accessible to us, then VR needs to be researched and developed within the context of the theory and history of media technology.

VR is a medium. The term "virtual reality" is somewhat of a misnomer; VR is not about reality—it is about mediation. Most researchers emphasize that VR is a tool for representing and manipulating *reality.* Without getting into a discussion about whether or not there is single, coherent reality, it is nonetheless important to agree that the human imagination—and its artifacts—mediates the world for us; we shape and understand the world through our mediations. Consequently, our experience of reality is always already *virtual,* that is, mediated by media.

When we think of VR as a medium, it becomes clear that the project of trying to represent all of reality is misguided. This is helpful for two reasons. In the first place, you can't do it. It is computationally too expensive to represent *all* aspects of the world. As Rudy Rucker [Ruc89] says, the world is as complex as it is because "God has the budget." In the second place, even if you could represent all of reality, you wouldn't want to. Media shape the way we understand our world, our bodies, and ourselves. They establish *conventions of representation*—conventions that make one painting appear "stylized" and another "realistic," one poem "abstract" and another "concrete," and one image a "scientific visualization" and the other a "processed image." It is conventions, abstractions, and representations that make reality intelligible and useful.

When we think of VR as a medium, it also becomes clear that VR is powerful as a means of communication. Communication is only possible if there are shared conventions of understanding. Conventions are precisely what need to be developed if VR is to become a mass communications medium—a medium we use to understand, construct, and envision our world. If we want to understand VR as a technology for manipulating and communicating the artifacts of the human imagination, we should shift our focus to an entirely different set of issues than the familiar technical ones, and turn to disciplines that study them: media, communications, and the arts.

VR is old news. People have been living in virtual worlds for 5,000 years. Every medium is a virtual world. Not yet virtual reality, but a virtual world. Theatre, books, music, film, dance, and amusement parks all create artificial worlds of the imagination. However, throughout the history of media, these virtual worlds, though engaging, have remained, for the most part, separate. So for as long as people have been creating and using media, they have been experiencing the advantages and limitations of virtual worlds.

People have also been doing VR research for 5,000 years. From the beginning of art and technology people have been trying to solve the problems of mass communications and virtual reality. Every communications medium has created virtual worlds and has shaped us in the process. For example, with the advent of movable type, the printed book became the dominant metaphor for understanding the world: nature was a book, human life a story, and to understand people was to "read" them. Likewise, in our own time, the computer has given us a new way of visualizing the world and ourselves: biological and social processes are understood as computational ones, and in cognitive science as in popular culture, the brain is a computer.

The visual and performing arts, painting, theatre, cinema, and music, have developed conventions for the structuring of imaginary environments, for transitions, emphasis, and juxtaposition, which are able to focus and expand our

attention and experience. These techniques offer an important resource of design ideas for VR makers, not only because of their effectiveness, but because they form the core of our methods of understanding; they are the language of the popular culture [of our imagination] which VR must respond to if it is going to take hold and survive.

New technologies create new metaphors, and these new metaphors drive us to consider new kinds of problems and to develop new technologies to address them.

VR is new news. VR research, in its current form, promises several important developments above and beyond "traditional" VR technologies.

One development is that VR will subsume all previous media. Media theorist Marshall McLuhan argued that each new medium takes an older medium as its content—VR takes *all* previous media as its content. Photography subsumed painting, film subsumed photography (and phonograph), television subsumed film (and radio), multimedia is subsuming television (and computers), and VR will subsume multimedia (and telephones).

Another development is that as a digital medium, VR, on the one hand, will allow us to more easily record, manipulate, and communicate information, and on the other hand, it will provide a common representation for the content of all media thus allowing media to be translated into each other. Take music, for example. With digital representations we can create meta-instruments, which allow us to sample, manipulate, and share any sound. If I want an oboe sound in a piece I am creating, I can sample it rather than having to produce it. Furthermore, I can manipulate it in multiple ways; among other things, I can modify the sampled sound itself as well juxtapose it with different sounds. Finally, if I am working with a collaborator in another city, we can work together in a virtual studio.

VR will also allow us to re-integrate the artificially separated worlds of work and learning. There have been a number of historical analyses that show the relationship between the advent of the book and the separation of work and learning [Ill81, Ber83], as well as the separation of people into "children" and "adults"—a separation which did not exist until the middle of the 17th century [Ari62]. With current communications technologies, certain elements of the population are marginalized. We accept specific forms of presence and mediation and do not accept others. We personally know several software consultants who are barely in their teens, at least one of whom has had the unfortunate experience of physically showing up at a client's firm only to be dismissed as a "kid." However, as long as they run their consulting companies out of their houses and conduct most of their business over the net and via telephone, they are treated as the professionals they really are. One might automatically assume that this advantage will be lost in VR when everyone can see everyone else. However, we believe that since people will be able to represent themselves in so many different ways, age, gender, and race could be used less and less as metrics of competence.

Finally, VR can effect powerful transformations on our social institutions through the creation of virtual communities—both in terms of virtual workplaces and in terms of the demographics of society. We already see the effect that email and networks have had on the limited community that has access to them until now: people continue to log in even when they are on vacation, it is possible to be more flexible about when, or if, one comes to work on a certain day, and so on. Imagine how making VR as common as the telephone and extending the capabilities to include images ("video phones," "virtual windows," and "visual teleconferenceing"), sound/speech, and graphic representations will affect people's work habits and the way they choose to live. The automobile created the suburbs: people migrated both out of the cities and

away from the farms. What kind of neighborhoods and boroughs will VR create?

VR is newsworthy. There are a lot of people currently working on the technological problems of VR. Some well-known practitioners include Myron Krueger [Kru91] who has been developing "artificial realities" for artistic and aesthetic experiences; Jaron Lanier [TBB+90] who is working on the development of navigation tools for cyberspace; Frederick Brooks [Bro90] whose development team is creating virtual tools to help biochemists; Scott Fisher [FT90] who is currently working on "telepresence" technology; and Eric Gullichsen [Gul87] who is trying to make VR cheap and accessible to everyone.

There are also a host of people who have been and are developing powerful theoretical frameworks that are directly relevant to understanding the social and intellectual consequences of VR. Among these researchers is Marshall McLuhan [McL66] who has probably done more than any other theorist to make popular the idea that media should be taken seriously as a subject of study; Ivan Illich [Ill88] who is probably the most probing analyst of the relationship between media and societal transformations; Roland Barthes [Bar77] who extended the syntactic, semantic, and pragmatic work of earlier semioticians to develop a powerful theory that accounts for the way meaning changes in changing contexts; Jean Baudrillard [Bau83] who has provided an entire theoretical vocabulary for understanding the relationship between reality and simulation; Umberto Eco [Eco86] who extends the work of McLuhan and Baudrillard to computing, media, and contemporary popular culture; and Brenda Laurel [Lau91] who is drawing on the history of representation and narrative—particularly theatre—in order to develop theoretical frameworks for understanding and enriching the human-computer relationship.

Many of us at MIT's Media Lab are developing VR-related technologies, while attempting to integrate technological with theoretical research. Dave Sturman's work is based, in part, on the insight that the strength of datagloves does not lie so much in *direct manipulation*, but rather in the development of different gestural languages and hand manipulations that provide leverage over the more traditional computer interface paradigms; Margaret Minsky has been developing haptic (tactile) interfaces for virtual environments in order to better understand how textures, for example, can be used for data navigation and representation; Mike McKenna, Steve Pieper, Steve Drucker, Tinsley Galyean, and Michael Johnson have, individually and as a group, been developing underlying representations for graphical and cinematic elements, as well as intelligent agents, for virtual environments; Mike Travers has applied social theory to the development of systems for computer-supported cooperative work in order to create virtual environments that facilitate, among other things, casual interaction; Marc Davis is developing systems for the annotation of multimedia content which address the need for the representation, manipulation, and repurposing of complex, large data in interactive narrative structures; and Kevin McGee is doing research on the integration of work, play, and learning by developing a networked microworld. We believe that these examples illustrate the power and effectiveness of combining the technological with the theoretical.

VR's problem space. What are some of the important problems that need to be solved in order for VR to become a reality? There are three main problem areas that need to be addressed: frameworks which make VR an intuitive, compelling, and transformational medium; access for the widest possible spectrum of users; and forms for connectivity and interaction which support community life.

- We need *frameworks.*

  VR can only succeed if it makes use of powerful conventions of representation. The

organizational and stylistic strategies which make the arts compelling, meaningful, and intelligible to us need to be combined with the intuitive and reliable design aspects of well-made interfaces, machines, and tools. We need languages for representing, manipulating, and constructing data which not only have useful grammars, but engaging rhetorics and poetics as well.

- We need *access.*

  The development of VR needs to take into account individual styles of working and learning, cultural differences, and issues of race, class, and gender in order to make sure VR is accessible to a wide spectrum of users.

- We need *connectivity.*

  Although this is a technical problem, it also a social and psychological problem. We need to facilitate people's ability to connect to things that matter to them: other people, tools, information, resources, and entertainment. We need to address the deep cultural needs for a sense of community and a *rapprochement* between work and learning.

We can learn the most about frameworks, access, and connectivity by looking at popular culture and the history of media.

VR is rooted in popular culture. Popular culture gives us significant clues about what people find important and the properties that they demand of a medium or artifact. Look at "America's Funniest Home Videos," phone sex, CDs, and talk radio. Clearly these touch on people's interests and drives: humor, sex, music, politics. Many of them also function as forums or channels of communication and interaction.

Perhaps the most pervasive and significant pop-culture phenomenon of recent years has been the extraordinary success of Nintendo games (so successful, in fact, that it has become a generic name for video games). Popular phenomena don't just manufacture desires, they point to what people find important. The success of email is in response to the need of a rapidly expanding research community; the success of VCRs is in response to people's need for more control over what they watch and when they watch it; the success of personals is in response to the disappearance of adequate social situations for meeting people; talk radio and community access TV give people the chance to conduct public political discussions; and the success of comic books, science fiction "fan-zines," CNN, and USA Today is the result of people wanting information that is personally relevant and approachable rather than proscriptive and normative. What needs will VR meet in popular culture? It seems that VR speaks to two intertwined needs: the need for community—access and connectivity—and the need for frameworks that structure our activities and help us make them meaningful—fantasy being perhaps the most compelling example.

Think about what makes Nintendo so popular. Among other things, it is a shared experience. There are magazines, clubs, and television shows. People can participate in the culture of Nintendo. They can talk about it at school or the office, trade game cartridges with their friends, exchange strategies and tips, and play together. Most importantly, members of the Nintendo community have a common language for talking about their lives in terms of the games they all play. Nintendo also offers a rich environment for fantasy. The multitude of characters and their various challenges provide powerful vehicles for role-playing, identification, and transference. They create a virtual world in which players can explore and act out their problems, concerns, and desires.

We can already see where Nintendo is going—and, to some degree, what VR will be like—by looking at networked games. These games,

called MUDs (for "multi-user dungeons") are an extension of earlier board games (notably *Dungeons & Dragons*) and computer text-adventure games (like *Zork*). To enter MUDs, individuals log into remote computers and find themselves in simulated worlds. Players are able to give themselves names, to look around, to interact with the environment by touching things, picking things up, talking to people, and by building extensions to the environment. Some of the characters in these environments are simply the result of programming—other characters are other players, logged in remotely from their computers. MUDs create a shared space of the imagination, a zone of interactive imaginary play in which groups of people can come together. Like comic books, Nintendo, movies, and MTV, they speak to, and articulate, a structured space for satisfying our deep cultural needs for community and fantasy.

We need to develop VR so it will become integrated into and change people's lives: so it will allow us to communicate with each other and facilitate desires we already have. VR must become a part of popular culture. It is a truism that pornography drove the VCR industry. However, it did more than drive it. Popular culture not only drives technologies—it sustains them and makes them worth having. It may be argued whether pornography is what makes the VCR worth having (though for some people it is), but it is certainly the case that a widespread demand for music, entertainment, political information, and religious writings continues to make the CD, the movie, the magazine, and the book worth having. VR must address the needs and desires expressed in popular culture, while at the same time providing the technology for articulating, communicating, and satisfying those needs and desires. And, of course, as with every other medium, sex will drive this one too.

VR is rooted in the history of media. The history of media—of the different conventions they developed and the social consequences they had—is full of important examples that can help us understand and satisfy people's need for frameworks, access, and connectivity.

- All media structure our lives and perceptions by establishing frameworks and conventions. For example, the first close-up of a woman's face in a movie literally sent audience members screaming from the theatre in fear. Similarly, in early movies, if a character was going to ride an elevator to another floor, the camera would continuously (without cuts) follow him into the elevator, show him telling the elevator operator which floor he wanted to go to, show him standing in the elevator, and then follow him out when it got to his floor. Film makers simply couldn't rely on audience members to understand what was happening if the film cut from a man entering an elevator to the same man walking out of an elevator. Conventions of seeing have to be cultivated and developed in order for audiences to understand and make use of media.

  Perhaps the clearest contemporary example of this is the spreadsheet. By building on the strengths of the computer's ability to handle computation, the spreadsheet totally transformed the way we work with numbers and data. On the other hand, the word processor, though it has certainly had a powerful effect on the way we work with text, is often cited as an example that has so far been unsuccessful in re-framing our relationship to the written word. One of the things we can learn from this is that it is often not enough to merely transfer an existing framework to a new technology. This is something we have to be acutely aware when we consider VR.

- Access has mixed effects. Depending on the types of access we have, the effects can

be positive or negative. Think of the telephone answering machine which was supposed to liberate us from being tied to the telephone and thus give us more free time. Now we call in for messages, play phone tag all day, and spend more time on the phone than ever before. Conversely, the video camera was once feared as the ultimate surveillance tool the state could use against its citizens. Now with the proliferation of the camcorder, we keep tabs on the state—as in the Rodney King incident, in which a passerby videotaped the violent beating of an African-American motorist by a group of police. In this case, access to individual tools (the camcorder) produced something compelling enough to provide access to corporate tools (the television networks). This is not always the case, and we will do well to learn from the cases where important information is withheld as well. It remains to be seen what unintended effects VR will have. What is certain is that they will be momentous.

- We often overlook peoples' need to connect with each other. For example, there is the well-known story that ARPANET was originally designed to connect researchers to the mainframes of larger institutions. One of the minor features of the system was something called "electronic mail." We all know what happened to that "minor feature." Users created conventions of interaction, forums for debate, and built bulletin boards, news groups, and news services. In effect, they built an entire culture around and with this technology.

There are many other insights we could derive from these examples, but three in particular are worth mentioning. First, each medium has to teach its use. Second, new media always have unintended effects. Finally, people appropriate media to their own ends. As we develop VR technology, we should keep these insights in mind and continue to look for more ideas and lessons from popular culture and the history of media.

Conclusion We believe that technological innovation is enriched when it is informed by an understanding of the way people making meaning, the strengths and weaknesses of a medium, the history of successful innovation, and the theoretical underpinings of media, communications, representation, and popular culture. Of course it is possible to build powerful tools without any grounding in theories of representation, the history of media, or studies popular culture. Those of us who develop technical systems do so for a variety of reasons, and there is always some part of the bigger picture which we ignore because we don't know or care about it. However, it is our belief that the story about email provides a perfect example of how to take into account the ideas we talk about in this paper. VR must be constructed in a way that facilitates its appropriation by the culture at large. This will be the right thing for two reasons. First, it means we don't have to solve—or even work on—all the problems; the architecture of our systems just has to allow users to work on the problems we didn't recognize or have the capacity to work on. The second reason is by far the more important one. If VR is going to be the next revolution in mass communications media, if it is going to realize the dream of externalizing and sharing the human imagination, then VR research needs to respond to popular culture and not lose contact with the people who use, make, and study mass media.

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