Immersion *vs.* Interactivity:
Virtual Reality and Literary Theory[1]

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Few of us have actually donned a HMD (head-mounted display) and DGs (data-gloves), and entered a computer-generated, three-dimensional landscape in which all of our wishes can be fulfilled: wishes such as experiencing an expansion of our physical and sensory powers; getting out of the body and seeing ourselves from the outside; adopting a new identity; apprehending immaterial objects with most of our senses, including touch; being able to modify the environment through either verbal commands or physical gestures; seeing creative thoughts instantly realized without going through the process of having them physically materialized.

Yet despite the fact that virtual reality as described above is still largely science fiction, still largely what it is called—a virtual reality— there is hardly anybody who does not have a passionate opinion about the technology : some day VR will replace reality; VR will never replace reality; VR challenges the concept of reality; VR will enable us to rediscover and explore reality; VR is a safe substitute to drugs and sex; VR is pleasure without risk and therefore immoral; VR will enhance the mind, leading mankind to new powers; VR is addictive and will enslave us; VR is a radically new experience; VR is as old as Paleolithic art; VR is basically a computer technology; all forms of representation create a VR experience; VR challenges the distinction fiction-reality; VR is the triumph of fiction over reality.

We may have to wait until the next millennium to see whether these promises and threats will be materialized, but since VR technology is depicted so realistically by its prophets, and since it exists very much in the popular imagination, we don't have to wait that long to submit the claims of its developers to a critical investigation. In this paper I propose to analyze VR as a semiotic phenomenon and to explore its implications for literary theory and the question of textuality.

The Two Components of VR

My point of departure is this definition by Pimentel and Texeira: "In general, the term virtual reality refers to an immersive, interactive experience generated by a computer" (11). While "computer generated" accounts for the virtual character of the data, "immersive" and "interactive" explain what makes the computer-assisted experience an experience of reality. To apprehend a world as *real* is to feel surrounded by it, to be able to interact physically with it, and to have the power to modify this environment. The conjunction of immersion and interactivity leads to an effect known as *telepresence*: "A virtual reality is defined as a real or simulated environment in which the perceiver experiences telepresence" (Steuer 76). Telepresence relates to presence as virtual reality relates to reality:

> Telepresence is the extent to which one feels present in the mediated environment, rather than in the immediate physical environment ... This [mediated environment] can be either a temporally or spatially distant *real* environment ... or an animated but nonexistent *virtual world* synthesized by a computer. (*ibid*)

Analyzing the dimensions of telepresence, Steuer (78) proposes a combination of factors that come very close to Pimentel and Texeira's formula: the sense of telepresence is a function of the vividness of the representation—which leads to immersion—and of interactive involvement with the electronic display.

As a literary theorist, I am primarily interested in the two components of the VR experience as a novel way to describe the types of reader response that may be elicited by a literary text. I propose therefore to transfer the notions of immersion and interactivity from the technological to the literary domain and to discuss the conditions of their textual implementation. While interactivity has been extolled by postmodern theory as the triumph of its own aesthetic ideals of a creative reader, an open text, and a ludic relation to language, immersion has been either ignored or dismissed as the holdover of a now-discredited aesthetics of illusion that subordinates language to its referent, and ignores its power of configuration over the reality it is supposed to represent. Through this comparative study of the immersive and interactive potential of literature and VR technology, I hope to pave the way for a more critical investigation of the concept of interactivity in literary

theory, a rehabilitation of the experience of immersion, and a greater aware-
ness of the expressive properties of the medium that supports literature.

Immersion

Since immersion depends on vividness, its factors are closely related to
the devices that lead to realism in representation. A factor that comes imme-
diately to mind is the projection of a three-dimensional display. The intro-
duction of perspective in painting took a first step toward immersion by
creating a sense of depth that integrated the spectator into the pictorial
space. In a work like "Chair" by van Gogh, for instance, the spectator is
situated above and to the left of the depicted object. But because the me-
dium of painting simulates depth on a flat surface the spectator cannot
break through the canvas and walk into the pictorial space. In the visual
displays of VR the barrier disappears—there is no plane of projection—
and the user feels surrounded by a virtual world that can be freely ex-
plored and "navigated," as a standard metaphor describes movement in
cyberspace.

The creation of a 3D effect falls under a more general category that
Steuer (81) calls "depth of information." This depth is a function of the reso-
lution of the display, i. e. of the amount of data encoded in the transmission
channel. As the other main source of immersion, Steuer mentions the
"breadth of information," a category defined as "the number of sensory
dimensions simultaneously presented." Breadth of information is achieved
through the collaboration of multiple media: image, sound, olfactory sig-
nals, as well as through the use of technical devices allowing tactile sensa-
tions (body suit). VR is not so much a medium in itself, as a technology for
the synthesis of all media toward a total experience.

Sheridan (58) proposes another factor of telepresence that stands half-
way between immersion and interactivity: the control of the relation of sen-
sors to the environment. In order to feel immersed, the user must be able to
move around the virtual space and to apprehend it under various points of
view. The computer tracks his movements and generates the sensory data
corresponding to his position in a continuously shifting display. The control
of sensors can go as far as a leaving the body, relocating the center of con-
sciousness into foreign objects and exploring in this way places and objects
normally inaccessible to humans, such as the inside of a molecule, or the
geography of a distant planet.

Insofar as immersion is "the blocking out of the physical world" (Biocca 25), it cannot be experienced if the user remains aware of the physical generator of the data, namely the computer. The "virtual reality effect" is the denial of the role of signs (bits, pixels, and binary codes) in the production of what the user experiences as unmediated presence. It is significant that Pimentel and Texeira title their first chapter "The Disappearing Computer;" as in the *trompe-l'oeil* of illusionist art, the medium must become transparent for the represented world to emerge as real. VR represents in this respect the refutation of a popular myth: the personification of the computer as an autonomous mind (a myth fostered by artificial intelligence and its attempt to endow machines with creative thinking). As Brenda Laurel declares, "Throughout this book [*Computers as Theater*] I have not argued for the personification of the computer but for its invisibility" (143). Jaron Lanier, a leading developer of VR systems, echoes: "With a VR system you don't see the computer anymore—it's gone. All that's there is you" (Lanier and Biocca 166). The disappearance of the computer— which constitutes the culmination of the trend toward increasing user-friendliness in computer design— requires the replacement of arbitrary codes with natural modes of communication. Binary coded machine instruction once gave way to the mnemonic letter-codes of assembly languages; assembly languages were in turn translated into high-level languages with a syntax resembling that of natural languages. Then arbitrary words were supplanted by the motivated signs of icons on the screen. In the foreseeable future, the machine will be enabled to respond to spoken commands, and the keyboard will become superfluous. Next to go will be the screen and the sight of the machine: visual displays should occupy the entire field of the user's vision, rather than forming a world-within-the world, separated from reality by the frame of the monitor. As Gabriel D. Ofeisch observes, "as long as you can see the screen, you're not in VR. When the screen disappears, and you can see an imaginary scene...then you are in VR" (quoted in Pimentel and Texeira, 7). Last but not least, language itself must disappear, at least in those areas where it can be more efficiently replaced by physical actions. According to Jaron Lanier, "There's also the ability of communicating without codes...I'm talking about people using their hands and their mouth, whatever, to create virtual tools to change the content of a virtual world very quickly and in an improvisational way" (160). "So, if you make a house in virtual reality, and there's another person there in the virtual space with you, you have not created a symbol for a house or a code for a house. You've actually made a house. It's that direct creation of reality; that's what I call post-symbolic communica-

tion" (161). For Michael Benedikt, this post-symbolic communication signals the beginning of a "postliterate" era in which "language-bound descriptions and semantic games will no longer be required to communicate personal viewpoints, historical events, or technical information... We will become again 'as children' but this time with the power of summoning worlds at will and impressing speedily upon others the particulars of our experience" (12). In this language without symbols, minds will become transparent to each other:

> Simply, virtual reality, like writing and mathematics, is a way to represent and communicate what you can imagine with your mind. But it can be more powerful because it doesn't require you to convert your ideas into abstract symbols with restrictive semantic and syntactic rules, and it can be shared by other people. (Pimentel and Texeira, 17)

The mystics of ages past (such as Swedenborg, an esoteric philosopher of the eighteenth century) had a term for this radically anti-semiotic mode of communication. They called it "the language of the angels."[2]

Immersion and Literary Theory

Through its immersive dimension, VR inaugurates a new relation between computers and art. Computers have always been interactive; but until now the power to create a sense of immersion was a prerogative of art. VR constitutes in this respect an attempt to put art into computer design. It is significant that when attempting to describe the immersive quality of the VR experience, the proselytizers of the technology repeatedly turn toward a metaphor borrowed from the literary domain:

> As [users] enter the virtual world, their depth of engagement gradually meanders away from here until they cross the threshold of involvement. Now they are absorbed in the virtual world, similar to being in an engrossing book.
> The question isn't whether the created world is as real as the physical world, but whether the created world is real enough for you to suspend your disbelief for a period of time . This is the same mental shift that happens when you get wrapped up in a good novel or become absorbed in playing a computer game. (Pimentel and Texeira, 15)

If developers of VR compare their technology to being caught up in a story, literary theorists could profitably return the favor by regarding the text as a virtual reality. Even before the term "virtual reality" became fashionable, this approach has been taken by a school of literary theory inspired

by the philosophical concept of possible worlds. (Its representatives include Eco, Pavel, Dolezel, Ryan and Ronen.) Possible worlds theory relies on a semantic model including a plurality of worlds, and regarding one of these worlds as the one and only actual world. The distinction actual/non-actual can be characterized absolutely, in terms of origin, or relatively, in terms of point of view. In the absolute characterization, the actual world is the only one that exists independently of the human mind; merely possible worlds are products of mental activities such as dreaming, wishing, forming hypotheses, imagining, and writing down the products of the imagination in the form of fictions. VR adds to this catalog of "accessibility relations" a mode of apprehension that involves not only the mind, but also the body. For the first time in history, the possible worlds created by the mind become palpable entities, despite their lack of materiality. The relative characterization of the concept of actuality—advocated by David Lewis—regards "actual" as an indexical predicate: the actual world is the world from which I speak and in which I am immersed, while the non-actual possible worlds are those that I look at from the outside. These worlds are actual from the point of view of their inhabitants. This indexical definition explains why fictional characters regard themselves as real human beings, and not as the products of a writer's imagination.

Among the modes of apprehension that enable us to contemplate non-actual possible worlds, some function as space-travel vehicles while others function as telescopes. In the telescope mode —represented by expressing wishes or forming conjectures about what might have been—consciousness remains anchored in its native reality, and possible worlds are contemplated from the outside. In the space-travel mode, represented by fiction and now by VR technology, consciousness relocates itself to another world, and recenters the universe around this virtual reality. This gesture of recentering involves no illusion, no forgetting of what constitutes the reader's native reality. Non-actual possible worlds can only be regarded as actual through Coleridge's much quoted "willing suspension of disbelief." The reader of a fiction knows that the world displayed by the text is virtual, a product of the author's imagination, but she pretends that there is an independently existing reality serving as referent to the narrator's declarations.

The notion of pretense and the related concept of games of make-believe is at the core of Kendall Walton's theory of fiction. According to Walton, a fictional text (as well as a painting) is a "prop in a game of make-believe" (*Mimesis*, 11). The game consists of selecting an object and of regarding it as something else, usually in agreement with other players. Just as a stump

may stand for a bear in a children's game, the picture of a ship is taken for a ship, and the text of a novel is taken for an account of real facts (an account that may or may not be regarded as accurate, as the case of unreliable narration demonstrates). Players project themselves as members of the world in which the prop is a bear, a ship or a text about the real world, and they play the game by "generating fictional truths." This activity consists of imagining the fictional world, according to the directives encoded in the prop. Some of the fictional truths concern the players themselves, or rather their fictional alter ego. The reader of a fiction does not simply generates truths of the type "p is fictional" but also "it is fictional that I believe p." And if p relates the pitiful fate of a character, it will be fictional that the reader's alter ego pities the character. The emotions experienced in make-believe in the fictional world may carry over to the real world, causing physical reactions such as crying or tensing up in fear. The affinity of Walton's theory of fiction with virtual reality and its concept of immersion resides in his insistence on the participation of the appreciator in the fictional world. It is truly a theory of "being caught up in a story."

An immersive approach to fiction has also been favored by recent studies in cognitive psychology. Victor Nell titles his book on the psychology of reading for pleasure *Lost in a Book*. Another psychologist, Richard Gerrig, proposes a phenomenology of reading based on two metaphors, both supported by concrete reader-text experiments: the metaphors of transportation and of performance. By transportation, Gerrig means an experience of moving away from the immediate physical environment and losing oneself in a story. Performance is the activity of participating in the fictional world "like an actor on a stage." In order to achieve participation, readers must "use their own experience of the world to bridge gaps in the text" (i. e. generate fictional truths, in Walton's terminology); "bring both facts and emotions to bear on the construction of the world of the text"; and "give substance to the psychological live of characters" like "actors performing roles" (17).

Anticipating the work of the phenomenologists, many literary authors have given thoughts to the phenomenon of immersion. Joseph Conrad advocates the participation of an extended sensorium in the fictional world: "My task which I am trying to achieve is, by the power of the written word, to make you hear, to make you feel—it is, before all, to make you see. (Joseph Conrad in the Preface to *The Nigger of the Narcissus*, xxvi.) Charlotte Brontë dramatizes immersion by inviting the reader to perform physical actions in the fictional world: "You shall see them, reader. Step into this neat

garden-house on the skirts of Whinbury, walk forward in the little parlor—they are there at dinner...You and I will join the party, see what is to be seen, and hear what is to be heard" (*Shirley*, 9). In this passage, immersive reading goes a step further than the customary fictional relocation of the reader's consciousness in that the relocated consciousness grows an imaginary body that takes up residence in the fictional world. For Brontë, full immersion thus requires the presence in the imagination of a physical world to a physical body. Reaching this sense of presence is not a passive subjection to the text, but the result of a demanding mental activity. Nowhere is this discipline more eloquently described than in the spiritual exercises prescribed to the reader of the Bible by Ignatius de Loyola:

> At the simplest level, those practicing the exercise would call to mind the physical setting in which a given event took place, or what Ignatius called 'an imaginary representation' of the place: for instance, the road from Bethany to Jerusalem on which Christ traveled toward his passion, the room in which he held his last supper, the garden in which he was betrayed, the house in which Mary his mother waited after the Crucifixion. Within these contexts, said Ignatius, one could move to a sharper picture by adding a sense of hearing: "listen to what is being said by the people on the earth's surface, talking to each other, swearing and blaspheming." Contrast with the words of the three divine persons of the Trinity, and listen to them as they say: "Let us bring about the redemption of mankind." After seeing and listening, one can proceed to involve the rest of the five senses in the act of memory: "Smell the indescriptible fragrance and taste the boundless sweetness of the divinity. Touch by kissing and clinging to the places where these persons walk and sit, always trying to profit thereby." (Spence, 15)

In this reading discipline, no mention is made of the actual words of the Biblical text. Like computer-generated VR, immersive theories of reading presupposes a relative transparency of the medium. When readers are caught up in a story, they turn the pages without paying too much attention to the letter of the text : what they want is the plot, the least language-dependent dimension of narrative communication. When they experience emotions for the characters, they do not relate to these characters as literary creations nor as "semiotic constructs," but as possible human beings.

The literary features that create a sense of participation in fictional worlds present many parallels with the factors leading to telepresence. One of the factors mentioned above is the projection of a three-dimensional environment. The literary equivalent of three-dimensionality is a narrative universe possessing some hidden depth, and populated by characters perceived as round rather than flat. By hidden depth I mean that the sum of fictional

truths largely exceeds the sum of the propositions directly stated in the text. In a virtual world experienced as three-dimensional, the user knows that reality is not limited to what can be seen from a given position: the outside conceals the inside, the front conceals the back, and small objects in the foreground conceal large objects in the background. Similarly, in a narrative world presenting some "hidden depth" there is something behind the narrated: the characters have minds, intents, desires, and emotions, and the reader is encouraged to reconstruct the content of their mind, either for its own sake, or in order to evaluate their behavior. The procedures of inference relating to inner life would be inhibited in the case of the referents of human names in lyric poetry or in some postmodern novels where characters are reduced to stereotypes, actantial roles or allegories. When the reader feels there is nothing beyond language, inference procedures become largely pointless.

As is the case in VR systems, the reader's sense of immersion and empathy is a function of the depth of information. It is obvious that detailed descriptions lead to a greater sense of belonging than sketchy narration. This explains why it is easier be caught up in a fictional story than in a newspaper report. But in purely verbal communication—in contrast to the visual or auditory domains—depth of information may reach the point of saturation and create an alienating effect: the length and minute precision of the descriptions of a Robbe-Grillet, as well as their restriction to purely visual information, constitute a greater deterrent to immersion than the most laconic prose. Breadth of information is not literally possible in fiction, since we are talking about writing and not about multi-media communication. But insofar as it relays sensations through the imagination, literary language can offer data to all of the senses, thus increasing the vividness of the representation. It has been said that a book is "cinema in your head" (Fischlin and Taylor 13). It is in fact much more than that : language can represent to the imagination the entire spectrum of human experience.

Another factor of immersion that seems at first glance impossible in textual communication is the control of the sensors. The reader only sees (hears, smells, etc.) what the narrator shows. But to the extent that the narrator's sensations become the reader's, fiction offers a mobility of point of view at least as extensive as that of VR systems. The development of a type of narrator specific to fiction—the omniscient, impersonal narrator— has freed fictional discourse from the constraints of pragmatically possible human communication. The disembodied consciousness of the impersonal narrator can apprehend the fictional world from any perspective, adopt any

member of the fictional world as focalizer, select any spatial location as post of observation, narrate in every temporal direction (retrospectively, simultaneously, even prospectively), and switch back and forth among these various narrative modes. Fiction, like VR, allows an experience of its reference world that would be impossible if this reference world were an objectively existing, material reality.

The ultimate freedom in the movement of the sensors is the adoption of a foreign identity. As Lasko-Harvill observes, "in virtual reality we can, with disconcerting ease, exchange eyes with another person and see ourselves and the world from their vantage point" (277). This "exchanging eyes with another person" is paralleled in fiction by the possibility of speaking about oneself in the third person, or of switching between first and third when speaking about the same referent. But there is an even more fundamental similarity between the role-playing of VR and the nature of narrative fiction. As authors strip themselves of their real world identity to enter the fictional world, they have at their disposal the complete spectrum of conceivable roles, from the strongly individuated first person narrator (who can be any member of the fictional world) to the pure consciousness of the third person omniscient narrator.

Both VR and fiction present the ability to transcend the boundaries of human perception. Just as VR systems enable the user to penetrate into places normally inaccessible to humans (the interior of a cell or the surface of Mars), fiction legitimates the representation of what cannot be known: a story can be told even when "nobody lived to tell the tale." Of all the domains represented in fiction, no one transcends more blatantly the limits of the knowable than foreign consciousness. As Dorrit Cohn observes: "But this means that the special life-likeness of narrative fiction—as compared to dramatic and cinematic fiction—depends on what writers and readers know least in life: how another mind works, how another body feels" (5-6).

The effacement of the impersonal narrator and his freedom to relocate his consciousness anywhere, at any time and in whatever body or mind conveys the impression of unmediated presence: minds become transparent, and events seem to be "telling themselves." The mobility of the "sensors" that apprehend fictional worlds allow a degree of intimacy between the reader and the textual world that remain unparalleled in nonfiction. Paradoxically, the reality of which we are native is the least amenable to immersive narration, and reports of real events are the least likely to produce a feeling of being on the scene. New Journalism, to the scandal of many, tried to overcome this textual alienation from nonvirtual reality by

describing real-world events through fictional techniques. The strain of credibility that ensued from this practice could only be forgiven by isolating New Journalism from the traditional brand of reporting through the compromise of a generic label: True Fiction, or Nonfiction Novel. In the television domain, the proliferation of the "docu-drama" bears testimony to the voyeuristic need to "be there" and to enjoy fiction-like participation, not only in imaginary worlds, but also in historical events.

Against Immersion

The theme of the danger of immersion has not awaited the advent of the electronic age to be thematized in Western literature. Its most celebrated victim is probably Don Quixote. As Cervantes writes: "In short, he so immersed himself in those romances that he spent whole days and nights over his books; and thus with little sleeping and much reading, his brains dried up to such a degree that he lost the use of his reason" (58). More recently, in Julio Cortázar's short story "Continuity of Parks," a reader immersed in a thriller becomes the victim of the narrated murder, thus paying with his life the disappearance of the boundary between fiction and reality.

Theories of fiction emphasizing participation in fictional worlds represent a somewhat reactionary trend on the contemporary cultural scene. Immersion in a virtual world is viewed by most theorists of postmodernism as a passive subjection to the authority of the world-designer, a subjection exemplified by the entrapment of tourists in the self-enclosed virtual realities of theme parks or vacation resorts. According to Bolter, immersion is a trademark of popular culture: "Losing oneself in a fictional world is the goal of the naive reader or one who reads as entertainment. It is particularly a feature of genre fiction, such as romance or science fiction" (155). There is no point in denying that the worlds of the stereotyped texts of popular culture are the most favorable to immersion: the reader can bring in more knowledge and sees more expectations fulfilled than in a text that cultivates a sense of estrangement. But immersion can also be the result of a process involving an element of struggle and discovery. A literary text is the most satisfying when it lures the reader into what appears at first a hostile environment.

The hostility of contemporary literary theory toward immersion is due in large part to the dependency of the phenomenon on the disappearance of signs. The VR ideal of a transparent medium is heretic in an age that regards signs as the substance of all realities. For postmodern theory, what-

ever "freedom from signs" the mind can reach is not achieved through their disappearance, but through the awareness of their omnipresence, as well as through the recognition of their conventional and arbitrary character. The aesthetics of immersion is currently being replaced—primarily in "high culture" but the tendency is now stretching toward popular culture—by an aesthetics of textuality. Signs must be made visible, for their role in the construction of reality to be recognized. A mode of communication that strives toward transparency of the medium bereaves the user of his critical faculties. The semiotic blindness caused by immersion is illustrated by an anecdote involving Diderot. As William Martin reports, "he tells us how he began reading *Clarissa* several times in order to learn something about Richardson's techniques, but never succeeded in doing so because he became personally involved in the work, thus losing his critical consciousness" (Martin 58). According to Bolter, this loss of critical consciousness is the trademark of the VR experience: "But it is obvious that virtual reality cannot in itself sustain intellectual or cultural development. ...The problem is that virtual reality, at least as it is now envisioned, is a medium of percepts rather than signs. It is virtual television" (230). "What is not appropriate is the absence of semiosis" (231).

In reducing VR to passive immersion, however, Bolter ignores the second component of the VR experience. If contemporary art and literature are to achieve an enhancement of the reader's creativity, it should be through the emulation of the interactive aspect of VR, and not through the summary condemnation of its immersive power.

Interactivity

Interactivity is not merely the ability to navigate the virtual world, it is the power of the user to modify this environment. Moving the sensors and enjoying freedom of movement do not in themselves ensure an interactive relation between a user and an environment: the user could derive her entire satisfaction from the exploration of the surrounding domain. She would be actively involved in the virtual world, but her actions would bear no lasting consequences. In a truly interactive system, the virtual world must respond to the user's actions.

While the standard comparison for immersion derives from narrative fiction, the most frequently used metaphor of interactivity invokes theatrical performance. The simile captures a largely utopian dream of dramatic art: putting spectators on stage and turning them into characters:

As researchers grapple with the notion of interaction in the world of computing, they sometimes compare computer users to theatrical audiences:

> Users are like audience members who are able to have a greater influence on the unfolding of the action than simply the fine-tuning provided by conventional audience response... The users of such a system are like audience members who can march up onto the stage and become various characters, altering the action by what they say and do in their roles. (Laurel, *Computers,* 16)

The interactivity of a VR system resides in a form of representation known as simulation. As Woolley observes (44), the difference between representation and simulation, or rather, the distinction of simulation from other forms of representation (such as imitation) is difficult to define, but it is crucial to the understanding of VR. The essence of simulation resides in its dynamic character. Friedman (86) calls simulation a "map-in-time" with a narrative dimension. But this feature of temporality, which enables simulative systems to represent change and movement, is not sufficiently distinctive: a camera can also record change and yield a narrative, though it does not produce a simulation. The difference between a movie and a computer simulation of the same process, such as an airplane flight, lies in the active role of the system. A camera records a flight passively, and the flight takes place independently of its recording, even if it was staged for a movie. Once recorded, the flight can be played over and over again and remain the same: iterability is the essence of cinematic representation. In contrast to a camera, a computer simulation does not reproduce a preexisting process, not does it output a durable image. The flight is the product of the simulator, and every use of the system produces a different sequence of events. It would take a recording device to replay the same flight. The non-iterability of the simulation derives from the fact that change and movement are calculated by the system on the basis of a variable input produced by an external source, such as a random-number generator or human user. In this latter case, the simulation becomes the narrative of the user's pursuit of a personal goal in collaboration with the system. Success or failure depends on the user's understanding of the laws of the virtual world.

An important feature of the interactivity of simulative systems is its so-called "real-time" dimension. The timing of the input is of crucial importance, since the response of the system depends on its current state. (Think of the different consequences of steering an airplane downwards when you are up in the sky or close to the ground!) Because simulation operates in real

time, the experience of the user is that of a continuously moving present. In contrast to traditional narrative, simulation does not represent history retrospectively, fashioning a plot when all events are in the book, but generates events prospectively, without knowledge of the outcome. The user may have a goal, but the input can miss the target. The trace of the simulation tells the story of the tribulations of the user in the pursuit of her goal.

Taken as a whole, however, a simulative system is not a narrative but a narrative matrix. Like a "Garden of Forking Paths"—to parody the title of a short story by Borges—it is open to all the histories that could develop out of a given situation. The system can also be compared to an alphabet containing all the books on a given subject, while the simulation itself is the actualization of a potential book, a book that vanishes when the writing in completed.

The degree of interactivity of a VR system is a function of a variety of factors. Steuer enumerates three of them, without claiming that the list is exhaustive :

> [S]peed, which refers to the rate at which input can be assimilated into the mediated environment; *range*, which refers to the number of possibilities for action at any given time; and *mapping*, which refers to the ability of a system to map its controls to changes in the mediated environment in a natural and predictable manner. (86)

The first of these factors requires little explanation. The speed of a system is what enables it to respond in real time to the user's actions. Faster response means more actions, and more actions mean more changes. (Existing systems, because of hardware limitations, are somewhat deficient in this domain. With currently available HMDs, the generation of visual data is said to lag annoyingly behind the movements of the head.) The second factor is equally obvious: the choice of actions is like a set of tools; the larger the set, the more malleable the environment. The factor of mapping imposes constraints on the behavior of the system. Insofar as "mapping" is defined in terms of natural response, it advocates the disappearance of arbitrary codes. Far from being associated with passive immersion, semiotic transparency is conceived by VR developers as a way to facilitate interactivity. The predictability of the response demonstrates the intelligence of the system. The user must be able to foresee to some extent the result of his gestures, otherwise they would be pure movements and not intent-driven actions. If the user of a virtual golf system hits a golf ball he wants it to land on

the ground, and not to turn into a bird and disappear in the sky.[3] On the other hand, the predictability of moves should be relative, otherwise there would be no challenge in using the system. Even in real life, we cannot calculate all the consequences of our actions. Moreover, predictability conflicts with the range requirement: if the user could choose from a repertory of actions as vast as that of real life, the system would be unable to respond intelligently to most forms of input. The coherence of flight-simulation programs stem for instance from the fact that they exclude any choice of activity unrelated to flying. Meaningful interactivity requires a compromise between range and mapping and between discovery and predictability. Like a good narrative plot, VR systems should instill an element of surprise in the fulfillment of expectations.

The *caveat* of putting spectators on stage is that if they take control of the action, the resulting performance may become utter chaos. The participation of users is both pursued and feared: "The problem with the audience-as-active-participant idea is that it adds to the clutter, both psychological and physical" (Laurel, *Computers*,17). The spectator is welcome on stage only if he can be made to behave in an orderly manner. In order to maintain some dramatic value, the performance must impose a script on the spectator's participation, a script that will channel his actions toward a goal sanctioned by the system. As Laurel argues : "The well designed [virtual world] is, in a sense, the antithesis of realism—the antithesis of the chaos of everyday life" (quoted by Pimentel and Texeira, 157). Howard Rheingold stresses the need for "scenario control": "They [VR developers] want a world that you can walk around in, that will react to you appropriately, and that presents a narrative structure for you to experience" (307). Is this a utopian goal ? Can the spectator turned actor be coaxed into taking actions that will give her pleasure, when she doubles as spectator of her own deeds? This goal is relatively easy to achieve in the visual domain: the repertory of elements controlled by the user—colors, shapes, and movements— can be preharmonized, so that every combination results in a pleasant experience. Additional pleasure will be derived from controlling the display through physical gestures: a pleasure taken in the creative power of the body itself. But coordinating the user's input in a narratively meaningful structure is much more difficult than harmonizing visual elements. It is in very restricted domains regulated by narrowly defined "narrative" scripts (flight simulators, golf, paddle ball, etc.), or in areas not subjected to the requirements of narrative logic (visual displays, or systems combining visual data with sound

and dance) that VR systems achieve the most satisfactory compromise between user freedom and system control.

Interactivity and Literature

In textual matters, the concept of interactivity can be interpreted in two ways: figuratively and literally. Each of these two interpretations may in turn be divided into a weak and a strong form:

	Figural	Literal
Weak	Classical narrative	Hypertext
Strong	Postmodern texts	MOOs, Interactive Drama

1. Figural interactivity

In the figural sense, interactivity stands for the collaboration between the reader and the text in the production of meaning. Even with traditional types of narrative and expository texts—texts that strive toward global coherence and a smooth sequential development—reading is never a passive experience. I have mentioned above the discipline necessary to the "mental simulation" (as Kendall Walton ["Spelunking"] calls it) that opens the door to immersion. As the phenomenologist Roman Ingarden and his disciple Wolfgang Iser have shown, this mental simulation requires a construction of the fictional world through which the reader provides as much material as she derives from the text. If it takes discipline to form a mental image of the fictional world, it takes an even more demanding activity to convert the temporal flow of language into a spatial configuration of meaning. As the critic Jean Rousset writes:

> Reading, which takes place over time, should, in order to achieve totality, renders the work present simultaneously in all parts. The exacting reader's job consists in reversing the natural tendency of the book so that it will present itself all at once to the mind's eye. There can be no complete reading that does not transform the book into a simultaneous network of reciprocal relationships. (139)

But the inherently interactive nature of the reading experience has been obscured by the reader's proficiency in performing the necessary world-building operations. We are so used to playing the fictional game that it has become a second nature: as "native readers of fiction" we take it for granted that worlds should emerge from texts. This explains why postmodernist attempts to promote active reader involvement in the construction of meaning usually take the form of self-referential demystification. As Linda Hutcheon writes: "The reader of fiction is *always* an actively mediating pres-

ence; the text's reality is established by his response and reconstituted by his active participation. The writer of narcissistic fiction merely makes the reader conscious of this fact of his experience" (141).

The price of this consciousness is an ontological expulsion from the fictional world. Insofar as it claims the reality of its reference world, fiction implies its own denial as fiction. By overtly recognizing the constructed, imaginary nature of the textual world, metafiction reclaims our "native reality" as ontological center. The implicit message "this world is the product of language" is not an invitation to make-believe, it is literally true. But the reader's interest is difficult to maintain in the absence of make-believe. The most efficient strategy for promoting an awareness of the mechanisms of fictionality is not to block access to the fictional world, but to engage the reader in a game of in-and-out: now the text captures the reader in the narrative suspense; now it bares the artificiality of plots; now the text builds up the illusion of an extratextual referent; now it exposes the textual origin of this referent. Shuttled back and forth between ontological levels, the reader comes to appreciate the layered structure of fictional communication, a layered structure through which he is both (in make-believe) narratorial audience in the fictional world, and authorial audience in the real world. One of the most successful examples of this game of in-and-out is John Fowles's *The French Lieutenant's Woman*. The fictional world may be eventually demystified as a textual construct, yet the text succeeds in creating an immersive experience. At times the reader regards the characters as human beings and invests an emotional interest in their fate, at other times he is made to acknowledge their status as literary creations. It is the memory of the immersive power of the text that engages his critical faculties during the self-reflexive moments. The object of the reflexive activity is as much the phenomenon of immersion as the artificiality of fictional worlds. We may call interactivity this switch in perspective from world-internal and immersive to world-external and reflexive. Under this interpretation, periodic de-immersion is essential to the "tilting game"[4] of interactive reading.

2. *Weak literal interactivity*

Interactivity between text and reader can only be literal if the text undergoes physical changes during the reading process. The reader must participate in the material production of signs.

A weak form of literal interactivity is found in hypertext. As the reader selects the direction to follow by activating one of many possible links, she determines the sequential order of her reading. As Bolter observes: "The

reader participates in the making of the text as a sequence of words" (158). If we equate "text" to one particular traversal of the underlying network of links and lexias, then indeed every reading session generates a new text, and the reader takes an active part in this writing. In this view, "text" is not a static collection of signs but the product of an encounter between a mind and a set of signs. If the concept of text is indissoluble from the act of reading, the physical interactivity of hypertext is a concrete metaphor for the mental interactivity promoted by all texts. While every particular path of navigation through a hypertextual network brings to the screen different chunks of text, every particular reading of a non-electronic text highlights different episodes, links different images, and creates a different web of meaning. This analogy presupposes that the act of clicking is not merely a physical gesture with purely material consequences, but either a reasoned action, or the stimulus of mental operations. Clicking is a reasoned action when it implements the reader's decision to pursue the reading in a relatively foreseeable direction. It stimulates mental activity when the reader, after making a relatively random choice, applies his sagacity to the detection of some kind of semantic relation between the linked elements.

In this interpretation of interactivity, the difference between the reading experience promoted by hypertext and by traditional texts is more quantitative than qualitative. Hypertext offers an intensification and heightened awareness of the kind of textual pleasure that Nabokov calls "combinational delight" (69): a delight he relates to the tracing of "links and bobolinks" (63). [Bobolinks are birds.] In the absence of the directionality imposed by a dominating story-line, it is hoped that the reader will wander for pleasure through the textual space. No longer distracted by the plot, she will devote more attention to textual architecture. As Bolter writes: "A printed book's natural order provides the foundation for the architecture of the text, but an electronic text is all architecture, all reference" (160). But how, the skeptic may ask, can this architecture stand without a foundation? To which the hypertext theorist might reply: textual architecture is not supposed to stand. It is a dynamic structure of metaphorical relations, not a time-defying monument.

The interactivity of hypertext appears much more limited if we define "text" as a sum of possible readings. The physical correlate of this mental definition equates text to the written signs that form the common source of the readings. In the case of hypertext, this would mean that the text is the entire network of links and of textual nodes. According to this view, the interactivity of hypertext is not a power to change the environment, as is the

case in VR systems, but merely a freedom to move the sensors for a personal exploration. The reader may chose in which order she visits the nodes, but her choices do not affect the configuration of the network. No matter how the reader runs the maze, the maze remains the same, and the author, far from relinquishing authority, remains the hidden master of the system. Some hypertexts may erase certain pathways after the reader has taken them, but this pruning of links is programmed into the text from the very beginning. The reader's actions could only modify the environment if the hypertextual system generated text in real time, as an intelligent response to the reader's decisions. As I have argued above, this is what happens in simulative systems. The computer calculates the position of the plane according to the user's input, rather than displaying a pre-calculated position. This will not happen in hypertext until it joins forces with AI—and until AI sharpens its story-generating capabilities.

In the domain of interactivity, hypertext thus scores a small advantage over traditional texts, but its interactivity is achieved at the cost of immersion. Because moving across an electronic text involves much more frequent, more extensive, and much less automatic interventions of the reader's body than turning the pages of a book, and because the text displays itself "in the face" of the reader, as a visually aggressive pattern of pixels on the screen, it is hard to forget its physicality. Moving through the words to the fictional world thus becomes much more problematic than in familiar print texts.

This problem may disappear when we become more used to reading on a screen, but other obstacles stand in the way of immersion. For many of us not yet schooled in the parallel mode of thinking, the distraction offered by the screen, keyboard and flickering display is compounded by the perplexity created by the branching system. The constant need to make decisions prevents the concentration necessary to immersive reading. What Gareth Rees writes of his experience of tree fiction (a variant of hypertext in which each branch develops separately, without possibility of return to a previously visited node) is even more to the point in the case of a more complex network: "I think that as readers we are not ready for tree fiction: I know that when I read such a story, I want to find out all the consequences of every decision, to read everything that the author wrote, fearing that all the interesting developments is going on in another branch of the story that I didn't investigate. I want to organize the whole story in my mind." The body of the reader's imaginary persona in the fictional world would have to undergo a dismembering to take all the roads at the same time, and to

overcome the nagging feeling of missing something along the way. Can a "corps morcelé" (as Christopher Keep describes the hypertextual body) experience immersion through all of its parts, or does immersion require a sense of physical unity?

Still another obstacle to immersion is the fragmented character and apparent discontinuity of most currently available forms of hypertext fiction. The link is a jump, and each act of clicking sends the reader to a new, relatively isolated textual island. It always takes time to make oneself at home in a text, to grow roots in the fictional world, to visualize the setting, to familiarize oneself with the characters and their motivation. In his novel *If On a Winter's Night a Traveler*, Italo Calvino allegorizes the difficulty of immersion by embedding in the narrative the beginning of a dozen other novels which are brutally interrupted after a few pages—just as the reader begins to develop a sense of place in the fictional world. In Calvino's novel, the reader is left stranded at the end of every chapter; in hypertext, the threat of uprooting occurs with every change of screen.

The best way to maintain an immersive quality in a hypertextual environment, it seems to me, would be to make the results of choices reasonably predictable, as they should be in VR, so that the reader would learn the laws of the maze and become an expert at finding his way even in new territory.[5] But if the reader becomes an expert navigator, he may be caught in a specific story-line and revert to a linear mode of reading. The readers of hypertext maintain a basic freedom enjoyed by all readers: the freedom to fight the text, to read it against the grain. As Robert Coover observes: "One will feel the need, even while using these vast networks and principles of randomness and expansive story line, to struggle against them, just as one now struggles against the linear constraints of the printed book" (quoted by Moulthrop, "Rhizomes," 119). Some of the readers of Michael Joyce's hypertext novel *Afternoon*—myself included—are indeed driven by the desire to find out whether or not the narrator's ex-wife and son have been killed in an accident.[6] In this "reading for the plot," we pretend that there is *one* world, *one* historical sequence of facts, and *one* answer to the haunting question.

It would be preposterous to pass a global judgment on the intrinsic merit of hypertext: whether the maze is experienced as a prison or as the key to freedom depends on the quality of the text and on the disposition of the reader. Hypertext is only in infancy. Like all technological inventions, it may develop in directions we cannot imagine at this time. But I would like to advance a general pronouncement concerning the immersive power—or lack thereof—of the genre as it is conceived today. We are told that the es-

sence of the aesthetic experience generated by hypertext is an awareness of
the plurality of worlds contained in the system. Since this plurality can only
be contemplated from a point of view external to any of these worlds, the
proper appreciation of the multidimensionality of hypertext is incompat-
ible with immersion. If hypertext fiction is to carve a durable niche in the
literary pantheon, it will have to demonstrate that textual pleasure can be
emancipated from immersion.

3. *Strong literal interactivity*

For interactivity to reach its strongest form it should allow the actual
production of signs. The "empowerment of the reader" advocated by
postmodern theory can only be more than a slogan if it involves the power
to use language. In some hypertextual systems—such as Robert Coover's
literary MOO, the Hypertext Hotel—the user is encouraged to add new
materials that become a permanent part of the system. In this form of inter-
active creation, however, the user is creating the fictional world from the
external perspective of the author. She alternates between reader-role and
writer-role, between immersion and interactivity, rather than combining them
in the mythical "wreader" experience.

Interactivity can only be reconciled with immersion if the user's input
counts as participation and as action in the fictional world. This performative
dimension requires a dramatic setup. Brenda Laurel and Joseph Bates are
currently at work on a form of VR (known as Interactive Drama) in which
the user will play a character in a fictional world and influence the develop-
ment of the plot through her speech and action.[7] Among purely textual forms
of communication, those that come the closest to merging the two dimen-
sion of the VR experience are the real-time multi-users role-playing games
known as MUDs or MOOs.[8] (I will ignore here the technical difference
between these acronyms and refer to both environments as MOOs.) In these
games, the user creates her own character by posting its textual description.
Once invested with a make-believe identity in the fictional world, the user
plays the role of the impersonated character from the inside. She encounters
other users playing other characters, and they engage in a dialogue in real
time. Most contributions are speech acts (x says), but the system also allows
the performance of physical actions and even the building of virtual objects.
As Elizabeth Reid writes: "On [MOOs], text replaces gestures and has even
become gesture itself" (167). If a user playing a character named Fred types
"pose (or any other code-word for physical action) flies through the win-
dow," this does not count as the description by an observer of Fred flying

through the window, but as the performance by Fred, here and now, of the act of flying away.

Through their written messages, MOO users thus participate in what comes very close to a dramatic action. The design of this action is almost entirely the responsibility of the players. As Reid observes: "The MOO system provides players with a stage, but it does not provide them with a script" (170). On the stage set by the system (usually a building with multiple rooms furnished with textually described objects), users meet other characters and talk or get involved in various activities: flirting, spying, building castles, making love, breaking up. As in a free-flowing conversation, characters may tell stories, or engage in actions that outline a story, but whatever narrativity emerges from this interaction is strictly a micro-level phenomenon. The minimal structuring of the MOO world makes aesthetic pleasure almost entirely dependent on the creativity, compatibility and cooperativeness of players. Art can sprout out of MOOs, as it can out of conversation, but MOOs in themselves are not objects of art. What you get out of them in terms of gratification is, more literally than in any other mode of textual communication, a function of your own performance. This is the inevitable consequence of seizing a creator's power over a fictional world.

Despite this lack of controlling script, MOOs seem to have no problem generating immersion—perhaps because players do not look at the game as art and do not expect sustained dramatic suspense or a steady display of poetic invention. The literature on the genre is full of expressions of fanatic loyalty on the part of its users. At this point it is difficult to tell how much of this enthusiasm is due to the pleasure of role-playing *per se*, and how much is infatuation with the technological medium, need for social interaction, or fascination for the real-world identities that hide behind the masks. Immersion is not the same phenomenon as addiction: it requires a sense of membership in a world, either real or imaginary, while addiction is an obsessive dependency on a certain kind of experience or activity. [9] But since MOOs create a relation to an imaginary world through role-playing, it is a safe assumption that immersion is an important part of the MOO experience.

Immersion or Interactivity: A Dilemma of Textual Communication

Whether textual interactivity takes the weak form of a mental play with signs leading to a production of meaning, or the strong form of physically producing these signs, one consequence appears unavoidable: in textual matters, interactivity conflicts either with immersion or with aesthetic de-

sign, and often with both. If we compare traditional narrative, hypertext fiction and MOO-type role-playing games in terms of interactivity, immersivity, and global design, no form scores highest on all three counts. I rank them in the following order:

Immersivity: 1. Traditional narrative. 2. Role-playing games. 3. Hypertext.
Interactivity: 1. Role-playing games. 2. Hypertext. 3. Traditional narrative.
Design: 1. Traditional narrative 2. Hypertext. 3. Role-playing games.

The strong forms of interactivity run most blatantly into the problem of design: how can the contributions of the reader-turned-author be monitored by the system, so that the text as a whole will maintain narrative coherence and aesthetic appeal ? It could be objected that literature does not guarantee pleasure either. There are good and bad novels and poems just as there are enjoyable and disappointing MOO sessions. In this respect MOOs are only quantitatively different from literary works. But the greater ability of literary texts to kindle the aesthetic experience is due to a large extent to their use of time-tested composition devices, such as plot, theme, symbol, and tropes.[10]

In the weaker forms of interactivity, design is easier to control, but immersion remains problematic. The various attempts by contemporary literature to emulate the interactivity of VR create a loss of involvement in the fictional world, a weakening of the imaginative experience and a momentary breakup of make-believe. The texts that come the closest to combining both immersion and interactivity are those that orchestrate them in round-robin fashion through a game of in-and-out.

The textual incompatibility of the two types of experience can be traced back to several factors. While immersion in a textual world depends on the forward movement of a linear plot, interactivity involves (and creates) a spatial organization. While immersion presupposes pretended belief in a solid extratextual reference world, interactivity thrives in a fluid environment of changing relations. While immersion looks through the signs toward the reference world, interactivity exploits the materiality of the medium. Textual representation behaves in one respect like holographic pictures: you cannot see the worlds and the signs at the same time. Readers and spectators must focus beyond the signs to witness the emergence of a three-dimensional life-like reality.

In computer-generated VR, by contrast, immersion and interactivity do not stand in conflict—or at least not necessarily. Steuer suggests that the

vividness of a virtual world may "decrease a subject's ability to mindfully interact with it in real time" (90). If a computer-generated environment is so rich in "fictional truths" that its exploration offers great rewards, why would the user bother to change this world? Immersion may offer an occasional threat to interactivity, but once a virtual world is in place as a multisensory display, its immersivity can only be enhanced by interactivity. There is nothing intrinsically incompatible between immersion and interactivity: in real life also, the greater our freedom to act, the deeper our bond to the environment. Why is it that the two types of experience harmonize in life and VR, but conflict in textual communication?

One reason has to do with the properties of the medium. The relative incompatibility of immersion and interactivity in classical narrative and hypertext is due to their exclusive reliance on language. While visual media are inherently immersive (it takes only a few seconds to feel part of the world of a movie or a realistic painting), text requires far greater mental activity to translate its signs into a representation. As the Loyola example suggests, it takes concentration to achieve immersion, because language itself offers no data to the senses (except for the look, feel and the smell of the book, which are usually not related to the message). All sensory data must therefore be simulated by the imagination. The reason for the tendency of literary theorists to dismiss immersion as a passive experience is that it is reached through a mental activity that must ignore itself in order to reach its goal. Any attempt to increase this activity is likely to lead to self-reflexivity, thereby destroying the delicate balance between constructing the textual world and experiencing it as language-independent presence. This dilemma is much less acute in a multi-media environment. In VR, the sense of immersion is given by image, sound, and tactile sensations. Interactivity is added to the experience by coordinating the display with the movements of the user's body. The physical presence of the body in the virtual environment reinforces the sense of the physical presence of the virtual world.

Another difference between VR and literature resides in the semiotic nature of interactivity. In a textual world, the tools of interactivity are signs, but in the real world all action passes through the body. It is therefore through the mediation of the body that VR developers envision the reconciliation of immersion and interactivity. "Our body is our interface," claims William Bricken in a VR manifesto (quoted in Pimentel and Texeira, 160). When the reader of a postmodern work is invited to "participate" in the construction

of the fictional world she is aware that this world does not exist independently of the semiotic activity; hence the loss in immersive power. But the user of a VR system interacts with a world that is experienced as existing autonomously because this world is accessible to the body through many senses, particularly to the sense of touch. As the story of Saint Thomas demonstrates, tactile sensations are second to none in establishing a sense of reality. The bodily participation of the user in virtual reality can be termed world-creative in the same sense that performing actions in the real world can be said to create reality. As a purely mental event, textual creation is a creation *ex nihilo* that excludes the creator from the creation: authors do not belong to the world of their fictions. But if a mind may conceive a world from the outside, a body always experiences it from the inside. As a relation involving the body, the interactivity of VR immerses the user in an world experienced as already in place; as a process involving the mind, it turns the user's sojourn in the virtual world into a creative membership. The most immersive forms of textual interactivity are therefore dramatic performances in which the user's verbal contributions count as the actions, gestures and speech acts of an embodied member of the fictional world. Rather than performing a creation through a diegetic, i.e. descriptive use of language, these contributions create the fictional world *from within* in a dialogic and live interaction with its objects and its other members. As I have pointed out above, these forms of texuality (MOOs, interactive drama, children's games of make-believe) have yet to solve the problem of design, a condition for being accepted as art, but they point the way toward a solution of the conflict between immersion and interactivity: turn language into gesture (here I paraphrase Reid), into a corporeal mode of being in the world.

By suggesting that interactivity and immersion are inherently more compatible in VR than in literature, I do not mean to promote VR as a superior art form. Immersion is a proven mean of aesthetic satisfaction, but it is not necessarily the only one. Many readers are willing to sacrifice at least some degree of immersion to the more intellectual pleasure of self-reflexivity. I defer to empirical studies the task of telling whether or not aesthetic satisfaction can be completely emancipated from immersion. But even if immersion turns out to be a necessary component of reading pleasure, its conflict with interactivity should be regarded as a challenge, not a limitation. Art is an exploitation of the properties of its medium and a compromise between conflicting goals. In VR and in the above-mentioned dramatic forms of textuality, the conflict involves the relation of interactivity to de-

sign—immersion being given by the medium. In literature, the conflict is two-pronged: it pits immersion against interactivity, and interactivity against design. The challenge may be more complex than in VR, but the compromises are more varied. To the strictures of its medium, literature owes its richness and diversity.

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NOTES

1. An earlier and shorter version of this essay is available in electronic form from the archives of *Postmodern Culture*, file ryan.994.
2. See Moulthrop, "Writing Cyberspace," for a critique of the idea of post-symbolic communication. It is obvious that VR developers understand symbol in a linguistic sense, as an arbitrary and discrete sign that can be combined into larger signifying units through the rules of a syntax. As in Peirce's typology, symbol contrasts for them with icon and index. But even if VR technology develops non-symbolic modes of interactivity—such as changing the color of an object by the touch of the hand, rather than by typing a command—it could not create reasonably complete simulacra of the real world if it excluded natural languages.
3. One may of course imagine a system of doing just that for the sake of aesthetic gratification: an interactive, multi-media implementation of surrealistic poetry deriving its effect from the incongruity of the metaphor. But in this case the user's action would aim toward magical transformation, not toward sinking golf balls into holes, and the response of the system would fulfill the user's intent.
4. I borrow this phrase from Iser, though I give it a different meaning.
5. Making choices predictable means providing the reader with a strategy for navigating the text. In the pamphlet that accompanies *Afternoon*, Michael Joyce provides a clue for detecting the "words that yield," i.e. the words that have links attached to them: "They are usually ones which have texture, as well as character names and pronouns" (3). Finding the "words that yield" becomes the stimulus that keeps the reader turning the electronic pages. This desire is hypertext's alternative to the incentive of traditional narrative: finding how it ends.
6. An example of a reader fascinated by the central enigma posed by *Afternoon* is J. Yellowlees Douglas. She writes: "So when we navigate through interactive narratives, we are pursuing the same goals we do as readers of print narratives—even when we know that the text will not bestow upon us the final sanction of a singular ending that either authorizes or invalidates our interpretations of the text" (184).
7. See Laurel, "Placeholder," and Kelso, Weyhrauch and Bates, "Dramatic Presence."
8. MUD stands for Multi User Dungeon (or Dimension) and MOO for Multi User Dungeon, Object Oriented.
9. In the case of reading, Victor Nell makes a clear distinction between involvement (an experience close to what I call immersion) and addiction. Addicted readers are voracious, completely block out reality, do not savor the story, and when they are done, the story "leaves no residue and it awakens no deep feelings" (211) because it lives for them

only in the present of reading. Nell goes on to say that "addictive behavior . . . predicts an undeveloped capacity for private fantasm" (212).

10. Another factor, of course, is the existence of a process of selection and of editorial policies that apply to published literature but not to MOO participation.

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