

MULTIMEDIA: FROM WAGNER TO VIRTUAL REALITY

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(Includes excerpts from the forthcoming book "Multimedia: From Wagner to Virtual Reality"^{xiii})

Overture

The attempt to apply a definition to multimedia has been a difficult proposition. To begin with, multimedia as a description of artistic activity has changed dramatically since the 1960s when it referred to experimental forms of performance art, happenings, mixed media, and other forms of interdisciplinary art. In the 1980s, multimedia was applied to the plethora of emerging forms of entertainment and educational media from CD-ROMs to interactive games to virtual reality. Since the mid-1990s, multimedia has taken on new definition and significance with the emergence of widespread networked technologies, most notably the World Wide Web. It is no wonder the term has become problematic: vague, over-hyped and referencing a seemingly endless array of new media forms, genres, and commercial application.

It was in response to this dilemma, particularly the medium's lack of historical context, that I began my research in the late 1980s. It became clear to me at the time that an idealized model for contemporary forms of multimedia could be found in Richard Wagner's Gesamtkunstwerk (Total Artwork), as well as the work of later composers whose artistic pursuits led them to the notion of composing with media. Throughout the 20th Century, artists and composers alike have explored the interdisciplinary realm of music theater, performance art, and interactive electronic media. Of prime importance in this analysis was linking experimental forms that blurred the boundaries of music and the arts to parallel movement in the cybernetic and information sciences – the work of engineers who also embraced interdisciplinary ideals and the quest for new avenues of subjective experience through integrated and non-linear forms.

From this investigation, I began to explore a set of key paradigms that provided a conceptual framework for bridging these two seemingly disparate worlds of creative activity in the arts and sciences. This framework was distilled to five essential concepts that have come to form a meta-description for discussing multimedia: integration, interactivity, hypermedia, immersion, and the emerging narrative forms that have resulted from these evolving paradigms.

Integration

In 1849, Wagner introduced the concept of the Gesamtkunstwerk, or Total Artwork, in an essay called "The Artwork of the Future."^{xiv} It would be difficult to overstate the power of this idea, or its influence. Wagner's description of the Gesamtkunstwerk is one of the first attempts in modern art to establish a practical, theoretical system for the comprehensive integration of the arts. Wagner sought the idealized union of *all* the arts through the "totalizing," or synthesizing, effect of music drama – the unification of music, song, dance, poetry, visual arts, and stagecraft. His drive to embrace the full range of human experience, and to reflect it in his operas, led him to give equal attention to every aspect of the final production. He was convinced that only through this integration could he attain the expressive powers he desired to transform music drama into a vehicle capable of affecting German culture.

Twentieth century artists have continued the effort to heighten the viewer's experience of art by integrating traditionally separate disciplines into single works. Modern experience,

many of these artists believed, could only be evoked through an art that contained within itself the complete range of perception. "Old-fashioned" forms limited to words on a page, paint on canvas, or music from an instrument, were considered inadequate for capturing the speed, energy and contradictions of contemporary life.

In their 1916 manifesto "The Futurist Cinema,"^{xv} F.T. Marinetti and his revolutionary cohorts declared film to be the supreme art because it embraced all other art forms through the use of (then) new media technology. Only cinema, they claimed, had a "totalizing" effect on human consciousness. Less than a decade later, in his 1924 essay describing the theater of the Bauhaus, "Theater, Circus, Variety,"^{xvi} László Moholy-Nagy called for a theater of abstraction that shifted the emphasis away from the actor and the written text, and brought to the fore every other aspect of the theatrical experience. Moholy-Nagy declared that only the synthesis of the theater's essential formal components – space, composition, motion, sound, movement, and light – into an organic whole could give expression to the full range of human experience.

The performance work of John Cage was a significant catalyst in the continuing breakdown of traditional boundaries between artistic disciplines after World War II. In the late 1940s, during a residency at Black Mountain College in North Carolina, Cage organized a series of events that combined his interest in collaborative performance with his use of indeterminacy and chance operations in musical composition. Together with choreographer Merce Cunningham and artists Robert Rauschenberg and Jasper Johns, Cage devised theatrical experiments that furthered the dissolution of borders between the arts. He was particularly attracted to aesthetic methods that opened the door to greater participation of the audience, especially if these methods encouraged a heightened awareness of subjective experience. Cage's use of indeterminacy and chance-related technique shifted responsibility for the outcome of the work away from the artist, and weakened yet another traditional boundary, the divide between artwork and audience.

Cage's work proved to be extremely influential on the generation of artists that came of age in the late 1950s. Allan Kaprow, Dick Higgins and Nam June Paik were among the most prominent of the artists who, inspired by Cage, developed non-traditional performance techniques that challenged accepted notions of form, categorization, and composition, leading to the emergence of genres such as the Happenings, electronic theater, performance art, and interactive installations.

In this climate, artists became increasingly interested in integrating technology into their work. While technology clearly played a significant role in 20th century arts (such as photography, film, and video, as well as various fine arts genres), it was not until Bell Labs scientist Billy Klüver placed the potential of advanced engineering into the hands of artists in New York that integrated works of art and technology began to flourish. Klüver conceived the notion of *equal* collaboration between artist and engineer. He pioneered forms of art and technology that would have been unimaginable to the artist without the engineer's cooperation and creative involvement. With Robert Rauschenberg, Klüver created several of the earliest artworks to integrate electronic media and to encourage a participatory role for the audience, including Oracle (1963-65) and Soundings (1968).

In 1966 Klüver co-founded E.A.T. (Experiments in Art and Technology) to bring artists and engineers together to create new works. E.A.T.'s most ambitious production was the Pepsi-Pavilion, designed for the Osaka Expo '70 in Japan – a tremendously ambitious collaborative, multimedia project that involved over 75 artists and engineers. As Klüver explained, audience participation was at the heart of their interests: "The initial concern of the artists who designed the Pavilion was that the quality of the experience of the visitor should involve choice, responsibility, freedom, and participation. The Pavilion would not tell a story or guide the visitor through a didactic, authoritarian experience. The visitor

would be encouraged as an individual to explore the environment and compose his own experience."^{xvii}

Interactivity

In the years immediately after World War II, under the shadow of the atomic bomb, the scientific establishment made a concerted effort to apply recent advancements in technology to humanitarian purposes. In this climate, Norbert Wiener completed his groundbreaking theory on cybernetics. While Wiener did not live to see the birth of the personal computer, his book, *The Human Use of Human Beings*,^{xviii} has become *de rigeur* for anyone investigating the psychological and socio-cultural implications of human-machine interaction. Wiener understood that the quality of our communication with machines effects the quality of our inner lives. His approach provided the conceptual basis for human-computer interactivity and for our study of the social impact of electronic media.

Bush and Wiener established a foundation on which a number of computer scientists associated with the Advanced Research Projects Agency (ARPA) – a U.S. government funded program to support defense-related research in the 1960s – began to build. Leading ARPA's effort to promote the use of computers in defense was the MIT psychologist and computer scientist J.C.R. Licklider, author of the influential article "Man-Computer Symbiosis."^{xix} Defying the conventional wisdom that computers would eventually rival human intelligence, rather than enhancing it, Licklider proposed that the computer be developed as a creative collaborator, a tool that could extend human intellectual capability and improve a person's ability to work efficiently.

While at ARPA, Licklider put significant resources towards the pursuit of his vision. Among the scientists he supported was Douglas Engelbart, who since the mid-1950s had been seeking support for the development of a digital information retrieval system inspired by Vannevar Bush's Memex. ARPA funding enabled Engelbart to assemble a team of computer scientists and psychologists at the Stanford Research Institute to create a "tool kit" that would, as he phrased it, "augment human intellect."^{xx} Dubbed the oNLine System (NLS), its public debut in 1968 at the Fall Joint Computer Conference in San Francisco was a landmark event in the history of computing. Engelbart unveiled the NLS before a room of 3,000 computer scientists, who sat in rapt attention for nearly two hours while he demonstrated some of his major innovations, including the mouse, windows for text editing, and electronic mail. Engelbart was making it possible, for the first time, to reach virtually through a computer's interface to manipulate information. Each of his innovations was a key step towards an interface that allowed for intuitive interactivity by a non-specialist.

Engelbart's NLS pioneered some of the essential components necessary for the personal computer, but it would be up to a new generation of engineers to advance computing so it could embrace multimedia. As a graduate student in the late 1960s, Alan Kay wrote a highly influential Ph.D. thesis proposing a personal information management device that, in many ways, prefigured the laptop. In 1970, as research in information science was shifting from East Coast universities and military institutions to private digital companies in Silicon Valley, Kay was invited to join the new Xerox PARC in Palo Alto. PARC's mandate was no less than to create "the architecture of information for the future."

At PARC, Alan Kay conceived the idea of the Dynabook – a notebook sized computer that enabled hyperlinking, was fully interactive, and integrated all media. With the Dynabook, digital multimedia came into being. Echoing Licklider, Engelbart and colleagues at PARC, Kay declared the personal computer a medium in its own right. It was a "meta-medium," as he described it in his 1977 essay "Personal Dynamic Media,"^{xxi} capable of being "all other

media." While the Dynabook remained a prototype that was never built, the work that came from its development, including the invention of the Graphical User Interface (GUI) and subsequent breakthroughs in dynamic computing, was incorporated into the first true multimedia computer, the Xerox Alto.

Hypermedia

It was Vannevar Bush who, in 1945, determined the chief narrative characteristic of multimedia by proposing a mechanical device that operated literally "as we may think."^{xxii} The challenge, as he saw it, was to create a machine that supported the mind's process of free association. Bush noted how ideas tend to evolve in a non-linear, idiosyncratic fashion. His Memex would be a tool that could supplement this aspect of human creativity by organizing its media elements to reflect the dynamics of the mind at play.

Douglas Engelbart expanded on Bush's premise. His quest to "augment human intelligence," as he aptly phrased it, was based on the insight that the open flow of ideas and information between collaborators was as important to creativity as private free association. The personal computer, as he envisioned it, would not only allow for the arrangement of data in idiosyncratic, non-linear formats. By connecting workstations to a data-sharing network and turning them into communications devices, Engelbart's oNLine System allowed for a qualitative leap in the collaboration between individuals – almost as if colleagues could peer into one another's minds as part of the creative process. In the early 1960s, experiments with networked personal computing promised the non-linear organization of information on a grand scale.

While few recognized this possibility at the time, it inspired a series of influential theoretical writings by the rogue philosopher Ted Nelson. Working outside of the academic and commercial establishments, following his own strongly held convictions, Nelson devised an elaborate system for the sharing of information across computer networks. Called Xanadu, this system would maximize a computer's creative potential. Central to Nelson's approach was the "hyperlink," a term he coined in 1963, inspired by Bush's notion of the Memex's associative trails. Hyperlinks, he proposed, could connect discrete texts in non-linear sequences. Using hyperlinks, Nelson realized, writers could create "hypertexts," which he described as "non-sequential writing" that let the reader make decisions about how the text could be read in other than linear fashion. As he observed in his landmark book from 1974, Computer Lib/Dream Machines,^{xxiii} "*the structures of ideas are not sequential.*" With hypertext, and its multimedia counterpart, "hypermedia," writers and artists could create works that encouraged the user to leap from one idea to the next in a series of provocative juxtapositions that presented alternatives to conventional hierarchies.

In 1989 Tim Berners-Lee, a young British engineer working at CERN, the particle physics laboratory in Geneva, Switzerland, circulated a proposal for an in-house on-line document sharing system which he described modestly as "a 'web' of notes with links."^{xxiv} After getting a grudging go-ahead from his superiors, Berners-Lee dubbed this system the World Wide Web. The Web, as he designed it, combined the communications language of the Internet with Nelson's hypertext and hypermedia, enabling links between files to extend across a global network. It became possible to link every document, sound file or graphic on the Web in an infinite variety of non-linear paths through the network. And instead of being created by a single author, links could be written by anyone participating in the system. Not only did the open nature of the Web lend itself to a wide array of interactive, multimedia experiences, but by hewing to a non-hierarchical structure and open protocols, Berners-Lee's invention became enormously popular, and led to an explosion in the creation of multimedia. By 1993 the Web had truly become an international phenomenon.

The success of the Web seemed to confirm the intuition of artists engaging in digital media that in the future, a global media database would inspire new forms of expression. Roy Ascott, for example, had already been exploring the creative possibilities of networking since the 1980s. He was interested in the notion of "dataspace," a territory of information in which all data exists in a continual present outside the traditional definitions of time and space available for use in endless juxtapositions. Ascott considers dataspace a new type of Gesamtkunstwerk, or a Gesamtdatenwerk as he calls it, in which networked information is integrated into the artwork. In such an environment, Ascott wrote, "meaning is not something created by the artist, distributed through the network, and *received* by the observer. Meaning is the product of interaction between the observer and the system, the content of which is in a state of flux, of endless change and transformation."^{xxv}

Immersion

There are many examples of immersion in the history of art. The Dionysian rituals of Greek Theater, and the construction of the great cathedrals of Europe, are two obvious examples. Richard Wagner's Gesamtkunstwerk was driven by a vision of theater in which the audience loses itself in the veracity of the drama, creating an immersive experience. As he wrote in "The Artwork of the Future,"^{xxvi} "the spectator transplants himself upon the stage, by means of all his visual and aural faculties." To facilitate his vision, Wagner reinvented the conventions of the opera house, and in 1876 opened the Festpielhaus Theater in Bayreuth, Germany, with the first complete production of *The Ring* cycle. The Festpielhaus, with its employment of Greek amphitheatrical seating, surround-sound acoustics, the darkening of the house, and the placement of musicians in an orchestra pit, focused the audience's undivided attention on the dramatic action. His intent was to maximize the suspension of disbelief, to draw the viewer into an illusionary world staged within the proscenium arch.

In the 1950s, a similar vision inspired the American cinematographer Morton Heilig to propose a "cinema of the future" that would surround the audience with facsimiles of life so convincing they would believe themselves to be transported to another domain. Such a cinema, he wrote, "would faithfully reproduce man's outer world as perceived in his consciousness, it will eventually learn to create totally new sense materials for each of the senses... [that] they have never known before, and to arrange them into forms of consciousness never before experienced by man in his contact with the outer world."^{xxvii}

While Heilig devised a theoretical framework that applied the technologies of his day toward the achievement of virtual experience, it was only as a consequence of advances in computer science that the immersion his work suggested became possible.

By 1965, Ivan Sutherland had already achieved legendary status among computer scientists as the inventor of Sketchpad, the first interactive graphics software. In a short paper published that year, Sutherland mused over the options available to the engineer to display computer data, to create a "a looking glass" into what he described as a "mathematical wonderland." It seemed reasonable for him to suggest that "The Ultimate Display"^{xxviii} (as the paper was titled) would represent this data in 3-dimensional form, allowing the construction of entirely believable 3-dimensional, computer controlled virtual worlds. However, like Heilig before him, Sutherland took this suggestion one step further. "The ultimate display," he wrote, "would ... be a room within which the computer can control the existence of matter." He suggested that such a display could present realities heretofore only imagined, as if seen through Alice's looking glass. Sutherland's proposal was startling, but it launched an entire field of scientific inquiry.

It also fueled the imagination of a generation of artists. One of the first to consider the possibilities of digitally-constructed virtual experiences was Myron Krueger. In the early 1970s, Krueger created the pioneering works *Metaplay* and *Videoplace* to explore the potential of computer-mediated interactivity. These works were interactive artistic environments, influenced by Happenings, designed to give participants freedom of choice and opportunities for personal expression. *Videoplace* also connected participants in different locations through networked technologies, creating the illusion of shared space. As Krueger later wrote about the piece, "our teleconference created a place that consisted of the information we both shared... a world in which full physical participation would be possible. This world is an 'artificial reality.'"^{xxxix}

During the 1970s and 1980s, several engineering projects pursued virtual environment display systems that could represent such an "artificial reality. Perhaps the most significant of these in the mid-1980s was led by Scott Fisher at the NASA-Ames Research Center. Fisher's intent was to engage the entire nervous system in a multi-sensory presentation of virtual space – extending multimedia beyond the screen. The Ames VIEW system (an acronym for Virtual Interface Environmental Workstation) included a headset with two small liquid crystal display screens, a microphone for speech recognition, earphones for surround-sound effects, a head-tracking device, and dataglove to recognize the user's gestures and place them within the virtual environment. The direction this work pointed in was clear. As Fisher wrote in his 1989 article "Virtual Interface Environments,"^{xxx} "with full body tracking capability, it would also be possible for users to be represented in this [virtual] space by life-size virtual representations of themselves in whatever form they choose." Immersive environments, Fisher observed, could give birth to a new form of participatory, interactive electronic theater.

The possibility of such a theater had already taken hold of the public's imagination. In *Neuromancer*,^{xxxi} his widely read novel from 1984, William Gibson described in palpable detail a future in which virtual reality was a fact of life. Echoing Myron Krueger's notion that teleconferencing created a "place" that consisted of shared information, Gibson's characters inhabited a virtual environment made possible by the networking of computers, which he named "cyberspace." Gibson's cyberspace provided the first literary definition for the computers, hubs, servers, and databases that make up the matrices of the network. His discussion of cyberspace was so tangible – and seductive, with its suggestion that any computer hacker could "jack-in to the matrix" with an encounter with a sexy avatar – it became a touchstone for every engineer, artist and theorist working in the field.

Narrativity

As we have already seen, experimental performances inspired by John Cage – including Happenings, interactive installations, immersive environments and performance art -- also gave rise to a variety of non-linear narrative strategies. But perhaps the most prescient explorer of this terrain was the novelist William S. Burroughs.

Like Ted Nelson, Burroughs was deeply suspicious of established hierarchies. He was especially interested in writing techniques that suggest the spontaneous, moment-by-moment movement of the mind, and how non-linear writing might expand the reader's perception of reality. Through his use of the cut-up and fold-in techniques, which he described in his 1964 essay, "The Future of the Novel,"^{xxxii} Burroughs treated the reading experience as one of entering into a multi-directional web of different voices, ideas, perceptions, and periods of time. He saw the cut-up as a tool that let the writer discover previously undetected connections between things, with potentially enlightening and subversive results. With the cut-up, Burroughs prefigured the essential narrative strategy of hypertext and its ability to allow readers to leap across boundaries in time and space.

Allan Kaprow, who coined the term "Happening," was particularly interested in blurring the distinction between artwork and audience. The ultimate integrated art, he reasoned, would be without an audience, because every participant would be an integral part of the work. As he wrote in his 1966 primer, "Untitled Guidelines for Happenings,"^{xxxiii} "The line between art and life should be kept as fluid, and perhaps indistinct, as possible." This approach led to a performance style that pioneered deliberate, aesthetically conceived group interactivity in a composed environment. Happenings artists devised formal elements that allowed participants the freedom to make personal choices and collective decisions that would affect the performance.

By the 1980s, Media artists whose roots lay in performance and video also began investigating hypermedia as a means of exploring new forms for telling stories. Artists such as Lynn Hershman and Bill Viola were drawn to the computer's ability to break down linear narrative structures. Viola approached the medium as a repository for evocative images that could be projected on screens in installations, "with the viewer wandering through some three-dimensional, possibly life-sized field of prerecorded or simulated scenes evolving in time,"^{xxxiv} as he described it. Hershman was among the first to create digital artworks using interactive media, in such pieces as *Deep Contact*, from 1989. She introduced interactivity into her work to combat the loss of intimacy and control brought about by the dominance of media such as radio and television. Her use of hypermedia allowed the viewer to choose directions inside the artwork's complex branching structure, and shape a personal experience of it.

This notion of the artwork as a territory for interaction, as a locus of communications for a community, echoes the Happenings of a previous generation. On-line role-playing games have become laboratories for exploring this form of interactivity. As the social theorist Sherry Turkle has pointed out, on-line communities, such as Multi-User Dungeons (MUD), "are a new genre of collaborative writing, with things in common with performance art, street theater, improvisation theater, Commedia dell'Arte, and script writing."^{xxxv} Pavel Curtis created one of the earliest MUDs, *LambdaMOO*, in 1990 at Xerox PARC. Though it consisted only of text, its interactive quality, made possible through intricate storytelling devices via the Internet, gave participants the illusion of immersion in a virtual environment. Interaction in the on-line environment, Curtis claimed, creates a kind of social behavior which "in some ways it is a direct mirror of behavior in real life."

Marcus Novak took William Gibson's description of virtual environments as the starting point for his own theoretical and artistic explorations. In his essay from 1991, "Liquid Architecture in Cyberspace,"^{xxxvi} he follows the pioneering work of Sutherland, Fisher, and Gibson, et al, to its logical conclusion, and notes its profound implications for architecture, our notions of space, and our attitudes towards the organization of information. He notes that in cyberspace, since all structure is programmable, all environments can be fluid. The artist who designs these immersive digital habitats will be able to transcend the laws of the physical world. As a consequence, architectural forms built in cyberspace can respond to the viewer, encouraging provocative and illuminating interactions. In cyberspace, architecture becomes a form of poetry.

The Future is Under Construction

The breadth and potential of multimedia has lent itself to utopian proposals. The French media theorist Pierre Lévy describes multimedia as belonging to a trajectory of planetary evolution that runs from DNA to cyberspace -- an arc that follows pure information as it

reaches towards its most evolved form of expression. He proposes that today's global networks will usher in an era of "collective intelligence,"^{xxxvii} and suggests that "cyberspace constitutes a vast, unlimited field... designed to interconnect and provide interface for the various methods of creation, recording, communication and simulation." His enthusiastic perspective evokes a world of intriguing possibilities.

At the same time, we are all aware of the dystopian qualities of the 24/7 infotainment juggernaut that is being delivered across the globe through an ever more sophisticated telecommunications network. We read daily about the new media's encroachment on privacy, its opportunity for abuse, and the specter of centralized control that it might make possible. These dangers are real. There is a tension between opposing factions at the heart of the Internet -- between those who prize its potential for an open, freewheeling exchange of art and ideas, and those who see its pervasiveness as an opportunity to expand upon the marketing-driven broadcast model of 20th century media -- and it is not at all clear whether utopian or dystopian visions will ultimately prevail.

To a remarkable degree, the scientists, artists, and theorists who have pioneered the medium of multimedia share a commitment to forms of media and communications that are non-hierarchical, open, collaborative, and reflective of the free movement of the mind at play. It is, in sum, an extraordinary vision. But whether we will achieve it is an unresolved question.