Multimedia

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How do we think through the new types of media created for the computer? We can begin by naming them, but what names are there for these works of human art in the digital age? Names have emerged like *digital media*, *new media*, *hypermedia* or *multimedia*. From each of these names we can weave definitions, histories and theories that would think through the issues in different ways. In this chapter we will start with *multimedia,* one possible name that captures one of the features of the emerging genre – its multiplicity, including its shifting multiplicity of names.

This discussion like the new medium it follows is provisional. To think through something announced as novel is to discuss it without the distance of a critical tradition that guarantees its importance and stability. To discuss the novel runs the danger that from the distance of a generation we could find the new media is trivial. It could be that there is nothing new to new media, that there is no multiplicity to multimedia, and that all there is to hypermedia is the hype.

What remains, however, is the proliferation of digital artifacts that don't fit comfortably in our traditions of criticism. In responding to this proliferation there has been a renaissance of critical theories and the development of a craft of multimedia production. Readers of this will participate in the formation of this new media through creation and discussion – and that is what is exciting and new about the field. What is before us are complex works of human artifice like computer games and online encyclopedias. These we want to think through and talk about, even if we should be aware of the dangers of enthusiasm as we turn from the usual subjects of the arts and humanities.

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What is Multimedia?

A definition starts thinking through with a name. It is a traditional first step to discovering if one is dealing with one thing or many. Definitions help bring into view limits to that about which you think. Here are some definitions of multimedia.

> A *multimedia* computer system is one that is capable of input or output of more than one medium. Typically, the term is applied to systems that support more than one physical output medium, such as a computer display, video, and audio. Occasionally, *multimedia* is used to refer to the combination of text and images on a computer display terminal. Although text and images are in fact distinct carriers of information, hence media, this usage of *multimedia* is not preferred. After all, newspapers with text and images are not considered to be multimedia publications!
>
> The term *medium* can also refer to an input device such as a keyboard, mouse, microphone, camera, or other sensor. Regarding computer input, *multimedia* then refers to the capability of using multiple input devices to interact with a computer system. (Blattner, Dannenberg, *Multimedia Interface Design*, p. xxiii)

Blattner and Dannerberg further make the observation that "Multimedia systems strive to take the best advantage of human senses in order to facilitate communication." (Blattner, Danneberg, p. xix). Embedded in their discussion is a view of communication where the communicator chooses to combine the media best suited to their communicative goals. Multimedia systems thus give the communicator the greatest breadth of communicative possibilities, even if they do not choose to use them. Multimedia works likewise have the potential to rhetorically encompass other media and their rhetorical possibilities. To understand multimedia, if one pushes the point, one has to understand human perception and communication through all media.

The *Encyclopædia Britannica Online* defines "Interactive Multimedia" as,

> any computer-delivered electronic system that allows the user to control, combine, and manipulate different types of media, such as text, sound, video, computer graphics, and animation. Interactive multimedia integrate computer, memory storage, digital (binary) data, telephone, television, and other information technologies. Their most common applications include training programs, video games, electronic encyclopædias, and travel guides. Interactive multimedia shift the user's role from observer to participant and are considered the next generation of electronic

> information systems. ("Interactive Multimedia" *Encyclopædia Britannica Online*. <http://search.eb.com/bol/topic?eu=1461&sctn=1> [Accessed 25 October 1999])

In this definition the emphasis is placed on interactivity and the computer control over the delivery of information in different media. This control includes the release of control to the user so that they can participate in the development of meaning through interaction with a multimedia work.

While similar, what is interesting in these definitions is what they are defining. The first defines a "multimedia system" while the second specifies "interactive multimedia." This essay proposes a third and shorter definition that combines many of the features in the others with a focus on multimedia as a genre of communicative work.

A multimedia work is a computer-based rhetorical artifact in which multiple media are integrated into an interactive whole.

We can use the parts of this definition to analyze what is commonly named multimedia.

Computer-Based - The word "multimedia" originally referred to works of art that combined multiple traditional art media as in *a multimedia art installation*. In this sense it is what today we call "mixed-media" - works of art that combine fine art media like paint, found objects, sculptural components and so on. By defining multimedia as "computer-based" such mixed-media works are deliberately excluded though that is say that works multimedia cannot be art. In other words, a multimedia work for our purposes is a digital work that is accessed through the computer even if parts were created in analog form and then digitized for integration on the computer. This definition also excludes works that might have been created on a computer, like a desktop publishing file, but are accessed by readers through an analog media like print. A multimedia work proper is one that is viewed or browsed on the computer.

Rhetorical Artifact – A multimedia work is one designed to convince, delight or instruct in the classical sense of rhetoric. It is not a work designed for administrative purposes or any collection of data in different media. Nor is it a solely technological artifact. This is to distinguish a multimedia work, which is a work of human expression, from

those works that may combine media and reside on the computer, but are not designed by humans to communicate to humans. By "artifact" the definition stresses that a multimedia work is something made - a work of human artifice. This is not a definition of multimedia as an adjective applied to other things such as a "multimedia computer" which is one capable of being used to create multimedia.

Multiple Media - Central to all definitions of multimedia is the idea that multimedia combines types of information that traditionally have been considered different media and have therefore had different traditions of production and distribution. This is made possible on the computer through digitization. The computer stores all information, whatever its original form, as binary digital data so it is possible to combine media into multimedia. The computer allows the combination of media because they are all accessed and stored in the same fashion. To be more specific, multimedia works tend to bring together media that are incompatible in other means of distribution, especially synchronous and asynchronous types of information like audio (which is time-dependant) and text (which is not.)

Integration ... Artistic Whole - A multimedia work is not just a random collection of different media gathered somewhere on the system. By this definition the integration of media is the result of deliberate artistic imagination aimed at producing a work that has artistic unity, which is another way of saying that we treat multimedia as a unified works that are intended by their creator to be treated as a whole. The integration of media is a conscious human act aimed at a unified work identifiable as such; likewise consumers of multimedia treat such works as integrated in their consumption of them. My hard drive has multiple media transcribed on it in common directories, but those directories are not multimedia works because the different media were not consciously placed so as to be integrated into a single work for rhetorical purposes – in other words I don't treat such directories as integrated works. Having said that integration is important doesn't exhaust the issue. The art of multimedia lies in the imaginative ways media are integrated in individual works. The novelty of new media lies in the new combinations of media that surprise us.

Interactive - One of the features of multimedia is the interactivity or the programming that structures for the viewer's experience. Some level of interactivity is assumed in any computer-based work, but by this definition interactivity becomes a defining feature that helps weave the multiplicity into a whole. The interactivity is thus important to the artistic integrity of multimedia. We might go further and say that interactivity, in the sense of the programming that structures the work, is the dominant media that integrates the others.

The names given for multimedia works emphasize different characteristics of these computer works. "New Media" emphasizes the experience of these works as "new" and different from existing forms of entertainment and instruction, but new media can also refer to media new to the 20th century including electronic (but not necessarily digital) media like television. Calling something "new" has the further problem that eventually it will no longer be new, at which point the name will be obsolete unless applied to whatever is then new. "Hypermedia" evolved out of "hypertext" and emphasizes the way these works are non-linear, presenting themselves as labyrinths of information the user navigates. This name, however suggests that all new media are organized as hypertexts with nodes and links, which is not the case for works like arcade games. While hypermedia is a useful term for those works that make use of hypertext features, "multimedia" emphasizes the combination of traditional media into rhetorical unities. A related term that mirrors "multimedia" is "multimodal". A multimodal work is one that is accessed through different sensory modalities. The emphasis is on the user's experience – multimodal works are ones that the user sees, hears, touches and eventually might be able to smell and taste.

Defining multimedia as a way of thinking about the new medium made possible by the computer runs the risk of fixing a moving target inappropriately. It could turn out that multimedia works are not a new form of expression, but that they are re-mediated forms of existing genres of expression. It could be that multimedia is not one type of expression, but the new form in which other media can be presented extending rhetorical traditions through the creation of multimedia versions of existing genres like multimedia

games, multimedia fiction, multimedia textbooks, and multimedia encyclopedias. What is interesting from this perspective, is the potential for the renewal through digitization of traditional forms of entertainment and instruction. These traditional forms, when represented digitally, are transformed by the limitations and capabilities of the digital computer. They can be processed by the computer; they can be transmitted instantaneously over the Internet without loss of quality; they can be extended with other media annotations; and they can be transcoded from one form to another (a text can be visualized or read out as synthesized audio.)

The ways traditional media are created and consumed are also transformed when represented digitally. Multimedia books are not only bought at bookstores and read in bed, they can be distributed over the Internet by an e-text library for your PDA (Personal Digital Assistant) and consumed as concordances with text analysis tools. In short, even if we think of multimedia as a way of digitally re-editing traditional works, there are common limitations and possibilities to the digital form that can be thought through. Multimedia works, whether born digital or re-mediated, share common characteristics including an emerging tradition of electronic production and consumption. Whatever else these works are, they can be defined as multimedia for the purposes of thinking through the effects of the merging multiple media into interactive digital works to be accessed on the computer.

What are the types of multimedia?

Classifying is a second way of thinking through, one that involves surveying the variety of the phenomenon. While multimedia is too new a form of human expression to confidently classify, certain popular types have emerged. It is also a common move in the discussion of multimedia to give examples of these types of multimedia, especially to make the point that these types are no longer academic experiments inaccessible to the everyday consumer. To give examples is to point out that you have already been using multimedia and can participate in the thinking through. Further, certain types of multimedia are important to popular culture, widely consumed, and difficult to ignore if

we are concerned with communication and art. Computer games, for example, are the most commercially successful form of multimedia work and the study of computer games is evolving into a field of its own which combines game criticism and multimedia theory. A topology of multimedia would be itself an intersection of academic hypertexts, digital art, and popular forms like computer games. The challenge of multimedia to the humanities is the challenge of thinking through the variety and asking about the clusters of works that can be aggregated into types. Here are some examples.

Web Hypermedia – The first multimedia works to be seriously considered in humanities computing circles were hypertexts like the *Dicken's Web* by George Landow, a work created to explore the possibilities for hypertext and multimedia in education. It was developed for a now discontinued hypermedia environment *Intermedia* and was an exemplary educational hypertext that illustrated and informed the theoretical work of Landow around hypertext theory. With the evolution of the World Wide Web as a common means of for distributing and accessing hypertextual information, we now have thousands of educational and research Web hypertexts, some of which combine multiple media and can be called hypermedia works. It is worth noting that the Web was based on two open protocols, HTML (HyperText Markup Language) and HTTP (HyperText Transfer Protocol) developed by Tim Berners-Lee and colleagues in the late 1980s and early 1990s for the networked sharing of technical documents that could include structured text and images. Hypertext was a paradigm for the digital representation of information that inspired one of the major means of distribution of multimedia, the Web. While we may bemoan the limitations of the Web, it made the creation and distribution of simple hypermedia accessible to the larger community and has been extended with formats like the Macromedia Flash file format (SWF for Shockwave-Flash) that make sophisticated interactive graphics and animation possible in mostly free Web hypermedia works.

Computer Games – By far the most commercially successful multimedia works are computer games. A game like *Myst* (1993) by the Miller brothers makes effective use of high quality images, animations and environmental sound to create a fictional

world that the user navigates, solving puzzles and collecting clues to reach new levels. *Myst* and its successors, one of the most successful game franchises ever, is an example of how multimedia can extend a genre, in this case the computer text adventure game. Other types of games like arcade games and "first-person-shooters" also combine multiple media into highly interactive entertainment. Games like *Myst* are usually not free and they are distributed on CD-ROM, a second important means of distribution and consumption along with the Web.

Digital Art – Artists have been using multimedia to create interactive installations that are controlled by computers and use multiple media. An example would be David Rokeby's *Very Nervous System* (1986-1990), an interactive sound installation where the user or a performer generates sound and music through movement. These playful works are exhibited in galleries and museums as works of art that bring multimedia into the traditions of art exhibition. Other digital artists have created Web works that are submitted to online exhibitions like those mounted by the San Francisco Museum of Modern Art in their E•SPACE which collects and commissions Web art objects. From the perspective of production, multimedia artists like Rokeby bring new media skills like programming to the creation of art and it is not surprising that art schools have responded by training students in multimedia.

Multimedia Encyclopedia – Multimedia has been used widely in education and for the presentation of research. A common form of educational and reference multimedia is the multimedia encyclopedia like the *Encyclopædia Britannica Online* and Microsoft *Encarta* (on CD-ROM). These electronic reference works are examples of multimedia instructional and reference materials that have surpassed comparable print resources in sales, becoming standard educational resources for home and school use. They combine interactive search tools, hypertext links, and multimedia components with the comprehensive reference information one expects from a print encyclopedia. The print encyclopedia was from the time of Diderot and his enlightenment *Encyclopédie* a genre that exploited links (by Diderot called *renvois)* and images in order to make information accessible and interconnected. One could say that

> Diderot's project was in the spirit of multimedia, using the media at hand to encircle what was known. Multimedia encyclopedias are the logical extension of this spirit, taking advantage of the computer's capability to play time-dependent media like audio, animation and video to enhance the accessibility of information. The idea is that multiple media, used appropriately to explain something, can enhance the communicative potential of a work.

These are but examples of types of multimedia. A proper topology would be based on criteria. For example we could classify multimedia works in terms of their perceived use, from entertainment to education. We could look at the means of distribution and the context of consumption of such works, from free Web sites that require a high-speed Internet connection, to expensive CD-ROM games that require the latest video cards to be playable. We could classify multimedia by the media combined, from re-mediated works that take a musical work and add synchronized textual commentary, to virtual spaces that are navigated. Other criteria for classification could be the technologies of production, the sensory modalities engaged, the type of organization that created the work, or the type of interactivity.

What is the history of multimedia?

A traditional way of thinking through what is new is to recover its histories. The histories of multimedia are still being negotiated and include the histories of different media, the history of computing, and the history of the critical theories applied to multimedia. One history of multimedia is the history of the computer as it evolved from a machine limited to numeric processing to a machine capable of handling multiple media. This is the history told here.

An important feature of the computer as distinct from dedicated calculating devices is that the computer is a general purpose machine that can be extended to do different tasks (and handle different media.) A calculator is an information appliance that is designed for, and limited to, certain operations. The modern computer as it emerged after the Second World War is a general purpose machine that can be adapted to new purposes

through programming and peripherals. The history of the computer since the ENIAC can be seen as the working out of this idea in different ways including the working out of techniques for managing different media. While the first computers were designed solely to do scientific and applied numerical calculations they were, over the years, extended to be able to handle alphanumeric strings (text), then raster and vector graphics (images), audio (sound), moving pictures (video and animation) and finally three-dimensional objects and space. Today's personal computer can handle all these media with the appropriate peripherals, making multimedia development and consumption available to the home user.

Numbers and Text

If the first computers were designed for number crunching and data processing for military, scientific and then business applications they soon became adapted to text editing or the manipulation of alphanumeric strings. The first commercial word processor was the IBM MT/ST (Magnetic Tape/Selectric Typewriter) which was marketed by IBM as a "word processor" and released in 1964. It stored text on a tape for editing and reprinting through a Selectric Typewriter. A word processor as opposed to a text editor was meant for producing rhetorical documents while text editors were for programming and interacting with the system. By the late 1970s personal computers had primitive word processing programs that allowed one to enter, edit, and print documents. WordStar, which was released in 1979 by MicroPro International, was one of the first commercially successful word processing programs for a personal computer, expanding the media that could be handled by a home user from numbers to text.

Images

The next step was access to graphics on a personal computer, a development that became accessible with the release of the Apple Macintosh in 1984. The Macintosh (Mac), which made innovations from the Xerox Palo Alto Research Centre accessible on a commercially successful personal computer, was designed from the start to handle graphics. It came bundled with a "paint" program, MacPaint, and a mouse for painting

and interacting with the Graphical User Interface. While it was not the first computer with graphical capabilities, it was the first widely available computer with standard graphical capabilities built-in so that anyone could paint simple images, edit them, print them or integrate them into other documents like word processing documents created with MacWrite, a WYSIWG (What-you-see-is-what-you-get) word processor also bundled with the early Macs.

Desktop Publishing

In 1986 the capabilities of the Macintosh were extended with the release of the Mac Plus, Aldus PageMaker and the PostScript capable Apple LaserWriter. The combination of these three technologies made "desktop publishing" accessible on the personal computer where before it had been limited to specialized systems. While MacPaint was a playful tool that could not compete with commercial graphics systems, a designer outfitted with PageMaker and a LaserWriter could compete with professional designers working on dedicated typesetting systems for low-end, monochrome publishing jobs like manuals and newsletters. It wasn't long before a colour capable Macintosh was released (the Mac II) and image editing software like PhotoShop helped the Mac replace dedicated systems as the industry standard for graphic design and publishing. Now, just about any publication, from newspapers to glossy annual reports, can be created, edited and proofed on personal computer systems. The only components still beyond the budget of the home user are the high-end digital cameras, scanners and printers which are needed to produce high resolution publications.

Desktop publishing is the precursor to multimedia even though desktop publishing aims at rhetorical artifacts that are not viewed on a computer but are read in print. Computer aided graphic design and desktop publishing are arts that use computers instead of traditional technologies to produce rhetorical artifacts. We can see desktop publishing as the precursor to multimedia as it made possible the creation of documents on the computer that professionally combined two media – text and images. The challenge of combining two media that each bring different creative and interpretative traditions

predates desktop publishing – designers before the computer have struggled to design the word and image – what was new was that the personal computer user was now challenged to experiment with different fonts, styles, and the placement of content in two-dimensional space. The initial result was a proliferation of horrid, over-designed newsletters, but that was the result of a dramatic increase in access to the tools of production without a parallel evolution in design education.

Authoring Environments

Further, the desktop publishing tools were themselves multimedia environments that provide for the direct manipulation of images and text. Desktop publishing was a precursor to multimedia is another way; desktop publishers typically spent most of their time viewing the for-print documents they manipulated on the interactive screen not on paper. Graphic designers comfortable with design for print (but on a screen) were ready when the first authoring tools became available for the design of screen-based media. They knew how to work with images and text in the two-dimensional screen space and were competent with the graphics tools needed to layout and create computer graphics. When Apple released HyperCard in 1987 the graphics community already had many of the skills needed to create screen-based media. HyperCard, developed by the creator of MacPaint (Andy Hertzfield) was an immediate success, especially since it came free with every Macintosh and therefore HyperCard stacks could be distributed without licensing costs to any other Macintosh user. Given the high penetration of Macs in schools it is not surprising that within a year of the release of HyperCard there were thousands of simple educational multimedia works that combined text, images, simple interactivity, and simple animations. HyperCard was the PageMaker of multimedia, popularizing a genre of interactive software and making the integration of media possible on a personal computer.

Authoring environments like HyperCard are important to the growth of multimedia as they were easier to learn than the programming languages needed previously to create multimedia and they were designed specifically for the combination of media into

interactive works by designers. HyperCard, as its name suggests was inspired by hypertext theory. The metaphor of HyperCard was that you were creating a stack of cards (nodes of information) which could have text, graphics and buttons on them. The buttons were the hypertext links to other cards. HyperCard had a scripting language with which one could create more complex behaviors and one could add extensions to control other media devices like audio CDs and videodisc players. One of the most popular computer games of its time, Myst (1993), was first developed on HyperCard. This metaphor was quickly imitated by one of the more popular multimedia authoring environments for the IBM PC, Asymetrix (now Click2learn) ToolBook. Toolbook's metaphor was a book of pages with text, graphics and buttons and had the added capability of colour.

Today the most popular authoring environments other than HTML editors (Dreamweaver and GoLive) are tools like Macromedia Director and Macromedia Flash. Both of these use a cell and timeline metaphor that evolved out of animation environments. Flash is used extensively to add animations and interactive components to Web sites while Director is used for more complex projects that are typically delivered on a CD-ROM. The Flash file format (SWF) has been published so that other tools can manipulate SWF.

Sound

The Macintosh also incorporated sound manipulation as a standard feature. The first Macs released in the mid 1980s had built in sound capabilities beyond a speaker for beeps. The 128K Mac had 8-bit mono sound output capability. By 1990 Apple was bundling microphones with standard Macs. HyperCard could handle audio, though it could not edit it. The standard Macintosh thus had simple audio capabilities suitable for interactive multimedia. With the addition of MIDI controllers and software Macintoshes became popular in the electronic music community along with the now discontinued Atari ST (1985) which came with a built in MIDI port.

One of the first multimedia works to make extensive use of audio was Robert Winter's interactive Beethoven's *Ninth Symphony*. This 1989 work came with HyperCard stacks on floppy disk which when installed and run would control a commercial audio CD of

Beethoven's *Ninth Symphony*. The user could navigate the audio and read critical notes that were synchronized to the symphony.

Digital Video

The latest media threshold to be overcome in affordable personal computers is digital video. The challenge of multimedia is to combine not just asynchronous media like text and images, neither of which need to be played over time, but also time-dependent media like audio, animation, and video. Video puts the greatest stress on computer systems because the demands of accessing, processing, and outputting the 30 frames-per-second typical of television quality video. Only recently, with the introduction of computers with Firewire or IEEE-1394 ports, has it become easy to shoot a video on a home video recorder, download the video to the personal computer for editing, and transfer it back to tape (or stream it over the Internet).

Given the challenge of the integration of video there have been some interesting hybrid solutions. One of the first multimedia works, the *Aspen Movie Map* (1978), by Andrew Lippman (and others) at what is now called the MIT Media Lab, combined photographs on a videodisk with computer control so that the user could wander through Aspen going up and down streets in different seasons. With the release of digital video standards like MPEG (MPEG-1 – 1989, MPEG-2 - 1991) and Apple QuickTime (1991) it became possible to manage video entirely in digital form. An early commercial work that took advantage of QuickTime was the Voyager CD-ROM of the Beatles *A Hard Day's Night* (1993). This published multimedia work was built around a digital video version of the innovative Beatles music movie. Lyrics were synchronized with the playing of the movie and the CD included background information and an image archive. It is now common for multimedia works to include low-resolution digital video components.

Virtual Space and Beyond

Current multimedia systems present the user with a two-dimensional graphical user interface. While such systems can manipulate three-dimensional information (3-D) they do not typically have the 3-D input and output devices associated with virtual reality

(VR) systems. Is VR the next step in the evolution of the multimedia computer and user interface? In the 1990s it seemed that cyberspace, as described by William Gibson in *Neuromancer* (1984), was the next frontier for multimedia computing. Gibson's vision was implemented in systems like those shown in the movie *Lawnmower Man* (1992) which combine head-tracking systems, data gloves, and 3-D goggles to provide an immersive experience of a virtual space. The metaphor for computing would no longer be the two dimensional desktop with icons of files and folders, but would be virtual spaces filled with avatars representing people and 3-D objects. The relationship between the user and computer would go from one of direct manipulation of iconographic representations to immersion in a simulation of a world. Space and structure could be handled as media within VR systems.

While this projected evolution of the multimedia interface is still the subject of academic research and development, it has been miniaturization and the Internet that has instead driven the industry. The desktop multimedia systems of the 1990s are now being repackaged as portable devices that can play multiple media. The keyboard and the mouse are being replaced as input devices by pen interfaces on personal digital assistants (PDAs). Rather than immersing ourselves in virtual caves we are bringing multimedia computing out of the office or lab and weaving it into our surroundings. There are multimedia devices in homes, in cars, and in classrooms. We can now carry simple multimedia players like MP3 players and Web enabled cell phones. The challenge to multimedia design is how to appropriately scale interfaces for these hand-held devices.

What are the academic issues in the study of multimedia?

How can we study multimedia in the academy? What are the current issues in multimedia theory and design? The following are some of the issues that the community is thinking through.

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Best Practices in Multimedia Production

The academic study of multimedia should be distinguished from the craft of multimedia. Learning to create multimedia works is important to the study of multimedia in applied programs, but it is possible to study digital media in theory without learning to make it. That said, a rich area of academic research is in the study of appropriate practices in multimedia design. For example, the field of Human Computer Interface (HCI) design is one area that crosses Computer Science, Information Science, Psychology, and Design. HCI tends to be the scientific study of interface and interactivity. In Art and Design schools the issue of interface tends to be taken up within the traditions of visual design and the history of commercial design. If the HCI scientist is interested in the psychology of perception and interaction, the media artist is interested in the imaginative possibilities of multimedia.

An important part of learning to create multimedia is learning the tools of creation from the graphic design tools, the Web authoring tools, animation tools, audio editing tools, video editing tools, and information management tools. For each of the media typically combined in multimedia there are specialized tools and corresponding practices. Likewise there are also tools for integrating multimedia, programming it, and managing media objects. For all of these there are also best practices that have emerged from the industry and which are being theorized.

One particular area of best practices which is important to humanists is digitization or the digital acquisition of evidence. Multimedia works of interest to humanists are often created through the digitization of existing materials or evidence. Even works that are born digital or conceived for digital delivery will often include images that are scanned, audio that is performed and recorded, and video shot with a video recorder. For this reason the process of digitization is important to multimedia. The choices made when digitizing material, both as to what to digitize and at what resolution to digitize, affect the final form of the multimedia work. As our generation of computing humanists digitizes the works traditionally significant for enquiry in the humanists we are making decisions about what it is important to re-mediate and how to do so.

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Game Criticism and Interactivity

If the practices of digitization create the media that make up multimedia, it is the practices of combining multiple media into rhetorically effective works that are the play of multimedia. As mentioned above, the design of interfaces for multiple media and their appropriate use is an important field of academic study. The possibilities of interactivity are what are characteristic to computer-based media. The computer provides a programmable system that has vastly more potential for interactive design than analogue media appliances. This would seem to be what is new in multimedia – the imaginative ways digital designers have coordinated multiple media for us to interact with. In particular, interactive game designers have created complex systems for interaction with media. For this reason the emerging field of Game Criticism that attempts to study computer games seriously as popular culture and rhetoric is important to the study of multimedia. What is a game and how can we think of games as forms of human art? What makes an effective or playable game? What are the possibilities for playful interaction through the computer? Questions like these have a way of reminding us of the playful dimensions of traditional media and turning us back to discussions of play in the humanities like *Homo Ludens* by Johan Huizinga. Questions like these are being debated along with sociological questions about the impact of games on teen culture. Whether on not games are corrupting our youth, as many fear, the game is a paradigmatic form of communication that places the reader in a unique situation of co-authoring meaning. It is not surprising that the game as a form is being reinterpreted in light of the emergence of computer games. The interactive game may be the paradigmatic form of multimedia, or for that matter, the paradigmatic form of expression in the digital age.

Theories and Histories of Multimedia

The study of multimedia as a form of expression has not developed a theoretical tradition. Instead critical theories from existing disciplines are being applied with increasing ingenuity from film studies to literary theory. The very issue of what existing theoretical traditions can be usefully applied to multimedia is a source of discussion. This essay has

taken a philosophical/historical approach asking about thinking about multimedia. Theorists like Brenda Laurel, *Computers as Theatre*, look at multimedia as dramatic interactions with users. George Landow in *Hypertext: The Convergence of Critical Theory and Technology* has applied literary theory to computing. Lev Manovich in *The Language of New Media* look at the continuity of film and new media.

The intersection of technology, communication and culture has also been a topic of wide interest. Marshall McLuhan in *Understanding Media* popularized an approach to thinking about the effects of technology and media on content. He and others, like Walter Ong (*Orality and Literacy*), drew our attention to the profound effects changes in communications technology can have on what is communicated and how we think through communication. It is now taken as given in influential industry magazines like *Wired* that we are going through a communications revolution as significant as the development of writing or print. There is no shortage of enthusiastic evangelists like George Gilder (*Life After Television*) and critics like Neil Postman, *Technolopoly*. There are also influential popular works of personal computing and media technology – works that have introduced ideas from the research community into popular culture like those of Stewart Brand, *The Media Lab*; Howard Rheingold, *Tools for Thought* and *The Virtual Community;* and Nicholas Negroponte in *Being Digital*.

Conclusion

There are two ways we can think through multimedia. The first is to think about multimedia through definitions, histories, examples, and theoretical problems. The second way is to use multimedia to think and communicate thought. The academic study of multimedia is a thinking-about that is typically communicated through academic venues like textbooks, articles and lectures. Thinking-with is the craft of multimedia which has its own traditions of discourse, forms of organization, tools, and outcomes. To think-with multimedia is to use multimedia to explore ideas and to communicate them. In a field like multimedia where that about which we think is so new it is important to thing-with. Scholars of multimedia should take seriously the challenge of creating multimedia

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as a way of thinking and attempt to create exemplary works of multimedia in the traditions of the humanities.

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