Multimedia

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How do we think through the new types of media created for the computer? Many names have emerged to describe computer-based forms, such as *digital media*, *new media*, *hypermedia* or *multimedia*. In this chapter we will start with *multimedia*, one possible name that captures one of the features of the emerging genre.

**What is Multimedia?**

A definition starts thinking through with a name. 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. (Blattner and 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 and Danneberg, p. xix). Embedded in their discussion is a view of communication where the communicator chooses to combine the media best suited to her communicative goals; therefore, multimedia, which encompasses other media, provides the greatest breadth of communicative possibilities.

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” (“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 reader or viewer 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 multimedia.

**Computer-Based** - The word "multimedia” originally referred to works of art that combined multiple traditional art media, as in a multimedia art installation. By defining multimedia as "computer-based" such mixed-media works are deliberately excluded. In other words, a multimedia work 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.

**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 solely a 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.

**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. Digitization makes this possible as the computer stores all information, whatever its original form, as binary digital data so it is possible to combine media, especially media that are incompatible in other means of distribution, like synchronous or time-dependent media (audio and video) and asynchronous media (text and still images).
**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 unified works that are intended by their creator to be treated as a whole. Likewise, consumers of multimedia treat such works as integrated in their consumption. The art of multimedia consists in how you integrate media.

**Interactive** - One of the features of multimedia is the interactivity or the programming that structures 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. 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 form that integrates the others.

The names given for multimedia works emphasize different characteristics of these 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. "Hypermedia" evolved out of "hypertext" and emphasizes the way these works are multi-linear 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.

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 remediated forms of existing genres of expression (Bolter and Grusin). These traditional forms, when represented digitally, are transformed by the limitations and capabilities of the 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, distributed 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 (re-encoding) traditional works, there are common limitations and possibilities to the digital form. Multimedia works, whether born digital or remediated, share common characteristics including emerging modes of electronic production, distribution and consumption. 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 multimedia, and one that involves surveying the variety of the phenomenon. It is also a common move in any 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. The challenge of multimedia to the humanities is the challenge of thinking through the variety of multimedia artifacts 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 considered seriously in humanities computing circles were hypertexts like *The Dickens Web* by George P. Landow, a work created to explore the possibilities for hypertext and multimedia in education. It was an exemplary educational hypertext that illustrated and informed Landow’s theoretical work around hypertext theory (Landow). With the evolution of the World Wide Web as a common means 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. The
early technologies of the Web like HTML have been extended with technologies like XML and the Macromedia Flash file format (SWF for Shockwave-Flash) that make sophisticated interactive graphics and animation possible.

Computer Games – By far the most commercially successful multimedia works are computer games, whose short but rich history is interwoven with the development of multimedia technologies. Games like Myst (Cyan, 1993) introduced consumers of all ages to the effective use of images, animations and environmental sound to create a fictional world characterized by navigation and puzzle-solving. More recently, advancements in hardware and software technologies for graphics, audio, animation, and video, and sophisticated artificial intelligence and physics models are making game worlds look and act more convincing. Games are normally distributed on CD-ROM or DVD, but frequently make use of the Web for distributing software updates and game demos.

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 body 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.

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). Multimedia encyclopedias are the logical extension of the print genre, taking advantage of the computer’s capability to play time-dependent media like audio, animation and video to enhance the accessibility of information.

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 remediated 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 something that 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 personal computer as it evolved from an institutional machine designed for numerical processing to a multimedia personal computer that most of us can afford. 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 (1946) can be seen as the working out of this idea in different ways, including the techniques for managing different media. While the first computers were designed solely to do scientific and applied numerical calculations, they were eventually extended to handle alphanumeric strings (text), raster and vector graphics, audio, 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. MicroPro International’s WordStar (1979) 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 came 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 (GUI). 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 very expensive 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), which, when combined with image-editing software like Adobe 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, is created, edited and proofed on personal computer systems. The only components still beyond the budget of the home user are the high-resolution digital cameras scanners and printers necessary to produce top-quality publications. But even these components are slowly moving into the reach of everyday computer users.

Desktop publishing is the precursor to multimedia even though desktop publishing aims at rhetorical artifacts that are not viewed on a computer. Computer-aided graphic design and desktop publishing are arts that use computers instead of traditional technologies to produce rhetorical artifacts that combine media like text and images. The challenge of combining two media, each with different creative and interpretative traditions, predates desktop publishing – designers before the computer struggled to design the word and image. What was new, however, was that the personal computer user now had the opportunity to experiment with the design and placement of content in two-dimensional space. The initial result was a proliferation of horrid, over-designed newsletters and posters that frequently exhibited unrestrained use of fonts and visual styles. Nevertheless, this dramatic increase in access to the tools of production was without a parallel evolution in design education.

**Authoring Environments**

Further, the desktop publishing tools were themselves multimedia environments that provided for the direct manipulation of images and text. Desktop publishing was a precursor to multimedia in 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 allowed multimedia authors to distribute HyperCard stacks without licensing costs to other Macintosh users. 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 animations and simple interactivity.

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. HyperCard, as its name suggests, was inspired by hypertext theory. The metaphor of HyperCard was that authors created 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 or 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. The card stack metaphor was quickly imitated by Asymetrix ToolBook, one of the more popular multimedia authoring environments for the IBM PC. Toolbook's metaphor was a book of pages with text, graphics and buttons and it added colour capability.

Today, the most popular authoring environments other than HTML editors such as 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 could 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 29.97 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 video, download it to the personal computer for editing, and transfer it back to tape, CD, or DVD or even stream it over the Internet.

Given the challenge of integrating video, there have been some interesting hybrid solutions. One of the first multimedia works, the Aspen Movie Map (1978), by Andrew Lippman (and others) from 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 in 1989, MPEG-2 in 1991) and Apple QuickTime (1991), it became possible to manage video entirely in digital form. An early published work that took advantage of QuickTime was the Voyager CD-ROM of the Beatles A Hard Day’s Night (1993). This 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 elements.

**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 that 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 desktop, 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 simulated world. Space and structure were the final frontier of multimedia.

While this projected evolution of the multimedia interface is still the subject of academic research and development, it has been miniaturization and the Internet has driven the industry instead. 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 by input devices like 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 carrying or weaving it in our surroundings. The challenge to multimedia design is how to scale interfaces appropriately for hand-held devices like MP3 players and mobile phones.

**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.
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. An important issue for computing humanists building multimedia is digitization – what to digitize, how to digitally represent evidence, and how to digitize evidence accurately?

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. The possibilities of interactivity are what characterize computer-based media. In particular, interactive game designers have created complex systems for interaction with media. For this reason, the emerging field of Digital 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? 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 yet to develop a theoretical tradition of its own. 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 debate and
discussion. This essay has taken a philosophical/historical approach, asking questions about how to think through 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*, looks at the historical, social, and cultural continuity of film and new media. In *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*, Janet H. Murray considers the new aesthetic possibilities of multimedia within the context of narrative tradition.

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*), draw our attention to the profound effects that changes in communications technology can have on what is communicated and how we think through communication. Influential industry magazines like *Wired* take it as a given 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 (*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 what we think about is so new, it is important to think-
with. Scholars of multimedia should take seriously the challenge of creating multimedia as a way of thinking about multimedia and attempt to create exemplary works of multimedia in the traditions of the humanities.
Bibliography

This bibliography is organized along the lines of this essay to guide readers in further study.

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(Includes “As We May Think” by Vannevar Bush.)


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