Hypertext, Hypermedia, Multimedia Defined?

Denise Tolhurst

The use of hypertext, hypermedia, and multimedia is blossoming in many arenas, including education. These media are being used creatively, as is the terminology that describes them. Different individuals and groups are using the terms to describe an idea that is clear in their *own* minds, but between groups the ideas and meanings associated with these terms vary considerably.

Providing a definition of the terms is not a straightforward process. Most articles and papers provide a definition of one or all three, but there is no real consistency and accepted usage of the terminology. The terms are defined in contradictory ways in different articles, which perhaps reflects the newness of the area and the fact that the terms and their applications are still evolving. Blattner and Dannenberg (1992) acknowledge this disparity and try to explain it by suggesting (p. xxiii):

> Manufacturers tend to define multimedia in accordance with their current product line, and even the academic community uses the term inconsistently.

Support for the influence of the rapidly developing technologies on the use of terms and their definitions is found in the work of Schwier and Misanchuk (1993, p. 3), who refer to the "rapid and seemingly endless changes occurring in the technology and language." They also acknowledge the difficulty of defining terms by providing a witty and well-suited analogy at the beginning of their book:

> It is not a simple matter to offer a concise working definition of interactive multimedia instruction. By its very nature IMI is invertebrate. You poke it and it slithers away.

Denise Tolhurst is Lecturer in Computing at the University of New South Wales, St. George Campus, Oatley, New South Wales, Australia.

This article attempts to differentiate between the meanings of the three terms in a discussion of the uses of each term in the literature. It then suggests how the terms and the relationships between them should be described.

Hypertext

Hypertext is defined in two different ways in the literature, each reflecting the interests of the groups using them. One definition of hypertext is in terms of its functional components and construction (Sweeters, 1994; Tolhurst, 1992; Jonassen, 1991; Jonassen & Grabinger, 1990; Leggett *et al.*, 1990; Begeman & Conklin, 1988; Frisse, 1988; Halasz, 1988; Campbell & Goodman, 1988; Conklin, 1987). This type of definition is typically used by "computer scientists" who are interested in the creation of hypertext systems and the effectiveness of the user interface. The second type of definition that can be used to describe hypertext is based on the semantic use of links, or the "associate trails...that reflect the way the human mind works" (Bush, 1945, p. 106; see, e.g., Tripp & Roby, 1990; Spiro & Jehng, 1990; Landow, 1990; Foss, 1989). A discussion of these two types of definitions follows, beginning with the functional definition.

A functional description of hypertext is provided by Leggett *et al.* (1990) in which hypertext is described in terms of four basic components: information elements (the text, graphical components); abstractions (an object which allows elements to be structured; grouped or otherwise related); the anchors (the source or destination of a link); and the links (the connectors among anchors).

In an alternative functional definition, Conklin (1987, p. 17) describes hypertext as "extending the traditional notion of 'flat' text files by allowing more complex organizations of...direct machine supported references from one textual chunk to another; new interfaces provide the user with the ability to interact directly with these chunks.... These extensions of traditional text fall under the general category of *hypertext* (also known as *nonlinear text*)." Conklin (1987, p. 18) in a footnote also states that "this article seeks to establish the criterion of machine-supported links as the primary criterion of hypertext."

Halasz (1988, p. 836) also provides a functional definition of "building systems for information *representation* and *management* around a network of multimedia nodes connected together by typed links." However, the term he is defining here is hypermedia. Such a definition raises the question of how hypertext and hypermedia differ, if indeed they do (which shall be discussed in detail later).

An alternative style of functional definition is offered by Sweeters (1994, p. 48) based on the importance of the links and the characteristic way in which hypertext facilitates the learner's activation of links. He suggests

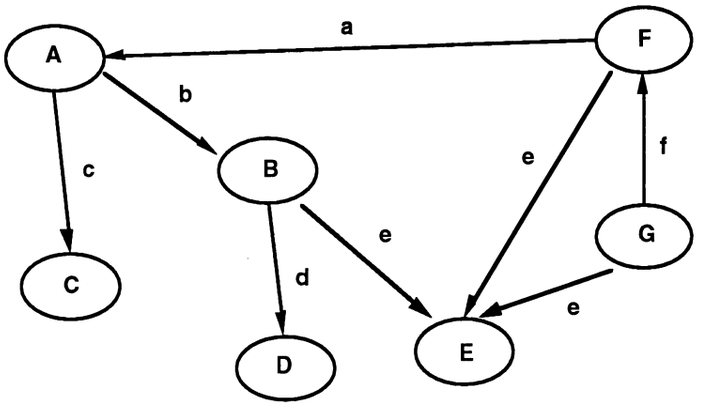

Figure 1. The relationship between nodes and links in hypertext.

that "hypertext is a collection of textual information on a specific topic featuring highlighted words known as 'hot spots' which can be activated by touch. When activated, they branch the user to additional information, such as definitions, elaborations, or related material."

When represented diagrammatically, functional definitions can be illustrated as nodes of information that are connected by physical links, as is shown in Figure 1. The capital letters in ovals represent the nodes and the lowercase letters the physical links.

An example of the second type of hypertext definition, a semantic definition of a system that allows information to be linked according to associations within the content, is provided by Tripp and Roby (1990). They define hypertext as a "non-linear, multi-dimensional, semantic structure in which words are linked by associations." Spiro and Jehng (1990) suggest that hypertext is organized in a nonlinear fashion that allows readers to pursue reading paths based on their own associative links (p. 160):

> The term hypertext refers to computer-based texts that are read in a nonlinear fashion and that are organized on multiple dimensions. The same material (which can be any kind of randomly accessible medium, e.g., text, video, audio) is capable of being explored in different ways, with different exploration paths producing what are essentially multiple texts for the same topic.

Spiro and Jehng do not limit hypertext to purely textual information, an idea which is supported by others (Landow, 1990; Foss, 1989; Megarry, 1988). Foss (1989, p. 407) endorses Spiro and Jehng's suggestion that "Hypertext systems contain frames of text, pictures, sound and animation that are organized non-linearly into a network of linked frames." A stronger endorsement of multiple media format in hypertext is provided by Landow (1990) in a claim that it is a fallacy that text is primarily alphanumeric. He suggests that visual cues have always been important in books, and that hypertext promises to make even greater use of them. These visual cues are not merely illustrations of some concept, but are a major element of the text.

Consequently, hypertext can be viewed functionally as nodes of information that are linked, allowing readers to follow a variable reading path of associations based on semantic links. Contrary to the suggestion in its name, hypertext has been described as including more than "textual information," that is, video and audio forms of information.

Hypermedia

Hypermedia has also been defined in the two ways described for hypertext, that is, from a functional perspective and from a semantic perspective, and in many instances the definitions overlap those of hypertext. One example of this is shown above in the functional definition of hypermedia provided by Halasz that reflects the definitions of hypertext.

A functional definition of hypermedia offered by Knussen, Tanner, and Kibby (1991, p. 13) could also easily be taken as a definition of hypertext. Specifically:

> Hypermedia...shares many characteristics with other forms of computer based learning material, but has a node and link structure which enables the user to explore the content in a non-linear and interactive way, both quickly and easily.

Sweeters (1994, p. 49) incorporates the term hypertext in his definition of hypermedia as the "...combination of full motion video and sound with hypertext." In their definition of hypermedia, Welsh, Murphy, Duffy, and Goodrum (1993, p. 19) quote Conklin, who describes hypermedia as a "means of representing information in chunks, or nodes, and of providing a learner with the ability to navigate through the information by following paths, or links, that appear relevant." These definitions of hypermedia fail to identify the distinguishing features that separate hypermedia and hypertext.

As with the functional definitions that mirror hypertext, the semantic definition of hypermedia offered by Gay, Trumbull, and Mazur (1991, p. 189) has the essence of the latter definitions of hypertext provided above, that is, of a multiple media, nonlinear information management system. They suggest that hypermedia is:

> ...a style of building systems for information representation and management around a network of multimedia nodes connected together by typed links. Hypermedia is a multi-voice medium. The bodies of material can include text, static and animated graphics, voice, sound, and music all contained in one delivery system. Well designed systems allow learners to link information, create their own paths through the material, annotate, and literally construct webs of information.

Similar semantic definitions of hypermedia can be found in the work of Kommers (1993), Weber (1992), and Locatis *et al.* (1989).

The fact that the definitions of hypertext and hypermedia are similar reflect the evolution of the technology and its application. As early computer systems were incapable of displaying graphics (or graphics of acceptable quality), systems which used the node and linking idea were purely textual in nature. It is not surprising then that the term was used for text based nonlinear systems. In the intervening period from the inception of the use and naming of hypertext to the present, the graphics capabilities of systems have improved enormously and the term hypermedia has become commonly used. As the graphics capability of computers has developed gradually, and the use of the terms hypermedia and hypertext has had no distinct "transition," it is not surprising that there is confusion among the terms.

Multimedia

Multimedia can be described as the use of two or more media to present information. The media that can be used include text, still or animated graphics, movie segments, sounds, and music. Kozma (1991) suggests that the term has been in use for several decades, and it is only recently that it has been linked to the use of computer technology. Specifically, he says (pp. 199–200):

> Until recently the term has meant the use of several media devices, sometimes in a coordinated fashion (e.g., synchronized slides with audio tape, perhaps supplemented by video). However, advances in technology have combined these media so that information previously delivered by several devices is now integrated into one device. The computer plays a central role in this environment.

Kozma goes on (p. 201) to describe hypertext as nonlinear text and hypermedia as an "extension of hypertext to include a variety of symbolic expressions beyond text."

In contrast to the above definition, Wiener, Knight, Arnold, and Richardson (1990, appendix of Apple Information Guide to Multimedia K–12) includes a definition of interactive multimedia that states:

> Interactive multimedia is the powerful combination of text, graphics, sound, animation and video under computer control....For education, multimedia has the following three characteristics: multi media types, nonlinear environment and users as producers.

The essence of this definition, that is, the use of multiple media in a nonlinear format, parallels the semantic definitions for hypertext and hypermedia.

As with the terms hypermedia and hypertext, multimedia is described differently by different authors. Weiner *et al.* (1990) include nonlinear linking of multiple formats, whereas Kozma (1991) does not. Multimedia is a term that is also the victim of its "newness" and, as Blattner and Dannenberg (1992) suggest, the development and promotion of multimedia products by manufacturers is contributing to confusion of the term.

A definition that offers a combination of functional and semantic perspectives of multimedia is provided by Park and Hannafin (1993, p. 63) that states:

> Interactive multimedia dynamically link and manage nodes of information containing multiple symbol systems and images within a given medium or across different media. As extensions of hypertext and hypermedia, they provide user-directed, non-linear methods for organizing and accessing information...; support access to knowledge according to individual demands...; permit access to individual elements contained in large databases...; and provide user-centered interactive environments.

Section Summary

In order to provide an overview of the terms hypertext, hypermedia, and multimedia, a summary of the above samples of functional and semantic definitions found in the literature is provided in Table 1.

	Functional Definitions	Semantic Definitions
Hypertext **media:** words, text, pictures, sound, animation **components:** elements, abstractions, anchors, links textual chunks nodes, links associative links 'hot spots'	Leggett *et al.* (1990) four basic components; elements, abstractions, anchors, links Conklin (1987) "...direct machine supported references from one textual chunk to another ..." Jonassen (1991) "The most basic building blocks of hypertext/hypermedia systems are nodes and links. ... Associative links tie the nodes together ..." Kozma (1991) "... nonlinear text" Sweeters (1994) "... textual information on a specific topic featuring highlighted words known as 'hot spots' which ... branch the user to additional information, such as definitions, elaborations, or related material."	Tripp & Roby (1990) "... a nonlinear, multi dimensional, semantic structure in which words are linked by associations." Spiro & Jehng (1990) "... computer-based texts that are read in a nonlinear fashion and that are organized on multiple dimensions." Foss (1989) "Hypertext systems contain frames of text, pictures, sound and animation ... organized nonlinearly...."
Hypermedia **media:** text, static and animated graphics, sound, voice, music, **components:** multimedia nodes, links node and link structure	Halasz (1988) "... network of multimedia nodes connected together by typed links ..." Knussen *et al.* (1991) "... has a node and link structure which enables the user to explore the content in a nonlinear and interactive way ..." Welsh, Murphy, Duffy, & Goodrum (1993) "... a means of representing information in chunks, or nodes, and of providing a learner with the ability to navigate through the information by following paths, or links, that appear relevant."	Gay *et al.* (1991) "... a multi-voice medium. The material can include text, static and animated graphics, voice, sound and music. ... well designed systems allow learners to link information, create their own paths ... annotate, and literally construct webs of information." Kozma (1991) "... extension of hypertext to include a variety of symbolic expressions beyond text." Sweeters (1994) "... the combination of full motion video and sound with hypertext."
Multimedia **media:** more than one media, text, graphics, sound, animation, video	Kozma (1991) "... the use of several media devices, sometimes in a coordinated fashion. ... advances in technology have combined ... media so that information previously delivered by several devices is now integrated into one device. The computer plays a central role. " Park & Hannafin (1993) "...interactive multimedia dynamically link and manipulate nodes of information...."	Weiner (1990) "... the powerful combination of text, graphics, sound, animation and video under computer control." Park & Hannafin (1993) "...provide user-directed, non-linear methods for organizing and accessing information...; support access to knowledge according to individual demands...; permit access to individual elements contained in large databases...; and provide user-centered interactive environments."

Table 1. Summary of a sample of definitions found in the literature.

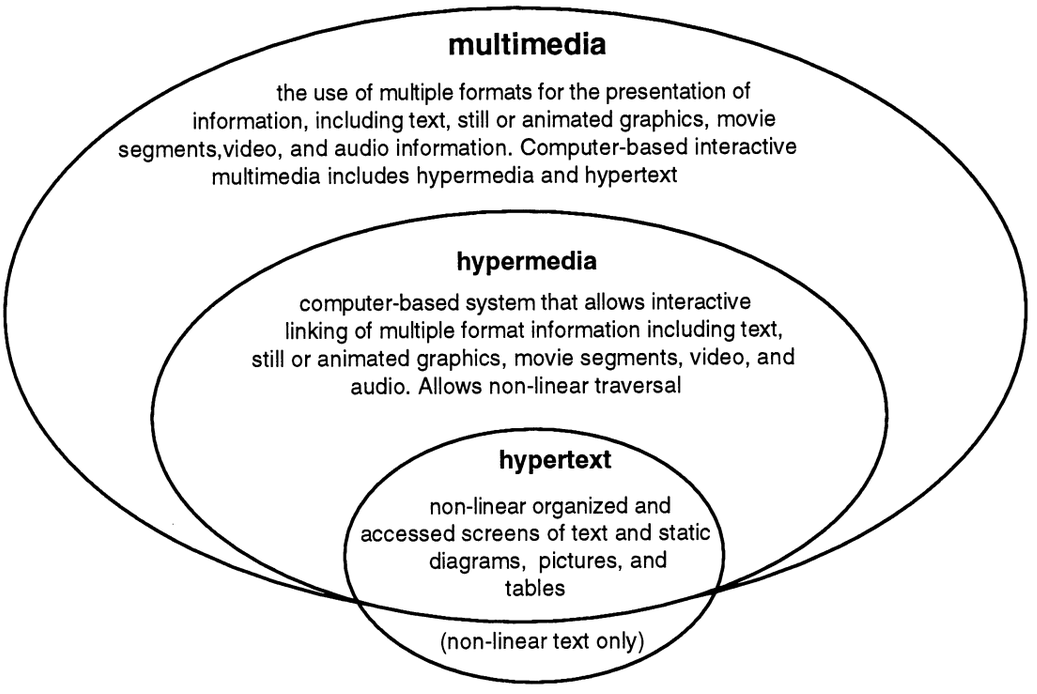

Figure 2. The relationship of multimedia, hypermedia, and hypertext.

Suggested Definitions of Hypertext, Hypermedia, and Multimedia

It is possible to find definitions of hypertext, hypermedia, *and* multimedia that all claim to include the use of multiple-presentation media, linked in a nonlinear format, in which users/learners can pursue an associative path of traversal. For example, Megarry (1988), p. 172) states that "Hypermedia is the name sometimes given to the multimedia capability of hypertext." From the previous discussion on hypertext, it is also apparent that hypertext is not confined to purely textual information, supported by Landow's highly defensible claim that visual cues in text are an essential component. It is apparent that the terms hypertext, hypermedia, and multimedia have in fact been used as alternate terms by the myriad of authors who have written in the area.

Perhaps over time more distinct meanings will evolve for each of the terms, but the following suggestions are made to define the terms and their relationships. The term *hypermedia* is used to refer to any computer-based system that allows the interactive linking, and hence nonlinear traversal, of information that is presented in multiple forms that include text, still or animated graphics, movie segments, sounds, and music. An important aspect in the media that are used in this definition is that hypermedia includes media formats that are not necessarily static in time—specifically, graphics that change and may offer different displays of a graphic depending on the current position in the animation or film sequence; or sounds and music that vary over a time period.

The use of the term *hypertext* to refer to formats of animation, video, and audio as being "text" is unsuitable. Adopting a "pure" approach to hypertext would suggest that *hypertext* should be considered to be nonlinearly organized and accessed textual information. Being realistic, however, textual information can include diagrams, tables, and pictures, as identified by Landow, but not animation, video, or audio information. For that reason, the media that are acceptable in the hypertext format are those which remain static, as they would on a book page. These include photographs, diagrams, tables, and sketches.

As multimedia has some definitions which do not include the nonlinear linking of the multiple media, *multimedia* is suggested as meaning the use of multiple media formats for the presentation of information. When presented using a computer system, multimedia may in fact overlap with the term hypermedia and hypertext, if it includes nonlinear interactive links, but multimedia does not necessarily include computer usage. See Figure 2.

As the Figure suggests, multimedia is a global term that in the main encompasses both hypermedia and hypertext. The term with the greatest focus is hypertext, which is in the majority of cases a subset of both hypermedia and multimedia. If the hypertext has no diagrams, pictures, figures, etc., having only the one medium of text, then it cannot also be called multimedia or hypermedia. The key difference between hypermedia and hypertext is that hypermedia can also include dynamic media that change over time, e.g., film clips and sound. Multimedia can be considered the most general term that involves presentation using multiple media, including computer-based multimedia presentations. □

Acknowledgment: Thanks to Bob Baker for comments on previous versions.

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