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The Roles of Video in the Design, Development, and Use of Interactive Electronic Conference Proceedings

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Abstract: In this paper, we discuss the design and development of a particular type of electronic publication that has gained recent popularity: electronic conference proceedings. We suggest that modern electronic proceedings should provide a high degree of interactivity. To support such interactivity, proceedings should include an extensive collection of features and diverse multimedia components. Features appropriate for electronic proceedings include annotation, presentation, and retrieval mechanisms. Conference papers and multimedia reproductions of conference presentations with features that allow readers to manipulate these reproductions particularly enhance the interactivity of electronic proceedings. Experience from interactive proceedings the authors have designed is also discussed. Special attention is given to the multiple roles video elements can and should play in interactive proceedings.

Key Words: Hypermedia, electronic publishing, electronic conference proceedings, digital video

Categories: H.5.1 [Information Interfaces and Presentation]: Multimedia Information Systems—Evaluation/methodology, Hypertext navigation and maps, Video; I.7.2 [Text Processing]: Document Preparation—Hypertext/hypermedia, Multi/mixed media; A.1 [Introductory and Survey]; H.1.2 [Information Systems]: User/Machine Systems

1 Introduction

Researchers disseminate their results in many ways, both formal and informal. Consumers of scientific information find this information in journals, by word-of-mouth, in the popular press, through newsletters, and at conferences. Given the high speed at which science and technology are evolving, conferences play an increasingly important role in presenting new results because they are frequent enough to provide the latest results, and formal enough that results are refereed. However, they are also informal enough that researchers can present results in progress.

These benefits have led to a dramatic increase in the number of conferences held each year. This increase has a corresponding drawback—it is now next-to-impossible for scientists to attend all the conferences in their areas of interest. Even when scientists can attend a conference of interest, they may not be able to attend all the sessions they would like, as conferences tend to include multiple simultaneous sessions. Most conferences supply printed proceedings as a permanent record of the results and ideas presented at the conference and to allow those who could not attend to learn about these results.

While printed proceedings provide a great deal of information, much more can be offered with electronic versions of the proceedings text. Such **text-based electronic proceedings** can allow for wider access, as not every library or researcher purchases every proceedings, while most researchers have access to computer networks. Electronic proceedings can provide a wide variety of tools for manipulating and annotating their contents. Modern searching and retrieval algorithms help identify key documents or segments of documents. Synthesis algorithms can be used to build single documents from a collection of documents, generate new summaries, or otherwise synthesize new texts from the contents of the proceedings. Researchers might also add their own comments to individual components and blaze new trails of ideas [Bush 1945] through the proceedings. Tools like these help researchers organize and navigate the potentially overwhelming mass of knowledge in conference proceedings, in electronic journals, and in other forms of academic communication.

Still, such text-based electronic proceedings do not present the experience attendees take away from a conference and illustrate a key difference between conferences and other forms of academic publication. If published papers were the only benefit conferences provided, researchers would simply order proceedings instead of attending. Many attend because they value the opportunities to discuss their research and to hear other researchers present their results. These presentations supplement conference papers with: tutorials; summaries of background material; discussions of the thought processes; diagrams that better explain key ideas, methods, and components; and answers to questions from the audience. Printed proceedings can convey only a fraction of the conference; proceedings that include presentations reproduce the conference more closely. In recent years, proceedings from a variety of conferences have been made available electronically, usually on CD-ROM or the Internet. While such digital proceedings can include a range of additional materials, most tend to focus on the electronic text of the papers, as [Table 1] suggests.

On the other hand, **interactive proceedings** containing both presentations and papers can maintain the explanatory and reference roles of traditional proceedings, while adding new dimensions and roles. For example, such proceedings can play an extended educational role, as presentations provide students with impressions of the people behind key research in the field, introduce students to modes of presentation and slide design, and help humanize research. Electronic proceedings that incorporate presentations can further enhance and encourage electronic collaboration among researchers. Sophisticated proceedings more closely involve readers in the conference materials, effectively making them *virtual participants* in the conference.

Because there is not yet a standard development system for electronic hypermedia texts—let alone electronic proceedings—different proceedings may demonstrate strikingly different design decisions. [Table 1] presents a selection of the electronic proceedings published in subfields of Computer Science over the past few years. Many of these proceedings are described further in the sections that follow.

In this paper, we draw upon our experiences in creating and evaluating interactive proceedings to analyze issues pertaining to their development and use. We suggest that such proceedings require a rich set of features to empower virtual participants to manipulate the materials included. They also benefit from diverse media, particularly reproductions of conference sessions. In [Section 2] we discuss the ways in which virtual participants use conference proceedings and explore these ways to motivate a collection of features for electronic proceedings. We also relate these features and design issues to extant proceedings. In [Section 3] we suggest how proceedings may be augmented with video and reproductions of conference sessions, grounding these discussions in examples from a number of electronic proceedings we have developed. [Section 4] contains a summary of the paper.

2 The Design of Interactive Proceedings

The choice of features for the proceedings and the interaction among those features are two key issues in the design of electronic proceedings. Proceedings are more than content. The value of electronic conference proceedings is governed in part by the features they provide. When designers, editors, and developers construct electronic proceedings, they may draw upon ideas and results from a wide variety of fields, including traditional publishing (especially layout and design), hypertext, multimedia, information retrieval, and human factors. Each of these fields provides ideas and inspiration for different components of the proceedings. By looking at the ways researchers use printed proceedings, one may derive useful features for electronic proceedings. By looking at the design and implementation of hypertexts, one can find ideas for navigation and organization. By looking at results from information retrieval, one can find new ways to allow readers to access information. Finally, by looking at multimedia objects and systems, one learns how to structure and relate media and what support (e.g., synchronization) is required from the multimedia authoring systems used to develop electronic proceedings.

SEAM'92 **[Macintosh Scientific and Technical Users Association Inc. 1993]**
Official SEAM'92 CD-ROM Proceedings of the 1992 MacSciTech Conference on Scientific and Engineering Applications for the Macintosh
Developed with HyperCard
Includes abstracts, selected papers, software, selected short video segments, and slides from conference presentations

DAGS92 **[Gloor, Makedon, Matthews 1993]**
Macintosh CD-ROM Proceedings of the 1992 Dartmouth Institute for Advanced Graduate Studies Summer Symposium on Parallel Computing
Developed with HyperCard and the Gloor-Dynes Hypertext Engine
Includes papers, hypertext links, video segments of speakers, complete audio from eight presentations, and slides
Described in [Cheyney, et al. 1996]

IWANNT93 **[Allen 1993]**
Networked electronic proceedings for the 1993 International Workshop on Applications of Neural Networks to Telecommunications
Developed with SuperBook
Includes papers, figures, and selected photos from the conference
Described in [Allen 1994]

SC93 **[Institute of Electrical and Electronics Engineers 1993]**
Multiple-platform (Mac, Windows, X-Window System) CD-ROM for Supercomputing'93, the IEEE/ACM SIGARCH Conference on High Performance Computing and Communication
Developed with custom software
Includes papers and color figures

MM93 **[Rada 1993]**
Multiple-platform CD-ROM for the ACM 1993 Conference on Multimedia.
Developed with Adobe Acrobat
Contains papers and selected videos

DAGS93 **[Makedon, Metaxas, Rebelsky 1995]**
Dual-Platform CD-ROM for the 1993 Dartmouth Institute for Advanced Graduate Studies Summer Symposium on Parallel I/O
Developed with HyperCard
Includes papers, hypertext links, and complete audio and slides from all presentations
Described in [Rebelsky, et al. 1995b]

NOSSDAV'95**[Gusella, Little 1995]**
Networked proceedings for the 5th International Workshop on Network and Operating Systems Support for Digital Audio and Video
Developed with HTML and PostScript
Includes papers and supporting materials

Table 1: Selected Electronic Proceedings in Computer Science.

CHI'95 **[Mack, Marks, Collins 1995]**
Networked and multi-platform electronic proceedings for the ACM 1995 Conference on Human Factors in Computing Systems
Developed with HTML
Includes papers and selected videos

DAGS95 **[Ford, Gloor, Makedon, Rebelsky 1995]**
Networked multimedia proceedings for the Dartmouth Institute for Advanced Graduate Studies Conference on Electronic Publishing and the Information Superhighway
Developed with HTML
Includes papers, segmented conference sessions (audio, picture, slide), and supplementary materials
Described in [Gloor, Makedon, van Ligten 1998]

EdMedia96/EdTelecom96 **[Carlson, Makedon 1996]**
CD-ROM proceedings for the 1996 World Conference on Educational Multimedia, Hypermedia, and Telecommunications
Developed with Acrobat and HTML
Includes papers and supporting materials

Table 1, continued.

2.1 Uses and Features of Traditional Proceedings

While it would be preferable to use a fixed set of criteria and guidelines when designing and implementing electronic proceedings, there are not yet precise guidelines. In a survey of many papers describing experiments in the design of electronic publications (particularly hypertext publications), [Nielsen 1989] suggests that "… there is little hope for a single, universal hypertext user interface design which will be optimal for everybody." To address this problem we begin by considering the reasons researchers use conference proceedings and the tasks they suggest. [Table 2] illustrates some of the many ways that researchers use conference proceedings and to motivate materials and features suggested in further sections. While some uses are appropriate for all forms of academic publication, others are more appropriate for the realm of conference proceedings, which correspond to a particular event (the conference) and which typically include a greater number of papers of varying quality than a typical journal.

Not only do these uses motivate design and features for electronic proceedings, they also suggest that electronic proceedings should be highly interactive — not in the commonly used sense of "readers may choose between predefined paths through the electronic document" but in the sense that readers may reorganize and otherwise personalize the proceedings to best support their primary tasks. In this sense, electronic proceedings must necessarily be more interactive than typical multimedia presentations.

Motivation	**Tasks**
Remain Current	• Scan abstracts • Scan/read papers • Check/compare/follow references
Identify Particular Results	• Keyword or topic search • Find background materials • Find similar materials • Evaluate results
Recall Source	• Contextual search • Maintain live workspace
Educate/learn	• Extract portions • Reorganize • Highlight results • Annotate • Build reference materials • Add reference materials • Duplicate
Collaborate	• Share annotations • Synthesize
Organize Activities	• Scan abstracts • Review details

Table 2: Selected uses of conference proceedings.

There is another way in which researchers use proceedings, which unfortunately argues against some forms of electronic proceedings. Many researchers use proceedings to *organize* their *activities* at a conference. Upon arriving at a conference, they *scan* titles, authors, abstracts, and details to determine which sessions they should attend. While attending sessions, they often *review details* in the paper (perhaps to check a proof or to find more details). When surveying attendees at a recent ACM STOC, we learned that while many would appreciate electronic versions of conference proceedings, almost all attendees highly value their printed proceedings for these and other reasons. Nonetheless, the common activity of reading or reviewing a paper while attending a session does provide motivation for including both in electronic proceedings and *including ties* between corresponding papers and presentations.

The above are uses made by readers of proceedings. Of additional interest are the reasons authors contribute to conference proceedings. Their primary reason is to *disseminate results*. Researchers have many motivations for sharing their results with others and for hoping that a wide audience will have the opportunity to learn of these results. Good research can influence not only other research, but also society as a whole. Publications are also necessary for funding, tenure and promotion. Researchers generally enjoy sharing their ideas and often find conferences an appropriate venue. Electronic proceedings can support authors by providing wider dissemination and by allowing authors to submit materials not possible in printed proceedings, such as prepared videos or software.

Having established a range of uses, let us now consider which **features** in printed proceedings support those uses. Although printed proceedings may appear to be static objects, readers often treat them as dynamic objects. For example, many readers add annotations to their printed proceedings—they write notes in the margins to elucidate points or to remind themselves of questions they may have had about a particular point. Some readers also highlight particular pieces of text with colored markers to remind themselves of the import of these pieces of text, and sometimes use different colors to indicate different types of information. Similarly, many printed proceedings also implicitly provide mechanisms for modification and duplication.

Printed proceedings also provide context and aid navigation through their front and back matter. Tables of contents, indices, and lists of authors help the reader find materials in the proceedings, and can also serve as guides as to where to look. For example, many readers do a quick scan of indices to find topics of interest or scan lists of authors to see if they include particular authors, such as researchers in closely aligned groups or particularly notable figures in a field.

Finally, printed proceedings provide a sense of context through their sheer physicality. When readers have a proceedings open to a particular page, they can sense how much appeared before that page and how much remains after that page. Some readers use this notion to aid their retrieval—they remember papers by their position in the proceedings.

Given the success of printed proceedings, one would expect electronic proceedings to support annotation, modification, duplication, and navigation. For example, electronic proceedings might simulate modification and duplication with a "cut and paste" feature. Some electronic proceedings rely upon their electronic publishing systems for these features. Others, such as the DAGS series of electronic proceedings (described in [Cheyney, et al. 1994] [Cheyney, et al. 1996] [Rebelsky, et al. 1995b] [Gloor, Makedon, Van Ligten 1996] [Gloor, Makedon, van Ligten 1998]), provide an array of features at least as comprehensive as those provided by a printed proceedings, include a variety of annotation and modification mechanisms, and include contextual cues to help readers locate themselves.

2.2 Advantages of Electronic Proceedings

Navigation in electronic proceedings requires further consideration. Virtual participants should be able to do more than flip pages and look up objects in a table of contents or index—electronic proceedings have a great deal to gain from nonlinear, hypertext-style links. Information science researchers remind us that humans do not always process information linearly; readers frequently jump from one text to another that does not follow sequentially from the current text. Such nonsequential jumps may be to footnotes, definitions, more detailed explanations, figures, or even new documents (e.g., [Nielsen 1995]). Not all of these transitions are predictable, the reader may find that an idea in one document raises issues or ideas that are addressed elsewhere. To many,

> *The first essential capability of a good electronic document system is to provide a means for promoting the connection of ideas and the communication between individual scholars. [Yankelovich, Meyrowitz, van Dam 1991, p. 59]*

While many hypertexts are initially static, it is not enough to include "built-in" links provided by authors and editors. Readers must be able to add their own links to existing documents and sets of documents. Even the earliest papers on hypertext-like systems highlight the need to support user-defined links.

> *[T]he basic idea of [associative indexing] is a provision whereby any item may be caused at will to select immediately and automatically another. This is the essential feature of the memex. The process of tying two items together is the important thing. [Bush 1945]*

However, few electronic publishing systems and fewer conference proceedings support this degree of linking. HTML [Berners-Lee, Connolly 1995] and the World Wide Web [Berners-Lee, et al. 1994]—perhaps the most popular electronic publishing system presently available—only allow readers to create links in documents they have written or otherwise own. There is no general and convenient way to tie together items so that one will "select immediately and automatically another." While some browsers support such links, there is no uniform mechanism for providing or sharing them.

These user-links can be extended to *paths* or *trails*,. Instead of just linking two documents, a path lists a sequence of components that should be read in order. In many hypertext applications, a path might also include annotations for the individual elements in the path. The Perseus project has used this technique quite successfully [Marchionini, Crane 1994] [Crane 1995].

In the DAGS proceedings, particularly [Gloor, Makedon, Matthews 1993] [Makedon, Metaxas, Rebelsky 1995], we chose not only to include a large collection of predefined links and paths (created by the editors and authors) but also to allow virtual participants to create their own links and paths. Some faculty are using paths, links, and corresponding annotation mechanisms to provide an order to these proceedings and thereby make them more accessible to students.

Conference proceedings are *partially-linear* documents, as each paper is intended to be read in order, and certain groups of papers may be ordered, but there is not necessarily an overall ordering. What is the relationship of these hypertext features to electronic proceedings with such structure? While much of the work on designing hypertexts focuses on "knowledge spaces" that could not easily be supported by printed texts (e.g., [Nelson 1993]), there is significant value in incorporating hypertext links into a detailed structure[van Dam 1995].

As [Wright 1991, p. 5] observes, "hypertexts are typically thought of as non-linear structures, but there could be benefits in some instances of taking a linear text and providing optional 'loops' of information." Electronic proceedings benefit from the linear nature of the individual components and from the relationships between the components. These relationships can not only provide the optional loops, but also suggest further exploration in other papers. However, as with many hypertext collections, this does lead to the possibility of the reader "getting lost in hyperspace" [Nielsen 1995] — losing track of the primary argument or no longer recalling the context of the current location in the hyper-document.

To alleviate the first problem, the DAGS proceedings provide a form of *history mechanism* to let the reader retrace steps in exploration, as well as a simple "back" button to return the reader to a prior point in the exploration. To alleviate the second problem, each screen in DAGS provides some form of **locator** that provides contextual cues. Locators include page numbers (within the complete proceedings or within the current document), a visual progress bar, and a name for the current page. In addition, more global locators, such as a document map (textual or graphical), highlight the relationship of the current page to other pages [Gloor 1991] [Gloor 1996] [Nielsen 1995].

As suggested above, electronic proceedings should support some form of **information retrieval** so that virtual participants may easily identify new objects of interest and retrieve or return to objects previously determined to be of interest. Since it is not the purpose of this paper to survey the forms of information retrieval and their particular benefits and drawbacks, a summary of potential retrieval mechanisms should suffice. Some of these are relatively primitive; however, they are all that some proceedings provide.

There are many types of retrieval systems one might employ for electronic proceedings. Most retrieval systems are *keyword-based* in that they identify documents by the words in the document. *Hypertext-style* navigation is also a form of retrieval and, in conjunction with well-linked front and back matter (e.g., list of authors, index, table of contents), provides a significant aid to navigation. For many readers, these guides to the proceedings plus a simple keyword-based searching mechanism will suffice. Most proceedings limit themselves to hypertext and variants of keyword searching. However, it is instructive to consider other forms of retrieval.

One might employ database-style retrieval using *meta-information* about the document, including author, institution, title, length, topic, and keywords (from a designated set of keywords). Unlike keyword-based retrieval, this type of retrieval separates the content of the document from knowledge *about* the document.

One might also use some form of *layout-based* retrieval. [Rus, Allan 1995] [Rus, Summer 1995] [Rus, Allan 1998] have suggested that some people retrieve information based on a sense of layout of the document (e.g., "the document with a graph on the upper left hand corner on page 3 or 5") and that electronic document presentation systems might support such retrieval. At present only a few systems (those based on Adobe Acrobat) provide thumbnail views of the individual pages to facilitate this type of retrieval.

Because the main content of proceedings is still text, the preceding search mechanisms are generally text-based. Electronic proceedings might also support searches based on other media, such as slides, images, video, and audio. At present, such retrieval is still in its infancy, with many multimedia retrieval systems based on textual annotations of such materials. However, as new multimedia retrieval algorithms are designed and developed, they can be incorporated into electronic proceedings.

2.3 Components of Interactive Proceedings

The wealth of information presented at scientific conferences comes in a wide variety of forms, including papers, presentations, poster sessions, panels, and discussions. However, the proceedings from a conference traditionally contain only the papers presented at the conference and, at some conferences, short written summaries of poster sessions and panels. These materials are traditionally prepared in advance of the conference. Missing are the **presentations** in which researchers present results, the interactive and non interactive demonstrations that exemplify and explain results, the panels, the question and answer sessions, the informal discussions, the workshops, and the many other materials available only at the conference.

Electronic proceedings present additional opportunities for reproducing these materials. The developers of electronic proceedings may record, transcribe, and reproduce both formal and informal conference sessions so that they may include audio, video, slides, and other appropriate materials.

There are many times that authors want or need to distribute additional materials related to their subject matter. Such materials include program listings, demonstrations, applications, and video. All these materials can substantially enhance readers understanding and reuse of research. In the past, authors distributed such materials on their own, independent of the conference proceedings (e.g., on floppy disk, on videotape, or as files retrievable over the network). Electronic proceedings may directly incorporate such materials.

The system used to develop electronic proceedings must not only support a wide variety of media, but also allow the creation of appropriate connections between the components as an author or editor may need to link slides, paper, audio track, video track, prerecorded video, and software demonstration. For example, authors and editors might link sections in papers to portions of talks, or provide “scripts” for their software that further illustrate points.

Electronic proceedings also have the capacity to act as a *dynamic object* forming the basis of a digital collection. The ideas presented at a conference may inspire follow-up ideas and research. An electronic proceedings that incorporates annotations and comments from its virtual participants encourages collaboration and provides new directions for the use of proceedings. While few early electronic proceedings supported such shared annotations, the increased role of HTML and the World Wide Web in the development of electronic proceedings suggests that such shared annotations may soon become a key component that readers and authors rely upon.

In addition to content and features, the **layout** and **organization** of papers and other materials have a significant impact on readability and usability. A primary layout decision is whether to design for the printed page or the computer screen. Surprisingly many electronic proceedings assume that their primary role is to serve as a form of index to an accompanying printed proceedings and therefore display documents only as formatted for the printed page. For example, the SuperComputing'93 electronic [Institute of Electrical and Electronics Engineers 1993] provides ASCII versions of the papers, but makes the ASCII text mimic the printed page. This leads to some awkward sequences, such as the inclusion of the footnote in the middle of a sentence. Other electronic proceedings reformat documents to accommodate the different dimensions and requirements of the computer screen (e.g., they use a different font and do not use two-column layout). Some go so far as to allow the reader to select the font family or size used to display documents, as is possible in many HTML viewers.

A key feature related to layout is the ability to *view multiple documents* simultaneously. As suggested earlier, readers frequently need to be able to compare documents or to refer to one document while reading another. For example, a reader might choose to view a talk, the paper related to the talk, and a past result that the paper improves upon. Electronic proceedings can support such uses by providing multiple windows onto the proceedings, preferably without limiting the contents of each window.

Many conferences understand the role of uniform document design. If all the documents in a proceedings have the same overall layout, readers can more quickly find key pieces of information. Since printed proceedings use stylistic guidelines, electronic proceedings should also. Of additional importance in layout design are the contextual locators on the page. Readers tend to lose sense of where they are in an electronic document (whether it be a single set of conference proceedings or a larger digital library that includes one or more proceedings) unless they understand the context of their current location. Some of these contextual locators are directly tied to the printed page (e.g., page number), other are more specific to the electronic version (e.g., a progress bar). Electronic proceedings might provide page numbers, page names, document name, proceedings name, and visual or audio locators to indicate position.

The level of segmenting significantly affects layout, navigability, and readability. For example, if a document is segmented into hierarchical sections, how does one navigate through the current section? There is a danger to using some form of scroll bar, as the reader may then have to contend with multiple forms of "forward": forward within the current section and forward to other sections.

Finally, the markup or editing language used to describe documents can affect the usability of the proceedings. It is important to understand limitations of a chosen implementation. For example, if tables or formulae are available only as images, as in earlier versions of HTML [Berners-Lee, Connolly 1995], then a document browser or analyzer (or reader, such as [Raman 1994] [Raman 1998]) cannot easily derive information about the contents of a table or formula. At the same time, appropriate choice of stylistic guidelines and text formatting packages can also ease incorporation into digital libraries. This is why many electronic proceedings are now relying on Acrobat, PostScript, or HTML for papers.

2.4 Evaluation of Extant Electronic Proceedings

The preceding sections suggest potential uses of proceedings and some potential features and materials to support them. We now consider the materials, components, and design a proceedings should include and the underlying publishing system should support. [Table 3] summarizes some key components of electronic proceedings.

Conference proceedings will often include a wide variety of materials, such as text, mathematical formulae, tables, prepared video, sessions, and interactive demonstrations (i.e., software). Unfortunately, many systems fail to support all of these media while providing sufficient features. For example, many systems require tables and mathematical formulae to be included as images. The navigation through these materials is enhanced by hypertext links and appropriate front and back matter. Readability is further enhanced by appropriate layout and design.

Materials
Text; Mathematical Formulate; Tables; Figures/illustrations; Prepared video; Sessions; Interactive demonstrations

Front and Back Matter
Table of Contents, Index, List of Authors, References

Layout, Design, and Organization
Design for window (rather than printed page); User-controlled font selection; Multiple windows; Uniform design/presentation, Contextual locators, Appropriate segmenting

Annotations
Marginal Notes, Notebook, Highlighters, User-defined links, User-defined paths/trails; shared Annotations

Search/Retrieval
Author/editor-defined links and trails; Keyword search, Boolean search, Approximate search, Contextual search, Layout-based search, Similarity-based search, Thumbnails

Miscellaneous
Copy contents; History

Table 3: Features and materials to support proceedings usage.

Annotations keep conference proceedings active and up-to-date by encouraging readers to extend the content of the proceedings. Because different types of readers may make different uses of the proceedings, it is important to provide a wide variety of annotation mechanisms. Unfortunately, few proceedings support such annotations, as [Table 4] suggests. In this table, the first entry represent generic printed proceedings. The nature of printed proceedings makes it impossible to create "point and go" hypertext links, but they can include so-called "dead" links—explicit references to other materials. The entries for CHI'95 and DAGS95 are hard to evaluate, as both of which use HTML as the underlying document format, and at the time these two proceedings were created, server-side, cross-platform annotation tools were not generally available. Hence, the features depended primarily on the browser or additional tools employed by the reader. The ability to share annotations in both printed and HTML proceedings is somewhat debatable — there are ad hoc solutions, but no simple method of sharing annotations that is generally employed.

As suggested earlier, readers of electronic proceedings will need ways to identify materials in the proceedings. Hypertext-style links and paths and a variety of searching mechanisms can support such identification. Finally, readers benefit from the ability to copy and paste materials and from history mechanisms that keep track of what portions of the document they have and have not visited.

	Shared	**User Links**	**User Paths**	**Marg. Notes**	**Note-books**
Printed	Ad hoc	“Dead”	“Dead”	Yes	Yes
SEAM'92	No	No	No	No	No
IWANNT'93	Yes	?	?	Yes	Yes
DAGS92	Yes	Yes	Yes	Yes	Yes
SC93	No	No	No	No	No
MM93	No	No	No	Yes	No
CHI'95, DAGS95	Ad hoc	Separate Doc	Separate Doc	Varies	Approx.

Table 4: Annotation formats and features for selected electronic proceedings.

3 Video In Reproduction of Conference Presentations

Although there is presently little use of digital video in electronic proceedings, there are many reasons to include video. One of the most compelling reasons is to better reproduce both content and “feel” of the original conference. An electronic proceedings with video from conference sessions allows the virtual participant to experience the presentations at the conference “as they happened” with the explanations, informality, and other details that make a presentation more than the mere reading of a paper. An additional role for video is to provide demonstrations that are not easily represented by static media. For example, a three-dimensional object might be described by an accompanying video that shows the object rotating and an interface might be demonstrated by a video of a user interacting with the interface.

In spite of the many benefits video can provide, it should not be simply “dropped into” electronic conference proceedings. Video should be as well linked as any other component of the proceedings so that, for example, when a paper refers to an object that appears in a video, there is a link to the video, and so that the video has links to texts that describe its components. Preferably, it should be possible to search and annotate video, although searching mechanisms for unmarked video are still somewhat primitive. This suggests one of the reasons that so few proceedings include audio and video: including audio and video *appropriately* is a far from trivial task, and requires a great deal of time and effort. Given that most electronic proceedings already take a significant amount of effort simply to convert papers to an appropriate and uniform format, this additional effort cannot always be justified.

Video can also be quite expensive to include in proceedings, particularly in terms of disk storage. While a proceedings with text from all papers and audio and slides from selected presentations can easily fit on a single CD-ROM, a proceedings that incorporates more than a small amount of video will require additional CD-ROMs, complicating the use and searching of the proceedings. Additionally, the processing and memory resources required to uncompress compressed video, synchronize audio and video, and show digital video may limit the platforms a proceedings can be used on and adversely affect the performance and usability of the proceedings. While many computers have the power and memory necessary to display digital video, and many more will soon gain those capabilities, the average desktop computer has limited ability to show extensive high-quality video in conjunction with audio and sequenced graphics. Because of those limitations, one may choose to use video loops (a short segment of video shown repeatedly) or still images instead of full video. Some of these alternatives are discussed in the following sections.

Conference presentations play a key role in conferences. Presentations often supplement papers with more background and tutorial materials for beginners, as conference presenters cannot assume the same access to resources for their live audience as they can for those reading their papers. Additionally, conference presentations often present a more high-level view of the material, employing more figures and sketches than particular details. Such high-level material interacts particularly well with the paper, as a reader might jump between an overview in the presentation and specific details in the paper.

Given the value of presentations, surprisingly few of these proceedings include the audio or video of presentations. The majority are simply renderings of the papers in electronic format, with only a small video component (if any at all). For example, while the SEAM'92 CD-ROM includes short fragments from individual sessions, it includes only one full session, and the short segments do not fully represent the session. Many that use video include only videotapes of results which have been prepared in advance of the conference. Although some also include software-based demonstrations, prepackaged results and demonstrations do not provide the same benefits as presentations and cannot replace presentations. It is therefore important to find a way to include conference presentations in the proceedings. Issues in reproducing presentations are discussed in the following sections.

The inclusion of conference presentations significantly affects the mode and time of delivery of proceedings. Many participants expect to have proceedings available at the conference. However, since the presentations themselves will not be available until the conference, conference proceedings that include presentations cannot be ready until after the conference and most frequently some time after the conference. The time delay for proceedings that include such presentations is often quite significant. For example, CD-ROM proceedings from DAGS'92 and SEAM'92 were not available until the year following the conference. Even electronic proceedings that do not include presentations (such as SuperComputing'94 and EdMedia/EdTelecom 1996) experience delays of several months. Such delays may interfere with the researcher's aim to remain current in the field. Our suggestion is to provide a preliminary version at the conference and an extended version later on.

3.1 Reproducing Presentations

When deciding how to reproduce the presentation using the available materials—video, audio, slides, notes, and transcriptions — a proceedings designer must consider how to segment each presentation, how to provide access to the segments of each presentation, how users control playback, how segments are synchronized and sequenced, and what features to provide. Because people are accustomed to passively watching video, it is tempting to employ a relatively simple interface to the presentation, with simple controls to start and stop each presentation and to jump to key points.

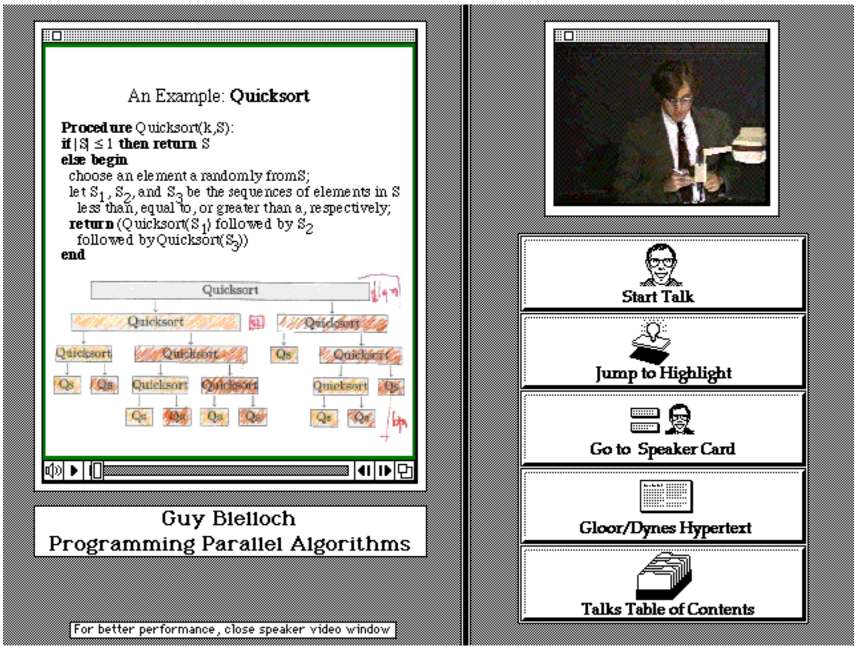

Figure 1: A simple interface for reproducing conference presentations. Copyright © 1993 Springer-Verlag/TELOS.

Even this restricted video can benefit electronic proceedings. A short video loop or key video segment can add to the comfort level of the proceedings and can give a better sense of the researcher presenting his or her results. This last benefit is especially important for attracting a broader variety of people to the proceedings and to the field. However, there are drawbacks to video loops. A key benefit to video is that it can show the gestures and expressions that cannot be adequately captured or conveyed by audio and text. A video loop does not present these gestures and expressions. One solution is to use a hybrid mechanism that uses a separate clip when the speaker does something “special.” This hybrid interface requires a significant amount of expert editing to identify the separate clips to use and when to use them.

[Figure 1] shows a simple interface for presentations used in [Gloor, Makedon, Matthews 1993] and described in [Cheyney, et al. 1996]. The slides from the presentation appear to the left of the screen and the video of the speaker appears in the upper-right-hand corner. The "Jump To Highlight" button allows one to quickly navigate to a key point in the presentation. The scroll bar at the bottom of the slide window also allows quick scanning through the presentation.

Rather than spend processing power synchronizing the video to the slides and audio, this interface uses a short (30 second) video loop of the speaker. Because the video segment was selected in such a way that the speaker's final position mimics the speaker's initial position, it is not immediately obvious that a loop has been employed. Surprisingly, these loops seem relatively realistic — and sometimes unexpectedly useful since, through sheer coincidence, odd movements in the video parallel particular comments in the presentation.

Reactions to the video loop have been mixed. Some virtual participants have said that they appreciate the video of the speaker for the comfort factor and because it gives a sense of how that speaker presents materials. These commentators say that they don't mind the lower-quality video on low-end machines. They also say that they mostly pay attention to the slides, and the moving figure need not be synchronized nor have a high frame rate to provide the necessary “comfort level.” Others have suggested that the video is not worth including because of the low quality and because playing it can make the audio and slide segments sluggish and unusable. To these virtual participants, it is only worth including video if that video is of sufficiently high quality.

Many electronic conference proceedings are now being created using HTML so that they may be presented in a cross-platform format that may be viewed from a variety of applications. Such proceedings include the electronic proceedings for the ACM SIGCHI’95 [Mack, Marks, Collins 1995] and IEEE SuperComputing’94 [Institute of Electrical and Electronics Engineers 1994]. At the time of this writing, HTML and the World-Wide Web (WWW) do not yet provide an ideal platform for electronic proceedings for a variety of reasons. The drawbacks often have to do with formatting — initially there was not sufficient support for common components of papers, such as tables or mathematical formulae. In addition, because there is no style sheet for HTML, the technical editors of HTML-based conference proceedings often spent significant effort reformatting papers [Rebelsky, et al. 1995a]. This is further compounded by the variety of ways in which authors create their HTML — some initially write HTML, some manually convert their paper to HTML; some use automated conversion programs like latex2html [Drakos 1995].

For presentations, the most significant drawback is insufficient support for multimedia synchronization. A complex interface requires synchronization to support the transition from slide to slide at key points in the audio, to animate the cursor (provided an animated cursor is used), and to scroll the transcription of the presentation in conjunction with audio from the presentation. Unfortunately, HTML was not designed with sufficient support for such multimedia synchronization. At present, the best solution seems to be to enforce synchronization by segmenting the audio and explicitly requiring to preload the next bit of audio upon opening the next slide.

The current design of the WWW has insufficient support for annotations. Given the preeminence of annotations and linking among the discussions of hypertext, it seems odd that neither HTML nor current WWW browsers provide any real support for shared annotations or user-links being added to existing documents. This lack makes HTML inconvenient for true hypertext publishing. Fortunately, researchers are developing extended browsers and support systems for shared annotations [Röscheisen, Mogensen, Winograd 1995].

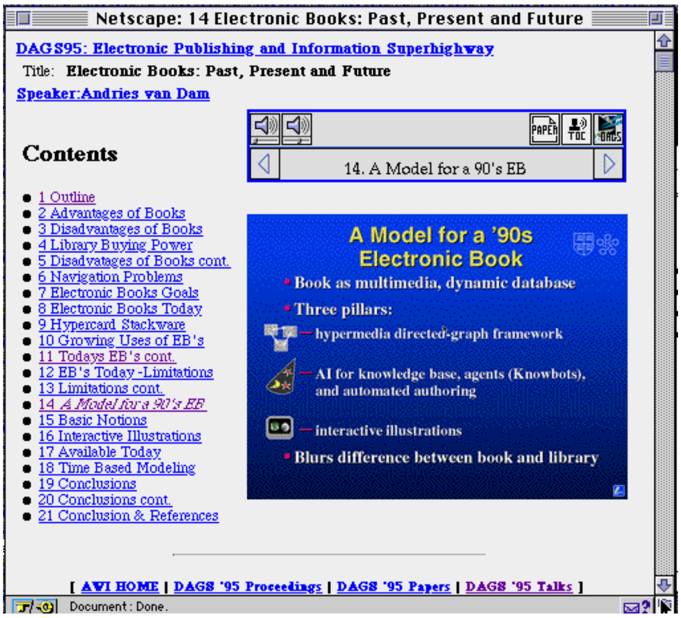

Figure 2: The DAGS95 Presentation Interface — a WWW/HTML based interface for presentations with audio and slides.

However, it is possible to create a simple and usable web-based interface for presentations. [Figure 2] shows the interface used for DAGS95 [Ford, Gloor, Makedon, Rebelsky 1995]. In this simple HTML-based interface, each document is designed to fit in one screen on a typical monitor. This means there is not room for a significant amount of extra material (e.g., a picture of the speaker). Because context aids the reader, a table of contents for the current presentation is available at every step, and the name of the current slide appears in italics. In addition, the title of the current slide appears over the slide. At the lower right of the screen is the slide (an inline image). Above that is the navigation bar for the presentation which allows the reader to move forward or back, listen to audio, or jump to the contents or paper.

Because of the difficulties in synchronizing media over the WWW, and because of the expense of transmitting video, this interface omits the video component. To help alleviate download problems with longer files, the presentation is segmented into shorter pieces, each of which is indicated with a small computer-speaker symbol. The interactivity of the interface was limited by the technology of the time; languages like Java make it possible to develop more complex interfaces [Gloor 1996].

3.2 Augmenting Electronic Presentations

While analog taped proceedings help convey some of the dynamic nature of a conference, a major drawback is that they require the virtual participant to experience the material *sequentially*, with the viewing of the tape often using as much time as the recorded events. Although modes of interaction not possible in the "live experience" can be added, such as the ability to review and scan ahead, many of the features that virtual participants might want are lacking. In particular, videotapes provide no real searching or segmenting (e.g., "where does the speaker describe the key results?"). An augmented digitized recording can easily provide not only scan and review controls, but also indices to key points and searching mechanisms.

An augmented electronic presentation can also be more closely linked to the corresponding paper than is possible in a hybrid printed proceedings with accompanying videotapes. For example, when listening to a presentation, a participant might choose to visit the corresponding part of the paper to see more details about a result. Similarly, participants might jump from a particularly difficult portion of a paper to an overview of that portion given in the presentation. Editors, authors, and virtual participants might also find relationships between slides in different presentations, or between a paper and an independent presentation. An electronic presentation can also provide more context for the reader — how far has the talk progressed, what topics are coming next, what topics have just been discussed. Finally, once in digital format, the presentation provides many other options for manipulation and retrieval. A participant might use video retrieval algorithms to identify key parts of a presentation (e.g., when the speaker waves his/her hands) or might copy slides from a presentation to modify and use in a new presentation.

The presentation interface for the DAGS93 Proceedings [Rebelsky, et al. 1995b] demonstrates one way to make electronic presentations more than indexed videotapes. The design of this interface, shown in [Figure 3], is based on the philosophy that nearly anything that virtual participants will want to do with papers in the proceedings, they may also want to do with presentations.

Because some readers may only want to watch and not interact, this interface does include basic low-interactivity controls. A virtual participant need only press the play button in the center right panel to watch the slides pass by, synchronized to the audio track. The participant may also bring up a contents list for the presentation and quickly jump to any section, or scroll through the slides using the progress bar or arrow keys. The scroll bar, slide number, and elapsed time reading all locate the virtual participant within the presentation. For virtual participants who wish to interact more closely with the proceedings, there are a variety of features available to support such interaction. The hand cursor in [Figure 3] points to one such feature: participants are able to add marginal notes to slides.

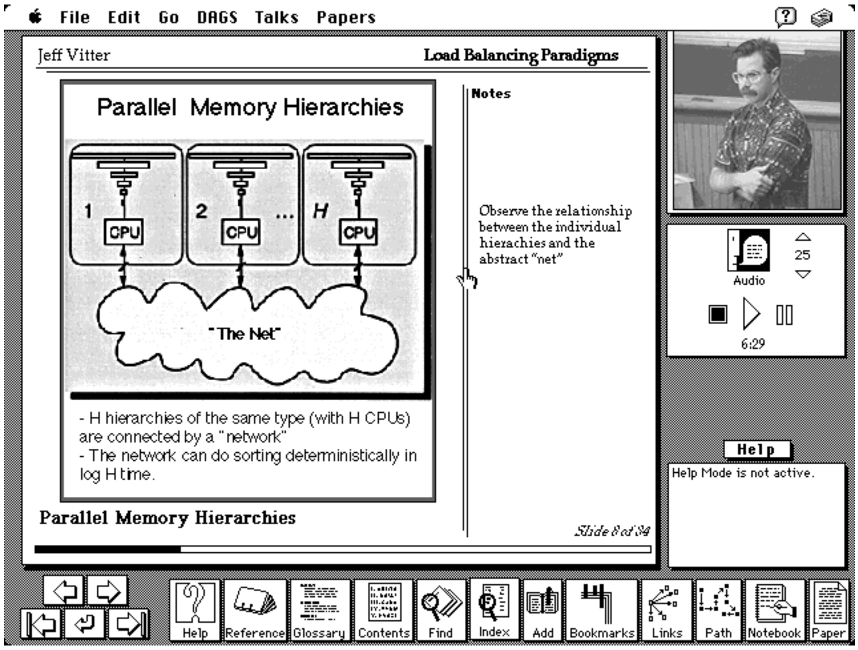

Figure 3: A more elaborate interface for presentations.

This interface also supports a variety of hypertext links, including bookmarks, user-definable links, and paths. The path implementation supports both pages in papers and slides in presentations allowing virtual participants to produce much more sophisticated paths through the proceedings. For example, one might create a path that moves from an explanation in a paper to a corresponding figure from a presentation to a related figure in another paper. Paths in presentations also support the creation of new presentations, as a presentation is simply an ordering of slides with an accompanying audio track.

It is also possible to search the text of slides using a variety of keyword-based mechanisms, so that a virtual participant may identify slides by their content. An appropriate extension to this would be to include a form of thumbnail for slides since many participants are likely to remember slides by general graphic description or layout.

Due to limitations in the hardware and software platforms this interface does not support a video version of the presentation. Instead, it provides slides, a still photo of speaker, audio, and a short video segment for a key result. It is likely that when there is sufficient technological support for better video, such video would play a greater role in the interface. Video can best convey facial expressions, gestures, and other nonverbal signals that contribute to presentations.

There are, of course, many other components that could be added to the interface for presentations. At present, the interface does not present notes from the speakers or transcriptions of the presentations. A transcription allows proceedings to let virtual participants search for a particular piece of text and then start the presentation at the point that text occurs. Finally, presentations might be extended with animated slides or animations of algorithms described in the presentation.

3.3 Additional Video Components

Video from presentations is only one of the many types of video that a multimedia conference proceedings can include. There are a variety of shorter pieces of video that can make conference proceedings more useful and enjoyable: some serve to present results in new ways and others help reproduce the environment and dynamic nature of a conference.

One simple form of video that many conferences include is the *prepared video.* Some presenters build short video clips that describe their work, and more may choose to do so if they are aware that the conference proceedings can include video clips. For example, the CD-ROM proceedings for the first ACM Multimedia Conference [Rada 1993] included a number of video clips prepared specifically for the CD-ROM. A video clip might provide an animation of a three-dimensional object that are difficult to describe statically or may show a user interacting with a new product.

This is not to say that video clips are the only way to present such results. For example, instead of a video of a three-dimensional object, an author might provide a model of the object and some rendering package could render the object at “read time.” Even with such capabilities, there are many reasons to present material with canned video rather than with data and simulations. One primary reason is processing power. It may take significant amounts of computational effort to produce even a simple animation of a complex object. If the animation is not prepared for the reader, then the reader may have to spend unbearable amounts of time waiting for the animation to be computed. A second is illustrative power. A virtual participant interacting “randomly” with an object may not observe all of its key attribute, while a well-prepared video can easily illustrate such attributes. A third is privacy of data or interface. A researcher may not be willing or able to release precise results and a video provides a reasonable compromise. A final reason is compatibility. Many video formats can now be displayed on all major platforms, but it is often the case that special software (an interface described in a video or a rendering system for a multidimensional object) will not be available on every platform.

Because it may not always be possible to include the whole presentation, and even when it is possible to include the whole presentation, there is a great benefit to including *key segments from presentations*. These segments can provide a key result or idea from a paper, and provide the same sort of overview, introduction, or starting place that abstracts provided for printed texts. In addition, for virtual participants eager to understand more about the key members of a field, they provide an informal visual summary of the speaker's style. Because not all presentations include an appropriate overview segment, it is often appropriate to include *separately recorded* *summaries and interviews.* These may be used as an introduction to a paper, to the field, or to the conference as a whole.

Finally, one might include *informal videos* recorded during informal conference sessions and conference social events. Such videos show aspects of a conference that are not traditionally included in a proceedings and better involve the virtual participant in the conference. They may also serve to remind virtual participants that there are many reasons to personally participate in a conference: in many cases, there is no substitute for personal contact.

3.4 Using Video Components to Support and Extend Uses of Proceedings

[Table 2] describes a number of ways in which researchers and students use conference proceedings and used those to motivate a number of features and design principles. Video components (both prerecorded and generated from conference presentations) can also be employed to support those uses. Researchers can use video components to *remain current.* They may watch the first few minutes of a presentation to determine the basics of a result; they may simply look at the overview slide or slides to get an even higher-level summary of current research topics; or they may best learn about a result by watching a prerecorded video that summarizes the result. While it is perhaps more difficult to follow references from a video segment, if the design of the video component does include hypermedia links, it is possible for editors to add appropriate reference links.

Similarly, if a transcription of a presentation or the slides from a presentation are available, then it is possible to use that text to *identify particular results*. It may also be possible to use video-, audio-, and/or image-based retrieval methods to help identify results and *recall sources* (e.g., "I recall that two key results were presented before the presenter got into a heated debate with an audience member.").

As suggested earlier, video components have particular applications in the use of conference proceedings to *educate and learn*. In part, this is because the basic structure of a conference presentation or prerecorded video is to teach. Presentations often begin with or include more background material than is in a paper; prerecorded videos can provide short but intense introductions to or surveys of a field. This educational role is further enhanced by a more sophisticated interface in which it is possible to annotate, reorganize, and extend presentations. These extensions can also aid in proceedings-based *collaboration*.

Because electronic conference proceedings with appropriate video components can enhance the reader's experience — by providing information in a new form or with additional context, by giving additional perspectives on the material, and by providing alternative mechanism for supporting basic uses of proceedings — they are a useful extension for this form of electronic publication. Because conferences have clear video sources, particularly conference presentations and the short video segments researchers often create, they are also an appropriate extension to electronic proceedings.

4 Summary

As the research community moves more and more toward electronic publication, these new digital publications should not only provide the features normally available in printed publications, but also look for new extensions made possible by their digital format. Unlike publications like electronic journals [Odlyzko 1996], which have a primarily textual component, electronic proceedings present the opportunity for a significant multimedia component, based in part on the presentations that form a key part of conferences.

In the DAGS interactive proceedings [Gloor, Makedon, Matthews 1993] [Makedon, Metaxas, Rebelsky 1995] [Ford, Gloor, Makedon, Rebelsky 1995], we explored the possibilities of incorporating digital video, slides, and audio from conference presentations in electronic proceedings. The DAGS92 proceedings provided an initial proof of concept; the DAGS93 proceedings demonstrated that it is possible to provide an array of features that support new uses of electronic proceedings; and the DAGS95 proceedings demonstrated possibilities for supporting reproductions of presentations in networked proceedings. Although all must make compromises on the amount of video used because of current network, software, and hardware limitations, they demonstrate that it will be valuable to include more video from conference sessions as technology becomes available to support such video.

The development of electronic conference proceedings is an emerging technology, and not all the issues surrounding the design, development, use, and extension of such proceedings have been completely determined. Even text-only electronic proceedings have potential for many new features and designs. Many of these issues are also being investigated in other electronic publishing domains. Given that very few electronic proceedings have included video, and fewer still have included video from presentations, there is still much work to do on the design and implementation of interfaces for interactive multimedia conference proceedings and other electronic publications with closely linked video and textual components.

Even though electronic proceedings do not yet have a stable interface, it is possible to create relatively sophisticated electronic proceedings for both small and large conferences. Such proceedings may require significant work from the editors and engineers of the proceedings, but the time spent has many benefits. Work spent designing and building electronic proceedings is repaid by the broader audience the proceedings accommodates and attracts and by the lessons learned. These lessons can be applied to a variety of multimedia projects and can influence the development of future proceedings. As more proceedings are available electronically, the scientific community will come closer to building and using standard proceedings interfaces.

We have focused in this paper in the perceived usefulness of interactive proceedings, paying special attention to the roles video can play in enhancing and separating them from traditional and text-based electronic proceedings. Our experience has showed that overcoming the development difficulties in some of these features is neither trivial nor inexpensive, yet it is doable. The next major issue is the monitoring and evaluation of their use — a process that should involve a formal study of the use patterns and user experiences. We are working in this direction and we hope our paper will serve as a basis for such evaluation of other electronic proceedings developers.

References

[Allen 1993] Allen, R. B.: "Electronic Proceedings of the International Workshop on Applications of Neural Networks to Telecommunications"; http://superbook.bellcore.com/SB/IWANNT/iwannt93.eprocs.html (1993).

[Allen 1994] Allen, R. B.: "Electronic Proceedings (Eprocs) for IWANNT'93"; Human Factors in Computing Systems; ACM (1994) .

[Berners-Lee, et al. 1994] Berners-Lee, T., Calliau, R., Luotonen, A., Nielsen, H. F., Secret, A.: "The World Wide Web"; Communications of the ACM, 37, 8 (1994), 76–82.

[Berners-Lee, Connolly 1995] Berners-Lee, T., Connolly, D.: "HyperText Markup Language Specification 2.0"; Internet Draft (1995).

[Bush 1945] Bush, V.: "As We May Think"; Atlantic Monthly, 176, 1 (1945), 101-108.

[Carlson, Makedon 1996] Carlson, P., Makedon, F. (Eds.): "CD-ROM Proceedings for the 1996 World Conference on Educational Multimedia, Hypermedia, and Telecommunications (June 17-23, 1996; Boston, MA)"; AACE, Charlottesville, VA (1996).

[Cheyney, et al. 1994] Cheyney, M., Gloor, P. A., Johnson, D. B., Makedon, F., Matthews, J. W., Metaxas, P. T.: "Conference on a Disk: A Successful Experiment in Hypermedia Publishing"; Educational Multimedia and Hypermedia, 1994; T. Ottmann and I. Tomek (Eds.); AACE (1994) .

[Cheyney, et al. 1996] Cheyney, M., Gloor, P. A., Johnson, D. B., Makedon, F., Metaxas, P. T.: "Toward Multimedia Conference Proceedings"; Communications of the ACM, 39, 1 (1996), 51-59.

[Crane 1995] Crane, G. (Ed.) "Perseus 2.0: Interactive Sources and Studies on Ancient Greece."; Yale University Press, New Haven, CT (1995).

[Drakos 1995] Drakos, N.: "All about LaTeX2HTML"; http://cbl.leeds.ac.uk/nikos/tex2html/doc/latex2html/latex2html.html (1995).

[Ford, Gloor, Makedon, Rebelsky 1995] Ford, J., Gloor, P., Makedon, F., Rebelsky, S. (Eds.): "Electronic Proceedings of Electronic Publishing and the Information Superhighway (May 30-June 2, 1995; Boston, MA)"; Addison-Wesley Interactive, Reading, MA (1995).

[Gloor 1991] Gloor, P.: "Cybermap, Yet Another Way of Navigation in Hyperspace"; Hypertext'91: Third ACM Conference on Hypertext; J. Leggett and J. Walker (Eds.); ACM Press (1991) 107–121.

[Gloor 1996] Gloor, P.: "Elements of Hypermedia Design: Techniques for Navigation and Visualization in Cyberspace"; Birkhauser, Boston, MA (1996).

[Gloor, Makedon, Matthews 1993] Gloor, P. A., Makedon, F., Matthews, J. W. (Eds.): "Parallel Computation: Practical Implementation of Algorithms and Machines"; Springer-Verlag (1993).

[Gloor, Makedon, Van Ligten 1996] Gloor, P. A., Makedon, F., Van Ligten, O.: "Obstacles in Web Multimedia Publishing: Bringing Conference Proceedings On-Line"; World Conference on Educational Multimedia, Hypermedia, and Telecommunications; P. Carlson and F. Makedon (Eds.); AACE (1996) 121-124.

[Gloor, Makedon, van Ligten 1998] Gloor, P. A., Makedon, F., van Ligten, O.: "Obstacles in Web Publishing: Bringing Conference Proceedings On-Line"; Electronic Multimedia Publishing: Enabling Technologies and Authoring Issues; Kluwer Academic Publishers, Norwell, MA (1998).

[Gusella, Little 1995] Gusella, R., Little, T. D. C. (Eds.): "Proceedings of the 5th International Workshop on Network and Operating Systems Support for Digital Audio and Video (April 18-21, 1995; Durham, New Hampshire)"; (1995).

[Institute of Electrical and Electronics Engineers 1993] Institute of Electrical and Electronics Engineers: "Supercomputing'93"; IEEE Computer Society Press (1993).

[Institute of Electrical and Electronics Engineers 1994] Institute of Electrical and Electronics Engineers: "Supercomputing'94: The Conference on High Performance Computing and Communications"; IEEE Computer Society Press; http://www.computer.org/p3/sc4home.html (1994).

[Macintosh Scientific and Technical Users Association Inc. 1993] Macintosh Scientific and Technical Users Association Inc.: "The Official SEAM'92 CD-ROM: Proceedings of the 1992 MacSciTech Conference on Scientific and Engineering Applications for the Macintosh (January 15–17, 1992; San Francisco, CA)"; MacSciTech, Worcester, MA (1993).

[Mack, Marks, Collins 1995] Mack, R., Marks, L., Collins, D. (Eds.): "CHI'95 Conference Electronic Proceedings and Companion CD-ROM (May 7–11, 1995; Denver, Colorado)"; ACM Press, New York, NY (1995).

[Makedon, Metaxas, Rebelsky 1995] Makedon, F., Metaxas, P. T., Rebelsky, S. A. (Eds.): "Parallel Computation and Parallel I/O: Electronic Proceedings"; (1995).

[Marchionini, Crane 1994] Marchionini, G., Crane, G.: "Evaluating Hypermedia and Learning: Methods and Results from Perseus Project"; ACM Transactions on Information Systems, 12, 1 (1994), 5—34.

[Nelson 1993] Nelson, T. H.: "Literary Machines 93.1"; Mindful Press (1993).

[Nielsen 1989] Nielsen, J.: "The Matters that Really Matter for Hypertext Usability"; Hypertext'89 Proceedings (November 5-8, 1989; Pittsburgh, PA).; R. Akscyn and F. Halasz (Eds.); ACM, Press, New York, NY (1989) .

[Nielsen 1995] Nielsen, J.: "Multimedia and Hypertext: The Internet and Beyond"; AP Professional, Cambridge, MA (1995).

[Odlyzko 1996] Odlyzko, A. M.: "Tragic Loss or Good Riddance? The Impending Demise of Traditional Scholarly Journals"; Scholarly Publishing: The Electronic Frontier; The MIT Press, Boston, MA (1996).

[Rada 1993] Rada, R.: "Proceedings CD-ROM of the First ACM International Conference on Multimedia (August 1–6, 1993; Anaheim, California)."; ACM Press, New York, NY (1993).

[Raman 1994] Raman, T. V.: "Audio System for Technical Readings"; Ph.D. 'Thesis'; Department of Computer Science Cornell University (1994).

[Raman 1998] Raman, T. V.: "ASTER—Toward Modality-Independent Electronic Documents"; Electronic Multimedia Publishing: Enabling Technologies and Authoring Issues; Kluwer Academic Publishers, Norwell, MA (1998).

[Rebelsky, et al. 1995a] Rebelsky, S. A., Allen, R. B., Baker, F., Mack, R., Owen, C.: "Perils and Pitfalls of Electronic Proceedings"; Electronic Publishing and the Information Superhighway; J. Ford, F. Makedon and S. Rebelsky (Eds.); Birkhauser (1995a) 91—96.

[Rebelsky, et al. 1995b] Rebelsky, S. A., Ford, J., Harker, K., Makedon, F., Metaxas, P. T., Owen, C.: "Interactive Multimedia Conference Proceedings"; Chi'95 Mosaic of Creativity; (1995b) 13—14.

[Röscheisen, Mogensen, Winograd 1995] Röscheisen, M., Mogensen, C., Winograd, T.: "Beyond Browsing: Shared Comments, Soaps, Trails, and On-line Communities"; Computer Networks and ISDN Systems, 27, 6 (1995), 739-749.

[Rus, Allan 1995] Rus, D., Allan, J.: "Structural Queries in Electronic Corpora"; Electronic Publishing and the Information Superhighway; J. Ford, F. Makedon and S. Rebelsky (Eds.); Birkhauser (1995) 91—96.

[Rus, Allan 1998] Rus, D., Allan, J.: "Structural Queries in Electronic Corpora"; Electronic Multimedia Publishing: Enabling Technologies and Authoring Issues; Kluwer Academic Publishers, Norwell, MA (1998).

[Rus, Summer 1995] Rus, D., Summer, K.: "Using Whitespace for Automated Document Structuring"; Advances in Digital Libraries; Springer-Verlag (1995).

[van Dam 1995] van Dam, A.: "Electronic Books: Past, Present, and Future"; Electronic Publishing and the Information Superhighway; J. Ford, F. Makedon and S. A. Rebelsky (Eds.); Birkhauser (1995) .

[Wright 1991] Wright, P.: "Cognitive Overheads and Prostheses: Some Issues in Evaluating Hypertexts"; Hypertext'91: Third ACM Conference on Hypertext; J. Leggett and J. Walker (Eds.); ACM Press (1991) .

[Yankelovich, Meyrowitz, van Dam 1991] Yankelovich, N., Meyrowitz, N., van Dam, A.: "Reading and Writing the Electronic Book"; Hypermedia and Literary Studies; The MIT Press, Boston, MA (1991).

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