Computational multimedia:
today's challenge, tomorrow's products

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I define computational multimedia to be a user-directed form of storytelling in which the computer orchestrates the presentation of information by mediating user input/inquiry and representations of media content. The following remarks focus on issues and challenges of the research environment today, particularly as regards applications which incorporate video and sound, 3D and 2D animation, text, and computer programs. While computer programs may include digital signal processing, animated graphics, and interpreters for one or more input device including speech, as well as structural envelopes such as HyperCard, spreadsheets, database and display managers, program content or the information which is orchestrated based on user input can be represented in almost any domain and may well cross traditional domains. These new media programs are distinguished from previous media types in that the content can be assembled and presented to the user in varying orders and in a range of time frames. Moreover, the user can direct this information flow to a greater or lesser extent. While these publication types are still quite chunky in their delivery I we imagine that we will eventually arrive at a truly conversational interaction where boundaries between individual chunks of information blur.

The digital revolution which is enabling these new messages is destroying those barriers which formerly separated the fields of publishing, movies and television, telephone and computers. The progress of digital hardware development frequently threatens to outstrip our ability to understand how the technical potential will impact creative structures. Our logic synapses are stretched as we examine how we might orchestrate massively parallel digital processing in ways which will eventually affect not only the delivery of the

message but the message itself. In our somewhat rarefied gardens of modern information research, we jump at the chance to experience, evaluate and learn from new interactive multimedia prototypes. Each new experiment forges a new vision. While the press constantly hypes the revolution, those of us who work in university and corporate research labs enter manic states as we tussle with the magnitude of the agenda. Issues range from cross-platform display of content to the construction of open ended stories and the development of "intelligent" programs which will allow the machine to assist us in sorting through the eventual deluge of the computational media age.

Traditionally, we humans have used stories as frameworks for information; stories allow us to sequence information into interpretable structures. We began with word of mouth and iconographic representations on walls; later we placed words on paper and invented the concept and tools for mass distribution; still later, we used motion picture and sound to create the messages of movies and television. Whether in the interests of scientific argument or social observation or imagined narratives, authors have combined images, text and sound with cognitive juxtaposition to communicate and expand our knowledge of the universe.

The new digital environments challenge our basic understanding of story. The random-access, programmable nature of the medium requires us to segment information and describe it within the computational environment. We have moved from single unified stories to multithreaded narratives which in certain aspects relate more clearly to the iconographic wall paintings than to movie stories.

As the invention of the Leica camera in the 1930's created a generation of photo-journalists, and a new publication --LIFE Magazine --we are witnessing today the emergence of a generation of makers who will comfortably orchestrate computational, multimedia on the desk top. The message, being both interactive and electronic, is fundamentally different from ones we have created in the past, and will dramatically impact what we know and how we learn. As with earlier advances in communications technology, the makers are also the participant users. As we cycle past the preliminary phase of invention, we witness the evolution of a group of creative entrepreneurs who embrace risk to turn research into product for profit. In hardware and programming software they are already numerous; however in the riskier area of publishing content, they are still a rare breed. If this dearth offers room to doubt, I have only to remember the comment of a 12- year-old who, after spending an hour with my prototype hypermedia magazine, the Elastic Charles, went over to announce to his mother, "Glorianna should go national." For me the impact of the compliment was tied to the age of presenter, which suggests there is indeed something after video games.

With encouragement from the market place, this research into computational communication moves forward, facing ever more difficult tasks. From large scale storage of digital pictures and sound to collaborative research using video and voice communication, from the introduction of hypermedia tools and computational program content in classrooms to previsualizing multithreaded narratives for the entertainment industry, we expand our individual and collective interest and understanding of digital multimedia. As we design, we continually question the technology, the ethics, the economics of the information market place. While I am on the side of motion pictures

and cinema and video, I no longer know whether or not I am on the side of television. What I imagine and want is television transformed --a delivery system which allow me access to multiple media as appropriate, and which allows me to decide when is appropriate. The images may become holographic over the course of time, but certainly for me neither the media nor the message can be confined to a box where what passes through once is all you get. Simply stated, I want both the cognitive and the sensory aspects of being challenged as I experience and interpret tomorrow's media messages.

As computers and video merge, both the acquisition and the distribution patterns will change. The tools --a camcorder and a desktop computer with HyperCard, spreadsheets, and a battery of image processing hardware and software --make media creation accessible to all. The integration of images and sounds into presentations or shared over networks in real time affects how we work and what we know. We are witness to this phenomenon in medicine, in education, in manufacturing, and in the investment industry. In the near future, we will monitor environmental impacts and farming endeavors. electronically monitoring and storing exact records and comparative images which can help us understand process and trends. Again. in the not too distant future, we can expect personal communication to rely on the long distance transmission of images as well as sounds. In preparation, commerce as it relates to networking utilities has shown enormous growth in recent months.

Despite progress at many levels there is always more we need to know and try. While most multimedia products today are point and click. media products of the future will allow the participant viewer to enter a conversational mode of interaction with the content of the message. This is the goal of our research at the Interactive Cinema Group of the MIT Media Laboratory in Cambridge, Massachusetts. Our group defines the basic area of investigation as "interactive cinematics." In the context of our explorations we build multimedia prototypes which rely on video as a primary information source. In these "Elastic" projects we model future publication types such as the magazine mentioned earlier, business case studies, intelligent maps. and a science and technology journal. As we build applications. we define and develop tools which we feel will be useful to the designer of multimedia projects. Recent tools include a 3D storyboarding environment, a model for logging rushes which can be applied to the camera, and a computational "editor's assistant" system for home movie makers.

All of our research indicates that entertainment will play an important role in designing information retrieval and learning systems. As we mentioned earlier, most of today's multimedia is limited to position and click; the content is very granular. Our research is concerned with designing projects which are deep, fluid and fun. Fun is a critical element of the vision. Of course, the information in multimedia projects must be correct and must be deemed relevant to our culture, our experience and our business interests. However; if the new media messages are not fun, they will not sell, at least not in the numbers which will generate profits. In addition to being fun, these projects must become relatively easier and cheaper to produce. In a research lab, prototype projects take a long time to build because each step of the process is new. However, in commercial publishing, once a format is selected. new material can be generated rather quickly. Obviously, building a team which is committed to producing a document in x amount of time and publishing at regular intervals (monthly, weekly) will streamline the production process.

As the technology improves, we gain experience with how computation can serve the interests of information seekers as well as information makers. Following two "Elastic" Magazines, one of which took the viewer down the Charles River and the other which explored science topics, we have begun work on a knowledgeable map which incorporates graphical map representations mapped to a navigational database. On top of this basic structure sit yellow pages, landmark and neighborhood profiles, real estate listings and custom guides. Such a map, distributed as a "dyna-book", may be a pocket item tomorrow. The key to enjoying this future product will be your ability to share your impressions of a city with your mother or a friend who is visiting your town. By knowing placement of all things relative to where you are, the system can offer you a walking tour of your favorite places or orchestrate an original path for your company. Another product which we imagine will be offered shortly will be a personalized newspaper. Today a program browses a text database for stories of interest; in the future a video database along with soft story models will offer current stories or on-the-fly summaries of older stories. The cross-fertilization of information sources suggests that education will be more fun and dynamic as we integrate electronic content. Already several distributors have entered the fray, including ABC News Interactive, CNN and Kid's Net.

When we look at this intersection of new commercial ventures and research, we see that research must push forward on all fronts, including digital signal processing of sound and picture, content representation, input devices, interface design, etc. There are a few program types, including the interactive map, which are almost ready for product development. Commercially, small companies are developing new videographic boards and can write software to orchestrate content or allow maker manipulation of images. The harder part for the entrepreneur today is risking the expense of developing of program content. It is hoped that digital television will ameliorate these problems and will generate an interest in coherency in the near future.

COMPUTATIONAL MULTIMEDIA:

MULTIPLE DATA SOURCES INTERACT WITH
EACH OTHER. BOTH THE INFORMATION AND
THE INFORMATION STRUCTURES WILL BE
MODERATED BY USER INPUT OVER TIME .

data with modem or fax macro

text

relational indices

YELLOW PAGES

micons and elastic
mini-movies as
commercials

navigational
representation
for streets

topological and
other map display
modes

MAP
DATABASE

micons and elastic
mini-movies for:
-community affairs
-historical sites
-entertainment
guides

GPS or
equivalent

ANNUAL
REPORT

MEDICAL
JOURNAL

HOME MEDIA
ALBUM

TRAVEL &
LEISURE
MAGAZINE

MANAGEMENT
TRAINING

TRADING
RESEARCH

JOURNALIST'S
WORKSPACE