Development of An Interactive Multimedia Presentation For Use in a Public Delivery Setting

by

Jeanne Gleason
DEVELOPMENT OF AN INTERACTIVE MULTIMEDIA PRESENTATION
FOR USE IN A PUBLIC DELIVERY SETTING

by

Jeanne Gleason

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APPROVED:

David M. Moore, Chairman

Jane A. Asche

John K. Burton

Norman R. Dodl

J. Thomas Head

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Jeanne Gleason

Committee Chairman: Mike Moore
College of Education

(ABSTRACT)

This developmental dissertation focuses on the creation of an interactive multimedia presentation for use in a public delivery setting.

Interactive multimedia appears to have outstanding potential for information dissemination. However, this technology is not commonly used by organizations which lack resources or skills to support total in-house development, and do not have funds to contract outside development at commercial rates.

This dissertation addresses these concerns in three ways:

1) It presents a comprehensive model, called ADOBE, to organize the steps of interactive multimedia design and implementation.

2) It outlines, in detail, the development and implementation of a fully-functional interactive multimedia presentation, The Natural Resource Extravaganza, to demonstrate interactive multimedia development based on the ADOBE model.

3) It presents (a) design templates, supporting original but parallel development, and (b) program templates, supporting adaptive development through modification of program elements.

A video tape demonstrating The Natural Resource Extravaganza, is available from the Reserved Materials section of the Virginia Tech Newman Library. The tape and information about the computer code also are available from NMSU Agricultural Information, Box 30003, Dept. 3AI, Las Cruces, New Mexico 88003. The Natural Resource Extravaganza presentation, graphics, video tape, and program code are copyrighted by New Mexico State University.
ACKNOWLEDGEMENTS

The development of a dissertation bears many similarities to the development of an interactive multimedia presentation. Both merge highly divergent elements into a cohesive product while obscuring the mechanics and sometimes tumultuous production details. Only in these acknowledgements can the reader gain a glimpse of the many people who have influenced the complex production process represented by the brief dissertation title. Without their encouragement, there would be no title page.

My first acknowledgement must go to my colleagues at New Mexico State University -- administrators, co-workers and students alike -- who astounded me with their unfailing encouragement. My department head, Terry Canup, provided administrative support with his signature and material support with his hammer, building the display room at the state fair. My colleague, Pat Hoiian, postponed several creative pursuits to carry my administrative duties while I was in Virginia for 15 months. My staff members, Andrew Ulibarri, D’Lynn Ford, Ken Downer, and Dorothy Hall have been true friends, lending their active assistance at every opportunity. My computer programmer, James Allen, proved himself a professional, demonstrating creativity, energy and responsibility rarely seen in a student worker. Debbie Conner’s and Larry Emerson’s transformation of my pencil sketches into an attractive, functional user interface fundamentally shaped this interactive multimedia presentation. Without the discipline of students, Rebecca Morgan, Jamey Simpson, Todd Stockton, and Aaron Weaver, to complete their detailed assignments while I was shooting a documentary in Guatemala, we would not have maintained our 90-day production timeline. More than 20 Extension specialists and researchers contributed text and slides to this educational program. My thanks to Sue Pieper, who has continued her practical encouragement since we first worked together on our first multimedia project in 1988, and to administrators, Dr. Robert Gilliland, Dr. John Owens, and Dr. William Conroy, who have maintained active interest and financial support over the years for our interactive multimedia productions.
I was introduced to the concept of interactive media for Extension education in 1986 by Tom Tate of USDA, and for the first time envisioned the possibility of partially fulfilling the responsibility I have often felt to extend the resources of the land-grant university to the people who ultimately pay the bill, the taxpayers. Nat Cannon designated NMSU as a beta test site for IMSATT in 1987, and Hernando Vera has been IMSATT's soft spoken voice of help since that time. Joe Meredith, Newport News Shipbuilding, has maintained steadfast, tangible encouragement, providing my first training in multimedia authoring, initial encouragement to request a sabbatical, and introduction to multimedia professionals I believe will be lifelong friends.

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It seems appropriate that my last thanks go to my editor, Jan Brydon, whose astounding eye for detail and tolerance for rereading has endured to this last period.
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PREFACE

Although 1991 was marked by painful financial and programmatic cutbacks for Extension in many states, including New Mexico, administrators in the NMSU College of Agriculture and Home Economics maintained support for a multimedia presentation for use in public delivery settings.

In May 1991, the College administrative council approved development of The Natural Resource Extravaganza. The project was to be completed in late August 1991 for installation at the fall fairs and later placement in high-traffic areas of Albuquerque, the state’s major population center. The College’s limited funding supported only direct costs for mastering the laserdisc and student wages. No funds were available for new equipment or software.

A development team from the Department of Agricultural Information, composed of this developer and three students, worked intensively for 90 days. As needed, the project received additional input from the professional, student and clerical staff of the electronic media unit managed by this developer. The presentation opened at the State Fair on September 6, 1991 and ran simultaneously in two locations. Since the fair, small improvements have been made, and both kiosks have been in demand for various public displays and conventions. One presentation was installed in an Albuquerque mall and the other is being used at College programs and displays.

As the dust settled, and the developer tried to put the project in perspective, she encountered a quote:

"Often the choice is to turn out a full product in 90 days or not at all. When faced with this situation, you must fasten your seat belt and give it your best shot. ... Insist that the design be kept simple, and based on proven techniques. Select the media elements that will be quickest to produce whenever possible, consistent with quality requirements. Keep your nights and weekends free. And be aware that despite the risks involved, many of the most effective IVD presentations ever produced were done under these trying conditions. Often, pressure is a catalyst to quality." (Bergman & Moore, 1990, p. 120).
Chapter 1
INTRODUCTION AND RATIONALE

INTRODUCTION

Across America in the early 1990s, one of the nation’s most widespread non-classroom educational organizations -- the Cooperative Extension System -- was fighting for its financial life. As state budget requests collided with revenue shortfalls, questions about the availability and value of Extension programs led to startling budget cuts in state after state. The report from Georgia, for example, said, "The Governor's reasoning was simple. The Extension Service, he declared, is out-of-date and long overdue for a reorganization. If we wouldn't do it ourselves, he would do it for us" (Rodekohr, 1991, p. 2).

In the mid-1980s concerns were raised that Extension served only a dwindling population of farmers and that it must modernize or go out of business. The challenge before the Cooperative Extension System was to (a) update its mission, clientele, and delivery methods, and (b) update its image, visibility, and delivery sites.

Extension has found that all its audiences, even traditional rural clientele, have a high degree of media sophistication (Yarbrough & Scherer, 1991). They accept and even expect new information delivery methods. Extension is exploring ways to expand its outreach through satellite communications, commercial video tapes distribution, dial-a-tip information, and a host of computer-based services, such as online information, computer conferences, software tools, CD-ROM, and interactive multimedia presentations.

Unfortunately, the need to update information transfer technologies coincides with severe budget cutbacks. Every decision made, every dollar invested, and every program instituted has to pay dividends. Many Extension administrators are unwilling to invest in an unproven idea, yet reluctant to ignore totally any technology that will help reach a broader audience and revitalize the Extension image.
There is a need within the system for models and templates which will allow states to test emerging information technologies while providing a structure for progressive evolution of in-house expertise for future development. Through this method, state Extension organizations can test new technologies and quickly implement methods proven effective with their clientele while minimizing development costs (McGrann, 1988).

It is the aim of this document to outline one possible framework for such development related to interactive multimedia presentations.

RATIONALE

In the years since Lincoln established the land-grant university system to provide practical educational opportunities for the public, population growth and diversification have made the task of disseminating Extension’s research-based information increasingly more difficult. One proposed solution has been a movement within Extension to embrace emerging electronic technology. "To fail to do so," declared Hussey in 1985, "is to endanger Extension’s very future" (p. vii).

Extension has acknowledged that as an advocate of change within its clientele, it must expand its information transfer and education capability, including interactive multimedia (Travieso, Dik, Russo & Curtin, 1987). Johnsrud, national Extension director, has said that Extension educators, if they are to maintain relevant, vital, educational programs, must become consumers in the supermarket of new ideas, innovations, and technology. "The trick," says Johnsrud, "is not to buy every item in the store, but to seek out and combine the right kinds" (cited in USDA, 1983, p. 1).

Combining ideas, innovations and technology is key to multimedia’s potential for delivering Extension educational programs to expanding publics. Cannavino points out, "With multimedia, we’re on the verge of something almost magical.... It will appeal to a much broader audience, including those who are intimidated by interacting with computers. With multimedia, we will win them over" (cited in Frenkel, 1989, p. 879).
Roadblocks to Implementation of Multimedia Presentations

Considering the potential power of an interactive multimedia presentation, it is easy to understand why many educators hailed it as the educational tool of the decade (DeBloois, 1982; Frenkel, 1989; Heuston, 1986). Yet the 1980s have passed without wide adoption of interactive video, in either the classroom or the public information sector (Chen, 1990; Hanson, 1990; Lambert & Sallis, 1987; McLean, 1985). Specifically within Extension, Baker and Harvey found in a 1989 national survey that "interactive video remains virtually untapped as a technological resource for USDA’s Cooperative Extension System" (p. 6).

In part, the hindrance could be conservative attitudes toward an unknown entity (Eikenberg, 1987) or overselling the potential of the technology (Calica, 1991; Fleit, 1987). In "Why Information Technologies Fail," Gayeski (1989) points out that although interactive video (interactive multimedia) is a powerful technology, the perceived cost, complexity, and lack of standardization has made many potential adopters wary. Chen (1990) cites the lack of sharing of interactive multimedia programs as a hindrance. Grimes and Potel (1991) say the fundamental problem holding back the widespread implementation of multimedia applications is simply that not enough people have the necessary skills to develop multimedia programs.

Organizations who do not (or feel they do not) have the ability to produce interactive multimedia within their current operation could look to outside contractors. Yet, Chen (1990) indicates that the cost of creative commercial design and development work can be prohibitively expensive. The difficulty in producing economical, customized interactive multimedia programs seemingly has put this information technology out of the reach of most organizations with limited resources, including the Cooperative Extension System.
A Case for In-House Development

Two Approaches to Interactive Multimedia Development

Grimes and Potel (1991) point out that there are two approaches to implementation of interactive multimedia: professional-controlled implementation and user-controlled, in-house implementation. They believe that traditional, professional-controlled implementation, which assumes that multimedia producers need special creative and production skills, will doubtless produce outstanding multimedia applications. They say if these applications take off, a very large multimedia industry might be spawned. "Progress," Grimes and Potel predict, "could be astounding. If it doesn’t take off, on the other hand, [the technology might have little lasting impact]" (p. 25). In contrast, they believe the in-house, user-controlled approach, guiding producers who are not primarily full-time multimedia developers, may take longer but will ensure that multimedia technologies become mainstream.

The needs and possibilities for application of multimedia techniques within the Cooperative Extension System are so extensive, the organization and the publics it serves could benefit from interactive multimedia development using both approaches.

Examples of Interactive Multimedia Development within Extension

One of the most comprehensive explorations into the potential for interactive video/multimedia information systems within Extension has been the Public Information System developed by Interactive Design and Development (IDD) at Virginia Polytechnic institute and State University.¹ The multimedia system developed by this professional team delivers comprehensive, problem-solving information tailored to meet needs of Virginians in a wide variety of settings (Hypes and Lambur, 1989). IDD has attained high standards for quality and effectiveness.

¹ In 1987, the W. K. Kellogg Foundation awarded a grant to the Virginia Extension Service at Virginia Tech to support development of public information systems. This work was conducted by Interactive Design and Development, founded and directed by Mary Miller.
National funding for development of Extension course-like interactive multimedia presentations, designed for individual or small group training, has included the Nebraska Farm Management Series\(^2\) (Rockwell, 1987) and the Pesticide Applicator Training Program\(^3\). Other projects include South Carolina’s Home Horticulture, Wisconsin’s Horticulture, Minnesota’s Nutrition Education, California’s Pest Identification, Maine’s Radon Gas, and Florida’s CD-ROM Horticulture Series.

Extension administrators and specialists in states without multimedia development capabilities have expressed interest in developing similar interactive multimedia programs for delivering customized information within their states. Nationally, many organizations, such as Extension and public television, have invested millions of dollars to create linear video programs that have been seen only two or three times and then have disappeared (Anderson, 1988). Expanded development of interactive multimedia presentations could give this video information new usefulness to the public. However, the complexity of developing an interactive multimedia presentation without a guiding template or simple model is beyond the budget, workload, and instructional design capability of most Extension units.

Possible Benefits from Expanded Development of In-House Techniques

To make new information technologies practical for Extension, new design strategies must be employed. Kearsley (1984) says the first step in successfully implementing new information technology is grassroots participation in development. Gayeski (1989) stresses that for a technology to succeed, it must have: (a) a broad base of generic "off-the-shelf" software and (b) a system or model that will allow organizations to produce their own custom materials. She points out that technology development models which encourage members who are not instructional technologists

\(^{2}\) Development at University of Nebraska, headed by Larry Bitney, was funded by the USDA. The study series was distributed to Extension programs in every state.

\(^{3}\) This development at Virginia Tech, funded by the USDA and the EPA, was headed by John Moore.
to become directly involved in design and development, create programs which are not only more accurate and comprehensive, but also will have wider acceptance of both the program and the technology.

The "non-generic" content of current multimedia training programs and contractual obstacles to transferring proprietary computer code have slowed widespread sharing among Extension organizations. In addition, programming languages and restrictive equipment parameters complicate modifications. Gayeski (1989) underscores the importance of in-house development of new technology. "No matter how excellent and plentiful the commercial software for any given medium might be, increasingly individuals and organizations want to create their own" (p. 15).

In short, without a highly specialized multimedia design and development team (not easily established within current tight budgets), Extension organizations wanting to implement this technology need a model to support in-house development of interactive multimedia for public delivery settings.

GOALS OF THIS DOCUMENT

This dissertation addresses these concerns in three ways:

1. It presents a comprehensive developmental model, called ADOBE, formulated by this developer to organize a step-by-step process of merging distinctive communication elements into an interactive multimedia presentation.

2. It outlines the development and implementation of a fully functional interactive multimedia presentation, called The Natural Resource Extravaganza, to demonstrate interactive multimedia development based on the ADOBE Model.

3. It describes how The Natural Resource Extravaganza may be used to support parallel in-house development through (a) design templates, supporting original but parallel development following the ADOBE Model, or (b) program templates, supporting adaptive development of new presentations through modification of the computer program for The Natural Resource Extravaganza.
DEFINITIONS

Although a lack of clear terminology is always a problem in relatively new fields, it is especially confusing within this technology. (See page 11.) "One of the stickiest problems confronting this new field is its lack of a single name. Today, there are at least three terms attempting to describe the same general territory: hypermedia, interactive multimedia, and interactive video" (Paske, 1990, p. 54). Therefore, the following definitions may be in order. (Note: When terms other than "interactive multimedia" are used in this document, it generally indicates that authors or developers specifically used the alternate term.)

*Interactive Multimedia* -- The merging of one or more static, discrete media (text, graphics, data, or still images) with one or more real-time media (motion video, animation, or audio) into an integrated, computer-managed information presentation which can be controlled interactively by the user.

*Developmental Model* -- An organized set of development steps which outline a course of action for the production of educational or informational media.

*Multimedia Presentation Template* -- A fully functional multimedia application which can support new parallel in-house development through minor modification and duplication of the presentation’s overall design and information organization and/or modification and duplication of the presentation’s computer code.

*Public Delivery Setting* -- A non-classroom, public access environment usually characterized by multi-purpose activities in which the multimedia presentation is *not* the primary center of attention.

*In-House Development* -- Development of a multimedia presentation during which the majority of the design and implementation responsibilities are kept within the general operation of the organization. While development may involve use of outside contractors for specialty services, such as animation or laserdisc mastering, one overall goal of the development is to mature skills and capability within the organization.
LIMITATIONS

The developer sees five primary limitations on the developmental work described in this document:

1. The ADOBE Model and templates from *The Natural Resource Extravaganza* are not designed to fulfill the needs of all potential multimedia developers. While the model and template could be adapted by many educational organizations, they are designed specifically to provide an alternative to meeting the needs within the Cooperative Extension System. Potential users of this model and set of templates may have little previous experience with interactive multimedia development or writing computer code, but may be experienced in presentation of Extension-related subject matter.

2. The design of *The Natural Resource Extravaganza* is not an open-ended format with infinite options for branches. While developers adapting the structure to deliver new information could expand or contract the number of informational units presented, the overall uncomplicated design will help inexperienced developers avoid creating an overly complex structure. The proposed template is basic, yet functional.

3. The ADOBE Model and templates from *The Natural Resource Extravaganza* are not specifically designed to support classroom or training activities. They do not address individual testing or tracking of users. The design is for delivery of educational information to users in non-captive, public delivery settings.

4. Potential developers can apply the steps in the ADOBE Model and follow design template ideas as presented in the video tape regardless of their selected computer hardware. (See details concerning a videotape overview in Chapter 4.) However, at this time, direct modification of *The Natural Resource Extravaganza* computer program code requires PC-based hardware and the IMSATT programming language.

5. Recommendations for future development will suggest tools to support automated modifications of computer code. Hardware and software support for some suggested features may not be available currently through commercial distribution.
ORGANIZATION OF THIS DOCUMENT

The four chapters which follow address in-house multimedia development to reach Extension audiences in public delivery settings:

Chapter 2: Factors Influencing the use of Interactive Multimedia Presentations within the Cooperative Extension System -- A review of the features and capabilities of interactive multimedia technology and the potential impact it could have on traditional Extension programs.

Chapter 3: ADOBE: A Model for In-House Development of Interactive Multimedia Presentations -- Presentation of a comprehensive model, called ADOBE, formulated by this developer to organize the step-by-step process of merging distinctive communication elements into an interactive multimedia presentation.

Chapter 4: Development and Implementation of an Interactive Multimedia Presentation for Use in a Public Delivery Setting -- Documentation of the development of a fully-functional interactive multimedia presentation, called The Natural Resource Extravaganza, created in mid-1991 at NMSU by the developer and a development team composed primarily of students. The continuing use of this presentation by the NMSU College of Agriculture and Home Economics was initiated at the 1991 New Mexico State Fair.

Chapter 5: Outlook for Future Template Development and Summary -- A summary of the potential for use of The ADOBE Model and/or The Natural Resource Extravaganza multimedia presentation to guide parallel development within similar organizations, either through original development using the ADOBE Model and design templates or parallel development through direct modification of the computer program code. Recommendations for future development will suggest a modification of the computer code through a graphical interface and various authoring systems.

The Appendices include examples of flow charts, computer code, and programming work sheet.
Chapter 2

FACTORS INFLUENCING THE USE OF INTERACTIVE MULTIMEDIA PRESENTATIONS WITHIN THE COOPERATIVE EXTENSION SYSTEM

INTRODUCTION

"Emotionally, I walk a fine line between exhilaration and terror," said Gery while considering the potential for computer-based technologies. "We tread in virgin territory. The terrain is complex and filled with unexplored and unknown dimensions; we are attempting to apply computer technology to one of the most complex and unfamiliar applications—human learning" (1987, p. 2). Heuston predicted that "by harnessing the speed of light in the form of running a million instructions per second, the computer can provide an extraordinary work bonus to the current educational delivery system" (1986, p. 1). Woolsey's 1991 evaluation of a host of multimedia projects supports the notion that such predictions may be coming true. "Multimedia also promises a transformation of our every day world, through the enrichment of educational and entertainment activities" (1991, p. 38).

However, critical thinkers (Martin, 1985; Gustafson & Peters, 1988) point to the historical march of educational technologies from the inventors' bench, under the researcher's magnifying glass, through the educational system, and into the relic room as a reminder of the folly of focusing on the hardware. Martin (1985) warns against the notion that technology alone can solve any problem. Instructional designers and Extension educators alike must remember that it is the educational design that is the genius behind this technology and not the hardware itself.

This chapter will address the potential that interactive multimedia holds for Extension to effectively deliver practical, problem-solving information to support lifelong education, and thus continue to fulfill its mandated mission.
OVERVIEW OF INTERACTIVE MULTIMEDIA

Historical Background

The dream that someday machines would extend an individual’s power to quickly search for information and provide customized methods for learning and exploring, with instant feedback, was evident in the 1920s when Pressey introduced teaching machines. In 1945, Bush’s landmark _Atlantic Monthly_ article described a device he called "Memex" which could quickly retrieve information from books, records and letters. Long before multimedia technology was developed, integral components, such as Nelson’s Hypertext to support nonlinear explorations, were taking form (Chen, 1990). Engelbart, not only had a vision that the computer could bring communities together to solve particular tasks, he also developed a number of Hypertext systems to bring his dream closer to reality (Ambron & Hooper, 1988).

Today, advances in information technology are giving these dreams form. Cleveland (1985) contends one of today’s great unheralded macrotrends is the computer’s ability to erase distance and erode geopolitics through information transfer. In 1990, Singapore implemented a powerful in-home information system, earning the city the title The Interactive Island (Richards & Yuen, 1991).

What Is This Technology Called?

Implementation of these interactive technologies are not without controversy, false starts, and unfulfilled promises. The industry can’t even decide on a name (Paske, 1990, p. 54). When the videodisc was the only rapid access source of motion video, the term "interactive video" was in vogue (Bergman & Moore, 1990). But as CD-I and DVI promised digital video, and applications using graphics instead of motion video became common, the term "multimedia" emerged. Davenport of MIT’s Media Lab countered, "Multimedia is an awful term, but it is nationally accepted, so we have to love it" (Garfinkel, 1991, p. 14). Others protest "multimedia" includes slide shows, and the term "interactive" is vital as well (Matchett & Elliott, 1991).
Iuppa (1984) supports the concept of interactivity and the user’s ability to determine the sequence and message selection. Matchett and Elliott (1991) say purists insist that "interactive multimedia" include video, animation and/or voice (real-time media) plus static media, such as data, text, graphics or still images.

**What Hardware Does Multimedia Involve?**

The computer receives user input from a keyboard, touch screen, bar scan, graphics tablet, joy stick, and/or light pen and makes the information available to the user as a video presentation, graphic stills, audio assistance, or a printout (Schwartz, 1984, p. 12). Requests for information trigger appropriate branching (Hansen, 1989).

Rapid changes and improvements in the technology’s hardware make recommending specific models or the "ideal" hardware platform impractical. Careful analysis and consultation with experienced developers should precede hardware selections. Consider literature which simultaneously discusses all commonly used platforms (such as Macintosh, Amiga and PC-based systems). Regardless of the platform, at this time multimedia developers (Brown, 1991; Robinson, 1991; Lomas, 1991) recommend the following basic hardware: A fast color-capable CPU; a large storage device; a color monitor with at least eight-bit display, an uncomplicated authoring system; a digitized sound card; a video frame-grabber; a video editor, a scanner; painting and drawing software, and animation and 3-D modeling software.

The hardware most likely to change in the immediate future is the video storage device. Although currently a 12-inch analog videodisc is commonly used, each month brings digital storage and retrieval of motion video one step closer to becoming an affordable possibility. In fact, Lippman of the MIT Media Lab predicts that digital technologies and "scalable video" soon will make fundamental changes in television technology’s traditional analog domain (Beacham, 1991). Magel (1991) predicts that digital technologies, CD-I and DVI, will be fundamental to interactive multimedia in the near future, and that the low-cost CDTV may soon be available in a professional version.
What Are the Levels of Interactive Multimedia?

Many extended definitions of interactive multimedia review distinctions among interactive multimedia presentations, based on categories of interaction established by the Nebraska Videodisc Design/Production Group in 1979 (Lambert & Sallis, 1987). Kent (1987) stresses that these levels are not necessarily degrees of interactivity, but simply degrees of hardware complexity.

The most basic design, called Level I, consists of a videoplayer, a remote control, and a television set. Users simply operate the disc player with a remote control. This level generally is not acceptable for public displays.

Level II involves a video player with an internal microprocessor programmed to perform certain playback sequences and respond to viewer choices during the program. The system is first developed, tested and debugged on a Level III system (described below) and then the program control is encoded on the Level II disc. If coded carefully, Level II can be used for public displays. This format is expensive to develop and, once pressed, cannot be changed. However, the cost of the equipment for delivery is lower because the external computer is eliminated (Kent, 1987).

Level III involves a computer which responds to user input and controls all devices, such as a videodisc player or attached training equipment. Some configurations include "virtual" devices, such as the Data Glove or Data Suit, which allow simulation of potentially dangerous or expensive learning situations (Baker, 1990). This level provides all the benefits of computer-aided instruction, such as branching, user-controlled pace, lesson management, record keeping, and feedback along with the options of touch screens, light pens, bar code readers, and special devices allowing simulated equipment adjustment (Gleason, Fedale, King & Miller, 1987).

An emerging configuration, Level IV, requires that the videodisc contain machine readable code (up to ten meg) along with video or audio storage (Sayers, 1989). Although there are currently few applications which use this level, it is sure to gain popularity in the near future (Chen, 1990).
THE POWER OF INTERACTIVE MULTIMEDIA

To understand why an organization might consider interactive multimedia, a potential developer must look beyond the hardware to the power this new tool can provide. "It is important to realize that interactive video [interactive multimedia] is not merely a merging of video and computer mediums; it is an entirely new media with characteristics quite unlike each of the composites" (DeBloois, 1982, p. 33).

The intriguing attraction of interactive multimedia is that it combines two of the most powerful educational tools available today -- computers and video technologies -- and makes them easily accessible to users who have never operated either type of hardware. Within seconds, users usually are able to receive customized information in an entertaining package. Unlike conventional linear video programs which allow viewers to remain passive, interactive programs not only allow viewers to become involved, but, in fact, demand it. Users are rewarded for each interaction with the multimedia presentation and become motivated to learn because the machine is responding to the users' immediate needs.

Kahle (1991) says it is this power of interactivity that allows Nintendo's low-resolution, low-variation games (currently in 25% of American homes) to successfully compete with highly-crafted, funny TV programs. He challenges educators to transform these popular "home computers" into tools for learning and exploration. Although learning theorists differ on many points, most agree that learning is best achieved when the student plays an active role in the process. DeBloois (1982) said, "Learners who are involved (in an active mode) in a learning experience which they consider to be relevant will learn more, more quickly, and retain it longer than those who are not" (p. 26).

Donahue and Donahue (1983) report that people retain about 25 percent of what they hear, 45 percent of what they see and hear, and 70 percent of what they see, hear and do. They point out that interactive multimedia programs keep the learner seeing, hearing, and doing. Through this mix of presentation techniques,
interactive multimedia can appeal to learners who prefer to receive information by reading, those who learn best through hearing, and those who are tactile or hands-on learners. Interactive multimedia’s ability to deliver a similar message in many different modes could allow Extension to enhance user understanding of relatively detailed and tedious tasks. For example, a multimedia presentation developed by Extension in Nebraska helps farmers complete a detailed cash flow statement (Rockwell, 1987).

THE POTENTIAL INTERACTIVE MULTIMEDIA OFFERS EXTENSION

Gone are the days when the education teenagers received could equip them for their life’s work. Knowles (1980) says, "Facts learned in youth have become insufficient, and, in many instances, actually untrue; and skills learned in youth have become outmoded by new technologies" (p. 28). Tomorrow’s students need not only mastery of subject, but mastery of learning. "Education cannot be simply a prelude to a career, it must be a lifelong career," Sculley maintains (1988, p. vii).

G. Miller (1989), University of Maryland Vice President, stresses that the prime goal of educational organizations should not be transferring facts. Rather, these organizations should strive to instill skills and provide support for lifelong education in a society marked by high levels of change. "There is simply too much information that becomes obsolete too fast for more possession of knowledge to be an end in itself. Instead, power rests, increasingly, with the ability to apply information--to analyze, to forecast, and to solve problems" (p. 24).

Martin and Rewerts (1988) say Extension educators must remember that "people change, move, and use time differently. Information sources change and new sources emerge" (p. 22). The challenge before Extension is to "put Extension information where people will find it" (Pounds, 1985, p. 20). A vast portion of the general population would use Extension’s information if they were even aware that such an agency exists.
Bower (1986) reports that Georgia Extension administrator Harris defines a state’s Extension clientele as people who have never participated in Extension programs at all, as well as those familiar with Extension. It is possible that groups defined by Ritter and Welch (1988) as unknown clientele, unreachable through traditional programs and somewhat unmotivated to seek further education could be most effectively reached through interactive multimedia presentations.

Extension researchers Meadowbrook and Fletcher (1988) found that a disproportionately large number of Extension clients in the county they studied were 60 years old or older. Conversely, their data indicated that only six percent of Extension’s adult clients were younger that 30 years of age. The researchers concluded that Extension needs to find a way to serve more young adults and more low-income and less-educated audiences. Richardson (1989) projects that future Extension outreach will involve more computer-based presentations.

Interactive multimedia presentations, operating in non-Extension educational situations, effectively deliver Extension-type information, such as The Field Guide to Insects and Culture (Gery, 1989). It is possible that a carefully designed interactive multimedia presentation, built on Extension’s practical information and situated in a readily available public delivery setting could fulfill these needs of adult learners (Miller, R., 1987). Such an interactive presentation could be available to a wide variety of users in public settings, could expand Extension’s outreach and educational services beyond its traditional audiences, and substantially increase the number of citizens receiving this educational information developed through public funding.

It would allow for access of information quickly and efficiently without users losing a sense of being self-directed or in control. The design of the presentation should allow complete user control over the sections of the program viewed or bypassed, and the information should be packaged in such a form as to allow users to retrieve the fact or learn the skill quickly and transfer the information immediately to the point of use.
INTERACTIVE MULTIMEDIA'S IMPACT ON TRADITIONAL EXTENSION PROGRAMS

When Extension began near the turn of the century in this country, the chief means of information transfer was an agent visit to farms, homes, feed stores and grocery markets. Extension educators held frequent evening educational meetings and the Extension office, usually located in the county seat, often served as the community center. Ideas were exchanged, university research findings were discussed, and problems were solved on a one-to-small-group basis at the community-center level.

Through the years, Extension developed a vast amount of information, and, following tradition, continued to funnel it through individual Extension agents. Personal visits and phone calls remain the most popular communication tool for Extension professionals (Bouare & Bowen, 1990). This personal contact between agent and client helps ensure that the overall Extension program remains relevant.

However, reduced staff strength and increasing clientele numbers mean that Extension agents cannot be everywhere at once. As Extension administrators search for tools to help fill the gaps, it is possible that interactive multimedia presentations could help by providing around-the-clock information and on-site printing. Most of the information on the computer-based interactive multimedia presentation is easily updated, or expanded by computer generated text, audio, or graphics (Josephson, 1991). Verduin and McEwen (1984) say that for information centers to be effective, they should be available in public sites of leisure activities. Knowles (1980) proposes "organizing educational services to individuals so that they can go on learning throughout their lives at their convenience in terms of time and place" (p. 19).

An interactive multimedia presentation in a public location would be readily available to clients, answering repetitious questions and supplementing answers with video or graphics unavailable through telephone transactions. It wouldn’t go on leave, stop working nights or weekends or back order educational information. In short, if the electricity is on, the Extension interactive multimedia presentation would be serving the public.
McGrann (1988) says information technologies will only help Extension change if they facilitate institutional changes as well. For example, development of an Extension interactive multimedia presentation should also change and expand the way Extension evaluates information development activities. Interactive multimedia presentations require considerable investment of time and effort and must receive equal recognition for career advancement purposes equal to that received by other teaching, research, and publication activities (Davidove, 1986). To achieve maximum effectiveness, Extension's field staff must also understand that the technology is not endangering their long-term employment (Hussey, 1985). In reality, the use of an interactive multimedia presentation could increase demand for local Extension services for additional information. Higher visibility could mean higher funding as well.

DO THE ADVANTAGES OUTWEIGH THE DISADVANTAGES?

"There is no question that the system works," says Lambur (1990), Extension evaluator for the Public Information Systems at Virginia Tech. "Results from using the system documented to date have been quite significant. A majority of users believe that the information they received from the systems would be of value to them in the future" (p. 1).

Yet a realistic consideration of implementing the technology must include the realization that initial development is resource intensive. While Extension organizations within some states may have the information and structure to support top-quality interactive multimedia development, there must also be a commitment from all organizational levels to invest the energy for development and the capital to cover out-of-pocket expenses. The willingness of a state Extension organization to invest in such a costly presentation may hinge, in large part, on the possibilities for economical prototyping through the use of models or other similar means to test the technology's ability to reach the unique clientele within an individual state.
Chapter 3

ADOBE
A Model for In-House Development
Of Interactive Multimedia Presentations

The following comprehensive model was formulated by this developer to organize the step-by-step process of merging or blending distinctive communication elements into an interactive multimedia presentation. Those considering development of an interactive multimedia project may benefit from reference to Chapter 4 which documents the practical application of the ADOBE model in the creation of The Natural Resource Extravaganza, an interactive multimedia presentation. For further background, refer to the supporting references, most published in the last 30 months, listed at the end of each section.

INTRODUCTION

For thousands of years throughout Meso-America and what is today the Southwestern United States, the medium of adobe clay met the construction needs of communities with limited resources. Development with adobe clay is a highly flexible, responsive process that has been adapted to meet modern demands by including some "high tech" additives in the traditional blend of materials. Adobe is both the clay binding agent and the collective name for the blend of elements -- clay, stones, straw, water, and asphalt -- which create a product that far exceeds the strength or capabilities of the individual components. While adobe clay construction is hard work and requires an understanding of the process, it is a process accessible to all people, regardless of their social or educational status. Adobe clay construction will tolerate a wide range of development techniques and has, through the centuries, provided a host of benefits to society.
In a similar way, the ADOBE Multimedia Development Model sets forth a process for blending traditional and high-tech communication inputs -- animation, computer graphics, digital audio, video, visuals, text, databases, computer programming and input and output options -- to create an information medium potentially more responsive to public needs than any of the individual media. It is hoped that the ADOBE Multimedia Development Model will bring multimedia development one step closer to those in the Land-Grant University System willing to roll up their sleeves and plunge their hands into the "clay" of multimedia development. In brief, the ADOBE Multimedia Development Model includes:

A -- Analyze the audience, goals, resources and constraints
D -- Design the conceptual model, interface and micro treatment
O -- Originate the program elements
B -- Build the computer control system to merge program elements
E -- Evaluate the product and process

Why Use a Model?

Similar to blueprints in building construction, models for educational materials help to organize the development steps, outline a course of action, and evaluate the project's ability to meet the objectives. They are especially valuable in multimedia work because the process is multifaceted and requires simultaneous and coordinated development. This type of model for interactive multimedia development has been neglected (Jih, 1990).

This developer agrees with Bergman and Moore (1990) that probably no one follows any model exactly as proposed. The ADOBE Multimedia Development Model is simply a building plan, one possible approach to multimedia development which has been customized for the Cooperative Extension System and yet is flexible enough for potential developers to adapt to the needs of their individual organizations.

(For related information, see Bergman & Moore, 1990; and Stefanac & Weiman, 1990.)
Steps in the ADOBE Multimedia Development Model

A — Analyze the audience, goals, resources and constraints
Steps in the process:
- Analyze organizational goals and expected outcomes
  - What does the organization hope to gain?
  - What will be the criteria for success?
- Analyze user needs and characteristics in this public setting
- Analyze the delivery site
- Analyze subject matter
  - Consider adaptability of subject matter to users
  - Consider adaptability of subject matter expert
  - Consider adaptability of subject matter presentation
- Analyze resources and restraints
  - Clarify team membership
  - Clarify funding
  - Clafiy ownership
  - Clarify restraints
- Analyze evaluation needs

O — Originate the program elements
- Originate graphics and animation
  - Graphic user interface and menus
  - Graphic pathfinders & transport elements
  - Graphic representations and icons
- Originate text
  - Modular presentation
  - Screen layout of text
- Originate video for motion and stills
  - Video production techniques
  - Editing techniques
  - Disc mastering
  - New video possibilities
- Originate audio tracks

B — Build the computer control system
- to merge program elements
  - Build user-centered computer management features
    - Build in user control
    - Build in user feedback
    - Build in user helps
  - Build designer-centered computer management features
    - Build in computer documentation & modification techniques
    - Build in user tracking & logging techniques
    - Build in system maintenance tools

E — Evaluation of the product and process
- Evaluate the project's achievement of original objectives
- Evaluate user reaction to overall presentation
- Evaluate organizational reactions to the presentation
- Evaluate production process
- Evaluate future development opportunities

D — Design the conceptual model, interface and micro treatment
Steps in the process:
- Design the macro model or conceptual model
- Design the high-level user interface and micro flow chart
- Design specifications
- Design the micro treatment
  - Design micro interface
  - Design interactivity and transport
  - Design information presentations
- Design the micro flowchart and management process
- Design the evaluation plan
- Design the master development strategy
- Design the budget
- Design the timeline
  - Consider expectations
  - Use a scheduling methodology
- Design the delivery environment
THE ADOBE MULTIMEDIA DEVELOPMENT MODEL
-- A Detailed Examination --

A -- Analyze the Audience, Goals, Resources and Constraints

While analysis is the technical starting point of most educational technology models, Gould and Lewis (1985) point out that systems designers rarely put these principles into practice. This is unfortunate because the analysis process often strengthens designer/client relationships and reveals potential problems or unrealistic expectations. Designers who quickly say what can and cannot be done, without proper analysis of the problems, could be answering quite a different question than is being asked (Tucker, 1979).

(For related information, see Bass & Dills, 1984; Briggs & Wagner, 1981; Carkhuff & Fisher, 1984; Gagne and Briggs, 1985; Knowles, 1980; and Price, 1986.)

Analyze organizational goals and expected outcomes

Without a goal, it is hard to know when success has been achieved. Without analysis, Extension communicators may find themselves responding to unrealistic demands to fulfill unclear goals for unknown audiences.

What does the organization hope to gain? Expectations for Extension multimedia presentations in a public location often include improved organizational image and visibility, increased services to traditional and new clientele, and economical delivery of educational material. There may be unrealistic, unspoken expectations as well. These may vary from the overnight recognition and appreciation of Extension to the extremely low cost, highly effective delivery of massive quantities of information. While multimedia presentations can contribute in these areas, rarely can any single communication tool solve problems that have taken years to develop.
Beware of overselling the technology. An interactive multimedia kiosk, even in a major population center, will not cause instant mass awareness and appreciation of Extension. Neither is it realistic to expect users to assimilate all the educational information in the interactive multimedia presentation. Experienced developers say it is more practical to expect a system to engage the user by inspiring, captivating, entertaining, or raising curiosity, than it is to expect it to guarantee explicit learning outcomes (Allen & Sterman, 1990).

What will be the criteria for success? Work with administrators, subject matter experts and the development team to establish in writing the criteria for success. Careful analysis will help keep goals achievable. For example, if the research shows that visitors to similar educational displays spend an average of 45 seconds per exhibit (Van Rennes, 1981), it is unrealistic to establish the criteria that all who pass the kiosk view and remember all the information available in the system. However, it is practical to expect that a carefully crafted Extension multimedia presentation will be easy to operate, provide information quickly, and thus help build Extension’s public visibility and image of efficiency, responsiveness and relevancy. (For related information, see Dumas, 1988; Morariu & Whitney, 1989; and Rudner, 1990.)

Analyze user needs and characteristics in this public setting

Understanding and including the user in the design process is critical to successful system design. In fact, many major companies (IBM, HP, AT&T, Xerox and Apple) not only analyze the users, but also include them in early development and keep them involved throughout the process.

An analysis of special user needs could expand designs to include option text scripts for the deaf, audio narration for the non-reader or those with limited vision, changes in kiosk designs for the handicapped, or alternate presentation styles with extra illustrations for young users.
Collecting basic demographics -- age, education, training, motivation -- is a start, but tells only part of the story. For example, designers of interactive multimedia presentations for museums, Allen and Sterman (1990), found their visitors were (a) often first-time users; (b) hesitant and anxious about using the new technology; (c) relatively uninformed; (d) representing various ages, nationalities and educational levels; (e) reading at about the seventh grade level; and (f) likely to interact with the interactive video system for only two or three minutes.

The user analysis also should consider user characteristics in the specific target public location. For example, the individual profile of museum visitors might show that they often read scholarly articles and educational materials. Yet in museum settings, users are not only interested in education, they are also interested in entertainment, staying in a group with family or friends, or interacting with children. In fact, visitors at one museum spent only 17-23 seconds looking at each diorama (Clowes & Wolf, 1980). By analyzing the users’ need to skim through educational presentations in public settings, interactive multimedia presentations can engage users for up to two or three minutes, if they entertain, inspire, captivate or raise curiosity (Allen & Sterman, 1990).

(For related information, see Brown, 1988; Buerger, 1989; Gould & Lewis, 1985; Martin & Rewerts, 1988; Meadowbrook & Fletcher, 1988; Miller & Ruberg, 1989; Mills, 1987; Piz & Weger, 1985; and Shneiderman, 1987.)

Analyze the delivery site

An analysis of the specific targeted delivery site also is critical for public interactive multimedia presentations. In addition to studying documented facts about the location, developers should spend time in personal observation to note ambient light and sounds, distractions, proximity of permanent workers, support personnel available, and existing attractions that will affect or be affected by this interactive multimedia presentation. Determine what type of attract loop will be most effective in this setting.
Analyze the subject matter

It is always important to select subject matter that is appropriate to the technology. This step, however, is especially critical for an Extension unit designing its first multimedia presentation. The technology alone will present a formidable challenge without tackling complicated, controversial topics. Keep the message simple while meeting the organizational goals, user needs, and requirements of the delivery site.

Consider adaptability of subject matter to users. Balance current high interest topics with findings from formative evaluation about the types of information users are willing to gather in a public site. For example, while polls may show high public interest in communicable diseases or spousal abuse, formative evaluation with potential users might reveal that they are unwilling to explore these topics in a public location. Brown admonishes, "As soon as you find yourself sitting in a meeting with other computerists, all announcing what users will and will not feel/think/do you are in trouble" (1988, p. 185).

Consider adaptability of subject matter expert. In most Extension organizations, the choice of specific subject matter is linked directly to the involvement of a specific subject matter expert (SME). The SME should ideally be knowledgeable, credible, a team player, and an effective communicator. Before selecting the final topic, consider the SME's track record for completing projects. Will the SME respond to findings from formative evaluation? Will this project benefit the SME professionally so that continued involvement will be ensured?

Use of a template of a multimedia presentation, such as The Natural Resource Extravaganza, can help subject matter specialists visualize the final product and thereby reduce miscommunication and design time.

(For related information, see Gould & Lewis, 1985; McCaslin & Board, 1990; and Morariu & Whitney, 1989.)
Consider adaptability of subject to the presentation. In general, interactive multimedia presentations will present information through animation, motion video, text, graphics, still images, audio, and data. Analyze each proposed topic in terms of its adaptability to interactive multimedia presentations. Some information may be most efficiently expressed by full motion. (Video motion ideally conveys the grace and beauty of a flying whooping crane.) Other information, such as directories of names and addresses, may be acceptable in a text-only format. This analysis of the proposed subject matter helps allocate resources and speeds design. New developers may benefit from consulting existing multimedia applications and/or design templates as explained in Chapter 5.

Analyze resources and restraints

Clarify team membership. A team approach is usually the most effective way to produce interactive multimedia applications. Regardless of the number of team members, there are at least ten roles to be performed. These include project manager, application designer, video director, graphics director, writer, audio producer, programmer, subject matter expert, evaluator, and support staff. Few Extension organizations, however, can afford to dedicate ten or more people to multimedia development. Therefore, the use of design and program templates (as described in Chapter 5), as well as involvement of students and temporary and/or contract labor is critical.

Analysis of team resources must consider available staff members or students to help with writing, graphics and video production, programming, and evaluation. How much time can each member contribute? What is the track record of each individual member? Can team members function in a group development situation? The creativity, dedication and organization of human resources are among the most important factors in successful development of an interactive multimedia presentation. In the long run, time spent building team unity and clear communication techniques will increase the efficiency and effectiveness of the overall development.
Clarify funding. Determining the cost of interactive multimedia development depends on how the total is calculated. A development team built from existing staff, using stock footage and existing computer and video equipment, may report only direct, out-of-pocket expenses for animation production and videodisc pressing. These reported costs may be as little as $15,000 to $20,000, a total that is deceptively low.

A more realistic cost accounting would consider student, staff and faculty time, the value of equipment and existing visuals, and office overhead. These factors could easily add more than $100,000 to the value of a project. In addition, if the team must contract for video, graphics, animation, coding, and kiosk design, totals can skyrocket. Finally, the complexity of the subject matter, the length of development, the number of delivery locations, and the scope of the evaluation can multiply the total again. In short, project cost reports could vary from $15,000 to more than $1,000,000, but may not necessarily be including the same types of costs.

A budget must be developed for each specific project. Consider funding possibilities from foundations, national organizations, training budgets, or promotional campaign budgets. Clarify the budget restrictions, administrative control, and the purchasing restrictions for specific program elements.

Clarify ownership. Is there a market for this interactive multimedia presentation after it is completed? Could venture capital be available, either from within the system or from an outside source? Will the designer or the organization own the rights to the finished product? Can the presentation be shared with other states or similar organizations? Early analysis and clarification, in writing if needed, can help clarify goals and avoid misunderstandings in the future.

Clarify restraints. In the real-world there are always limiting factors. Face them squarely. The team may be working with mandated criteria which preclude some actions and predetermine others. Perhaps the limitations include old hardware, a small staff, a short turn-around time, or limited experience.
Again, analysis can identify limitations and lead to designs which work around them. If the equipment is old or slow, try to avoid on-line processing of user input information, such as analysis of their financial status, which could be especially time consuming. If the turn-around time is limited, create designs using modules that are structurally similar, selecting material already in near-modular form, or using templates which will meet both administrative goals and user needs (see Chapter 5).

(For related information, see Bergman & Moore, 1990; Jih, 1990; Mock, 1989; and Tucker, 1979.)

Analyze evaluation needs

While Extension has encouraged summative evaluation for years, formative evaluation may be a new practice for many subject matter experts and potential multimedia developers. However, because of the highly complex nature of multimedia presentations, formative evaluation should be woven throughout the entire production process (Rubin, 1988).

Formative evaluation is the continual process of testing and improving materials and procedures during development and implementation to ensure that the program goals are met (Baker & Atkin, 1984). The following types of questions may be asked during formative evaluations: (a) Does this icon convey the message the development team intends? and (b) Do users intuitively understand the menus and how to navigate through the system? Formative evaluation also may be used to establish global factors, such as topics, approaches and overall design philosophy.

The analysis stage should identify the goals of the evaluation program and schedule formative evaluation sessions. Because team members can develop a sense of ownership of program designs and elements as they are created, they may have difficulty being impartial during evaluations. The services of an outside evaluator may be valuable at this point. However, team member involvement and observation of user interaction with prototypes provide insights impossible to reach any other way.

(For related information, see Baker & Atkin, 1984; Bergman & Moore, 1990; Bosco, 1986; Foelber, 1989; Lambur & Miller, 1988; Lee & Roadman, 1990; and Rubin, 1988.)
D -- Design the Conceptual Model, Interface and Micro Treatment

Although everyone seems to agree that careful design work is important, limited budgets and tight deadlines cause many project teams to abbreviate the process, often leading to expensive delays and revisions later in the project (Floyd, 1985). Malamed (1991) warns, "Anything overlooked during design will come back to haunt you" (p. S-18). A clearly defined process will make the design process as efficient and effective as possible.

Design the macro model or conceptual model

Developing the macro design is one of the more exciting parts of the entire project. The creativity and excitement it generates can help carry the team through subsequent difficult and sometimes tedious development tasks. Based on the results of the analysis, the team is ready to map out the overall macro model or the concept upon which the presentation will be built. (For example, an educational theme park was selected as the macro model for The Natural Resource Extravaganza (see Chapter 4).

The overall macro or conceptual model should offer enough creative options to support later development of program elements within individual modules. Consider approaches taken by other multimedia presentations and related consumer marketing techniques. Consider the current trends within the individual media, such as new video styles or animation techniques when designing the overall concept.

(For related information, see Barker, 1990; Bergman & Moore, 1990; Holder, 1987; Kearsley & Frost, 1985; and Peterson, 1988.)

Design the high-level user interface and macro flow chart

After building the macro model, divide and cluster the proposed information into overall units or modules. Working through each module, design the high-level user interface. What techniques will help users find the information they desire?
The goal is to create an environment in which users intuitively know how to get information. The overall manner in which the user and computer interact -- sometimes called the user interface -- needs to be appealing, but not so clever or showy that it distracts from the information.

Strong designs require no explanation because they trigger links to familiar items. Consider designs or metaphors that are analogous to physical objects and therefore are logical and easy-to-understand (Barker, 1990). For example, the application may be presented within the overall metaphor of books on a shelf which will be opened, a Roll-a-dex which can spin, or buildings which can be entered, such as those used in *The Natural Resource Extravaganza* (see Chapter 4).

The design should encourage browsing and help the user quickly understand what options or decisions are available. Develop an overall macro flow chart to help the team organize the factual information according to the high-level user interface (see Appendix A). It provides a short, usually one page, summary of the project. *(For related information, see Bodker, 1991; Brown, 1988; Jones, 1989; Rubinstein & Hersh, 1984; and Shneiderman, 1987.)*

**Design Specifications**

Before developing the presentation details or micro designs, the team needs to establish design specifications -- a standard way to accomplish and coordinate development. Consistency and simplicity are vital to strong design. Without common specifications, each team member may develop creative, but inconsistent terminology, operations and display designs (Koritzinsky, 1989). Integrating all the elements into one operating system becomes a nightmare, and ultimately users will find the system confusing and hard to use.

Design specifications are developed by the design team, for the design team. Each member agrees to standards to preserve cohesiveness and increase efficiency. This frees more time for creativity. Design specifications should cover the way the program looks, operates, and responds to users. *(See an example in Chapter 4.)*
In general, specifications will evolve throughout the development process to cover such basics as consistent labels, functions for navigational buttons, methods of acknowledging user input, locations of information or user tools, warnings and timeout processes, writing style, and information presentation techniques.

Specifications also can include designs of commonly used modules, a glossary, and examples of system-wide operational strategies. While, in general, these specifications are to be followed system-wide, they can be modified when formative evaluation or special material requires. The key is that modifications or inconsistencies are the exception and must be specifically justified.

(For related information, see Barker, 1990; Cox & Cox, 1990; Dumas, 1988; Friedrich, 1987; Mock, 1989; Nielsen, 1989; Rubinstein & Hersh, 1984; Schvier, 1987; Shaw, 1990; and Shneiderman, 1987.)

Design the micro treatment.

The micro treatment expands the overall treatment to cover the subject matter. Although each module can have variations within its presentation, there should be an overall consistency of concept and a similarity among modules.

Design the micro interface. If the macro design is the overall metaphor, then the micro interface is the user myth -- the simulated environment under the user's control (Barker, 1990). See Chapter 4 for examples. The micro interface design often flows directly from the macro design of the overall presentation.

Designs which entertain as well as educate will help maintain user interest in Extension interactive multimedia presentations. Consider using fantasy, role models, challenging game-like situations, and the element of surprise or curiosity (Arwady & Gayeski, 1989). These techniques may require exciting video effects, taping in exciting locations, including well-known personalities, or creating animation sequences. A high degree of user interaction is also a powerful motivator in presentations in public delivery environments. The opportunity to "make just one more selection" is almost irresistible.
Design interactivity and transport. Interactivity and user control are among the most valued principles of interactive multimedia presentations (Baggott & Dennis, 1990). The design should give users full control to quickly access information. Users of multimedia presentations in public delivery settings are always free to walk away. In fact, they are actively enticed away by surrounding displays, merchandising techniques and companions. Highly interactive presentations, giving the user ample opportunity for input and brief or user-interruptable responses, hold a high degree of attraction for users, especially first-time users (Schwartz & Buckley, 1990).

Users are generally attracted to the multimedia presentation by an opportunity to interact, often from an inviting attract routine. These designs usually involve highly appealing graphics, simple instructions ("Please Touch"), or eye-catching samples of the type of information provided in the interactive presentation. This attract routine repeats, usually without annoying sounds, until activated by a user. When possible, the attract routine should connect with the overall macro design.

Designs within the presentation may simulate real world experiences. Users predict the type of information they could expect from each selection by providing carefully designed, progressively specific menus to reduce apparent complexity. Many users will not follow sequential order if they can find a short cut to quickly link related information. Help users understand the links between material and provide clear paths to and from the information (Jones, 1989).

Without navigational guides, users can easily get lost. At each decision point, users of multimedia presentations wonder: Where am I? What can I do here? How did I get here? Where can I go? How do I get there? Just as locator maps help shoppers in malls, navigational pathfinders in an interactive multimedia presentation keep the user on track. Most users respond well to spatial designs because they can remember where they saw something, even when they can’t remember exactly what it was they saw (Zechmeister & McKillip, 1972).

(For related information, see Baggott & Dennis, 1990; Baur, 1990; Emery & Holder, 1990; Jones, 1989; Nievergelt & Weydert, 1989; Schwartz & Buckley, 1990; Seybold, 1981; Shaw, 1990; and Wadlow, Haas, Boyarski, & Crumley, 1991.)
Design informational presentations. Because the user has full control of multimedia presentations, information must be organized into chunks that remain logical, regardless of the order in which they are read. An information chunk can be a small unit of text, a video still or motion clip, an audio presentation, a graphic, or an animation clip. Give the system maximum flexibility by allowing users to link small information units within the overall information design.

(For related information, see Baggett, 1989; Mattson, 1989; Miller & Lambur, 1988; and Tsaia, 1988.)

Design the micro flowchart and management process

Create a micro flowchart showing the relationship among the smallest units of information (see Appendix A). The flowchart will help designers support the user's ability to explore the material in a non-linear fashion. Repeating the use of certain interaction templates can increase consistency within the application and speed overall development. Designers can modify ideas from published sets of interaction flowchart models, such as "Interactive Design Strategies" by Holder and Daynes (1987), or a more complete model, such as The Natural Resource Extravaganza template (see Chapter 5).

Experience can help the design team establish efficient levels of documentation and paperwork. Paine and Grady (1990) point out that while traditional practices insisted on detailed diagramming of every possible event or path, practical experience has revealed otherwise. "Anyone who says that it is necessary to diagram all possible paths ... either doesn’t understand the problem or is lying" (p. 26). Paine and Grady say use of templates and data-processing methodologies provide superior information.

(For related information, see Alessi & Trollip, 1991; Paine & Grady, 1990.)

Design the evaluation plan

Design a formative evaluation plan for collecting the opinions, suggestions, and criticisms of many audiences, including potential users and Extension faculty and administrators. This will not only improve the final product, it will also increase
understanding of the process and help build political support for interactive multimedia development. The results should guide revisions and help make the presentation as efficient and effective as possible. The evaluation plan should cover every stage of development including topics, the treatment, the delivery site, and the specific program elements.

Typically, formative evaluation does not involve controlled experimental design with quantifiable results or large numbers of subjects. Instead use qualitative techniques for extracting as much information as possible from the potential users. (For related information, see Dick & Carey, 1978; Lambur & Miller, 1988; Norman, 1991; and Reeves & Glynar, 1988.)

Design the master development strategy

The culmination of the design process is documenting the master development strategy in the Master Project Book. All the complex details involved with each possible branch should be captured on paper, sometimes called the Super Story Board or Master Design. Regardless of how much discussion a particular idea received during design, if it does not appear in the Master Project Book, it will not be in the final product. There is no best super story board layout. Just be sure that the documentation of the team’s plans and designs is clear, complete, and consistent.

This is the longest, and often the most tedious, part of the project. However, attention to details at this point -- including consistent naming strategies for text, graphic, audio, and touch pad files -- can help guarantee smooth and cost efficient production in the origination stage. If possible, establish a project room and post records of development on the walls. (See example in Chapter 4.) This can be the central location for master records, reference materials, chronological logs, organizational material, business records, testing materials, and shared computers and graphics equipment.

(For related information, see Bergman & Moore, 1990; and Mock, 1989.)
Design the budget

A detailed Master Project Book is invaluable to team members who are designing the project’s budget. It enables the team to calculate the exact numbers and complexity of video clips, stills, graphic, audio tracks, and animation segments to arrive at realistic cost figures. The Master Project Book also can serve as the basis for bid specifications from outside production facilities.

When designing the budget, allocate contingency funds for backup tools, extra programming consultation and rush production. While careful planning can minimize emergency costs, contingency funds avoid compromise of the process. As plans are modified, keep the originals as evaluation tools (Biethyn & Parker, 1990).

Design the timeline

In addition to keeping development on target, the process of building the timeline will help clarify expectations and avoid misunderstandings. Again, include contingency time and be careful that you do not oversell the team’s ability to deliver.

Multimedia applications are so detail-intensive that often the smallest error (one misnamed file, one forgotten line of code) can have enormous consequences. If the system crashes or one obvious interaction is flawed, users may judge the entire project a failure, not realizing that 99 percent of the work was flawless. Allow time for complete debugging and formative evaluation. A simple but effective application is more productive in the long run than a flashy but flawed product.

Consider expectations. Clarify the organization’s expectations for delivery dates and backdate development steps. Usually there is too much work to be done in too little time. Although there will be pressures to abbreviate design and formative evaluation, these shortcuts will hurt the entire project. Instead, reduce the project’s scope or use modular designs which can be expanded after the deadline (Chapter 5).
It is also important to design methods to cope with the divergent expectations of the team members. Meredith and Blanchard (1990) say, "The integration of personnel having diverse perspectives of the product into an effective team is one of the greatest challenges" (p. 8). They say the easiest and cheapest method of fostering communications is designing team members' work stations in the same location.

**Use a scheduling methodology.** Computer-based scheduling programs, such as Super Project, Project Manager or Project Scheduler, can help manage scheduling. Mock (1989) estimates the time the team spends on a project will break out as follows: Analysis, 10 percent; Design, 20 percent; Development, 40 percent; Testing, 20 percent; and Business management, 10 percent.

**Design the delivery environment.**

At this time, most interactive multimedia kiosks used in public locations present commercial rather than an educational applications. These commercial kiosks are expected to see a 47 percent annual growth rate through 1995 (Josephson, 1991) and will help set the public expectations for quality of everything ranging from the sophistication of the computer graphics to the attractive appeal of the kiosk.

The physical appearance needs to be suited to the surroundings and yet stand out enough to stimulate user attention. Consider the type of attract loop which will be most effective in the environment. This may be a preview of the presentation (Sterman & Allen, 1990) or simply an attractive computer graphic to attract user interaction. Contact the management of the public delivery site early in the development process to accommodate possible design restrictions or guidelines.

Also consider the specifications of the delivery equipment. If the budget require that the delivery machines operate with different cards, memory or computer than used during development, design for these limitations (Malamed, 1991).
O -- Originate the Program Elements

The origination stage is perhaps one of the most exciting in multimedia development. This is the time when all the analysis and design come to life, producing color, sound, motion, and results. The tools used to produce the elements, such as scanners, animation software, desktop video editors, and digital recorders, are improving almost monthly and putting more power into the hands of non-specialists while increasing the effectiveness and efficiency of skilled professionals.

The importance of continuing formative evaluation with potential users during the origination and development of program elements cannot be overstated. As screen designs, video clips, and audio helps are developed, they should be tested as soon as possible with potential users to ensure their effectiveness. (See Formative Evaluation in the Analysis section of this chapter for guidelines.)

Originate graphics and animation

What the user sees is paramount, since so much multimedia interaction takes place in the visual realm (Hanson, 1990). The graphic design sets the tone for the entire presentation and affects production of most other elements, such as the size and shape of video windows or text blocks.

High visual momentum helps maintain user interest. Animation, for example, can add considerable impact to multimedia presentations and, thanks to emerging computer tools, is one of the fastest growing areas in multimedia presentations. Fantasy and animation also offer a timeless quality and extend the "shelf life" of presentations.

Study conventional graphic design principles developed for paper media, computer applications in industrial or military environments, and guidelines for computer and video graphic designs intended for consumer applications. Validate
through formative evaluation that the intended functions of all graphic elements, such as buttons and menus, are instantly obvious.

(For related information, see Baek & Layne, 1988; Birkmaier, 1990; Braden, 1986; Cook 1989; Iuppa, 1984; Malamed, 1991; Reiber, Boyce, & Assad, 1990; Tognazzini, 1985; and Vanderheiden, 1989. NOTE: Using computer color effectively: An illustrated reference. Thorell & Smith, 1990, is especially helpful.)

Graphical user interfaces and menus. In a touch screen multimedia system, the screen’s graphic layout is the basis for user interaction and helps users intuitively predict how to achieve the desired effect. This predictability makes the system easy-to-use. Provide immediate visual and perhaps audio feedback to acknowledge a user’s touch. Buttons can change color, knobs can turn, or switches can flip through use of bit-mapped graphics. Instead of visually unexciting menu boxes, create graphics of real world objects which -- although on a two-dimensional computer screen -- behave like objects familiar to users. Spatial designs help users remember how information can be found.

(For related information, see Jones, 1989; Shaw, 1990; Vanderheiden, 1989; and Wadlow, et.al, 1991)

Graphic pathfinders and transport elements. Graphic designs also should provide navigation aids. Presented with multiple branching alternatives, a user may become confused. When practical, provide users with an overview of the program, their present location, and an easy way to move to another point, or a direct route to return to the opening menu. Use signposts, pathfinders as geographical metaphors.

(For related information, see Jones, 1989; Kearsley & Frost, 1985; Shaw, 1990; Vanderheiden, and 1989.)

Graphic representations and icons. At times, a graphic representation conveys a clearer message than the photographic image. Graphics can exaggerate traits which may not be noticed in a photo. Cartoons also can provide information compression by eliminating superficial or redundant details, leaving only the essentials.
Icons, which have been carefully designed and tested, can represent an object, action, or concept in less space than the equivalent text label. Thus, they save time or increase communication efficiency. Again formative evaluation is critical. (For related information, see Brown, 1988; Dwyer, 1978; Foster, 1990; MacKnight, 1990; Palamar, 1990; Veith, 1988; Wadlow et al., 1991; and Yelon & Anderson, 1989. NOTE: Graphic design for electronic documents and user interfaces. Marcus, 1992, offers especially complete recommendations and annotated bibliographies.)

Originate text

**Modular presentation.** Writers for multimedia presentations are idea jugglers who often create screen text, audio scripts, user feedback, and video dialogue. Their work is guided by an understanding that users have full control over the sequence of information and can decide to read, scan or bypass text. Therefore, a clear, modular writing style is critical. Information provided by the subject matter experts is often written in a linear style and must be divided into short, clear modules which can be absorbed in short chunks.

Each text block should indicate the general topic presented, and either the text block or the graphic interface should give the user a sense of how that information fits into the overall information presentation. Use lists or bulleted statements instead of paragraphs to help users quickly grasp the critical points. Each block should be a self-contained unit without vital reference to previous screens. Avoid saying, "As explained before." As writers develop the text, they may use standard text markup, such as SGML, to permit easy modifications in design. (For related information, see Baur, 1990; Buerger, Brunsman, Messerly, & Lammers, 1988; Franklin, 1990; Hoekema, 1983; and Ives, 1987. NOTE: "Steps for developing award-winning interactive video scripts," Emery & Holder, 1990, offers guidelines to help multimedia writers brainstorm, research, develop a master plan, and write in modular styles.)

**Screen layout of text.** Reading text from an electronic screen is generally about 28% slower than from paper (Jones, 1989). Therefore the layout, structure and legibility of the text in a multimedia presentation is critical.
Not all principles of text layout from print media research apply to multimedia presentations. For example, justified text, common in the print world, does not increase readability on a screen (Rubinstein & Hersh, 1984). On the other hand, as with print, the use of both upper and lower case letters on the computer screen is faster and easier to read (Marcus, 1984; Tullis, 1983). Decreasing text density with white space, bullets, and spacial design, increases reading speed (Jones, 1989).

Scrolling text blocks, common in some computer applications, distract multimedia users and are hard to assimilate. Instead, break the text into separate page presentations for higher comprehension and spatial orientation of the information. *(For related information, see Schwartz, Beldie & Pastoor, 1983; Shaw, 1990; and Thorell & Smith, 1990.)*

**Originate video for motion and stills.**

**Video production techniques.** Video contains the highest information content of all multimedia elements because the information is constantly updated, and incorporates most other media elements (Birkmaier, 1990). Multimedia production uses traditional linear video techniques as well as new methods to accommodate multimedia's reliance on branching and the user's power to control the story line.

Video segments must be designed as relatively free standing information units which can be viewed in any sequence. The design may require many similar but slightly different scenes which allow the users to "replay" the same scene with different options and see the consequences of specific choices. Because of these multiple options, visual continuity (logical similarity and connection between scenes) is critical. For example, actors should wear the same clothes and items should start in the same place on a table in each retake. During editing, slightly backup the action, if it is a continuation of a story in progress, to help viewers maintain the flow. Keep careful records to be sure every possible branch is taped and edited.

Use only professional video formats. Low-budget, home quality video usually will not hold viewers in the public delivery environment. Each scene must have maximum impact, using tight close-ups, high speed action, graceful slow motion, and
dramatic interaction. Because multimedia designs may freeze any single frame of motion video, photographic composition is crucial. Compositions also should consider space needed for graphic buttons overlays.

**Editing techniques.** Editing video for multimedia often avoids common video techniques, such as dissolves or fade to black, which can leave the screen frozen in black or one-half of a dissolve. Cuts and very quick fades are more suitable. Freeze the last video frame on all motion segments to eliminate jitters when the motion stops.

Brief video clips, sometimes only a few seconds in duration, also are common. In contrast to linear video, video for interactive multimedia cuts out all scenes that are not vital to understanding. Users in public environments often are rushed for time and will not tolerate lengthy video. Allow users to request several short segments instead of one long video. Provide techniques to skip the video motion at any time.

**Disc mastering.** Currently, video for a multimedia presentation usually is mastered on a laserdisc, which provides random access to top quality video motion or stills. Because commonly used CAV laserdiscs hold only 30 minutes of motion video, short video clips and innovative use of stills are common to conserve valuable disc "real estate." Even when using the new videodisc players offering developers a full hour of video from a CLV disc (Miller, R., 1989), wise use of disc space is still important. The disc geography should leave no space between segments. Segments used frequently should be placed near the middle of the disc, and may even need to be repeated several times on the disc. For complex videodiscs, consider software to manage disc frame numbers and segment order.

Mastering video for a laserdisc requires special considerations, such as an industry-specified tape layout, consistent field editing to ensure that still frames have no jitters, and consideration of placement on the disc for efficient access. For specifics, follow the mastering house specifications (3-M, 1988).
New video possibilities. New tools are emerging which could drastically affect the way video motion and stills are stored. New computer cards allow real-time digitizing of video stills and motion from the videodisc. This means that the shape and location of the video image can be changed after the disc is pressed. Emerging laser-based technologies, such as DVI, CT-ROM-XA, CD-I, and CDTV, may soon be practical for multimedia presentations (Reisman, 1991). Promises of digital stored video will be fulfilled—someday. (Within two paragraphs, McQuillin (1991), uses the following two phrases to discuss digital stored video: (1) "In the not-too-distant future..." and (2) "Don’t hold your breath.") Until then, watch for new technologies, such as video capture boards, desktop video editing, and video overlay cards. (For related information, see Alessi & Trollip, 1991; Allen, 1986; Arwady & Gayeski, 1989; Bergman and Moore, 1990; Crowell, 1982; Gay, 1989; Hanson, 1990; Kearsley & Frost, 1985; McEntee, 1982; McQuillin, 1991; and Reisman, 1991.)

Originate audio tracks.

Audio for multimedia applications is usually supplied from optical storage (CD-ROM or videodisc) or computer files. Although audio computer files allow for continual updating of audio and flexible "user input" designs, they cost in terms of hard drive space and audio quality. While audio from laser technologies can not be updated, it is high quality, can sync to video, and with multiple videodisc channels, can vary presentations for bilingual or various age groups. While only still-store laserdisc players can play audio while showing a video still frame, all can play audio under computer graphics. If lists appear on the monitor during audio segments, the order and wording of the visuals and the sound track should be identical.

Unlike multimedia systems designed for the classroom, multimedia systems in public settings are usually in a high traffic area, surrounded by conversation, music, noise and advertising. Therefore use only brief sound effects and short audio segments. Long audio passages may bore users. Annoying sounds, especially in the attract loop, can even encourage sabotage from people working nearby. (For related information, see Birkmaier, 1990; Michaelis & Wiggins, 1982.)
B -- Build a Computer Management System to Merge Program Elements through Continued Formative Evaluation

The computer program code is the binding agent that holds the individual elements together and makes the final product more functional and beautiful than the sum of the individual parts (the same function served by adobe clay in building construction). Authoring the computer code is at the heart of multimedia production and is the culmination of months of careful planning and production.

Carefully designed, powerful computer code can implement highly effective multimedia techniques, such as seamless transition and merging of graphics, text and video, high levels of user interactivity, and comprehensive data gathering. On the other hand, limited capability in the software or poor code designs can virtually destroy creative design in all other elements. One simple mistake in a file name, a line of code, or a decision point can crash the system. This makes the environment and the tools the team selects for development critical.

Barker (1990) says that there are a wide variety of programming tools multimedia developers can consider and that they vary considerably in the features they offer. There are generally six types of authoring tools available for multimedia work, ranging from those offering great flexibility to those offering simplicity of use: (a) general purpose languages, (b) authoring languages, (c) time line processors, (d) hypermedia generators, (e) application shells, and (f) authoring systems (see Chapter 5).

General purpose languages, commonly used in a wide variety of non-multimedia applications, are very flexible and can respond to most designs. However, code must be written by a highly skilled programmer. Authoring languages, on the other hand, provide a great deal of flexibility through the use of a command set and can be mastered, given time, by developers without computer backgrounds. Time line processors have become popular, especially with non-programmers and video producers (Bergman & Moore, 1990), however complicated design functions are difficult to program in this environment.
Hypermedia generators have expanded from the initial concept of linking words to linking graphics, words, motion, and data processing. (Hypercard is one example.) Designers can use these systems with little formal study, and, therefore, often use them in the early stages of a project to test designs. Application shells restrict the design, but allow the user to quickly create an interactive presentation by simply filling in the blanks within the program. These programs are best suited to information designed in a hierarchy. Finally, authoring systems offers the greatest ease of use, but are fairly rigid in the functions they will perform. These systems can provide efficient development if the material ideally suits the restriction of the program. They also can support prototyping and testing by non-programmers during the design stage.

When selecting an authoring environment, realize that projects usually grow, not diminish, in complexity. The key is to balance the power of the environment with the ease of use. Canter, Neumann & Fenton (1987) say that building an interactive presentation is somewhat like producing a movie, recording an album, preparing online tutorials, writing a book and programming an application -- all at once. They point out that this task is hard enough for a seasoned programmer. If interactive multimedia technologies are to be viable and effective, there must be computer management techniques which will empower people with little programming background.

Lockwood (1990) says design teams also will need software tools to support flowcharting and prototyping; indexing and management of video, text, images and graphics; production software for graphics and text; and software to manage the geography on the laserdisc.

Regardless of the tools used, the public usually judges the presentation on its responsiveness, not economy. In addition, the team will want features to support their developmental needs of the final computer control code are the same and should include features to benefit both the user and the designer (Allen, 1990; Richards & Fukuzawa, 1989).
Build user-centered computer management features

Build in user control. User control, one of the most important features of multimedia presentations in public access areas, is made possible by branching options within the computer code. The computer code should continuously monitor the input device to allow the user to interrupt current action, such as motion video, and request direct movement to new information, without backing out of a presentation. By cataloging branching structures according to use, programmers can reuse templates and speed development while cutting costs.

Build in user feedback. User feedback also affects computer management design. Feedback can include audio, motion sequences, animation, animated characters, and beeps. On the most basic level, the computer control program should acknowledge all user input. For example, the system can offer visual response (switches that flip or signs that highlight) and/or sound (beeps or boops). The computer program also can provide feedback to non-action. For example, when user interaction stops, the program prompts an audio message explaining how to continue.

Build in user helps. Ideally, the multimedia presentation is so clear that users need no instructions. However, the computer code should provide a means for supplying simple instructions, if only to confirm the user's assumptions. For example, code related to the first menu could access an audio message, such as "Select a path," or "Find your home town treasures." Simple on-screen instructions are also effective if they are easily understood and can be quickly read.

More complex help messages should either be accessible without leaving the current screen location or should return to the current location when completed. Helps should be as specific as possible to the current screen choices and potential points of confusion. While this requires a more complex computer coding, it greatly enhances the presentation's usability. All help messages should be tested early in development through formative evaluation.
The computer management also can include helping the user understand the relationship of the current information to the overall multimedia presentation. Computer code can provide a dynamic map showing users their current location and the structure of the system. The code could even allow users to touch the map to quickly change locations (Shaw, 1990).

To support user information gathering, consider code which allows users to mark interesting information and assemble a customized collection of facts (Jones, 1989). Computer designs also can integrate user input data, such as household budget information, to provide computer processing and analysis. (For related information, see Dumas, 1988; Holder, 1987; Jones, 1989; Kearsley & Frost, 1985; Litchfield, 1990; and Shaw, 1990.)

Build designer-centered computer management features

**Build in computer documentation and modification techniques.** It should go without saying that documenting the computer code is essential. In fact, Blethyn and Parker (1990) say that without documentation and modification techniques, it might be cheaper for the programmer to throw out current code and start again. (See documentation guidelines in "How to Design Information Systems", Blethyn & Parker, 1990, or their forthcoming book, Designing Information Systems.)

Development of the computer code should include methodical back-up. It is important to back-up the code, graphics and text as they are being created. The entire system, as a unit, should be periodically backed-up and the disks labelled and stored in another location. It is especially important to back-up corrections as they are made, even after the presentation is in use.

In addition to changes made in response to formative evaluation, problems needing correction or modification also are discovered during systematic debugging. This is a tedious but highly informative phase of building the computer management system. Using a flowchart or other current copy of the computer code, systematically move through every path. Record needed changes in code, text, graphics or video.
Build in user tracking and logging techniques. Evaluators often request computer code development to support data collection and analysis. While building the computer control system, consider the extent of user tracking needed. Unlike skills-mastery presentations where individual tracking is vital, overall numbers of interactions in each specific area are more important for multimedia presentations in public areas. However, this raw data can be misleading without a clear understanding of the design underlying each section. For example, a simple tally of the number of touches within each module could be misleading if one design required eight touches before arriving at the main information level while another required only two.

Build in system maintenance tools. As the computer control program is written, include tools for system maintenance and ease of setup and restart. In most cases the initial AUTOEXEC.BAT should automate as much of the start up routine as possible. If the same program provides a number of program options, such as expanding or narrowing the scope of the overall multimedia presentation, provide the operator with on-line instructions immediately prior to each keyboard input option. Keep start-up keyboard operations simple and to a minimum.

Within the program, provide techniques for the computer to restart the presentation if there is no user input for a predetermined period of time. This restart usually involves an audio warning, requesting input if the user is still present. Without user input, the system should restart. This timeout procedure serves two functions. First, it keeps the program from "locking up" when users walk away, thus preparing the attract screen for the next user. Second, by automatically restarting the program, users never have to stop the program or indicate that a session is over. This helps invite continued involvement with the system and allows an onlooker to continue using the presentation after the original user has gone.

(For related information, see Blethyn & Parker, 1990; Cox & Cox, 1990; Davidove, 1986; Iuppa, 1984; MacKnight & Balagopalan, 1989; Pliskin & Shoval, 1987.)
E -- Evaluation of the Product and Process

For interactive multimedia presentations, traditional distinctions used for more than 25 years between the formative evaluation conducted during the development process and summative evaluation conducted at the conclusion of a project are beginning to lose their meaning because there is no longer a sharp contrast between stages (Rubin, 1988). Interactive multimedia presentations often are refined long after they are introduced. Traditional summative evaluation questions for interactive multimedia projects focus on the user’s ability to accomplish tasks, pass a pre/post test, or perform skills. While these types of questions may be appropriate for training or classroom multimedia applications, they do not suit the usual goals for applications operating in a public setting. Bergman and Moore (1990) have adapted summative evaluation questions to more closely suit the needs of public multimedia presentations: "Did the target audience(s) achieve the objective? Did they like the application? Is the application installable and usable?" (p. 117).

Additional points to be evaluated include organizational reaction, effectiveness of the process, and future potential for related development. Evaluators usually employ a variety of techniques, including on-line data gathering, observations, exit interviews, follow-up interviews, focus groups, mail surveys, and testing (For details, see Usability Testing in the Real World, Mills, 1987). Because each technique provides different information, employ a variety of methods.

Evaluate the project’s achievement of original objectives

The evaluation of an interactive multimedia presentation also should consider whether it meets the original goals. If the goals were clearly documented, and if development was modified in response to formative evaluation based on project goals, the results of this summative evaluation should be no surprise. (Note that it is common for the original goals to be modified during the design and development to reflect achievable objectives and findings from formative evaluation.)
Follow-up interviews and observations are especially useful if the goal was to convey specific information. While this type of evaluation is important for reports to funders, perhaps a more primary consideration in public delivery environments is whether the presentation is attractive to users (Abbate & Lawrence, 1986).

**Evaluate user reaction to overall presentation**

It is possible for a multimedia presentation to meet the exact program objectives and still draw a negative reaction from users. Perhaps it presents the desired material, but is simply too repetitive, boring, or slow. While these problems are undesirable even in self-study courses for "captive users," they are deadly in the public delivery environment. The user will simply walk away, or, even worse, develop a negative image of the organization.

Evaluation of user reactions is often best achieved by on-site observations, perhaps coupled with exit interviews. Because these systems are already in a public place, the presence of an observer often has little impact on user actions. In fact, users usually are not aware that anyone is watching.

Evaluators should not only determine whether the users liked the application, but what specific features were most and least attractive. Evaluators also may try to separate the users' reactions to the technology ("Wow, this touch screen is great.") from their reactions to the specific application ("It's so easy to find the exact information I want on these birds.").

Bergman and Moore (1990) offer detailed suggestions for conducting various types of evaluations and are valuable sources of specific suggestions for various situations. They point out that is it almost impossible to find consensus on the desirability of any system because the audience is so widely varied. They encourage developers to be most concerned about users who fall in the midrange of user ability. 

*(For more information see Abbate & Lawrence, 1986; Baker & Atkin, 1984; and Rubin, 1988.)*
Evaluate organizational reactions to the presentation

Because the system was probably developed to meet specific perceived needs of the organization, evaluation of the organization's reaction to the final product is vital. In Extension, this should include reactions of all components, from top administrators through the state staff, to county faculty, to advisory group members. Ideally, representatives of each of these groups were involved in setting the original goals, as well as formative evaluation during development.

The process of conducting this evaluation will involve both updating the organization on the results and listening to reactions. Although preparing reports, showcasing the multimedia presentation, and encouraging feedback may be time consuming, it is also a key step in evaluating the current project while building support for future work (Koritzinsky, 1989).

Complaints about features or subjects not included in the original presentation can be an opportunity for building understanding and support for expanded projects. This showcase evaluation time also can help refocus the organization on the original goals and reinforce the notion that interactive multimedia presentations supplement and expand, but do not replace traditional educational programs.

Evaluate production process

Evaluation also should consider the development process itself. How did the group function? What stages were the most productive and where did the process hit snags.

Evaluation of the process at the conclusion of the project can be difficult. Time has doubtless distorted the accuracy of memories, and some early problem may be totally forgotten while recent roadblocks take on disproportionately higher importance. While group introspection can be useful, guidance from an impartial experienced evaluator and records of actual time and budget expenditures can help bring the process into perspective.
The goal of this type of evaluation is not only to bring closure to the process, but to improve the process before the next project. Especially productive techniques should be documented, along with names of desirable subcontractors, subject matter specialists, production tools and products. Pinpointing unsuccessful techniques is equally important to future projects. While no two development projects will ever be the same, identifying and eliminating as many unproductive and uncertain elements as possible is especially important in multimedia development.

**Evaluate future development opportunities**

In addition to looking back on the completed project, the evaluation process should include a look forward toward future development: What other information could be easily or economically delivered in a similar presentation? What additional locations could be included?

Developers also should initiate evaluation of emerging hardware, software, and design techniques which would have made the process more efficient, effective or creative.

Finally, this is a time to evaluate the possibilities for sharing lessons learned and even program modules with other Extension organizations.

*(For additional information, see Baker & Akin, 1984; Iuppa, 1984; Mills, 1987; Rubin, 1988; and Shneiderman, 1987.)*
Chapter 4

DEVELOPMENT AND IMPLEMENTATION OF AN INTERACTIVE MULTIMEDIA PRESENTATION FOR USE IN A PUBLIC DELIVERY SETTING

The purpose of this chapter is twofold. First, it is designed to document the development and implementation of the interactive multimedia presentation, *The Natural Resource Extravaganza*. Second, it provides potential developers with a comprehensive overview of this presentation to facilitate parallel development by using the recommendations presented in Chapter 5.¹

OVERVIEW OF DEVELOPMENT FOR THE NATURAL RESOURCE EXTRAVAGANZA

Although 1991 was marked by painful funding and program cutbacks for Extension in many states, including New Mexico, NMSU’s College of Agriculture and Home Economics maintained its support for development of a multimedia presentation. In May 1991, the College Administrative Council approved development of *The Natural Resource Extravaganza*. After the program made its debut at the State Fair in September, it was installed in a high-traffic area in Albuquerque.

¹ A video tape summary of this interactive multimedia presentation is available at Virginia Tech from the Reserved Materials section of the Newman Library. The tape and information about the computer code also are available from NMSU Agricultural Information, Box 30003, Dept. 3AI, Las Cruces, New Mexico 88003. *The Natural Resource Extravaganza* presentation, graphics, video tape, and program code are copyrighted by New Mexico State University. Possibilities for cooperative development with similar organizations will be reviewed in Chapter 5.
College funding supported only direct costs for mastering the laserdisc and for student wages. No funds were available for new equipment or software. However, the presentation was needed and the commitment level was high.

The Department of Agricultural Information’s development team, composed of this developer and three students, worked intensively on the project for 90 days. As needed, the project received additional input from the professional, student and clerical staff of the department’s electronic media unit.

Development activities generally followed the steps outlined in the ADOBE Model presented in Chapter 3. A complete model and clear team assignments were especially critical for such a short turn-around schedule. The presentation opened at the State Fair on September 6, 1991 and ran simultaneously in two locations at the fair. After the fair, small improvements were made. Both interactive multimedia kiosks have been in demand for use at conventions and for other public displays. Winrock Mall in Albuquerque provided no-cost space for the multimedia presentation and the kiosk was installed in late 1991.

OVERALL PROGRAM ELEMENTS

The Natural Resources Extravaganza presentation is built on the design of an educational theme park with "pavilions" which users explore by touching the screen of a color monitor. The multimedia theme park contains six major modules or pavilions, covering many natural resources topics. The pavilions include Discovery World (Figure 1), Home Town Treasures (Figure 2), The Pinnacle (Figure 3), Adventure Land (Figure 4), Career Control Central (Figure 5), and The Answer Machine (Figure 6).

Overall, the presentation contains more than 1050 stills, 725 text blocks, and 120 video motion clips. The computer manages more than 1,000 files of text, graphic, bitmap, touchpads, and computer code files. A graphic overview follows.
Discovery World  (A) is a silver globe, (B) that opens as users "zoom" (sound effects) into the lab. (C) Audio instructs users to select microscope slides to explore. (D) After viewing a 5-second video clip, (E) users see microscopic details and enlargable stills of research projects. (F) Petri dish buttons transport users to lab or Main Street. Discovery World contains more than 48 stills, 24 text files, and 7 motion video clips.

Figure 1. Discovery World
Home Town Treasures. (A) When users touch this treasure house (advertised in preview), they zoom through the door to the roof. (B) The earth moves in and (C) New Mexico spins off, (D) into the Stargazer's Treasure Book. (E) Selecting a county, (F) reveals names and addresses of local NMSU resources. The digital text is superimposed over a graphic book, allowing for continual customization and updating.

Figure 2. Home Town Treasures
The Pinnacle — New Mexico’s Finest. (A) Touching the doors of this tower, (B) zooms users into the opening elevator doors. (Photo taken during motion) (C) Once in the elevator, users select a floor and see a video preview. (D) Users select a specific display from the floor directory, (E) and see a 5-second music video. (F) The display window gives access to motion, enlargements, more information, or transport to other selections. This module contains more than 100 text files, 200 stills, and 35 motion video segments.

Figure 3. The Pinnacle — New Mexico’s Finest
**Adventure Land** (A) This Pavilion is a ranger station. (B) Users zoom up and through the tower and (C) into the forest. (D) The user selects a path and sees a 5-second video overview, (E) before selecting from a binocular menu. (F) Users see a 5-second video clip on a specific animal, (G) then can see stills through the binoculars (enlargeable) and text blocks. (H) Range maps are available for each animal. **Adventure Land** contains approximately 300 text files and maps, 600 stills, and more than 50 motion video segments.

Figure 4. **Adventure Land**
Career Control Central. (A) is a moving space station, (B) which beams users though a fast moving space scene, (C) into the control room. (D) Exploring the universe of NMSU offers users 72 options. (E) The transporter room allows users to explore career options, (F) and six facts on each of 29 majors. (G) Costs outlines both expenses and available aid, and (H) Apply outlines the eight-step enrollment process. This module contains more than 250 text files, 225 stills, and 40 motion video segments.

Figure 5. Career Control Central.
The Answer Machine. (A) Touching the front of this game, (B) pulls the user into the machine. (Action photo shows motion.) (C) Users see a game board with 24 topics. (D) Selection of one button, (E) triggers a swirl of the cubes, (F) as users see first the question and, on request, (G) the answer. All text is superimposed over a generic video board, allowing easy customization of the game to suit the delivery location.

Figure 6. The Answer Machine
SUMMARY OF THE DEVELOPMENT PROCESS

The development process followed in this project paralleled the steps presented in the developer's ADOBE Multimedia Development Model, Chapter 2. Details of this development, documented below, will be organized under general ADOBE headings to further clarify the process of interactive multimedia development.

Analyze the Audience, Goals, Resources and Constraints

Analyze organizational goals and expected outcomes

Professionals in NMSU's Department of Agricultural Information and administrators in the College of Agriculture and Home Economics have worked for years to overcome the "cows and cooking" image of the College. As with earlier multimedia systems from the College, the goals of this presentation were (a) to present a high tech image when delivering information about the College; (b) to address natural resources topics of high interest; (c) to design information delivery techniques which would be effective with extremely short user interaction times; and (d) to create a template for economical and timely development of future projects.

The general criteria for success, as with early interactive multimedia presentations, was to engage the users in innovative, high tech information technology and link that high tech image to the College. At a more practical level, this project had to be initiated, developed, tested and functioning in approximately three months for delivery at the State Fair.

Analyze user needs and the delivery site

Analysis of the setting at the New Mexico State Fair indicated that the noise level and fast flow of pedestrian traffic through the displays would strongly affect the design. Two identical systems were needed for the 1991 State Fair. They each were
housed in major pavilions on the main street of the fairgrounds and were displayed in similar kiosks. One was in a prime location in the most visited building at the fair -- the Natural Resources Building. The noise level was intense, the traffic flow strong, and the excitement and visitor interest level high (see Figure 7A).

The second system was centrally located in the Agriculture Building, noted for its display of monstrous fruits and vegetables. This kiosk was surrounded by restful benches, green plants, and engaging, but relaxing displays (see Figure 7B).

Although most users could read and, in another environment, would possibly spend time watching or reading educational presentations, the pressure to "keep moving" would be strong. Therefore the presentation needed to be highly concrete, use little or no narration, provide intuitive interaction opportunities, contain clear navigational aids, and present numerous "chunks" of information which could be retrieved and understood quickly.

Locations of the interactive multimedia presentations at the New Mexico State fair included (A) the crowded, noisy, and highly popular Natural Resources Building, and (B) the calmer, greener, but highly traveled Agriculture Building.

Figure 7. Locations at State Fair

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Analyze the subject matter

The on-going public image campaign of the College has been: "The College of Agriculture and Home Economics -- Your Resource College." Therefore, selected topics were related to natural resources issues. Subject matter was selected through formative evaluation with prospective users and further discussions with Extension faculty and program directors. The topics available within Extension are highly adaptive to a modular, visual presentation. The subject matter experts (SMEs) who supplied the information were highly creative, responsive professionals.

Analyze resources and restraints

Resources. Probably the biggest "resource" supporting this development was intangible -- the high commitment and enthusiasm at all levels of the College, from top administrators to part-time students.

The Agricultural Information Department's core development team, this developer and three students, worked intensively for 90 days. As needed, the project received additional input from this developer's professional, student and clerical staff within the electronic media unit. (The department head and the developer's husband even contributed two days with hammer and nails to build the room behind the kiosk in one State Fair building.) Approximately 20 specialists and administrators contributed information and visuals (see Figure 8).

The video stock footage archives in the unit were also a major resource. As topics were proposed and determined appropriate, the video archives were checked to determine if suitable footage already existed.

Restraints. The restraints on development were basic -- money and time. As stated above, administrative funding was limited and met only direct costs for mastering the laserdisc, graphics, limited field production, and student wages. There were no funds for new equipment, software or professional personnel. Therefore
development was completed on three-year-old IBM InfoWindow equipment and IMSATT software -- ancient technology by 1991 standards.

The time line of the project also had a major impact on production decisions. Yet the group accepted the challenge and adopted a corporate determination to follow the advice of Bergman and Moore (1990) to groups faced with a 90-day turn around time: "Fasten your seat belt and give it your best shot. ... Insist that the design be kept simple ... Keep your nights and weekends free. And be aware that despite the risks involved, many of the most effective IVD presentations ever produced were done under these trying conditions. Often, pressure is a catalyst to quality" (p. 120).

Design the Conceptual Model, Interface and Micro Treatment

Design the macro model or conceptual model

The conceptual model for The Natural Resource Extravaganza grew out of evidence of consumer trends, formative evaluation with users, and the project analysis. Reports of 1991 consumer preferences indicated that the most popular vacation destination in the United States was Orlando, Florida, a distinction that city has enjoyed for many years (Cheatham & Cheatham, 1991). The explanation for such popularity is more than climate; many southern cities claim similar climates. Orlando gained the leading edge over other sunshine cities with its theme parks which skillfully merge education and entertainment. In essence they are massive three-dimensional multimedia presentations.

Formative evaluation with potential users (including homemakers, teenagers, construction workers and college professors) in New Mexico revealed high interest in exploring pavilions in an educational theme park, such as The Natural Resource Extravaganza (see Figure 9A). Visitors at state fairs and public information open houses are predisposed to explore educational displays and could quickly understand and use an interactive multimedia tour.
The conceptual model also was accepted enthusiastically by the administration, relevant subject matter experts, and the development team. The model supported the College’s image, and the development team thought the project would remain interesting. Finally, the topics identified were interesting to potential users and could be easily adapted to a theme park type of educational treatment (see Figure 9B).

The Agricultural Information Department’s core development team included three students (James Allen, programmer, seated left; Janie Simpson, writer, seated right; and Rebecca Morgan, artist/clerk, not pictured) and this developer (Jeanne Gleason, leaning over seated students). As needed, the project received additional input from this developer’s electronic media unit staff (Standing 1 to r: Aaron Weaver, research aide; Andrew Ulbarri, engineer; D’Lynn Ford, audio specialist; Dorothy Hall, clerk; Ken Downer, video archive manager; Byron Christiana, student engineer; & Pat Holian, video producer. Not pictured: Debbie Conner, graduate student, artist; Todd Stockton, research aide; & Larry Emerson, computer graphics contractor. The video stock footage archive hung on wall.

Figure 8. Development Team and Developer’s Electronic Media Staff

(A) The concept of an educational theme park proved to be highly interesting to both potential users and Extension faculty during formative evaluation. (B) The development team organized the proposed information into related clusters, named the pavilions, and created the macro designs.

Figure 9. Conceptual model and macro design
Design the high-level user interface and macro flow chart

The development team created macro designs based on pavilions users could explore. A sketch and brief description was prepared and tested with users (see Appendix A). Although the buildings had no particular names yet, formative evaluation indicated potential users had an interest in "touring" the buildings. They correctly predicted from the sketch of the opening menu -- Main Street -- that touching a door should allow them to visually enter and explore information inside.

Next, the specific types of information in this application were divided into modules and the pavilions took on names and began to develop personalities. As initial designs evolved, they were subjected to formative evaluation and analysis of adaptability to the information. The six basic types of information and their corresponding pavilions evolved (see Chapter 5 for design templates):

1. Presentations built on primarily textual information (*Home Town Treasures* -- address directory of agents, Figure 2);
2. Presentations built on limited visuals and equal amounts of information (*Discovery World* -- NMSU’s research activities, Figure 1);
3. Presentations built on extensive visuals and equal amounts of information (*Adventure Land* -- Exploration of plants and animals, Figure 4);
4. Presentations built on extensive visuals and unequal amounts of information (*The Pinnacle* -- *New Mexico’s Finest*, Figure 3; and *Career Control Central* -- *Student Recruiting*, Figure 5);
5. Presentations built on primarily visual information (Video "Hits" in *The Pinnacle*, Figure 3C); and
6. Presentations of primarily textual information built on a question/answer module (*The Answer Machine*, Figure 6).
Design Specifications

The initial design specifications were established before micro design and development. They were expanded or altered as needed during the process. The following examples of design specifications are not rank-ordered:

Operational design specifications

- All levels of the program will provide clear transport back to major decision points within the module or back to the main menu (Main Street) without intermediate backtracking.
- Presentations with motion or still video segments will allow the user to play or stop the video motion, and to enlarge or reduce the stills at any time.
- Information screen will default quickly to a summary visual and text block, with options to view related information.
- User inputs (touches) will be acknowledged with both a beep from the computer and some alteration in the button touched, usually a change in color.
- Users will receive two audio warnings before the system resets to the beginning.
- The presentation include an attract loop with optional sound.

Aesthetic design specifications

- The visual layout of each section will parallel the physical and spacial design of an educational theme park, providing a feeling of movement and exploration.
- Menus, user decision points, and navigational aids will parallel objects a visitor might find in a real theme park pavilion and will be consistent with the conceptual design of the module.
- Graphics design and selection of colors will reflect a Southwestern theme, when appropriate within the 1990 computer color selection guidelines.
- Design of Native American images will be historically correct.
- Graphics that appear to be buttons should provide a response, such as new text, a new visual, enlarged still image, motion video, or movement within the program.
- The topic of each button will be clearly labeled.
- When possible, screen text will be double-spaced, and contain visual aids, such as bold words for emphasis and bulleted key points.
Instructional design specifications

- Users can usually arrive at the desired "information level" after three or less touches.
- Each information screen will contain an independent unit of information which is meaningful without reference to other information within the system.
- Information screens present small text blocks which can be read in 20 seconds or less.
- The topic of each information screen will be identified by titles, related visuals, and a highlighted button.
- The writing style will be conversational.
- When possible, the amount and quality of the information presented on each topic will be equivalent to all other topics within that specific module.
- When possible, the user will be given a motion visual preview of the upcoming presentation. This motion can be reviewed at any time the user remains within that specific presentation.
- Motion video segments will be primarily music and video, with little narration.
- Motion video segments will be brief, usually less than 10 seconds.

Team function design specifications

- Development and standard element labels will be posted on a wall flowchart in the development area, as well as in the design notebook.
- The design team will meet regularly to coordinate development and identify opportunities for formative evaluation.
- Text and visuals will receive final "sign-off" from the subject matter specialist before being included in the program.
- Names of elements within each module (i.e. names of computer text and graphics) will share a standard root.
- Text will be stored as ASCII files and written within the graphic by the computer.
Designing the micro treatment and graphical interface.

In *The Natural Resource Extravaganza* the "metaphor" of an educational theme park implies the "myths" of space worlds to explore, forest paths to investigate, and displays to visit.

Once the macro design of a theme park for *The Natural Resource Extravaganza* was validated, the team considered numerous micro designs for each type of information presentation. For example, staff directories could include agent pictures, office location maps, or even videos of staff in action. Presentations on natural resources could include a dynamic modeling program showing the effects of various environmental inputs and management decisions.

The team was torn between two opposing factors -- a vision of all the possibilities that could be included in the micro design of each module, and the reality of the time and resource constraints identified during the evaluation session. The designs selected allowed for a two-staged development: (a) a workable micro design for core information which could be delivered on schedule, and (b) expansion designs for expanded development as resources allowed.

The following micro designs were developed for each pavilion:

*Discovery World* -- NMSU's Research Activities (see Figure 1). The initial design would be built around a laboratory with categories of research activities determined by the effects each have on the citizens of the state, such as "A Safe, Abundant Food Supply;" "Clean, Plentiful Water;" "Thriving Economy;" "Healthy, Active Families;" "Protected Natural Resources;" and "A Beautiful, Protected Environment." Users select the topics to be explored from a lab bench and make the detailed examination of the information through a microscope. The expanded design may include an equal set of details on each project, additional visuals, and links to addresses of researchers and printed materials on the research.
Home Town Treasures -- An Address Directory of Agents (see Figure 2). The initial design is a directory of resources across the state. Again, the digital text is superimposed over a generic book, allowing for customization of the information. The expanded design could include agent pictures, office location maps, or video of local events. Additional information related to university research conducted in the area or local tourist attractions could be added.

The Pinnacle: New Mexico’s Finest -- The State’s Outstanding Products and Programs (see Figure 3). The initial design allows the user to "travel" in an elevator to a specific floor, select a display area from the floor directory, and view presentations on food, crops, fruits and nuts, livestock, and videos. The module contains about 100 text files, 200 stills, and more than 35 video segments. The expanded design may include an equal set of details on each product. The display could link to addresses of producers or outlets for the products. Information about initiating similar activities also could be included.

Adventure Land -- Exploration of Natural Plants and Animals (see Figure 4). The initial design uses paths and binoculars to present natural resource information on wildlife, birds, weeds, water and the forest. The module contains approximately 300 text files and maps, 600 stills, and more than 50 motion segments. The expanded design could include computer modeling showing the effects of various environmental inputs and management decisions. Links could be provided to natural resource attractions listed in Home Town Treasures or related games in The Answer Machine.

Career Control Central -- Student Recruiting (see Figure 5). The initial design beams users up to a spaceship to be transported to a "universe of career options." Through operating switches, slide controls and radar, users explore NMSU, the majors available in the College, costs, and application requirements. The module contains more than 250 text files, 225 stills, and more than 40 motion video segments. The expanded design could customize analysis of student background and personalized recommendations on financial aid, areas of study, or activities.
The Answer Machine -- A Question and Answer Game (see Figure 6). This game supplies a template for 24 questions and answers. All graphics and text in this section are superimposed over a generic video board, allowing easy customization of the questions to suit the delivery location. The expanded design would involve more of a game format, allowing users to answer and subsequently receive feedback and more information. The game could involve score keeping and the reward of an additional interactive game with enough correct answers.

Designing the micro flowchart, management process

The development group used several methods to document the micro planning and coordinating of the process. The group agreed on a standard menu structure in Word Perfect to facilitate shared text development. Using the design specifications, results of analysis, and the macro design, the developer created the initial micro flowchart. Because some students and administrators still had difficulty grasping the overall concept, the designer proposed a wall-sized flowchart, displaying all branches.

The wall-sized flowchart (see Figure 10) was tremendously successful and became the master guide for development. A check-off box and line for every task under every option was created and color coded. Standard file naming strategies were recorded and current graphic designs were displayed. Students and professionals referred to the chart daily. When specialists were asked for information, they came to the studio and studied the design templates and the location of the requested information on the wall flowchart. With this type of overview, the professionals and students could easily grasp the overall concept.

With the aid of the wall chart, flowcharts in the notebook began to make sense to the team and were used as portable work documents. The printouts of the graphics screen designs were probably more important. Members of the development group recorded design decisions and computer text information on the graphic designs (see Appendix C). These pages became the basis for the Master Project Book.
The wall-sized flowchart became the master record for the project, showing the file names and the graphic names, as well as the status of the development of each element. The large flowchart also helped specialists understand how their material fit into the overall presentation.

Figure 10. Micro design wall flowchart
Designing of development strategy and timeline

Using the wall flowchart and the Master Project Book, the timeline and work assignments were developed. Tasks needing immediate action included fact gathering; graphics development; checking video and visual availability; and prototyping the code and interaction design. Deadlines were set and sub-contractors, video production houses, and mastering houses (and spouses) were warned of the upcoming work load.

This timeline was especially tight because of the other projects already underway in the Electronic Media unit. The unit produces educational video tapes and broadcast public service announcements for the College of Agriculture and Home Economics. In addition, the unit is taking leadership on a national documentary targeted for the Discovery Channel. As a co-producer, this developer traveled to Guatemala and nearby countries for three weeks during the development of this multimedia project. This made clear development strategies and a precise time line crucial. The weeks of intense analysis and design prior to this trip helped maintain the enthusiasm of the student staff.

Designing a budget

Over all, the cash support for this project was $18,000:

$4,000 student wages
$2,500 computer graphics
$5,000 video squeeze for 1050 stills and 1 inch master
$3,000 laserdisc check discs and mastering
$1,000 limited original video costs
$2,500 kiosk, repairs to equipment and insurance
$18,000 ²

² Note the distinction between the cash support and the overall value discussed in Chapter 3.
Originate the Program Elements

Overall job assignments

The development team worked intensively. The team included this designer, a student programmer, and two student writers/graphic artists. In addition, two part-time students were employed for computer graphics and fact finding. The unit professional staff contributed video raw footage, engineering support, display setup and office management (see Figure 8). Because of the work load imposed on the unit from other projects, it was critical that all team members understood their role immediately and maintain responsibility for their duties over the life of the project. Maintaining careful records of work accomplished, standardization of file names and synchronization of activities also helped with overlapped job assignments.

Early project media origination activities

Before the origination of any media elements, this designer coordinated the analysis, formative evaluation, and design of the overall macro and micro design. Tasks were organized as explained above, plans were approved, and simultaneous origination activities began.

The developer provided training and made initial contacts with specialists. Then students, guided by the design specifications and project documents, conducted fact finding and gathered visuals. The group evaluated all topics to ensure enough supporting information was available, then finalized the topics.

The graphic designs of the screens affected the development of all other elements, including the shape and location of the video stills, the exact length of the text, and the specifics of the computer code. Therefore, graphics were given early attention. A computer graphics professional was contracted to create the opening "City Tour" and "Main Street" which served as the main menu (see Figure 11).
Billboard "Sneak Previews" on the City Tour help users predict what they will find in each pavilion.

Figure 11. Video preview

A graduate anthropology student with extensive computer graphics skills worked 40 hours to create the graphic templates. In accordance with design specifications, she incorporated colorful New Mexico styles and insured that all Native American designs were authentic (see Figure 12). Students modified graphic templates and added buttons for each unit.

Figure 12. Outcome of Design Specifications

Navigational tools guide users (A) starting with the fireworks attract loop, (B) through the signposts or (C) elevator buttons. Real-world metaphors help users intuitively know how to move to desired information.

Figure 13. Navigational tools
Mid-project media origination activities

During origination of program elements, such as video for the attract loop and graphics, special attention was given to menus and techniques to help users jump to another place in the program (navigational tools). These helps flowed naturally out of the overall design metaphor and paralleled real-world sights from an educational theme park, such as signposts, elevator buttons, floor directories and even fireworks used in the attract loop (see Figure 13). Buttons were highlighted when selected, indicating that the user would travel to the chosen location. Sound effects were added, such as the zoom sounds when entering buildings and audio instructions at decision points.

The bulk of the origination work consisted of writing and visual development. A senior level journalism student worked with SMEs to write and validate the 725 text files. This developer edited 120 motion video clips to music and captured and squeezed the 1050 video stills. At the same time, the student programmer created prototypes and templates of code and established management systems for more than 1,000 files used to operate the system. User groups provided formative analysis.

In short, limited resources required team members to wear many hats. However, the small development group maintained efficient communications, and their personal dedication and sense of ownership of the project greatly contributed to the overall quality of the final presentation.

Late-project media origination activities

As elements of an individual module were completed, one branch of the corresponding code was completed and debugged. All media elements were tested through formative evaluation, and the checklist on the wall flowchart was validated.

The developer finished production of the one inch master video tape and ordered a check disc. Seeing the presentation operate with the check disc gave the group an extra boost of energy. The final discs were ordered for the fair display.
Build the Computer Control System to Merge Program Elements

One of the benefits of the analysis stage in the ADOBE model is that the overall presentation could be designed to capitalize on IMSATT's strengths and avoid many of its problems. The student programmer participated in design decisions and, therefore, understood the importance of requested programming features. While the student programmer managed the creation of the initial code, other team members were able to read the code, duplicate and debug (see Appendix B). Because plans for user control, user feedback, and navigation tools were built into the design, building the supporting computer code went smoothly. The programmer also used the graphics package to create the bit blocks needed.

The major problems with the coding activities centered around the file size limitations of the older IMSATT software and equipment being used. This restriction compounded the work of designing the overall computer control system. In addition, the student programmer found several undocumented features of the software which slowed the process.

The main disappointment was the processing time required by the older software and hardware to respond to a user's touch. Formative evaluation indicated this was one of the few real complaints about the system. The programmer invested significant time attempting designs to speed up the action, with limited success.

Late in the development process, as all media elements became available, the developer worked with the programmer to duplicate templates of code and enter the program variables. The developer's first hand understanding of the code allowed her to immediately troubleshoot and correct errors found in debugging.

Documentation of the final code was added to the Master Project Notebook. All files were archived on floppy discs (as they were throughout development), and three systems (two display, one back-up) were prepared for the State Fair.
Evaluation of the Product and Process

Evaluate user reaction

The developer observed both systems, alternately, for nearly 12 hours a day during most of the 17-day fair. An administrator from the Experiment Station also invested two days in observation and assistance with the display.

Because of the high traffic pressure at the fair, it was common for fair-goers to stand near the current user and watch the interactions. Therefore, this developer was able to make detailed, uninhibited observations of users for many hours each day.

Occasionally, the developer joined the group viewing the presentation and asked how it worked. Thinking the developer was a new user and, therefore, uninformed about the system, the current users gave not only complete instructions on the use of the touchscreen presentation, but also honest personal evaluations about the system's strengths and weaknesses.

While both systems were in constant use, the style of use was markedly different between the two sites. Most users in the more highly trafficked building made 10 to 20 touches per use in approximately 60 to 90 seconds. They explored not more than two menu items, operating in what this developer would describe as a skimming mode. Rarely did individuals or groups of users systematically move through a major portion of a presentation. There were constant interruptions from both friends and strangers, resulting in a great number of random touches.

Most users in the calmer Agriculture Building made 40 to 75 touches per use in about five minutes. These users explored three or more menu items, operating in what could be described as an information-gathering mode. Often each day, users could be seen systematically moving through major portions of the presentation, reading text, examining enlargements, and discussing the subject matter with others in their groups.
As the developer alternated between the two systems, she frequently recognized users she had seen earlier at the other kiosk. In almost every case, the style of use generally followed the norm for the building, regardless of which kiosk the group visited first.

Because the material was divided into screen-sized presentations, users could receive educational and entertaining information after only a 30-second interaction, or they could use the system for more than one-hour and still continue to explore new material.

In almost all cases, users indicated they liked the interactive, touch screen technology. More specifically, they liked the overall theme park design, the fast pace of the animation, the colorful computer graphics, the "real world" geographic methods of "traveling" to find information, and the quality of the videos and stills. Users liked *Adventure Land*, *Home Town Treasures*, and *The Pinnacle: New Mexico's Finest* modules, but rarely read text blocks in their entirety.

Beyond a doubt, the major criticism was the slowness of the system to move to the next level, and its inability to sense a touch while it was producing computer-generated speech (used in time-out warnings).

**Evaluation of organizational reaction and attainment of goals**

The criteria for success, as with early interactive multimedia presentation systems, were to engage the users in innovative, high tech information technology and link that high tech image to the College. The response by the public was almost unanimously positive. Users would touch the screen, exhibit amazement and pleasure, and consciously look to see what organization was responsible for the display. The criteria for success were achieved via passive viewers who never actually touched the screen.
The response from the organization has been extremely positive as well. Immediately after the interactive multimedia presentation was returned from the State Fair in Albuquerque, Extension water specialists requested that it be temporarily redesigned to address only one path, "Water," (in *Adventure Land*) for the Southern New Mexico State Fair.

The next week the agricultural economic development specialist moved the equipment himself for presentation at an agricultural economics conference in Artesia 200 miles away from Las Cruces. The presentation was then moved to the Governor's Economic Development Conference in Socorro. *The Natural Resource Extravaganza* is currently in use at the Winrock Shopping Center in Albuquerque.

**Evaluation of possibilities for future development**

At this writing, the development group has received a grant from USDA for interactive multimedia development to deliver nutrition and food quality information on the Navajo Reservation in northwest New Mexico. While the group hopes to have funding to secure new computer equipment (and therefore use a different software authoring system), this project will serve as a design template for the new project.

In addition, the dean of the NMSU College of Agriculture and Home Economics indicated that he believes other universities will want to develop similar systems. He requested that the developer work with university officials to establish a system to allow controlled sharing. Although information about *The Natural Resource Extravaganza* has not yet become public, the developer has already received a call from a former NMSU employee who currently works for Texas A&M. He has attempted for several months to design a system and has been unable to grasp either the theory or the practical application of interactive multimedia presentations. Because his department has identical equipment to that used in New Mexico (Texas was an inactive IMSATT Beta test site.), Texas may well become the test case for the techniques of sharing and templating suggested in Chapter 5.
Chapter 5
OUTLOOK FOR FUTURE TEMPLATE DEVELOPMENT AND SUMMARY

In this chapter, methods are suggested by which The Natural Resource Extravaganza may support parallel development of a new interactive multimedia presentation. This presentation, developed at New Mexico State University, can be used as (a) a design template, supporting original but parallel development following a model such as ADOBE, or (b) a program template, supporting adaptive development through modification of program elements. The authoring tools needed to enhance interactive multimedia development in the future also will be examined.

THE NEED FOR TEMPLATE DEVELOPMENT

In October 1991, the Extension National Information Technology Standards Management Committee initiated a process designed to support national parallel development and sharing of information and information technologies among land-grant universities. As a member of the committee, this developer heard repeated calls for Extension to quickly find ways to maximize access to educational programs developed within individual states to benefit all states. Reports of slashed state budgets and layoffs of Extension faculty, including information and education professionals (Rodekohr, 1991), underscored the urgency of the task.

Reeves tells organizations in this situation to approach development with the use of instructional models and templates. "We fail to capitalize on our experiences and ignore the commonality that exists across many training and instructional tasks," he said. "Instructional models provide a powerful avenue by which effective instructional materials can be developed more quickly than by traditional methods" (Roberts, Rizza, Reeves, & Misselt, 1990, p. 110). Phillips (1990) says an educator's the single largest barrier to developing highly effective interactive programs is the high investment of time and energy needed to master conventional computer techniques. He says educators need to use new development approaches.
Extension, museums and other out-of-school educational agencies face similar needs for models and templating of public outreach techniques. Allen and Sterman (1990) say these sources of free public information have been slow to adopt interactive multimedia because they do not have access to practical examples of how these technologies can make information more accessible to the public. They also point out that even if museum specialists understood the potential of the technology, they "do not have enough experience with these new media to visualize complex computer-based designs from paper-based specifications" (p. 274).

Canter, Neumann & Fenton (1987) point out that before multimedia technology can realize its full potential, new systems must be made available that will open development to writers, designers, artists, musicians, and administrators. Runge (1989) says using prototyping and templating tools can help these types of groups develop quality programs quickly at a lower cost. He says, "by effectively using prototyping, we were able to polish and refine our design, like a jeweler polishes a gemstone" (p. 20).

THE POTENTIAL FOR A DESIGN TEMPLATE

Allen and Sterman (1990) emphasize that use of a design template, or prototype, showing the type of information proposed for a public information system is the first step to more extensive development of multimedia systems to serve the public. They point out that securing funding for such new technologies can be especially difficult unless the potential sponsor can see an example of the proposed project. These developers of multimedia information systems for public museums stress that the prototype does not necessarily have to show the full scope of complexity or exact examples of subject presentations. Ideally the prototype would help the agency's educational professionals and administrators understand the proposed program's potential and would serve as a guide to localized development or modification.
Organizations considering interactive multimedia development similar to *The Natural Resource Extravaganza* could use the ideas presented in this document, supplemented by the video tape or the entire presentation, as a design template to foster understanding of overall multimedia concepts and development steps involved in multimedia presentations. (See details at the beginning of Chapter 4 for arranging use of the tape or kiosk.) Pliskin and Shoval (1987) point out that while using only an approximation of the intended final system has drawbacks, it does enhance communication within the organization concerning possible future development.

Until tools are perfected to transfer multimedia codes across hardware platforms, organizations not using MS-DOS hardware and IMSATT software can initiate parallel but original development, following the principles of an interactive multimedia model, such as ADOBE. In this case, *The Natural Resource Extravaganza* and corresponding flowcharts can serve as a design template of techniques for presenting various types of information. Holder (1987) strongly advocates this type of design templating and has published a specialized set of mini-module templates for developers of training materials.

When using this design template, realize that it is primarily the design of the information, not the graphic design on the screen, that will be duplicated or used as a template. The graphic design or number and location of buttons can be modified to suit new needs without affecting the design of the information. For example, instead of using a book for presentation of textual material, as seen in the *Home Town Treasures* (see Figure 2), the new development could use a graphic of a library shelf or a roll-a-dex. Although the visual design changes, the design template would remain the same. Instead of a tour through floors of displays as in *The Pinnacle* (see Figure 3), a new application could substitute graphics simulating a visit to sections of a video tape rental store to see text on the jacket and sneak previews. Even though the look of the new presentation changes, the design for dividing and managing information chunks provided by *The Natural Resource Extravaganza* design template should prove most helpful to potential developers.
Careful study of the pavilions on Main Street reveals that each has a modular template for delivering different types of information. Evaluate topics proposed for the new development in light of the following classifications.

SIX DESIGN TEMPLATES ADDRESSING INFORMATION TYPE

1. Presentations built on primarily textual information (as seen in Home Town Treasures, Figure 2). This design template offers two subdivisions of information and easily could handle more than the current 4 by 8 design. In addition, at the information level, designers could add more information by "turning the page." This design template could be considered for presentation of titles of free publications or video tapes, a calendar of events, or presentation of brief leaflets, especially when used to supplement more visual presentations in other parts of the program.

2. Presentations built on limited visuals and equal amounts of information (as seen in Discovery World, Figure 1). This design template is ideal for material with limited unifying themes. Note that only four topics are grouped in each "Slide Box" and each information level contains only one text block. Note also that the labels on the first sub-menu -- the lab -- use highly descriptive terms to convey an image even if the user does not explore further. This design template could be considered when developers must cluster information with little commonality, such as an overview of highly different programs within the same county Extension program.

3. Presentations built on extensive visuals and equal amounts of information (as seen in Adventure Land, Figure 4). This design template can present large numbers of information chunks in a relatively "shallow" layout. For example, in this presentation users have access to more than 530 chunks of information after only three touches from the main menu. This design, with its strong and consistent structure, helps users quickly predict the type of information available at each level.

4. Presentations built on extensive visuals and unequal amounts of information (as seen in The Pinnacle, Figure 3). This design template offers a "More Info" option, a way to present topics with different amounts of information. (One topic may have only three information chunks while another in the same cluster may have six.) Indicate to the user the sequence of the current screen and maintain a technique to immediately return to a major menu or sub-menu.

5. Presentations built on primarily visual information (as seen in "Video Hits" in The Pinnacle) At times, textual support is impractical, unavailable, or unnecessary if the visuals tell the full story, as is the case in this presentation. This design template truncates the intermediate menu and moves directly in and out of motion. Provide users with a way to skip the video and return to the decision point.
6. Presentations of primarily textual information built on a Question/Answer module (as seen in *The Answer Machine*, Figure 6). This template is perhaps one of the most flexible in the presentation because it supports almost instant modification of the system and is highly adaptable to the multitude of Question-and-Answer type of information available through Extension.

After selecting a design template which most closely suits the information to be presented in the new development, duplicate or eliminate branches on the micro flowchart (see Appendix A). Careful analysis of the information and adoption of the flowchart will prepare the development group to continue original development.

**THE POTENTIAL AS A PROGRAM TEMPLATE**

As a program template, portions of *The Natural Resource Extravaganza* could be modified through a cooperative agreement between NMSU and the new developer. The modular design of this multimedia presentation and the digital storage of all information (except video) allow for relatively easy expansion or contraction of any unit within the presentation. In addition, single units can stand alone for highly specialized presentations. The generic nature of some topics in the presentation should allow potential developers to consider maintaining portions of the video presentations, as well. For example, parallel development in another state could use many of the wildlife music video clips.

Modification of the IMSATT computer code (Appendix B) can be made with a word processor. (For details on the delivery platform, see the limitations section of this paper in Chapter 1.) With a minimal amount of training, those who are not computer specialists should be able to expand, substitute or modify the code. Nonprogrammers may be especially interested in the suggestions presented in Appendix C for creating graphic guides to code modification.
Current techniques used to modifying template code

The first step in the code modification process involves noting on the micro flowchart of all modification needed to fit the design template to the new material. See Appendix A for flowcharts of this program. Record the information (video disc numbers, graphic names, text file names) that the computer will need at each level to operate the new presentation. Although this information can be recorded directly on the code, many nonprogrammers find it easier to comprehend if the information is recorded on paper copies of the graphical user interface (the graphic the user sees at menus or decision points). For an example, see Appendix C.

Once the information is collected on the paper documents, it can be color coded, as seen in Appendix C, for transfer to the IMSATT code. An understanding of the IMSATT code structure will help first-time nonprogrammers to modify the code. For example, the new information will be almost identical to the information it is replacing, i.e., frame numbers replace frame numbers and file names replace file names. Because the code can be retrieved by a word processor, the developer can use a familiar program to speed keying. Code will be saved in ASCII.

The block of code for each information chunk has the identical format as code for similar information chunks. Therefore, the structure for a pilot module used for initial testing and formative evaluation can be duplicated and modified to fit the new information by substituting new file names and frame numbers. The process quickly becomes routine and understandable. Finally, IMSATT allows testing of small sections at a time. Mistakes can be found easily and corrected. During debugging, inexperienced developers should refer to a printed copy of the latest code so mistakes can be pinpointed immediately and corrections made.

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1This discussion of how code is currently modified is intended to help the reader understand why the recommended templating tool specified at the end of this section would be beneficial. However, potential developers desiring to use the template code may contact the developer at the address given in Chapter 4. Universities who purchased copies of IMSATT in the mid-80s should verify that their contract contains no restriction barring the use of the program at this time.

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SUGGESTED AREAS FOR FUTURE CONSIDERATION

The problems that will be encountered by potential developers desiring to
duplicate and modify The Natural Resource Extravaganza code are not new to the
field (Fox, 1989; Junkala, 1991; Meredith & Blanchard, 1990; Rymer, 1990) and
clearly new tools and techniques are needed. Phillips (1990) says that programming
languages powerful enough to adequately manage emerging learning systems have
been low level, difficult to learn, and very time-consuming to write.

Canter, Neumann, and Fenton (1987) say what is needed instead is a technique
for programming interactive multimedia that can be powerful yet convenient for
nonprogrammers, such as writers, designers, artists, musicians, and administrators.
Such tools may be available in the foreseeable future. Grimes and Potel, in their
introduction to the July 1991 IEEE Computer Graphics & Applications, say that
creative developments related to interactive multimedia computer tools are at an all-
time high. (For additional published documents on software tools, see the annotated
bibliography compiled by Franklin, 1990.)

Indeed, new authoring tools have been released in 1991 and development is
underway to fulfill technical design specifications for many more. Although the
platforms and approaches vary, the common objective is to put some of the power of
believe that the ultimate likelihood of multimedia becoming mainstream may well
depend on the industry's ability to empower the nonprogrammer.

With such a profusion of design specification activity, there is little need for
this developer to attempt to propose technical specifications. Instead, as this
developer concludes this activity, she reviews the tools that would have simplified the
many tedious tasks she performed during early morning hours. The following review
of desired capabilities may be helpful to computer programmers who are currently
working to improve interactive multimedia authoring systems.
Limitations of Current Tools

There are many ways to create computer code for multimedia presentations (Bergman & Moore, 1990). Designers/programmers who need maximum flexibility for highly complex designs use a programming language. However, these general purpose languages were not specifically designed for authoring multimedia presentations and require extensive training.

Authoring languages, such as IMSATT, were generally designed for multimedia, and can be learned in approximately one month. While these languages slightly restrict the flexibility of the design, they make it possible for educators to build a system which accommodates most media elements. Recent developments of specialized systems, such as time line processors and hypermedia application generators, provide nonprogrammers more options and generally provide a visual, non-text basis for development. However, there is still a lack of portability across hardware platforms (Barker, 1990). Some highly desirable systems for the Macintosh do not have equivalent counterparts in the PC-based machines.

Finally code can be developed through the use of authoring systems or application shells. Authoring systems provide fill-in-the-blank templates and generate the overall program structure. However, options for modification are usually extremely limited. Shells are generally fast and inexpensive to modify and have the added advantage of providing structure at the start of the development.

The proposed program template from The Natural Resource Extravaganza provides this type of a shell for modification. Phillips (1990) points out that such prototypes and shell options can put new power in the hands of educators to quickly develop new learning systems. The drawback to the current IMSATT system used in this development, however, is that modification requires alteration to the actual lines of code. This can prove to be a tedious and potentially confusing process to a nonprogrammer.
The advantage of a visually based tool

The first tool this developer proposes would allow the designer/programmer to modify or create IMSATT code (or any similar language eventually used to control *The Natural Resource Extravaganza* presentation) directly through windows opening within the same graphical interface that the users will see in the final application. (The capabilities desired to modify the IMSATT code are similar to the capabilities Hypercard provides to modify Hypertalk code.) Such a system also should provide the ability to create text blocks while working within the graphical interface and should automatically name and store the text file. In a similar manner, the system should allow viewing of the video source and one-key capture and entry of the frame numbers.

Paske (1990) points out that the novice working with a visually based interface works faster, better, is more productive and has lower frustration and fatigue than the novice working with a character-based system. Rymer (1990) says, "Visual programming is so seductively simple you could call it no-gramming" (p. 82).

The advantage of a fully integrated system

Although development through the graphical interface is highly desirable for many tasks, there are situations when modifying or fine tuning the final program is would be accomplished most efficiently by using another method (Phillips, 1990). In general, tools with simple authoring environments provide less flexible programming options.

The second tool suggested by the developer is a fully integrated system which blends the capabilities of the authoring system, hypermedia generator, time line processor, and even the ability to call on the power of general purpose languages. Such a system would allow overall development and initial modification through one of the less complex, easier to use methods, with fine tuning options available directly through the more complex, but less restricted methods. The system should support easy movement from one system to another, allowing the developers to take advantage
of the strengths of each process at the appropriate time. The developer should have the freedom to select the design process which best suits the task and can be learned efficiently (MacKnight, 1990).

For example, working from carefully developed flowcharts and micro designs, as described in Chapter 3, a simple menu driven system allowing the developer to simply enter the names and number branches at each decision point could generate all the basic "stacks" (to use Hypercard terminology). The designer would then want to move to the graphical interface to create or import a colored background graphic, relocate and reshape buttons and video windows or add text blocks. For more complex development of media elements, such as complex graphics, the developer may want to temporarily move to more specialized tools integrated into the system.

At some point during development, manipulation of the flowchart is generally needed. Friedrich (1987) points out that when a look at the overall system flowchart is needed, nothing else will substitute. In this situation, the developer may want to move temporarily to an object oriented/dataflow diagramming combination system such as used by Prograph (Rymer, 1990). In this environment, the developer could modify the overall flow of the program or capture, duplicate, alter and place an entire cluster of interactive events. These capabilities are somewhat provided by the "tiles on graph paper" approach used by AmigaVision (developed by IMSATT).

While many desirable tools are available individually, in general, they are not integrated into the one full-featured environment needed in interactive multimedia development (Richards and Fukuzawa, 1989). For example, while producing the text for an interactive multimedia system, developers need not only the 32 text capabilities standard for most word processors (Ramakrishna, 1989), they also need integration of the grammar, readability and spelling aids specified by the Applied Science Association (Cox & Cox, 1990).

While many systems are striving for full capability integration, improvements are still needed. For example, the Amiga offers a templating system so powerful that Cook (1989) says people with bigger machines are using Amigas for prototyping,
storyboarding and idea generating. On the other hand, Cook points out that developers quickly hit serious limitations within the Amiga environment when they want to add more complex features.

Institute for Research on Learning has piloted limited integration of a wide variety of multimedia tools on the Macintosh II as part of a program for teenage writers. Pea (1991) says the program can be initiated by selecting one of five media type icons, representing program templates. By means of dialogue boxes, elements are named and text is created. Developers then can move to programs which allow editing of video and graphics. Yet another module allows development by altering a module on a flowchart. Although audio, video and animation displays can be imported, synchronization in this integrated environment remains a problem. The use of the database for factors such as frame numbers also needs to be improved.

In the future, systems also would need to accommodate the special requirements of emerging technologies, such as CD-I, DVI, and CDTV. In a similar way, as computer stored digital video becomes a reality (McQillin, 1991), even more complete authoring environments will be needed. Such complex systems would not be easy to learn, and clearly written on-line tutorials would be needed (Friedrich, 1987).

In short, the industry still needs a full-functional integrated system to support interactive multimedia development. As these tools are developed, the Cooperative Extension System will be among the many organizations which can benefit from the efficient development, sharing and modification of multimedia applications.

However, an improved computer programming tool is only a small piece of an integration approach needed to accomplish efficient, effective information transfer. Both the product and the process must be improved continually. Extension can benefit from adopting concepts such as Total Quality Management used in industry to guide development of complex systems (Meredith & Blanchard, 1990). This would help insure that no program is developed in a vacuum nor expected to stand alone. Instead, a tool as powerful as interactive multimedia would be only one of many Extension could use to efficiently meet the needs of an ever changing public.
SUMMARY

This developmental dissertation has focused on the creation of an interactive multimedia presentation for use in a public delivery setting. The developer first created a customized developmental model (ADOBE) organizing the steps of interactive multimedia design and implementation (Chapter 3), and then applied this model to the development of an interactive multimedia presentation, The Natural Resource Extravaganza (Chapter 4). It is possible that this model and presentation could encourage in-house development within similar organizations by providing (a) design templates, supporting original but parallel development, or (b) program templates, supporting adaptive development through modification of computer code.

Multimedia development is certainly no simple matter. R. Miller (1990) says "the combination is truly a Gestalt phenomenon in which the whole of the experience is significantly greater than the sum of its component parts" (p. xvii). Such academic descriptions may be appropriate for a textbook, but anyone who has lived through the experience is more likely to agree with Malamed (1991) when she says, "Standing in the midst of a multimedia development project can feel like being caught in a hurricane with no rain gear. You wish you were better prepared, and you feel as though you might get swept away" (p. S-18). While nothing can prevent the sensations of the multimedia hurricane, this developer hopes that by providing development guidelines and design templates, she, at least, can help her fellow multimedia developers find the sunshine on the other side of the storm.
REFERENCES


Appendix A

FLOWCHARTS FOR THE NATURAL RESOURCE EXTRAVAGANZA

The following documents are flowcharts used during the development of *The Natural Resource Extravaganza.*
Adventure Land Flowchart
Note: All units open with a brief video clip which can be skipped.
*All units offer 6 options at information level.

T1-Adventure Land Intro Video
Adventure Land Menu

Wildlife
- Antelope
- Deer
- Javelina
- Oryx
- Mountain Lion
- Elk
- Bear
- Coyote

Birds
- Redtail Hawk
- Meadowlark
- Turkey
- Eagle
- Owl
- Dove
- Killdeer
- Roadrunner

Water Fowl
- Sandhill Crane
- Whooping Crane
- Yellow Legs
- SnowGoose
- Puddle Ducks
- Diving Ducks
- Canada Goose
- GreenBacked Henn

Forest
- Kinds of Trees
- Growth
- Insects
- Urban Trees
- Tree Programs
- Biggest Trees
- Fire
- Education

Water
- In Nature
- In Homes
- In Farming
- In Ranching
- In Dairies
- In Cities
- Water Cycle
- For Children

Weeds
- Leafy Spurge
- Spotted Knap
- African Rue
- Toad Flax
- Goat Grass
- Russ.Knapweed
- Musk Thistle
- Diffuse Knap
Career Control Flowchart
Note: All units open with a brief video clip which can be skipped.

T2-Career Control Control Intro

Career Control Central Menu

NMSU Life
- Campus Life
- NMSU Facts
- Las Cruces
- Music
- Clubs
- Spectator Sports
- Campus Action
- Special Interest
- Participant Sports

Enroll
- Who?
- When?
- Test?
- Transcript
- Application
- Financial Aid
- Majors
- NMSU

Cost/Aid
- Tuition
- Housing
- Food
- Books
- Total Costs
- Grants
- Scholarships
- Loans
- Work
- Co-op

Majors
- Accounting
- Ag Education
- Animal Science
- Business
- Clothing
- Communications
- Computers
- Consumerism
- Computers
- Consumerism
- Crops
- Economics
- Family/Child
- Food Industry
- Human Nutrition
- Marketing
- Plant Path.
- Pre-Vet
- Range
- Soils

Tourism
- Urban Hort.
- Weed Science
- Wildlife Law
- Wildlife Manage.
- Wildlife Research
- Entomology
- Finance
Discovery World Flowchart
Note: All units open with a brief video clip which can be skipped.

T3-Discovery Worlds Intro Video

Discovery World Menu

Abundant Food
- Organic
- Chile
- Beef
- Less Chemicals

Thriving Economy
- Livestock
- Crops
- Cities
- Food Industry

Healthy Families
- Native Americans
- Food
- Stress
- 4-H

Multiple Use
- Pinon Land
- Rangeland
- Forests
- Competitive

Clean Water
- Irrigation
- Streams
- City Water
- Watershed

Protect Environment
- Trout
- Deer
- Antelope
- Bosque
The Pinnacle Flowchart
Note: All units open with a brief video clip which can be skipped.
*All units multiple screens at the information level.

T4-The Pinnacle Intro Video

The Pinnacle Menu

Food Products
- Flour Tortilla
- Corn Tortilla
- Beans
- Sprouts
- Candy
- Spices

Livestock
- Cattle
- Sheep
- Horses
- Dairy
- Wool
- Goats

Fruits / Nuts
- Berries
- Pistachio
- Pecans
- Peanuts
- Wine
- Apples

Crops
- Alfalfa
- Cotton
- Wheat
- Onions
- Chile
- Corn

Video Hits
- Exotic Foods
- Spanish Rada
- For Kids
- High Tech Ag
- No Chemical Food
- Top Choice
Answer Machine Flowchart
Note: All questions and answers can be changed through alteration of the text file.

T6-Answer Machine Intro Video

Answer Machine Menu

Water
- Water in food
- Water in you
- Water for crops
- You need water

NM's Finest
- Chile
- Blue Corn
- Top Dollar
- Livestock

Weeds
- Roots
- Roadside
- Poison?
- Morning Glory

4-H / Youth
- What is
- The Four H's
- Why Different
- How Many?

Ranching
- Hurt Range?
- Greenhouse Gas
- Toxic Weeds
- Underground?

Range Management
- Profitable?
- Hot Spots
- Stop Grazing?
- Fires?
Welcome to the Natural Resource Extravaganza
Touch a Door — Explore the Resources Inside

The Pinnacle
New Mexico's Finest

Career Control Center

Hometown Treasures
"We Deliver"

Discovery World

Resource Answer Machine

Natural Resource Adventure Land
Appendix B

SAMPLE IMSATT CODE FOR THE NATURAL RESOURCE EXTRAVAGANZA

The following document is a sample of the IMSATT code used in *The Natural Resource Extravaganza*. This code is compiled by the IMSATT into a B32 file to operate this section of the program.
********** VARIABLES **********
ECHO.OFF
********** BIT BLOCKS **********
MONTAGE BITBUTT
164 106 477 194 BIT.BLOCK BOX
MONTAGE ACTBIT
15 5 80 31 BIT.BLOCK QA
MONTAGE ZOMBIT
15 30 80 60 BIT.BLOCK QS
MONTAGE BITB
22 14 61 34 BIT.BLOCK ZIA
MONTAGE BINOCBIT
540 12 628 25 BIT.BLOCK SI
18 5 74 30 BIT.BLOCK AC
18 33 74 58 BIT.BLOCK AO
MONTAGE BIGBLOC
185 110 263 145 BIT.BLOCK BO
CLS

DEFINE SERVES
EXIT.INT
END.DEF

DEFINE BINFO
XOR.OFF
FROM.FILE FRAMES
STORE 13 TO L#
GREEN BACKGROUND
BR.WHITE FOREGROUND
BEGIN E0F? WHILE.FALSE
INPUT TO $LINE
17 L# AT PRINT $LINE
1 INC L#
REPEAT
FROM CONSOLE
BLACK BACKGROUND
5 5 AT
END.DEF

DEFINE GET.ADV.GRAPH
ADV
CASE STRING
(" 1") MONTAGE BINOCEND TOUCH.KEYS BISIGN
(" 2") MONTAGE BINOCEND TOUCH.KEYS BISIGN
(" 3") MONTAGE BINOCEND TOUCH.KEYS BISIGN
(" 4") MONTAGE BINOCEND TOUCH.KEYS BISIGN
(" 5") MONTAGE BINOCEND TOUCH.KEYS BISIGN
END.CASE
END.DEF

DEFINE VF
*{ TI > 1 }*
IF.TRUE STORE " 1" TO OPT STORE 1 TO TI
END IF END.DEF

DEFINE ZOOM
MONTAGE QUITZOOM
ZOOM NEAR
SEARCH
TOUCH.KEYS ZOOM
BEGIN
INPUT
CASE.STRING
TIMEOUT.CASE TIMEOUT5
("Z")
XOR.ON 19 30 QZ
TOUCH.KEYS BISIGN
STORE VOPT TO OPT
VF EXIT
END.CASE
AGAIN
END.DEF

DEFINE ADVIDEO
VIDEO.OFF
ON.INT SERVES
MONTAGE QUITACT
TOUCH.KEYS VIDEO
V1 SEARCH
VIDEO.ON
V1 V2 PLAY
STORE "G" TO $KEY
WAIT.INT
STORE $KEY TO AV
STILL VIDEO.OFF
AV
CASE.STRING
("S") 15 5 QA GET.ADV.GRPH STORE VOPT TO OPT VF
DEFAULT.CASE GET.ADV.GRPH STORE VOPT TO OPT VF
END.CASE
LOAD.PIC BINOCEND
END.DEF

\\**WILDLIFE**\\

DEFINE ANTELOPE
STORE "1" TO OPT
STORE "1" TO ADV
STORE OPT TO VOPT
STORE 36029 TO ZOOM#
STORE 35793 TO V1 STORE 36008 TO V2 ADVideo
MONTAGE BINOCEND 50 91 B0 36030 SEARCH VIDEO.ON
TOUCH.KEYS BISIGN
STORE "ANTELOP.ADV" TO FNAME BINFO
LOAD.PIC BINOCEND
BEGIN
XOR.OK
STORE OPT TO VOPT
INPUT TO OPT
OPT
CASE.STRING
("A") SWAP.PAGES 18 5 AC ADVideo STORE 1 TO TI
("Z") SWAP.PAGES 18 13 ZO STORE 1 TO TI ZOOM
END.CASE
SWAP.PAGES
OPT
CASE.STRING
TIMEOUT.CASE TIMEOUT6
("1") 50 91 B0 36030 SEARCH STORE "ANTELOP.ADV" TO FNAME BINFO STORE 36029
DEFINE JAVELINA
STORE " 1" TO OPT
STORE " 1" TO ADV
STORE OPT TO VOPT
STORE 36490 TO ZOOM#
STORE 36489 TO V1 STORE 36490 TO V2 ADV VIDEO
MONTAGE BINOCEND 50 91 Bo 36491 SEARCH VIDEO ON
TOUCH.KEYS BISIGN
STORE " MULDEER1.ADV" TO FName BINFO
LOAD.PIC BINOCEND
BEGIN
XOR.ON
STORE OPT TO VOPT
INPUT TO OPT
OPT
CASE.STRING
(" A") SWAP.PAGES 18 5 3B ADVIDEO STORE 1 TO TI
(" Z") SWAP.PAGES 18 33 TO STORE 1 TO TI ZOOM
END.CASE
SWAP.PAGES
OPT
CASE.STRING
TIMEOUT.CASE TIMEOUT6
(" 1") 50 91 Bo 36286 SEARCH STORE " MULDEER1.ADV" TO FName BINFO STORE 3628
(" 2") 50 127 Bo 36278 SEARCH STORE " MULDEER2.ADV" TO FName BINFO STORE 3627
(" 3") 50 163 Bo 36272 SEARCH STORE " MULDEER3.ADV" TO FName BINFO STORE 3627
(" 4") 512 91 Bo 36282 SEARCH 154 108 BOX STORE 36281 TO ZOOM#
(" 5") 512 127 Bo 36298 SEARCH STORE " MULDEER5.ADV" TO FName BINFO STORE 3629
(" 6") 512 163 Bo 36296 SEARCH STORE " MULDEER6.ADV" TO FName BINFO STORE 3629
(" W") 540 12 SI VIDEO.OFF STORE 1 TO TI 5 EXITS
(" P") 540 33 SI VIDEO.OFF STORE 1 TO TI 2 EXITS
(" L") 540 54 SI VIDEO.OFF STORE 1 TO TI EXIT
END.CASE
LOAD.PIC BINOCEND
VIDEO.ON
AGAIN
END.DEF

DEFINE DEER
STORE " 1" TO OPT
STORE " 1" TO ADV
STORE OPT TO VOPT
STORE 36285 TO ZOOM#
STORE 36270 TO V2 ADV VIDEO
MONTAGE BINOCEND 50 91 Bo 36286 SEARCH VIDEO ON
TOUCH.KEYS BISIGN
STORE " MULDEER1.ADV" TO FName BINFO
LOAD.PIC BINOCEND
BEGIN
XOR.ON
STORE OPT TO VOPT
INPUT TO OPT
OPT
CASE.STRING
(" A") SWAP.PAGES 18 5 3B ADVIDEO STORE 1 TO TI
(" Z") SWAP.PAGES 18 33 TO STORE 1 TO TI ZOOM
END.CASE
SWAP.PAGES
OPT
CASE.STRING
TIMEOUT.CASE TIMEOUT6
(" 1") 50 91 Bo 36286 SEARCH STORE " MULDEER1.ADV" TO FName BINFO STORE 3628
(" 2") 50 127 Bo 36278 SEARCH STORE " MULDEER2.ADV" TO FName BINFO STORE 3627
(" 3") 50 163 Bo 36272 SEARCH STORE " MULDEER3.ADV" TO FName BINFO STORE 3627
(" 4") 512 91 Bo 36282 SEARCH 154 108 BOX STORE 36281 TO ZOOM#
(" 5") 512 127 Bo 36298 SEARCH STORE " MULDEER5.ADV" TO FName BINFO STORE 3629
(" 6") 512 163 Bo 36296 SEARCH STORE " MULDEER6.ADV" TO FName BINFO STORE 3629
(" W") 540 12 SI VIDEO.OFF STORE 1 TO TI 5 EXITS
(" P") 540 33 SI VIDEO.OFF STORE 1 TO TI 2 EXITS
(" L") 540 54 SI VIDEO.OFF STORE 1 TO TI EXIT
END.CASE
LOAD.PIC BINOCEND
VIDEO.ON
AGAIN
END.DEF
STORE "JAVELIN1.ADV" TO FName BINFO
LOAD.PIC BINOCEND
BEGIN
XOR.ON
STORE OPT TO VOPT
INPUT TO OPT
OPT
CASE.STRING
{ "A" } SWAP.PAGES 18 5 AC ADVIDEO STORE 1 TO TI
{ "Z" } SWAP.PAGES 18 13 ZO STORE 1 TO TI ZOOM
END.CASE
SWAP.PAGES
OPT
CASE.STRING
TIMEOUT.CASE TIMEOUT6
{ "1" } 50 91 BO 36491 SEARCH STORE "JAVELIN1.ADV" TO FName BINFO STORE 3649
{ "2" } 50 127 BO 36501 SEARCH STORE "JAVELIN2.ADV" TO FName BINFO STORE 3650
{ "3" } 50 163 BO 36499 SEARCH STORE "JAVELIN3.ADV" TO FName BINFO STORE 3649
{ "4" } 512 91 BO 36495 SEARCH 154 108 BOX STORE 36494 TO ZOOM# ST
{ "S" } 512 127 BO 36511 SEARCH STORE "JAVELIN5.ADV" TO FName BINFO STORE 3651
{ "6" } 512 163 BO 36497 SEARCH STORE "JAVELIN6.ADV" TO FName BINFO STORE 3649
{ "M" } 540 12 SI VIDEO.OFF STORE 1 TO TI 5 EXITS
{ "P" } 540 33 SI VIDEO.OFF STORE 1 TO TI 2 EXITS
{ "L" } 540 54 SI VIDEO.OFF STORE 1 TO TI EXIT
END.CASE
LOAD.PIC BINOCEND
VIDEO.ON
AGAIN
END.DEF

DEFINE ORYX
STORE "1" TO OPT
STORE "1" TO ADV
STORE OPT TO VOPT
STORE 36735 TO ZOOM#
STORE 36526 TO V1 STORE 36722 TO V2 ADVIDEO
MONTAGE BINOCEND 50 91 BO 36716 SEARCH VIDEO.ON
TOUCH.KEYS BISEIGN
STORE "ORYX1.ADV" TO FName BINFO
LOAD.PIC BINOCEND
BEGIN
XOR.ON
STORE OPT TO VOPT
INPUT TO OPT
OPT
CASE.STRING
{ "A" } SWAP.PAGES 18 5 AC ADVIDEO STORE 1 TO TI
{ "Z" } SWAP.PAGES 18 13 ZO STORE 1 TO TI ZOOM
END.CASE
SWAP.PAGES
OPT
CASE.STRING
TIMEOUT.CASE TIMEOUT6
{ "1" } 50 91 BO 36736 SEARCH STORE "ORYX1.ADV" TO FName BINFO STORE 36735 T
{ "2" } 50 127 BO 36730 SEARCH STORE "ORYX2.ADV" TO FName BINFO STORE 36729 T
{ "3" } 50 163 BO 36726 SEARCH STORE "ORYX3.ADV" TO FName BINFO STORE 36725 T
{ "4" } 512 91 BO 36740 SEARCH 154 108 BOX STORE 36739 TO ZOOM# STORE 1
{ "S" } 512 127 BO 36738 SEARCH STORE "ORYX5.ADV" TO FName BINFO STORE 36737 T
{ "6" } 512 163 BO 36726 SEARCH STORE "ORYX6.ADV" TO FName BINFO STORE 36725 T
{ "M" } 540 12 SI VIDEO.OFF STORE 1 TO TI 5 EXITS
DEFINE MTNLION
STORE " 1" TO OPT
STORE " 1" TO ADV
STORE OPT TO VOPT
STORE 36971 TO ZOOM#
STORE 36751 TO V1 STORE 36972 TO V2 ADVIDE
MONTAGE BINOCEND 50 91 BO 36978 SEARCH VIDEO.ON
TOUCH.KEYS BISIGN
STORE " MTNLION1.ADV" TO FNAME BINFO
LOAD.PIC BINOCEND
BEGIN
XOR.ON
STORE OPT TO VOPT
INPUT TO OPT
OPT
CASE.STRING
{ " A" } SWAP.PAGES 18 5 AC ADVIDE STORE 1 TO TI
{ " Z" } SWAP.PAGES 18 33 2O STORE 1 TO TI ZOOM
END.CASE
SWAP.PAGES
OPT
CASE.STRING
TIMEOUT.CASE TIMEOUT6
{ " 1" } 50 91 BO 36978 SEARCH STORE " MTNLION1.ADV" TO FNAME BINFO STORE 3697
{ " 2" } 50 127 BO 36976 SEARCH STORE " MTNLION2.ADV" TO FNAME BINFO STORE 3697
{ " 3" } 50 163 BO 36986 SEARCH STORE " MTNLION3.ADV" TO FNAME BINFO STORE 3698
{ " 4" } 512 91 BO 36974 SEARCH 154 108 BOX STORE 36973 TO ZOOM# STORE 1
{ " 5" } 512 127 BO 36980 SEARCH STORE " MTNLION5.ADV" TO FNAME BINFO STORE 3697
{ " 6" } 512 161 BO 36992 SEARCH STORE " MTNLION6.ADV" TO FNAME BINFO STORE 3699
{ " M" } 540 12 SI VIDEO.OFF STORE 1 TO TI 5 EXITS
{ " P" } 540 33 SI VIDEO.OFF STORE 1 TO TI 2 EXITS
{ " L" } 540 54 SI VIDEO.OFF STORE 1 TO TI EXIT
END.CASE
LOAD.PIC BINOCEND
VIDEO.ON
AGAIN
END.DEF

DEFINE ELK
STORE " 1" TO OPT
STORE " 1" TO ADV
STORE OPT TO VOPT
STORE 37243 TO ZOOM#
STORE 37001 TO V1 STORE 37226 TO V2 ADVIDE
MONTAGE BINOCEND 50 91 BO 37244 SEARCH VIDEO.ON
TOUCH.KEYS BISIGN
STORE " ELK1.ADV" TO FNAME BINFO
LOAD.PIC BINOCEND
BEGIN
XOR.ON
STORE OPT TO VOPT
INPUT TO OPT

123
DEFINE COYOTE
STORE " 2" TO OPT
STORE " 1" TO ADV
STORE 37739 TO ZOOM
STORE 37513 TO V1 STORE 37732 TO V2 ADVIDE
STORE OPT TO VOPT
MONTAGE BINOCEND 50 91 BO 37740 SEARCH VIDEO.ON
TOUCH.KEYS BISIGN
STORE " COYOTE1.ADV" TO FNAME BINFO
LOAD.PIC BINOCEND
BEGIN
XOR.ON
STORE OPT TO VOPT
INPUT TO OPT
OPT
CASE.STRING
( " A" ) SWAP.PAGES 18 5 AC ADVIDE STORE 1 TO TI
( " Z" ) SWAP.PAGES 18 31 20 STORE 1 TO TI ZOOM
END.CASE
SWAP.PAGES
OPT
CASE.STRING
TIMEOUT.CASE TIMEOUT6
( " 1" ) 50 91 BO 37740 SEARCH STORE " COYOTE1.ADV" TO FNAME BINFO STORE 37739
( " 2" ) 50 127 BO 37736 SEARCH STORE " COYOTE2.ADV" TO FNAME BINFO STORE 37735
( " 3" ) 150 163 BO 37744 SEARCH STORE " COYOTE3.ADV" TO FNAME BINFO STORE 37743
( " 4" ) 512 91 BO 37738 SEARCH 154 108 BOX STORE 37737 TO ZOOM TO STORE 1
( " 5" ) 512 127 BO 37746 SEARCH STORE " COYOTE5.ADV" TO FNAME BINFO STORE 37745
( " 6" ) 512 163 BO 37742 SEARCH STORE " COYOTE6.ADV" TO FNAME BINFO STORE 37741
( " M" ) 540 12 SI VIDEO.OFF STORE 1 TO TI 5 EXITS
( " N" ) 540 33 SI VIDEO.OFF STORE 1 TO TI 2 EXITS
( " L" ) 540 54 SI VIDEO.OFF STORE 1 TO TI EXIT
END.CASE
LOAD.PIC BINOCEND
VIDEO.ON
AGAIN
END.DEF

******************************************************************************

DEFINE WILDLIFE
VIDEO.OFF
MONTAGE SKIPBTN
TOUCH.KEYS VIDEO
ON.INT SERVES 35362 SEARCH VIDEO.ON
35362 35753 PLAY
WAIT.INT
STORE $KEY TO OPT
OPT
CASE.STRING
( " S" ) STILL VIDEO.OFF
END.CASE
STORE " 1" TO OPT
VIDEO.OFF
BEGIN
MONMAGE WILDPATH
TOUCH.KEYS BINO
STORE OPT TO VOPT
XOR.ON
INPUT TO OPT
OPT
CASE.STRING
TIMEOUT.CASE TIMEOUTJ5
( "1" ) 303 54 ZIA STORE 1 TO TI ELK
( "2" ) 303 81 ZIA STORE 1 TO TI DEER
( "3" ) 303 110 ZIA STORE 1 TO TI JAVELINA
( "4" ) 301 138 ZIA STORE 1 TO TI COYOTE
( "5" ) 508 54 ZIA STORE 1 TO TI ORYX
( "6" ) 508 80 ZIA STORE 1 TO TI BEAR
( "7" ) 508 108 ZIA STORE 1 TO TI ANTELOPE
( "8" ) 507 137 ZIA STORE 1 TO TI MOUNTAIN
\( "M" ) XOR.OFF 63 56 MS 3 STORE 1 TO TI EXITS
( "P" ) XOR.OFF 74 56 PT STORE 1 TO TI EXIT
END.CASE
AGAIN
END.DEF
Appendix C

PROGRAMMING GRAPHICAL WORK SHEETS
FOR THE NATURAL RESOURCE EXTRAVAGANZA

The following documents are samples of the graphical work sheets used during the creation of The Natural Resource Extravaganza. These pages were used by nonprogrammers to record the data needed to modify code from one module to operate a similar module. This type of graphical work sheet helps nonprogrammers relate the numeric data needed to operate the program to the final graphical interface seen by the users when operating the multimedia presentation.
Adventure Land Logging Sheets.
Log frame numbers and file names for one animal in one graphic below.
Example of use of the Adventure Land Logging Sheets.

Currently programmers must log numbers and file names on paper for later transfer to computer code. Ideally the computer program would not only capture and store this information, but would also create the initial generic template, and provide integrated tools to develop text, graphics and databases.

```
STORE " 1" TO OPT
STORE " 1" TO ADV
STORE OPT TO VOPT
STORE 36285 TO ZOOM#
STORE 36037 TO V1 STORE 36270 TO V2 ADV VIDEO
MONTAGE BINOCEND 50 91 BO 36286 SEARCH VIDEO.ON
TOUCH.KEYS BISEGN
STORE " MULDEER1.ADV" TO FNAME BINFO
LOAD.PIC BINOCEND.
BEGIN
XOR.ON
STORE OPT TO VOPT
INPUT TO OPT
OPT
CASE.STRING
(" A") SWAP.PAGES 18 5 AC ADV VIDEO STORE 1 TO TI
(" Z") SWAP.PAGES 18 33 ZO STORE 1 TO TI ZOOM
END.CASE
SWAP.PAGES
OPT
CASE.STRING
TIMEOUT.CASE TIMEOUT6
(" 1") 50 91 BO 36285 SEARCH STORE " MULDEER1.ADV" TO FNAME BINFO STORE 36285
(" 2") 50 127 BO 36278 SEARCH STORE " MULDEER2.ADV" TO FNAME BINFO STORE 36277
(" 3") 50 163 BO 36272 SEARCH STORE " MULDEER3.ADV" TO FNAME BINFO STORE 36271
(" 4") 512 91 BO 36282 SEARCH 154 108 BOX STORE 36281 TO ZOOM#
(" 5") 512 127 BO 36298 SEARCH STORE " MULDEER5.ADV" TO FNAME BINFO STORE 36291
(" 6") 512 163 BO 36288 SEARCH STORE " MULDEER6.ADV" TO FNAME BINFO STORE 36287
(" M") 540 12 SI VIDEO.OFF STORE 1 TO TI 5 EXITS
(" P") 540 33 SI VIDEO.OFF STORE 1 TO TI 2 EXITS
(" L") 540 54 SI VIDEO.OFF STORE 1 TO TI EXIT
END.CASE
LOAD.PIC BINOCEND
VIDEO.ON
AGAIN
END.DEF```
Jeanne Gleason
4225 Holliday Lane
Las Cruces, New Mexico 88005
(505) 646-2701 Work


School:
Virginia Polytechnic Institute and State University.

New Mexico State University.
Degree: Master of Science, 1976, Family Studies and Television.
Degree: Bachelor of Arts, 1974, Journalism & Mass Communications.
Degree: Bachelor of Science, 1974, Home Economics and Media.

Publications & Awards: Director/Producer of over 200 videotapes and TV public service announcements. Authored chapters in the National ACE Communications Handbook. Author of numerous media training manuals.

Awarded National USDA Honor Award; NMSU Distinguished Service Award; ACE Professional Skills Award in Interactive Video; ACE Pioneer Award; and numerous national awards for media and training materials from ACE and Press Women.

Personal Data: Born: April 1, 1952
Reared on a farm in Lovington, New Mexico.
Married to Dennis M. Roberson.