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HYPERCARD®: A PROMISING TOOL FOR CONSTRUCTIVIST
METHODOLOGY

A PROJECT
PRESENTED TO THE
FACULTY OF
CALIFORNIA STATE UNIVERSITY,
SAN BERNARDINO

IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE
MASTER OF ARTS
IN
EDUCATION
OPTION: INSTRUCTIONAL TECHNOLOGY

BY
SHIRLEY A. SHAW
DECEMBER 1992

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ABSTRACT

This project addresses the need for educational software that considers the individual needs of learners, provides for multimedia learning experiences, and allows students the chance to construct meanings from their involvement with the material. Software that can address these concerns is minimal and expensive. The advent of authoring languages gives the teacher the means to create such software, but this requires a great deal of time and expertise. One possible solution to these problems is the collaboration between universities, schools, teachers, and other groups. This project is an example of one such collaborative effort.

The purpose of this project was to design a HyperCard® stack to be used as a social studies project in the high school curriculum. The project focused on the final 100 hours of John F. Kennedy. This stack was designed to maximize student involvement and incorporate visuals. The time required to develop this ambitious stack was minimized by collaboration.

ACKNOWLEDGMENTS

Every personal accomplishment is made possible by the commitment of many people. I would like to thank the many people who remained committed to me during my involvement with this project. I extend my appreciation to Dr. Susan Cooper for her efforts in making the option of Instructional Technology a reality and for the endless patience she has shown during the production of this manuscript. I also wish to thank Dr. Robert Senour for his calm guidance throughout my endeavor. The assistance and accommodations of my mentor and director, Dale Hahs, Director of Compensatory Education at Victor Valley Union High School District has been immeasurable. To my inspirational brother, Dr. James Plummer, I would like to express my gratitude for his encouragement in my involvement with technology. Finally, I wish to thank my children, Gabriel and Katherine, whose support and love have made my efforts meaningful.

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Chapter 1: Introduction

This project demonstrates collaborative authoring of software. The advent of authoring languages allows teachers to meet the specific objectives of the teacher, learn more about student learning, create inexpensive software, create multimedia learning experiences, gain computer expertise, and give students a chance to create programs for other students. Authoring a program requires a great investment of time, but the collaboration between teachers decreases this individual investment of time. The collaboration also results in higher quality software. The collaborative ties also provide a network for the sharing of this software. This project is an example in a high-tech partnership to design a learning module for use on the computer. This module considers the needs of learners who learn most productively through differing modalities. Text is balanced with visuals to engage these differing learning styles. Sound is used where appropriate. Students are able to make choices in the way they choose to navigate through the information. During the course of this program, an electronic notebook is available to record the meaning derived by the student. Students are thus a part of the collaborative team in the development of this module. As leaders in the use of technology in education the Advisory Committee on Information Technology and Bates and Pomernacki (1991) state that high-tech partnerships formed between local schools, corporations, and universities can provide answers in the search for dynamic new models. "Partnering relationships can enable us to move in a proactive direction and achieve the results we need to meet our educational technology goals now and for future generations." Two instructors in the program of Instructional Technology and the director of Facilities of Computing and Information

Management Services worked collaboratively with 14 graduate students in the Instructional Technology program to design and develop this module. Students from the History department at California State University, San Bernardino and students from two high schools joined the project.

The project investigates the final 100 hours in the life of the late president, John F. Kennedy. The module was produced for use by high school and middle school students enrolled in social science classes. The project's intent was not only to deliver content, but to explore the development and application of a module that would include visuals, sound, and alternate pathways.

Design considerations were based on philosophically defensible positions that reflect Finn's advice found in Simonson and Thompson (1990) :

Finally, the most fundamental and most important characteristic of a profession is that the skills involved are founded upon a body of intellectual theory and research. Furthermore, this systematic theory is constantly being expanded by research and thinking within the profession...The practice of a profession cannot be disjoined from its theoretical understandings, and vice versa...the antithesis to a profession is an avocation based upon customary activities and modified by the trial and error of individual practice. Such as avocation is a craft...the difference between the bricklayer and the architect lies right here. (p. 25)

Chapter 2: Literature Review

Simonson and Thompson (1990) describe the predominant theories that have been the basis for computer design and many educational methodologies in education; behaviorism, systems theory and cognitive theory. The underlying principle of behaviorism is that learning should produce observable and quantifiable behaviors in the learner. Pavlov's classical conditioning and Skinner's operant conditioning have given us a plethora of computer based instructional programs that feature the following techniques found in Simonson and Thompson (1990):

1. Objectives stated in terms of measurable terminal behaviors.
2. Assessment of a student's pre-instructional behaviors.
3. Sequencing an instructional path until one can achieve at a 90% level.
4. Using teaching machines to reinforce desired behaviors.
5. Recording progress in order to revise the lesson. (p. 28)

From the perspective of a teacher and a student at the university, one can see the effects of this theory. One frequently hears students, when given a vague assignment, lament, "Just tell me what to do.". Our frameworks and textbooks are preceded with goals and objectives. Necessarily, it is not the students' goals and objectives, but the states' and authors'. Students are left with two choices; they may choose to explore areas of their interest or meet the objectives of the authorities. Too frequently, these choices are mutually exclusive.

Following behaviorism, as Simonson and Thompson (1990) suggest, came the systems theory. Systems theory examines the organization and structure of entire organisms. This theory prescribes an educational approach that features

the principle that the world has a natural order and rationality about it. The development of methodologies using this approach results in the following ideas found in Simonson and Thompson (1990):

1. The application of a method of logical problem solving similar to the scientific method.
2. Self-correcting and use of logical methods of decision making.
3. Rational procedures that ensure the attainment of specific behavioral objectives.
4. Looking at complex organizational problems that take into account all contingencies. (p. 31)

The systems approach, like behaviorism, ignores the processes that occur internally. They maintain that these processes are not observable, not measurable, and therefore are impossible to predict. They both are more concerned with outcomes than processes. The behaviorist approach and the systems approach are at a loss in assisting students in developing constructs and associations in a novel way, necessary when they enter the real world of complex problems that have no simple solutions.

Simonson and Thompson (1990) term the theorists who focus on learners and their processes cognitive scientists. Under the umbrella of cognitive scientists fall many branches, of which constructivism is one. This broad domain can not be fully described under one heading, but basically it attributes a great deal of autonomy and initiative to the learner. It focuses on how information is received, organized, retained, and used by the brain. The following guidelines in designing computer based instruction with a cognitive approach is found in Simonson and Thompson (1990):

1. Predisposition to learning must be activated, maintained and directed.
2. The structure and form of knowledge must be considered and the material representing that knowledge should be organized in an optimal way.
3. The sequencing of material can also be optimized according to cognitive patterns or progressions of the learner. These learner styles include brain hemisphere dominance, level of field dependence, and level of visual processing among others.
4. The form and pacing of reinforcement must be commensurate with the learner's needs. (pp. 34-35)

Jonassen (1990) noted instructional systems technology's roots to behaviorism. Instructional technology reflects behaviorist's methodology while there is a growing trend in learning theory to reflect cognitive theory. He maintains that instructional systems technology (IST) historical roots should evolve with the rest of learning theory. He proposes that IST design should mature and promote more of a cognitive learning theory.

Constructivism is one aspect of cognitive theory. Constructivists maintain that although there is a real world that we experience, the meaning of this world should be imposed by us upon that world. The goal of education then is not to assure that individuals gain a certain amount of factual knowledge as proposed by behaviorists and systems proponents, but as Cunningham (1991) states, the goal of education is to show students how to construct plausible interpretations of their own, using the tools that teachers have provided or developed in collaborations with them.

The constructivists, such as Perkins (1991) emphasize the active learner component of constructivism. The active learner not only processes information, but elaborates upon and interprets the information. The educational environment then is not just an information bank; it is a "phenomenaria". Evaluating what a learner constructs from this experience can not be tested with a multiple choice format. Educators need to assess through explanation, extrapolation, and evidence giving.

Spiro, Feltovich, Jacobson and Coudon (1991) afford us a different slant on context. Concepts must be explored in the complex environment in which we find it. To develop an understanding of the concept requires several examinations of the contexts; finding a different point of view each time we encounter the concept. Instruction would help the learner develop strategies for these examinations.

These strategies in knowledge traversal go beyond higher order thinking skills. Instead, constructivists reject the notion that it is possible to teach skills independently of the problems to which they are applied. This is consistent with an approach that would alleviate the problems learners face outside the formal school setting. Educational experiences grounded in constructivist theory would be a mirror of the experiences faced outside the formal setting.

Venezky (1991) suggests that the vehicle that would make this traversal possible could be developed in an authoring system such as HyperCard®. Venezky offers four reasons for using technology: new capabilities, access, efficiency, and discipline. The new capabilities available with technology can provide instructional experiences otherwise too expensive or dangerous to afford students in a more traditional setting. Technology provides access to

large databases making it possible to explore knowledge beyond the scope of the average classroom. The color graphics potential allows the student to visually represent ideas difficult to grasp, such as in the areas of chaos theory. Venezky further states that computers offer the ability to adapt to different learners, content, and pedagogical differences, i.e., computers can store information about student's needs or abilities.

Access to reach remote areas is another reason to use technology. It is often difficult to take advantage of this capability due to costs. Efficiency of computer use in education is difficult to determine due to factors such as student and teacher motivation, degree and quality of program implementation, and rapidly changing technologies. The final reason that Venezky offers is the effect that developing courseware has on the producer. The production of good courseware advances the study of instruction. The producer must understand learning and instruction to a higher degree than typically necessary. The producer could be the learner, constructing and presenting their new found knowledge.

Traditional computer based instruction can be a linear presentation of information followed by some form of multiple choice or short answer responses. Van Horn (1991) offers that today's authoring programs allow us to evolve from that approach. Hypertext involves the linking of words and ideas. These links resemble the associative links in our own brain. Rather than reading a text book from beginning to end, hypertext allows the learner to follow the association path of his/her choice. The learner chooses to explore everything containing the word "Lincoln", or explore everything associated with the time period of "Lincoln", or perhaps jump from president to president. The learner

has the ability to wander the associative pathway of the mind. Hypermedia is the inclusion of other media as containers of information. The media includes, but is not limited to, graphics, animation, video, speech, audio, and text from a multitude of sources. While studying about "Lincoln", you might choose to view an historical reenactment of the Civil War, listen to music of the period, or view paintings of the time. Jonassen (1991b) describes hypertext as a "flexible information technology that provides a powerful environment for designing, developing, and displaying instruction". Its theoretical foundations are consistent with contemporary instructional design and development models, albeit with a more consistent cognitive and systemic emphasis than many. Hypertext systems provide designers with a tool that can liberate their designs from the constraints of objectivism and determinism. Hypertext systems provide sophisticated tools that can advance the integration of cognitive learning principles into practice in the instructional design and development field. However, Jonassen (1991b) warns that hypertext systems are not a panacea, rather they are a sophisticated tool that can help us reduce the dissonance between the declarative and procedural knowledge of our field.

Our world is a multi-sensory, complex environment. It is richly filled with sights, sounds, motions, and meanings that are intertwined in a complex way. In most cases, our formal educational representation of this world is served to us in departmentalized, linear segments of simplistic questions and answers. Our repertoire of textbooks and videos seldom represents the fullness of life. Seldom would a student choose to revisit a passage in a book or even rewind the video as would be necessary to traverse the complexity of these concepts to gain

deeper understanding. Jonassen (1991) proposes that HyperCard® has the ability to provide these sensory experiences that text alone lacks.

Heinich (1989) claims that we learn approximately 10 percent from listening but over 80 percent from what we see. Most importantly we remember only approximately 20 percent of what we hear, but over 50 percent of what we see and hear. Bruner (1966) proposes that instruction should lead a student from direct experiences (enactive) through iconic representations (pictures, films, etc.) to symbolic representations (words, numerals). This suggests that the primary function of visuals as a communication device is to serve as a more concrete referent to meaning. Visuals can do what text alone cannot. Words are arbitrary; they don't look or sound like what they represent. Visuals are iconic; they resemble what they represent. Heinich suggests that offering a learner a visual image closes the communication gap. The realism of the visual images must be measured. More realism is not necessarily better. Dwyer (cited by Heinich) demonstrates that too little or too much realism affects achievement adversely. For example, while a picture of the Dallas parade route prior to the assassination may be more realistic, a labeled map would be more clear to the user.

Another way graphics can assist in HyperCard® stacks is to act as cognitive organizers. Although graphic organizers can help to structure main points in textual material, Alesandrini (cited in Heinich, 1989) found that graphics become more helpful when the learner can manipulate them in some way. As explained by Norman and Rumelhart (1979), this might include drawing their own pictures or manipulating graphics in some way. This is another application of constructivistic theory. There are optimal ways of

sequencing graphics. Alesandrini (cited in Heinich, 1989) suggests three steps for using visuals with adults; begin with analogical visuals to relate the new information to prior learning, follow with arbitrary pictures to convey the essence of the new information and distinguish it from analogous information, conclude with representational pictures that serve to further define and distinguish the new information.

Research by Dalton (1986) indicates that inclusion of visuals in computer based instruction is highly effective. Both students at the junior high level in an industrial arts instruction program through computer assisted video instruction (CAVI) or tutorial computer-assisted instruction scored significantly higher on performance posttests than students receiving "stand-alone" video instruction. The students in the CAVI group responded more positively on an attitude survey, showing that they also enjoyed this medium more (ibid. 1986).

Research presently available suggests that the application of constructivism in HyperCard® is promising. Barba and Merchant (1990) present a study in which 54 tenth grade biology students were given the opportunity to use two HyperCard® stacks. One stack was language based and the other was more visually based, embedded with generative cognitive strategies. They found that embedding cognitive strategies significantly affected student learning at the rule and principle level. These techniques were most effective for those that Barba and Merchant termed low verbal learners.

There are certain drawbacks to multimedia. Fernlund and Cooper-Shoup (1991) weigh the costs and benefits of using hypermedia in the classroom. They reiterate that the benefits include the interactive role of the students while the teacher becomes the facilitator, student opportunities to develop information

retrieval and processing skills, a new way to demonstrate understanding and actively participate in a team effort. Costs can be substantial, approximately \$4,500 for hardware alone. The amount of time required for preparation of hypermedia is substantial. This investment of time required of teachers would be lessened if the construction of the stacks was primarily done by the students. This is exactly the type of activity that this author proposes that students be involved in. The cost of a computer is more than the cost of a chalkboard or overhead projector. The educational cost of continuing to use the traditional, behavioristic, linear approach needs to be considered. Research contrasting these costs needs to be conducted. The technology that can act as a vehicle for implementing constructivistic principles is here and improving rapidly. The use of HyperCard® and other authoring programs is still relatively new and requires much more research before its effectiveness is ascertained. HyperCard®'s ability to provide choices and multimedia to the learner is particularly promising. It is a tool that has the ability to track student choices, record, and react to those choices. These capabilities enhance the research that will be required to fully ascertain its potential.

Chapter 3: Statement of Goals and Objectives

In most educational institutions, financial resources are strained. Schools would have difficulty purchasing educational software at any price. Most software is based on the behaviorists' tradition of drill and practice or tutorials. This is deemed by some a serious misuse of technological resources. Teachers are educated professionals who are in the position to determine how to meet their students' needs. However, most teachers lack the time and the expertise to create software with typical programming languages. Students' needs are multiple, as are their preferred learning modalities. Constructivists propose that people learn best when given the opportunity to impose their own meaning in a construction of their own. Yet, there is very little software available that would test this theory. Even if that software was created, the network through which that software might be shared is meager.

It is the goal then, to collaboratively author a HyperCard® stack that will be shared nationally. It is to provide a multimedia environment to motivate and engage students of all modalities. The program will be authored by teachers, while allowing expansion by students. To further promote an opportunity for students to impose their meaning of the content, an electronic notebook will be available. During the interaction, students will be able to create notes as well as copy items from the body of the stack.

Chapter 4: Design of the Project

The Product

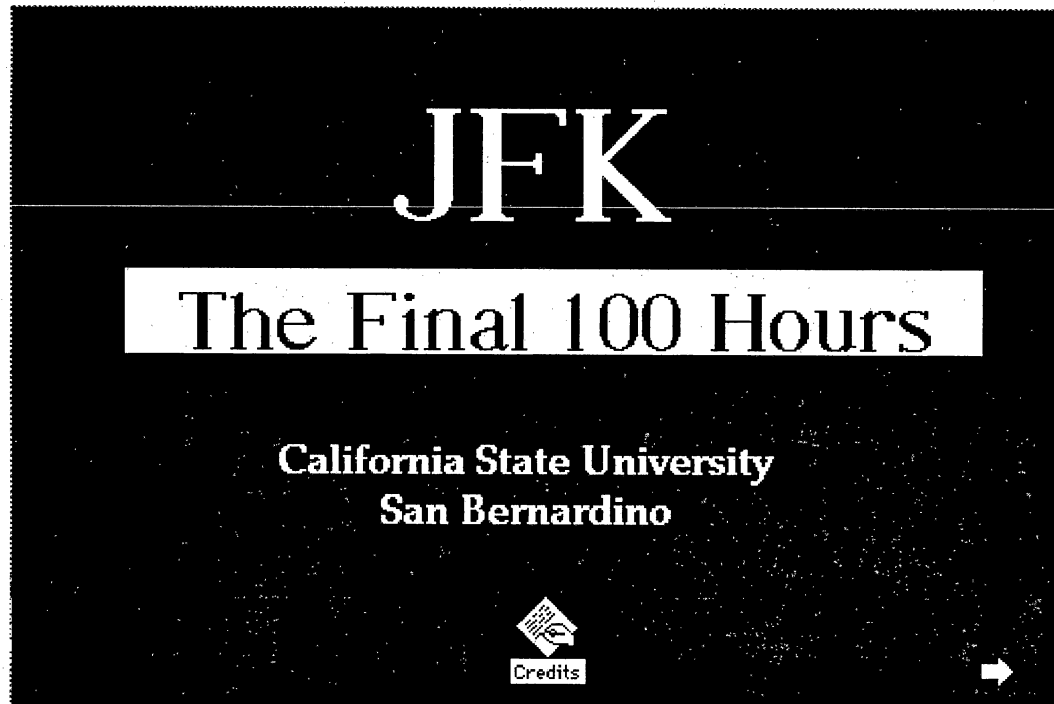


Figure 1. Text scrolls across the opening screen announcing the title of the project: JFK: The Final 100 Hours. It is accompanied by an attention demanding sound effect of an approaching helicopter.

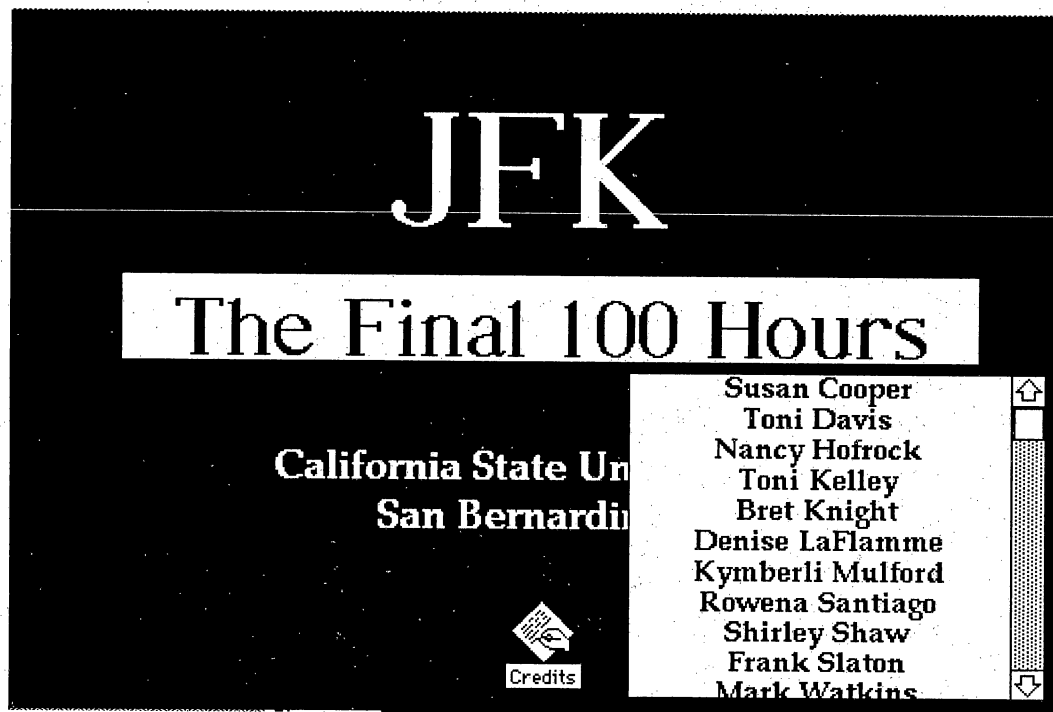


Figure 2. Clicking on the "Credits" button reveals the credits of the prototype's authors: three university instructors and 14 graduate students. Clicking on the right-hand arrow leads the user to the next card.

This prototype project was created as a collaborative effort by students and faculty in the MA program in Instructional Technology at CSUSB, the History and Art Departments, CSUSB, as well as students and faculty at Moreno Valley High School, California through the Christopher Columbus Consortium.

Photographs and newspaper reprints were obtained from: The Tampa Tribune, The Houston Chronicle, The Miami Herald, The Tampa Times, The Dallas Morning News, The San Antonio Express, and the New York

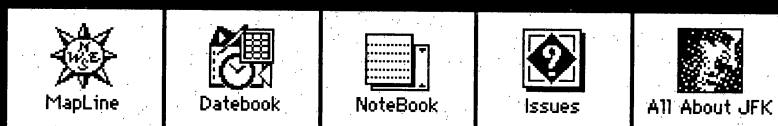


Figure 3. The icons at the bottom lead the user respectively to: the map line, the date book, the notebook, issues, and the “All about JFK” stacks. Each section is a separate stack. The separation of stacks allows for authors to work on the project separately.

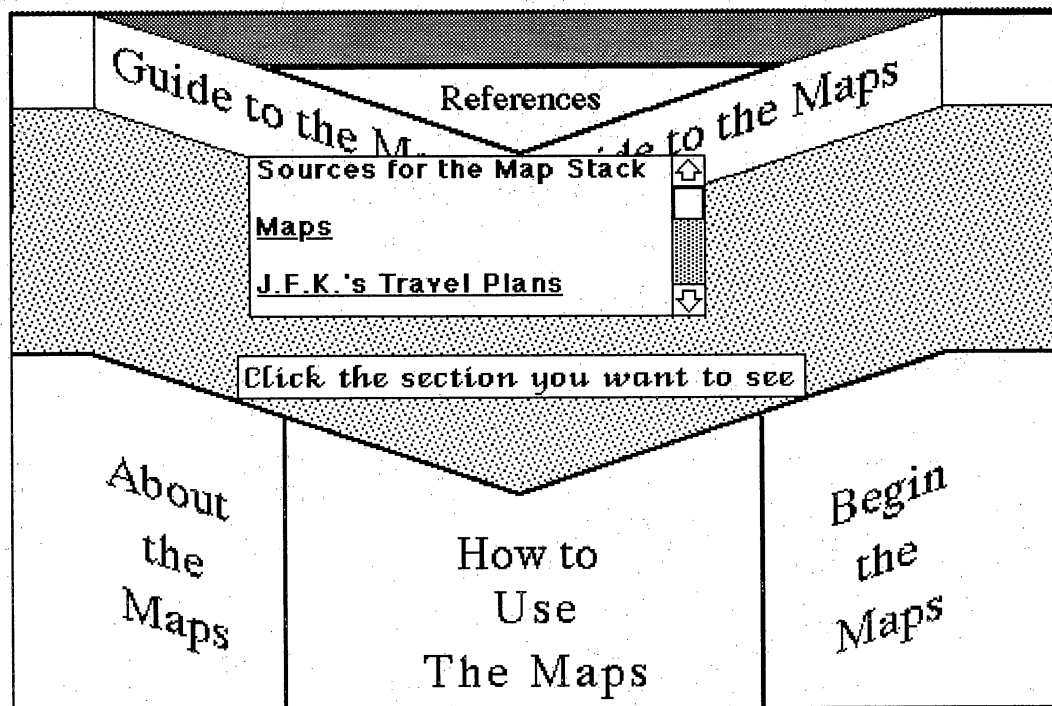


Figure 4. The initial screen of the map line shows a graphic of the United States. It automatically leads into this screen. Note that there are several options at this point: one may learn about the maps, learn how to use the maps, or begin a tour. This "help" field helps the user to avoid frustration.

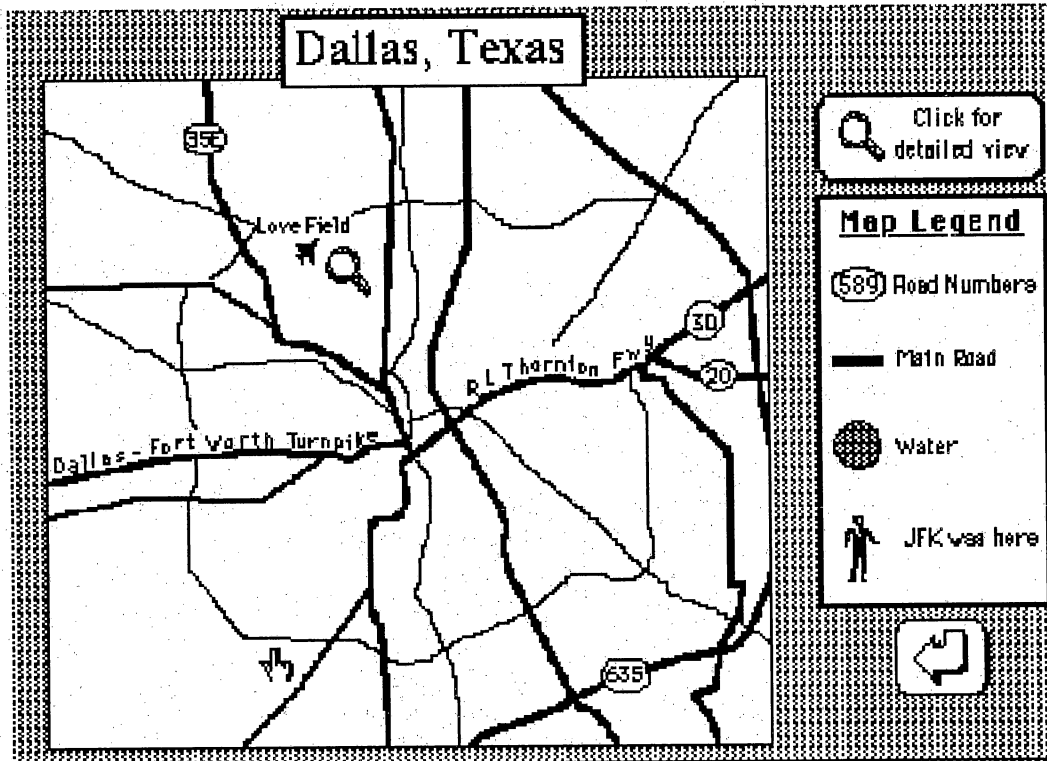


Figure 5. Clicking on a city button, e.g., the button for Dallas, gives the user a close up view of the city. The magnifying glass will provide an even more detailed view as well as text that explains the episodes in that locale.

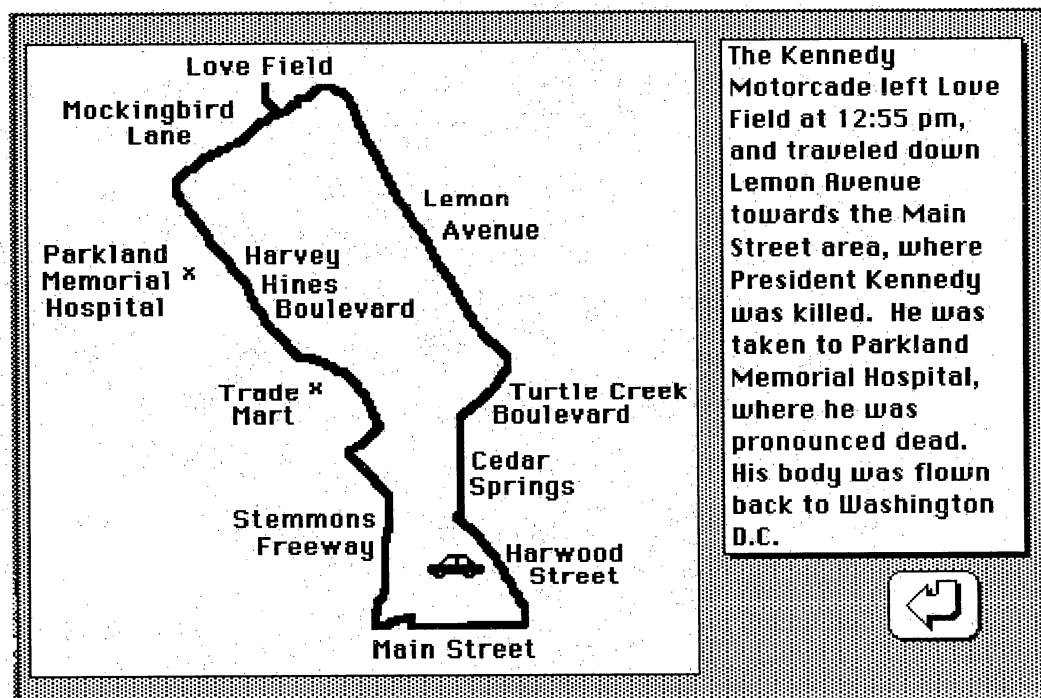


Figure 6. Clicking on the little car allows the user to traverse the motorcade route in the indicated city.

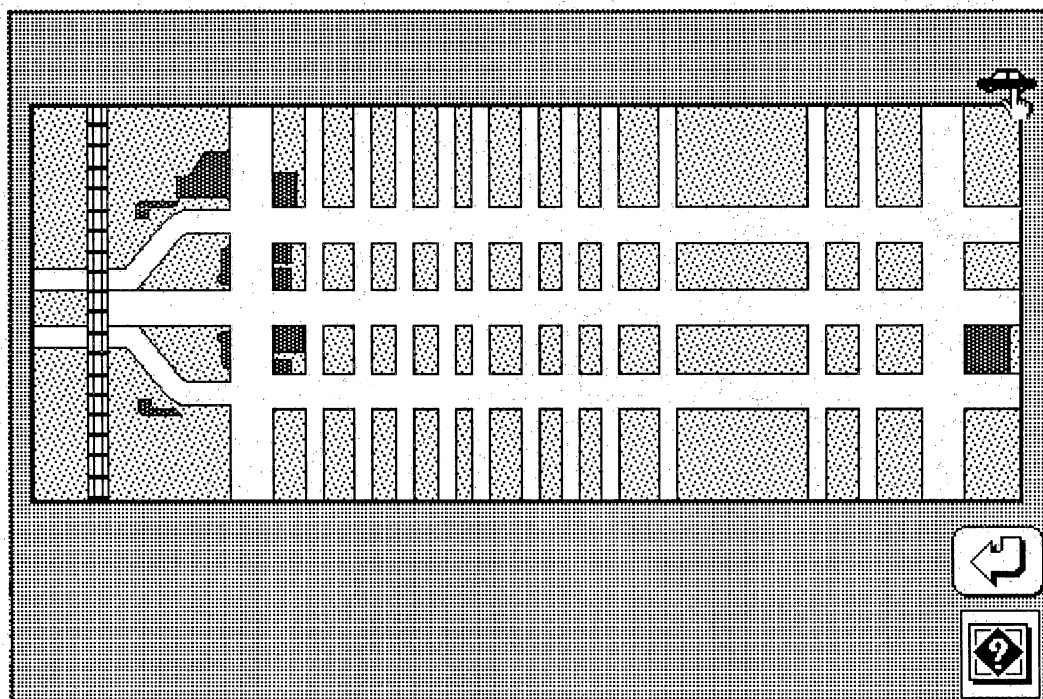


Figure 7. Clicking on the car again begins an animation sequence with a textual account of the motorcade route.

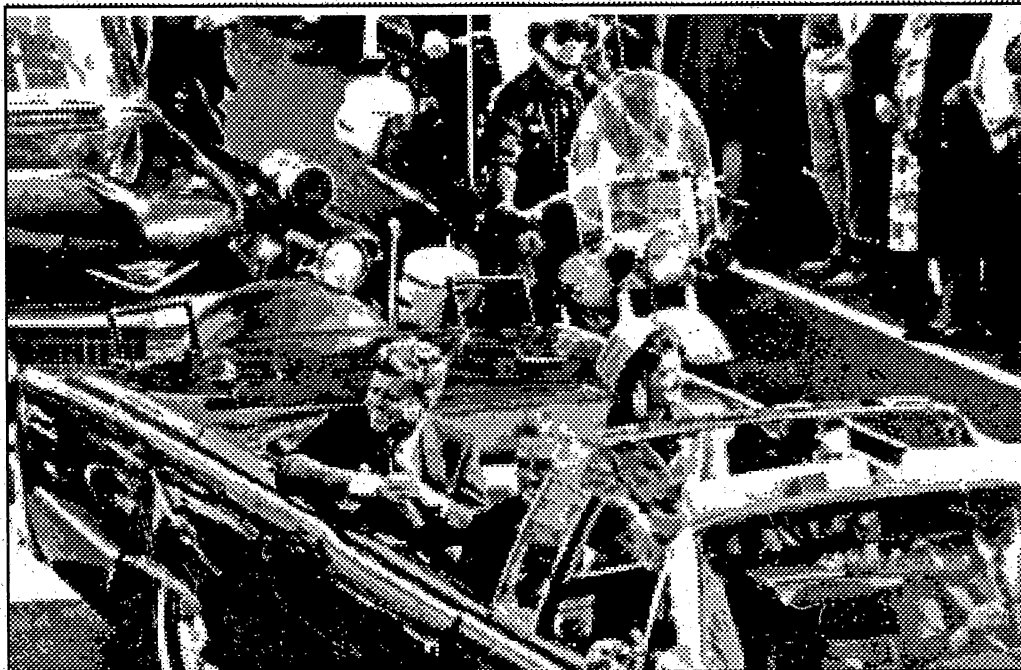


Figure 8. An actual photograph of the president in the motorcade pops up as the car heads west. At the conclusion of the motorcade route, another magnifying glass appears.

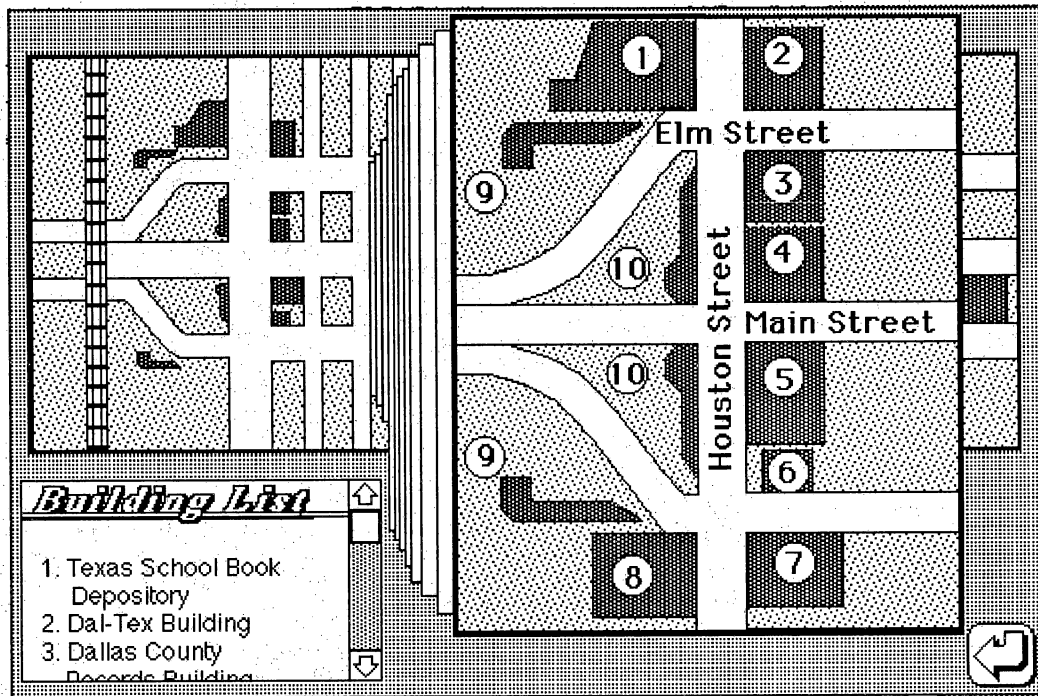


Figure 9. When clicked, a layered close up evolves. Each building at the end of the motorcade is labeled. The bent arrow will take the user to the previous screen returning by the route already traveled.

The Tampa button reveals a series of screens that is developed, while the others will be developed in the next version of the stack.

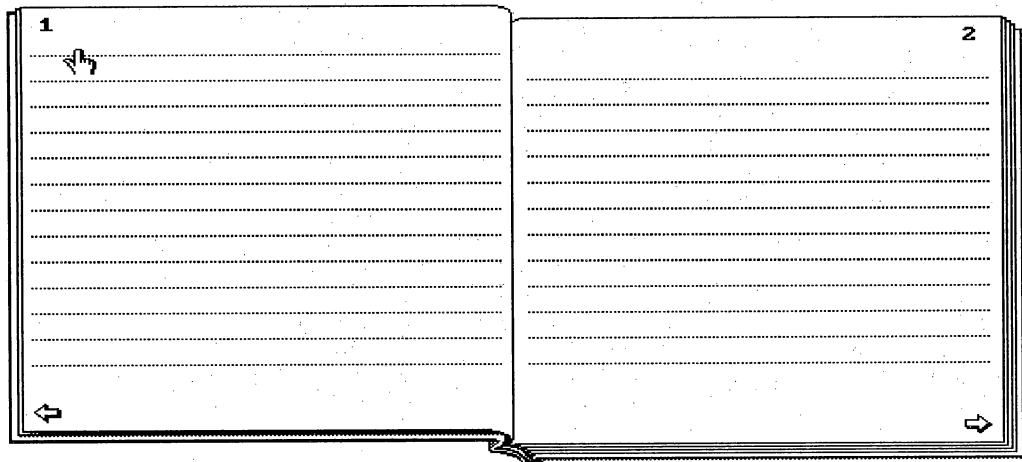


Figure 10. This notebook is a stack that is available to the user at all times. The user can copy text and graphics from the “JFK” stack to paste in the notebook. The user can also type their own ideas and impressions into the notebook.

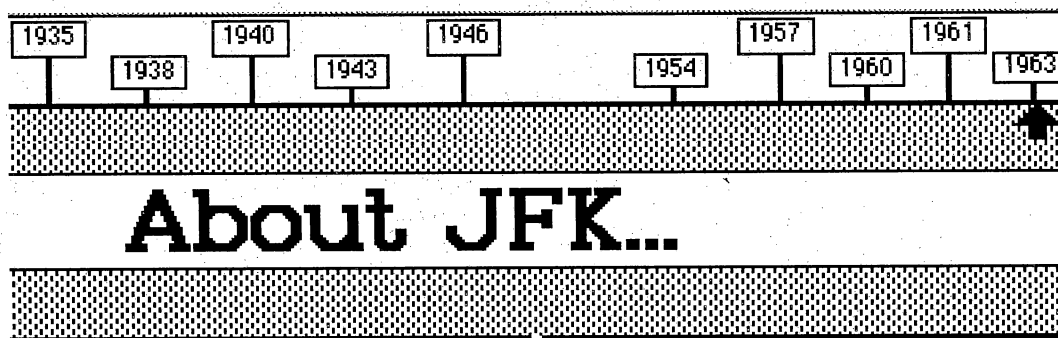


Figure 11. The “About JFK” stack is an annotated photo album. This section spans the years from 1917-1963. Scrolling text accompanies each screen.

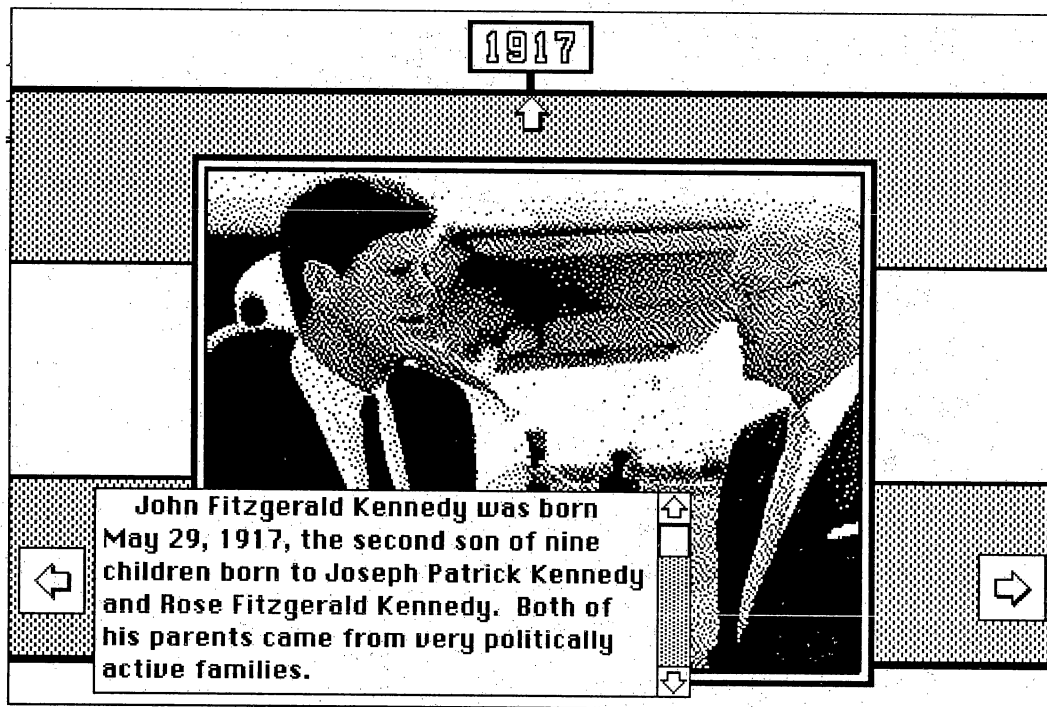


Figure 12. "About JFK" stack continued...

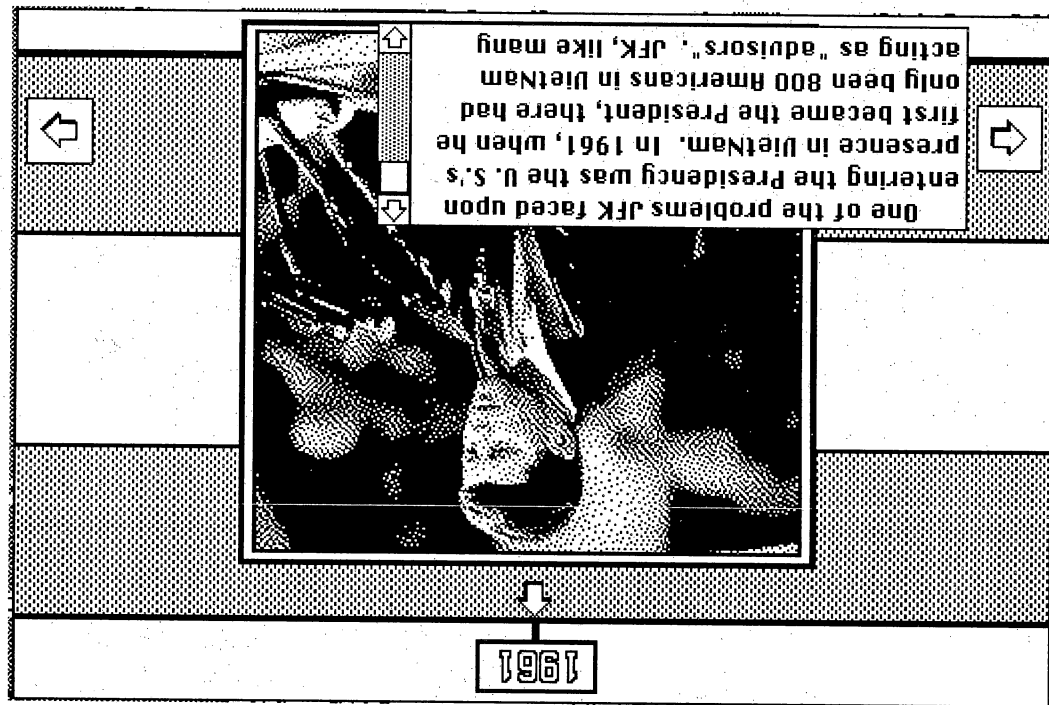


Figure 13. "About JFK" stack continued...



Figure 14. The "Issues" stack represents a newspaper of the 1960's containing issues pertinent to that time. Beneath each scanned image is the credit.

The New Frontier Gazette		
Vol. LXXIV	Monday, June 5, 1961	Daily 10 cents
Issues and Personalities of the JFK Administration		
Kennedy's Top Priority Domestic Issues Announced <ul style="list-style-type: none"> ● The CIA ● The Civil Rights Movement ● The Economy ● The F.B.I. and J. Edgar Hoover ● NASA and The Space Race ● Organized Crime ● The Revamping of the Military 	Time Magazine Lists Domestic Personalities of Interest <ul style="list-style-type: none"> ● Lyndon Johnson ● Jacqueline Kennedy ● Joseph Kennedy ● Robert F. Kennedy ● Kennedy's leading Republican rival ● Marilyn Monroe ● Publicity Surrounding the "Rat Pack" ● Texas Politics 	In World News <ul style="list-style-type: none"> ● Fidel Castro's Cuba ● Cuban emigres in the U.S. ● Nikita Khrushchev, U.S.S.R. ● The Peace Corps ● The Progression of the Vietnam War 
		

Figure 15. This section of the "Issues" stack lists the topics to be covered.

The Peace Corps

Kennedy's Vision of Peace Throughout the World

Index

Kennedy and The Peace Corps A-3
The Peace Corps--Defined A-3
Goals and Functions B-3
History of the Peace Corps B-1
Volunteer Requirements C-1
JFK Editorial Activities D-1



Pending Copyright

Figure 16. Clicking on a subtitle on the previous card will take the user to more information on the selected topic. The screen below is a result of clicking on the subtitle "The Peace Corps".

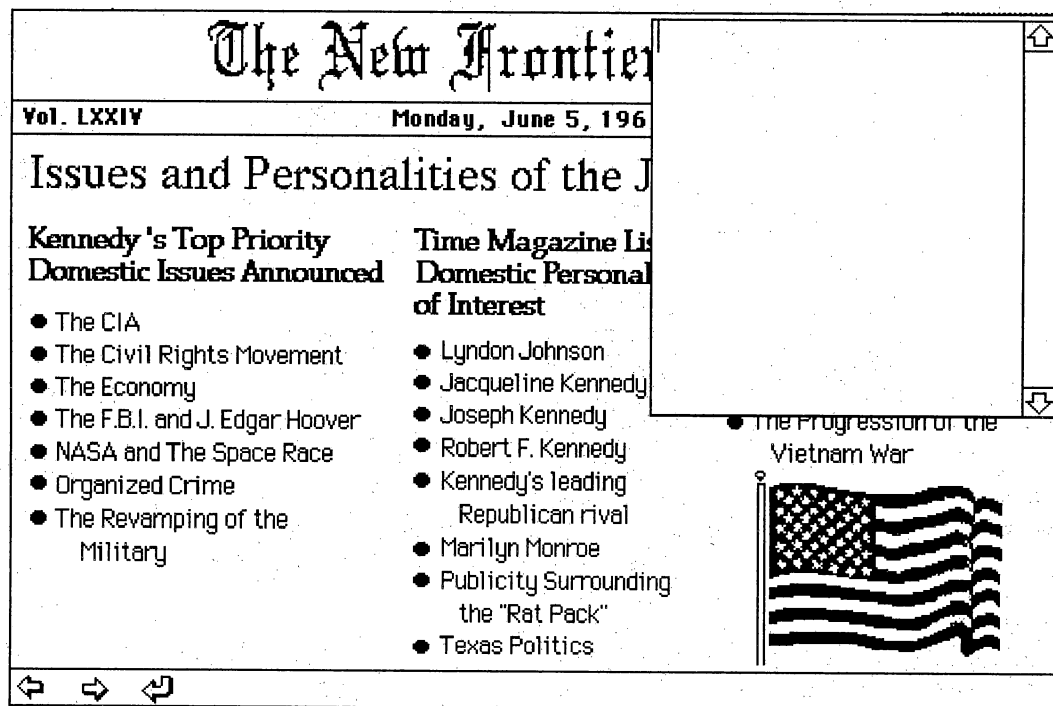


Figure 17. The menu gives an option to produce a pop up scratch pad that acts just like its physical counterpart.

The Transcontinental Stack Team

The instructors and graduate students involved in the design and production of this project were referred to as "The Transcontinental Stack Team". "The Transcontinental Stack" Team included several smaller teams: design and scripting team, research team, scanning and video team, and the audio team. Members were assigned to their team based upon their interests and expertise as expressed during the application and interview process before the project was undertaken. Three staff members from California State University, San Bernardino led the teams. The project met as an entire group during which time the scope and intent of the project was discussed. Team members confirmed that they were in a team that they felt comfortable with. Individual teams then met separately to accomplish their part of the project.

This author was one of three members on the scanning and video team. My primary function was to use a video capture board, the Video Spigot Pro, to digitize still frames and video clips from available videos. One of my primary contacts throughout the project was a member of the research team. The research team member would bring available videos to me. Once the videos were received, it would be determined if the video contained desirable content.

The Digitizing Process

Of the videos for which copyright permission was granted to the team, four contained information that dealt with the assassination: "Who Didn't Kill JFK?" (3-G), "JFK...The Day That The Nation Cried" (VIEW), "Reasonable Doubt...The Single Bullet Theory" (Kultur), and "Best Evidence: The Research Video" (Rhino.) Both "The Speeches of John F. Kennedy" (MPI) and "The Kennedy's' Early Years" (Time Life Video) contained numerous usable sequences. However, black and white images were the only available medium. Footage of the era was very grainy and of lesser quality than we have become accustomed.

Digitizing images and sound requires an enormous amount of memory, both to work with the images and to save those images for later use. It was necessary to keep at least 10 MB of hard drive storage free at all times. A 17 second clip of black and white video with sound occupied approximately 5 MB of storage space. The prototype that was produced was to fit on two 1.4 MB floppy disks. The memory constraints of the project therefore negated the possibility of using the video clips. These clips are available for the upcoming version of "The Final 100 Hours". This version will be allotted 88 MB as it will be saved to a removable cartridge capable of storing that amount of material.

The video clips are actually sequential snapshots. The Video Spigot card allows the user to determine the number of frames per second that will be saved. The viewer is accustomed to seeing 30 frames per second as is shown during a television show. This results in an image being shown for $1/30^{\text{th}}$ of a second. It takes $1/10^{\text{th}}$ of a second for this stimulus to reach the brain and another $1/10^{\text{th}}$ of a second for the brain to shut off the impulse. This phenomenon of images

remaining in the brain past the point of actual presence is known as persistence of vision. The brain further smoothes out these sequential images by filling in images that should be there. An example of this process is the sparkler sticks that children play with during the 4th of July. When the sparkler stick is waved around, it is perceived as a continuous stream of light, allowing the youngster to draw circles and figure eights in the air.

When determining the number of frames per second to save, memory again becomes a prime consideration. A balance must be achieved between recording a sufficient number of frames to be viewed without loss of meaning and reducing the amount of memory required to save this image. The resultant clip must also be aesthetically pleasing to the viewer in order to assure that the clips will be viewed. It was determined that 15 frames per second was usually the optimal balance between these considerations.

QuickTime™ is the recently released system extension that allows the use of these video clips. This software is free, but only those users with a color-capable Macintosh, that is those that have a 68020 coprocessor can use it. If the computer is using System 7.0 software, an additional requirement is that 4 MB of memory needs to be available in the computer. To use the QuickTime™ video clips in HyperCard®, the author of the stack must install the QuickTime™ resources in either the home stack or the stack containing the video clip. This is accomplished by using the HyperCard® QuickTime™ tools that are included in the HyperCard® developer's kit. Clicking on "install resources" on the main card and selecting the stack on which you wish to install the resource accomplishes this process. The next step is to click on the QuickTime™ tool kit. This intuitive card allows one to click on buttons that will dictate the parameters

of the movie in the stack. The movie will appear on the HyperCard® as a movie poster with controls for the user.

The still video images were also captured using the Video Spigot. Memory considerations were able to be balanced by adjusting the quality of images saved. This option can be adjusted under the "compression menu". On a scale of one to four, with four being the highest quality, it was found that the image was at sufficient quality and required approximately 250 KB when saved at a quality setting of two. Three images typically fit on one double sided floppy disk. The Video Spigot allows the user to save these still images in the Joint Photographic Experts Group (JPEG) format. The images then can be viewed in HyperCard® in one of two ways.

The HyperCard® author can copy the image to the clipboard. This reduces the quality of the image but also reduces the amount of memory required to store the image. The memory requirement is reduced from approximately 250 KB to 50 KB. It was determined for use in the prototype that a higher quality image was desired. To view the higher quality images, a script was added to the card on which the image was desired. The command used was the "call picture" command, which allows the HyperCard® stack to exhibit a picture file outside of the stack. The image quality is thus preserved, but the memory requirements prohibited the use of more than two of these images for the prototype stack.

The two images chosen to be viewed in this manner were scanned in using a flat bed scanner, the Apple OneScanner™. This scanner digitizes images in shades of gray. The number of images used in the prototype stack were limited by memory limitations and a lack of permission to use copyrighted materials.

As stated earlier, the final version of the stack will be allocated 20 times the memory space more than the prototype. This available space could be easily filled with the wide variety of materials that the team has since been granted permission to use.

Due to the very nature of a prototype, that is that it has not been made available to the public, it would be premature to discuss if objectives for learners have been met. However, individual needs of learners have been addressed by providing a variety of visuals for learners. Interesting photographs were used where appropriate. Maps visually represent geographical locations and the presidential travels. A timeline illustrates the temporal relationships covered in the material. Iconic symbols aid students in the navigation of material. The multimedia aspect of the prototype was minimal considering the potential for implementation. This is expected to be expanded in the future version. Although sound effects were included, actual conversations and speeches are expected to be included in the final version. An interface with laserdisks will also expand the multimedia aspect in the future version.

Students were limited in their navigational freedom for several reasons. The need to keep the stack safe from changes made by students, intentional or otherwise, required certain restrictions. These restrictions came in the form of menu choices that were unavailable, e.g. print availability in one stack, typing in most areas, and the lack of fields where students might add cards or fields to their stack. These restrictions are necessary if the pristine nature of the stack is to be maintained for other users, but this results in restrictions to the learner. These restrictions are an impediment to the constructivistic activities that the learner might be involved in. These restrictions and limitations must be

balanced with other considerations in modifications to the final version of this stack.

Conclusion

This project has addressed specific issues related to education. The "Final 100 days of JFK" is a prototype of what The Transcontinental Stack Team views as one partial avenue for addressing these issues. As educators with computer expertise, the team and other such collaborative teams are uniquely qualified to produce such projects, software produced for their educational value rather than marketing value.

Evaluating the project while still in the prototype stage is a challenge. This task can be aided by consulting a checklist such as that presented by Tolhurst (1992). This checklist reveals several areas in this stack that require attention. Documentation for this software will need to be written. Thought should be given to suggesting classroom activities, classroom management techniques, overhead transparencies, and possible uses of the software. Manipulation of notes and graphics in the student notebook is primitive, a link to a word processor suited to this task is suggested. Feedback provisions could be made by peer or teaching editing on or off-line. These concerns will be addressed by those who continue the work on the prototype.

A further evaluative concern to the future authors of this stack is the task of authentic assessment of the learning that takes place in a constructivistic environment. Jonassen (1991) suggests that these evaluative methods should be more goal free, assessing learning in relevant real-world contexts, requiring authentic learning tasks that represent multiple perspectives and viewpoints. These assessment techniques are relatively new and quite different from the criterion referenced tests most educators are comfortable with. This innovation

is a reflection on the novelty and diversity of educational challenges facing educators today.

The completion of this collaborative project prototype implies a new methodology for education. It is envisioned that teachers and students will act as a collaborative team, joined by other such groups across the boundaries of time and space to construct new meanings from available knowledge.

Appendix I

GLOSSARY

Authoring- Creating or modifying buttons, links, fields, cards, backgrounds, and stacks using the Button tool, the Field tool, and commands in the Objects menu. Also refers to the user level that allows you to use the Button Tool, the Field tool, and the Objects menu. (Claris Corp., 1990)

Bit- Contraction of binary digit. The smallest unit of information that a computer can hold. The value of a bit (1 or 0) represents a simple two-way choice, such as yes or no, on or off, positive or negative, or something or nothing. (Apple, 1989)

Bitmap- A set of bits that represent a graphic image. Used by the Macintosh computer to construct graphic images and fonts. (Apple, 1989)

Button- A type of HyperCard® object; a rectangular “hot spot” on a card or background that responds when you click on it according to the instructions in its script. (Claris Corp., 1990)

Byte- The number of bits used to represent a character. For personal computers, a byte is usually 8 bits. (Apple, 1989)

Card- A type of HyperCard® object; a rectangular area that can hold buttons, fields, and graphics. All cards in a stack are the same size. Each layer can contain its own buttons, fields, and graphics. (Claris Corp., 1990)

Cognitive Science- The psychological science that deals with how people process information and how that information is used. (Simonson and Thompson, 1990)

Constructivism- Constructivism is concerned with how we construct knowledge from our experiences, mental structures, and beliefs that are used to interpret objects and events. (Jonassen, 1991)

D.p.i.(dots per inch)- A measure of screen or printer resolution; the number of dot in a line one inch long. (Aker et al., 1991).

EPS (encapsulated PostScript)- A file format that carries both a description of an image in the PostScript page-description language and an optional bitmap equivalent for screen display. This format is used increasingly for image interchange on the Macintosh. (Apple, 1989).

Flatbed scanner, e.g., Apple OneScanner™- Flatbed scanners work like a photocopy machine; the original art is positioned face down on a glass plate. This design can accommodate thick objects, such as books, and allows for exact alignment of the original page. (Apple, 1989)

HyperCard®- The HyperCard® application is a software development package that lets you control the way you use text, graphics, and sound on your Macintosh computer. (Claris Corp., 1990).

Hypermedia- Hypermedia extends the concept of hypertext to include other media--graphics, animation, scanned images, voice, sound, music, still video, and full-motion video. (VanHorn, 1991)

HyperTalk®- The HyperCard® built-in script language for HyperCard® users. (Claris Corp., 1990).

Hypertext- Hypertext allows words, and hence ideas, to be associated with other words or ideas. (VanHorn, 1991).

Icon- A graphic symbol usually representing a file, folder, disk, or tool. (Aker et al., 1991).

Kilobyte(K)- One thousand. Actually, in computer terminology, K= 1,024 bytes of memory (2 to the tenth power). (Simonson and Thompson, 1990)

Liquid crystal display (LCD panel)- Output display consisting of a liquid crystal deposited between two sheets of polarizing material that when exposed to an electrical signal creates an image. (Simonson and Thompson, 1990).

Megabyte (MB, meg)- A unit of measurement equal to 1,024 kilobytes, or 1,048,576 bytes, commonly used in specifying the capacity of computer memory. (Apple, 1989).

Memory- Storage locations in the computer, in RAM or ROM. (Simonson and Thompson, 1990).

Menu- A list of choices presented by a program, from which you can select the desired action. In the desktop interface, menus appear when you point to and click on menu titles in the menu bar. Dragging through the menu and releasing the mouse button while a command is highlighted selects that command. (Apple, 1989).

Monitor- An output device that converts the raw video output of a computer into a visible image on a cathode ray tube. Similar to the picture tube of a television. (Simonson and Thompson, 1990).

Multimedia- Usually refers to any audiovisual presentation using more than one medium; for example, slides, video, sound, and movies. (Apple, 1989).

Paint- A type of graphics program that treats images as a collection of individual dots or picture elements (pixels) rather than a collection of shapes. (Apple, 1989).

PICT- Short for Picture Format; a format for the storage and exchange of graphics documents on the Macintosh, and the format used by the Clipboard. (Apple, 1989).

PICT2 or PICT II- An update of the basic Apple format for the storage and exchange of graphics documents on the Macintosh. PICT2 adds support for color and for more formatting instructions carried as comments within the image file. (Apple, 1989).

Pixel- Short for picture element the smallest dot you can draw on the screen. Also a location in video memory that corresponds to a point on the graphics screen when the viewing window includes that location. In the Macintosh monochrome display, each pixel can be either black or white, so it can be represented by a bit; thus, the display is said to be a bitmap. For a color or gray-scale display, several bits in RAM may represent the image. In the high-resolution display on the Apple IIGS, each pixel is represented either two or four bits. Thus, the display is not a bitmap but rather a pixel map. (Apple, 1989).

QuickTime movie- High-quality video footage that can be assembled on the Macintosh, stored on an ordinary disk drive, incorporated in any Macintosh application, and played back without any external video equipment. (SuperMac, 1991).

QuickTime™-A media-integration standard that makes digital video a transparent data type just as text and graphics are. It gives developers a common set of routines for manipulating and synchronizing moving images and sound. (SuperMac, 1991).

Scan- To convert an image from a visible form to data that the computer can process. (Apple , 1989).

Script- A collection of instructions written in HyperTalk, often associated with a button. You use the script editor to add to and revise a script. (Claris Corp., 1990).

Stack- A HyperCard document. Every stack consists of one or more cards. (Claris Corp., 1990).

System- On the Macintosh, special files containing the operating system (the software that forms the bridge between the hardware and individual application programs) and its supporting utility and auxiliary programs. Some of the more important Macintosh system files include System (the operating system code), Finder (which manages the desktop), MultiFinder (which allows several programs to be open at the same time), LaserPrep (which sends initial information the LaserWriter printer), and LaserWriter (the driver program for sending text and images to the LaserWriter). (Apple, 1989).

TIFF (Tag image file format)- A file format for graphics developed by Aldus, Adobe, and Apple that is particularly suited for representing scanned images and other large bitmaps. The original TIFF saved only black-and-white images in uncompressed forms. Newer versions support color and compression. (Apple, 1989).

VideoSpigot™ - Digital Video Frame Grabber- A device that converts the analog signals representing one screen's worth of video information into digital format. (SuperMac, 1991).

Appendix II

PRODUCT REFERENCES

Apple OneScanner™

Flatbed scanner that works like a photocopy machine; the original art is positioned face down on a glass plate. This design can accommodate thick objects, such as books, and allows for exact alignment of the original page.

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

HyperCard® Developer's Kit

The HyperCard® application is a software development package that lets you control the way you use text, graphics, and sound on your Macintosh computer.

Claris Corporation
5201 Patrick Henry Drive
Box 58168
Santa Clara, CA 95052-8168

Macintosh II

Modular style personal computer. Originally contained a 68030 co-processor.

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

QuickTime™

A media-integration standard that makes digital video a transparent data type just as text and graphics are. It gives developers a common set of routines for manipulating and synchronizing moving images and sound.

Apple Computer, Inc.
20525 Mariani Avenue
Cupertino, CA 95014

**VideoSpigot™ - Digital
Video Frame Grabber-**

A device that converts
the analog signals
representing one screen's
worth of video
information into digital
format.

SuperMac Technology
485 Potrero Avenue
Sunnyvale, CA 94086

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JFK: The Final 100 Hours

The Disk

