

# THE INTERACTIVE MULTIMEDIA SOFTWARE PROJECT

## A Planning and Development Guide



**Gary McCauley**

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## HOW TO USE THIS DOCUMENT

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This document is a guide for those considering the development of interactive multimedia software. The information provided here is applicable to the development of interactive multimedia intended for stand-alone applications (to be delivered on CD-ROM, for example), electronic kiosks, or WEB learning sites.

For those readers with previous interactive multimedia experience, much of the material here may be perused quickly, especially the two introductory sections. These readers will want to focus on the subsections titled, *The Lawmaker Experience*. This subsection is intended to highlight critical information by relating it to the *Kansas Lawmaker CD-ROM* project developed for Continuing Education at the University of Kansas. The *Kansas Lawmaker CD-ROM* is an interactive multimedia software application designed to teach middle school students the Kansas state government legislative process.

Readers with virtually no experience in the development of interactive multimedia software should be prepared to carefully read the entire document. More than anything, the information here is repeating a central point: thorough planning and careful analysis are critical to minimizing costly mistakes. Because of the potential complexity of an interactive multimedia project, doing your homework in advance could save you many headaches and much time and money.

## WHAT IS INTERACTIVE MULTIMEDIA SOFTWARE?

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An important distinction exists between a multimedia project and an interactive multimedia software project. A *multimedia* project simply presents information to an audience through the use of a variety of media; music videos, for example, employ audio and video to present entertainment. On the other hand, *interactive* multimedia allows the audience or user to participate and control information. For example, touch screen buttons on electronic kiosks allow the user to control when and what information is presented.

Once you introduce interactivity to the equation, you are requiring a software control component be a key part of your project. In essence, this means you must be prepared to develop computer software. By adding interactive software to the project you intend to develop, you have potentially increased the complexity 100%.

An interactive multimedia software project has at its core a computer application. The function of this application is to allow a user to interact with it in such a way that a range of media may be displayed to convey specific content. The media could include text, graphics, audio and video. Undertaking such a project means that software should be recognized as central and that the project will require a person or persons skilled in developing computer software for the display of a range of media.

One should realize that the complexity, and hence cost, of an interactive multimedia software project is directly related to the range of media used and the complexity of the interactivity. A project that employs only text and graphics and uses Forward and Back buttons for navigation will be vastly less expensive to develop than a project that uses text, graphics, audio and video, and allows the user to make decisions which control navigation. This is very important to keep in mind during the initial design phase when you are discussing the project with your client.

### The Lawmaker Experience

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Because of the need to engage sixth to ninth graders in a relatively dry subject matter, the decision was made to use the full range of media in the *Kansas Lawmaker* application. Also, to maximize the pedagogical efficacy, the design was based on an exploratory, decision-based approach to the interactivity. We were pushing the envelope, and the cost was high in terms of organization and production of media, and the technical difficulties of the software development.

#### What was Learned

The more complex the design of your interactive multimedia project, the more important it is to have highly skilled, highly experienced resources. First-timers should work hard to make the design simple enough to be compatible with expected resources, and when presenting designs to the client, one should be certain to explain the significant costs in terms of time and money associated with increased complexity.

A good instructional designer can create a simple yet effective interactive multimedia design with high quality graphics and text only.

## WHAT RESOURCES ARE REQUIRED?

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Critical to the success of any project are the resources available to do the project. And the most important resources are the people who will be the various players in the endeavor.

An interactive multimedia project requires collaboration and communication among a multidisciplinary team, and it should be clearly understood that those players may not always share organizational methods, ideas about schedules, or a common vernacular.

### **The Project Manager**

Do not consider undertaking an interactive multimedia project without formally assigning a person the responsibility of project management. Because of the need to coordinate a range of players and the need to communicate with the client, this position is an absolute necessity.

The project manager should be responsible for:

- 1) Meeting with the client and helping the client translate ideas into a workable interactive multimedia solution. This requires good listening skills, a knowledge or sense of instructional design, and a knowledge of the limits and capacity of interactive multimedia.
- 2) Identifying and directing the activities of a multidisciplinary team. This requires strong organizational and communication skills, an ability to create schedules (preferably with software tools), and a working knowledge of the talents each team member brings to the project.
- 3) Estimating costs and managing budgets. The project manager may be required to negotiate contracts with outside parties.
- 4) Creating project plans. Planning requires mapping out strategies to allow the work of many disciplines to proceed in parallel, designing client review and software testing strategies, and making it all work within a specific time frame and budget.
- 5) Giving formal and informal presentations to clients. Clients will need demonstrations of progress during the course of a project. For interactive multimedia, these often are in the form of stand-up computer-projected presentations.

### **Team Players**

The team players required for an interactive multimedia project will depend directly on the initial design established with the client. Here is a list of the full range of potential team members:

**Instructional Designer –**

The instructional designer is responsible for working with the client and translating the client's goals for instruction or presentation of information into an interactive multimedia framework.

**Graphics Designer/Artist –**

The graphics designer/artist is responsible for deciding on the graphical approach to presenting information and for producing the graphics. This role may actually require a graphics development *team*.

**Software Developer –**

The software developer is responsible for creating the computer program that will control and display the interactive multimedia on the target system(s) specified by the client.

**Scriptwriter/Content Developer -**

The scriptwriter/content developer is responsible for writing scripts for audio and video segments and helping determine how best to convey textual information.

**Audio/Video Producer -**

The audio/video producer is responsible for recording and videotaping all audio and video and converting those to a format compatible with the software implementation. This will likely require organizing and scheduling talent.

**Dream Team**

Simplicity typically makes life easier for any project manager. The following recommended Dream Team has only three members.

**Project Manager/Lead Designer –**

This person has the combined skills of the project manager, instructional designer, and scriptwriter/content developer described above. A mature person with prior experience in interactive multimedia and/or video production designed for instruction could have all these skills.

**Graphics Developer –**

This individual has the talents to both design and produce a range of computer graphics and has experience with and a strong working knowledge of interactive multimedia.

**Software Developer –**

This individual has the technical skills necessary to create software for interactive multimedia as well as considerable experience developing interactive multimedia software. Ideally, this person has an intuitive ability to help with interactivity design decisions.

This Dream Team is quite possible but finding such talented and experienced people would require a thorough and time-consuming search process.

### **Equipment Required**

Due to the rapid changes in technology, specific equipment requirements for interactive multimedia projects are nearly impossible to predict. Generally speaking, however, the following may be needed.

- 1) Computer hardware capable of supporting the needs of all in-house team members.
- 2) Software tools capable of supporting the needs of all in-house team members.
- 3) Audio and video production equipment and facilities capable of supporting the needs of all in-house team members.
- 4) Computer hardware that is representative of the target systems specified by a given client for a given project.

### **Time Required**

For the team members of an interactive multimedia project, a significant amount of job time may be required. For a relatively complex project, at minimum, the project manager should be able to devote a third to half time to the project.

Once the initial scoping of a project has been completed, all players should meet to carefully review and study the project and then provide an estimate of time needed.

### **Special Logistics**

Because of the range of skills an interactive multimedia project may require, some team players may need to be contracted. This should be understood in advance and a mechanism should be in place for such outsourcing.

## **The Lawmaker Experience**

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The demands of the *Lawmaker* project were relatively high because of the design chosen and because of the unusual nature of the client, a special eleven-member legislative committee. Projects directed at K-12 require highly engaging multimedia, hence the range of media used in *Lawmaker*. And having a committee as a client meant working with and satisfying many people.

### **What was Learned**

Without question, the lack of qualified resources was at the heart of the most significant difficulties with the *Lawmaker* project. Working with such a relatively inaccessible client also created special problems, but for the most part those were unavoidable.

Many decisions made by the project manager were not in his original project plan. Originally, the plan was to use in-house resources to scope and storyboard the project and then contract out a person for graphics development and a person for software development. Unfortunately, the resources available were not able to maintain the schedule for storyboarding and it was learned that the outsourcing process could create considerable delays. Both factors led to the decision to choose one contractor who had experience in storyboarding as well as software development and who could also

subcontract the graphics work. This contractor was not the first choice of the project manager, and ultimately the result was a less-than-satisfactory group.

The key lesson learned regarding resources is to have available individuals who can fill the roles described here, who can work as part of a team toward a common goal, and who understand the importance of schedules. With the *Lawmaker* project, the project manager did not find this to be the case, and the result was a project requiring probably twice the amount of time it should have required and a product of lower quality than it would have been otherwise. If qualified resources are not readily available, the project manager should have a well-documented time frame for the outsourcing process.

## STEP 1: INITIAL SCOPING

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Project scoping is meeting with the client to learn how interactive multimedia will be used and distilling all the discussion into a clear set of objectives that specifically apply to interactive multimedia. Before beginning this process, a person with the qualifications of the project manager should be identified for this task, and, if necessary, an instructional designer assigned to help. Do not even consider starting an interactive multimedia project without this bare minimum of resources.

### **Working with the Client**

The first step in scoping is to insist the client establish a specific decision-maker and if a group is required, keep the group to no more than three people if possible. This will help keep the scoping process focused.

### **Draft an Objective**

Once a client point person has been identified, the real work of initial scoping may begin. The goal is to obtain answers to the following basic questions.<sup>1</sup>

- 1) What exactly is the objective of the interactive software piece? Draft a short paragraph that describes the objective.
- 2) Who are the target users?
- 3) What is the target hardware system?
- 4) In what form is the software to be delivered? For example, CD-ROM, WEB, intranet, kiosk, etc.?
- 5) Will supplemental print materials be required?

Obtaining answers to such basic questions will force the client to focus the project goal. It is an essential step in beginning an interactive multimedia project.

### **Reevaluate**

With a concise statement of the client objective in hand, it is time to sit down and take a first pass at conceptual designs required to meet this objective. As you sketch several ideas, you must now answer the question, Is this a project Continuing Education has the resources to accomplish in the client's time frame? If not, can you sketch a proposal you could accomplish that would satisfy a variation of the client objective? If, after discussing alternatives with the client, the answer is always no, then do not attempt the project.

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### **The Lawmaker Experience**

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Scoping of the *Lawmaker* project was, unfortunately, extremely long. This was a result of a dual agenda or objective that complicated the project throughout. The paying client, the state legislature, was primarily interested in focusing on the legislative process,

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<sup>1</sup> England E., Finney A. (1996) *Managing Multimedia*. Addison-Wesley

whereas the Kansas State Department of Education and the Kansas State Historical Society were interested in a broader educational scope. The following is the result of our initial scoping:

The objective of the CD-ROM project is to produce a quality educational package for the purpose of providing a unique, technology-based, instructional resource for teaching middle school students the importance of the legislative process of state government. The application will make use of stories concerning historic and contemporary Kansas legislation, Kansas events, and Kansas persons to illustrate the role of state government in the lives of Kansans. Through such illustration the application will also provide learning opportunities in the disciplines of history, economics and geography, and will emphasize the value of good citizenship and generate pride in being a Kansan.

**What was Learned**

The project manager did insist on establishing a client decision-maker during the initial scoping, however, because the client was a legislative committee, we were only able to work with a liaison to that committee and therefore we were unclear regarding who actually had ultimate decision-making authority. The project manager should have been more aggressive in requesting identification of such an ultimate decision-maker, and should have not allowed such a broad scope for the objective statement.

## STEP 2: DETAILED SCOPING

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The initial scoping (**Step 1**) establishes the overall objective of the multimedia application. The next step is to begin fleshing out specifically the content to be presented and ideas for how to present this information within an interactive multimedia software application.

The client may be interested in a cost and time estimate, but you will only be able to give very rough guesses based on projects that seem similar. Avoid estimates at this time if possible.

### **A Suggested Scoping Method**

Of the many scoping methods reviewed, one of the best I've seen is described in the section on Specify Content in Chapter 9 of *Interactive Multimedia Instruction*<sup>2</sup>. Here the authors suggest scoping the details of an IM (interactive multimedia) project by using a form divided into three columns: Objectives, Content, and Treatment.

The Objective column is used for listing every learning objective or information objective the client hopes to achieve.

The Content column is used to outline the content known to subject matter experts (SME's) to address a given Objective.

The Treatment column is used to list ideas describing how multimedia may be used to present the Content.

This process will only be useful if the results are captured in a clearly titled, easy-to-read document.

### **The Subject Matter**

As suggested above, a thorough knowledge of the subject matter for the project is required to execute the detailed scoping step. Complete familiarity with the subject is typically not possible by the developers of IM, so the client will be required to provide what are known as subject matter experts or SME's. The project manager and/or instructional designer of the project team must be familiar enough with the subject matter to work with the SME's during the scoping phase of the project and to convey the subject matter to other team players later.

### **The Lawmaker Experience**

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The *Lawmaker* project would have benefited from the approach described above; the approach used led, essentially, only to the Objectives column. The result was a document titled Requirements Specification, which is included in the appendix. Also, because the interested client parties were numerous, this step in the process took months to complete, did not focus the project as it should have, and delayed the

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<sup>2</sup> Schwier, Richard A., and Misanchuk, Earl R. (1993) *Interactive Multimedia Instruction*. Englewood Cliffs, NJ: Educational Technology Publications

expected completion. The importance of insisting on a well-defined client and the need to perform the detailed scoping step carefully cannot be overemphasized.

**What was Learned**

Before detailed scoping begins, do what you can to stress to the client the importance of having a well-focused objective and establishing the client decision-maker. The scoping method described here is a good approach that, if followed, would have produced better results.

## **STEP 3: DEVELOPING AN OUTLINE FOR INSTRUCTIONAL DESIGN**

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This step should be based on the document created in the Detailed Scoping step. Be sure to have a detailed scoping document prepared prior to this step.

### **Overall Design Decisions**

At this stage of the project you are ready to brainstorm a general plan for the overall approach to your IM design. This should be guided almost strictly by the Treatment column of your detailed scoping document. Here you will decide the following fundamental design aspects.<sup>3</sup>

- 1) Method of instruction, e.g., drill and practice, simulation, presentation, gaming, etc.
- 2) Style of navigation, e.g., exploratory, linear, etc.
- 3) Types of media that will be used, .e.g., graphics, audio, video.
- 4) Nature of the interactivity, e.g., buttons, links, random events, etc.

Once these design questions are answered and match the detailed scoping requirements, the ideas must be organized in a document that clearly describes the proposed design to the client. An accompanying flow diagram is recommended.

### **Approval from Client**

Beginning with this step, client approval of design decisions is critical. You should work hard to explain clearly the design you are suggesting. Ask your client to carefully analyze and completely understand the design document and your presentation of it. Here you will likely need to revise according to the critique of the client. Do not hurry this step; changes made later could be costly in both time and money.

## **The Lawmaker Experience**

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The *Lawmaker* project made this stage a team effort that was based on the Requirements Specification document. The result was a document titled Application Design, which described the navigation strategy, the key interactive elements, and the focus of the content. The *Lawmaker* Application Design document is included in the appendix.

### **What was Learned**

Too much time was required as a team effort. A single person with a good feel for instructional design should have performed this task. Time would have been reduced by 75%.

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<sup>3</sup> Alessi, Stephen M. (1991) *Computer-based instruction: methods and development*. Prentice-Hall

## STEP 4: DEVELOPING A PROJECT PLAN

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At this stage of the process, the Design Outline or Application Design document created in **Step 3** is the most important completed piece of the project. You will use it to draft an overall project plan.

### **Determine Team Players**

Having specified the types of media required and the complexity of the interactive software, you are now able to begin your search for resources qualified to develop the required media and software. This could be a time consuming process if outside contractors are needed. A database of qualified persons should, therefore, be established in advance if possible.

### **Estimate Cost and Time**

You are now ready to provide a first *rough* estimate of the cost to create your client's IM product and the time necessary to complete it. The project manager should consult with the required team resources to make this estimate, supplying them with a guess at numbers and types of graphics, minutes and quality of audio and video, and the complexity of the IM software design. This is an extremely difficult task at this stage of the project, and your client should be told your estimate will have a margin of error of at least 25%. As a rule of thumb, you may want to double the time estimates provided by team players.

At this point the project manager should also draft a tentative project timeline.

### **Approval from Client**

This is the time to present a budget outline to the client, breaking out the various development costs, e.g., graphics development, software, etc. Also, you need to present a timeline. Does the cost and time fit the client's goals?

## **The Lawmaker Experience**

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The *Lawmaker* budget presented to the special legislative committee is provided in the appendix. Costs were estimated at the stage described in this section. The final cost for this project was probably closer to \$150k than the original estimate of \$125k. A timeline was not attempted due to the inability to maintain schedule with available resources prior to this point in the project. However, the legislative committee was given a completion date estimate of August, 1999. Final completion date was January, 2000.

### **What was Learned**

Because many of the details of the design have yet to be determined at this point, any estimates given to the client should be heavily qualified as rough and preliminary. Also, your estimates will only be as good as the estimates of the resources who provide them. Ask your resources to justify their numbers. Finally, with respect to timing and scheduling, avoid resources who have not previously met critical deadlines.

## **STEP 5: CREATING STORYBOARDS**

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This step is the process of creating a detailed blueprint from the Application Design document. All team players will use these specifications for their respective parts in the production, i.e., a script for the audio/video producer, a schematic for the software developer, etc. A storyboard is like a screenplay with added specifications for a computer program, those specifications being functionality and navigation.

Because the field of IM is relatively new, few standards exist for the project development process and hence storyboards do not have a standard format. Read the literature, look at examples, and decide for yourself. Keep in mind that the purpose is to create a detailed specification for all who will be providing media and software, and the format should be easily understood by all involved, including client reviewers.

This step is the most critical in the entire project and for that reason it should be done carefully and thoroughly. Preferably, the storyboards should be created by a person with instructional design skills, consulting with potential team players for advice on the use of media and the feasibility of implementing ideas in software.

### **Constraints**

During this process of creating a detailed design specification, costs, in terms of time and money, must be considered as design decisions are made. The technology currently exists to present information in a wide range of formats, but each has its particular expense which should be factored into the instructional design process.

### **Must Work with SME's (Subject Matter Experts)**

Because the storyboards are a complete design specification, they will include specifications for the presentation of all content. For this reason, subject matter experts must be involved to verify the accuracy and depiction of content, in addition to providing content material.

### **Review and Revise**

Again, because all future development/production work will literally use the storyboards as a blueprint, client review and clear understanding is vital. For this reason, a review and revise cycle should be scheduled in the project plan. Give the client time to thoroughly review the storyboards and time to revise based on changes required by the client.

### **Approval from Client**

This is the most important client sign-off. The more detail in the storyboards at this point and the more assurance you have the client understands and approves the storyboards, the more likely you are to stay on schedule during the production and software development phase. Changes suggested by the client during production or software development can be very costly.

## The Lawmaker Experience

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Due to the inexperience of available internal resources, the storyboarding of *Lawmaker* was made part of the contract with the outsourced team for software and graphics development. Because the *Lawmaker* design used the full range of media, a convenient storyboard format was difficult to determine and the contractor decided on the script-like document included in the appendix.

### What was Learned

Somewhat late in the *Lawmaker* project, two interns from the design department at KU were made available to help with the graphics development work. Unfortunately, the point in the project when they became available coincided with the storyboarding step. For this reason, the graphics development began simultaneous with the storyboarding. This should be avoided. Avoid any production work until storyboards are finalized. Of course, advance search for production talent, etc. should occur during storyboarding, but actual production should be avoided until final storyboards have been approved.

Because the *Lawmaker* design included a relatively large amount of content in the form of audio and video, a specialist in scriptwriting was subcontracted by the outside contractor working on the storyboards. The number of people involved continued to grow. Avoid this if possible. Try to find an instructional design person who can do the storyboard process alone. This minimizes communication problems with the client.

Review of the *Lawmaker* storyboards was an unexpectedly long process. Better communication with the SME's and closer involvement of the SME's during the storyboard development would have reduced *some* of the review time. Much time was spent trying to convince the client SME to reduce the amount of content to improve the pedagogy.

Due to tightness of the *Lawmaker* schedule at this point in the project, the storyboarding was less complete than it should have been. A final storyboard should describe all user interactivity in as much detail as possible. This will make the job of the software developer easier and more time efficient.

## STEP 6: IDENTIFYING A TEAM

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At this point you are like a builder with a set of detailed blueprints, i.e., your storyboard document. You are now able to intelligently select resources based on the requirements of the storyboard specifications. For example, if the storyboards require 3D graphics, you know you must find a graphic designer/artist with this special skill.

### **Selection Criteria**

Team members are selected primarily to meet the specific skill sets required for the project, but their availability and cost relative to the project schedule and budget are also important factors.

### **The *Lawmaker* Experience**

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This step did not apply to the *Lawmaker* project because the storyboards were driven to a large extent by the resources available internally. Because of the ready availability of an audio/video production facility, the design incorporated much audio and video. And, because the resources to storyboard were not available internally, this service as well as graphics and software development was provided by a group contracted to work on a fixed budget, within a fixed time frame.

### **What was Learned**

Because storyboards should be complete before production/development resources are contracted, resources for creating storyboards should be available to the project from the beginning. If outsourcing is a difficult, lengthy, possibly prohibitive option, then an IM project requiring such resources may not be practical.

## STEP 7: STARTING DEVELOPMENT

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You now have a team in place and a set of blueprints, and so are ready to begin development.

### **Graphics**

The first step in graphics development is to decide on an overall look or style. Work with the graphics designer/artist and client to create a style to match the storyboards, taking into account costs and the limitations of the target hardware systems.

### **Software**

At this stage, meet with the software developer to make sure he/she clearly interprets the storyboard. Ask for an explanation of the tool or method that will be used to develop the software. Finally, you should be assured that your design can be developed for the target hardware system within your budget and time constraints.

At this point, the software developer and graphics developer should be introduced. Their working relationship is important in an IM project.

### **Develop Prototype**

The prototype is a project milestone: the stage in which ideas are finally converted to software. A prototype is developed for the following reasons.

- 1) To demonstrate the graphics style to the client.
- 2) To demonstrate the basic navigational scheme and interactivity approach to the client.
- 3) To perform preliminary tests on the target hardware systems.
- 4) To allow the software developer to establish a development framework.
- 5) To initiate working interactions between team members, particularly the graphics and software developers.

### **Approval from Client**

A prototype that fully demonstrates the design aspects of points (1) and (2) above is an essential piece in the development phase of the project. This is the first opportunity to present actual software to the client and hence should be an official sign-off point in the project. Be prepared to revise storyboards at this point based on the client feedback.

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### **The Lawmaker Experience**

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As the Application Design document explains, *Lawmaker* was designed to simulate the experiences and environment of a newly elected Kansas legislator. In terms of graphics development, then, an approach to creating an environment representative of a legislator's working environment had to be determined. Initially, a photo-realistic approach was considered, i.e., photographing actual work spaces in the statehouse and

digitizing and manipulating those images to serve as backdrops for user interactions. Thorough investigation led the project manager to believe this approach would be too costly in terms of resources and logistics. Fortunately, the graphics subcontractor proposed using illustrations based on photographs. This approach not only was less time consuming but was judged to be particularly appealing to middle school students.

Continuing Education decided before the project began that one objective was to expose internal staff to a specific IM software development tool, Macromedia's *Authorware*. This decision dictated both the tool used to create the IM software for *Lawmaker* and choice of the subcontracted software developer.

The prototype developed for the *Lawmaker* project met all the requirements listed above. It was formally presented (using a laptop and projection system) to the special legislative committee funding the project. The committee was specifically asked to approve the illustrative graphics approach and the simulation approach to the instructional design. The prototype also included audio for the most frequently used voice to assure its approval. Fortunately, all was approved, with suggestions only to improve the enunciation of the recorded voice they heard.

#### **What was Learned**

Had a graphics development resource been available internally, those not formally qualified would not have spent time researching approaches to the graphics style. Having a graphics designer available prior to **Step 5** would be ideal.

More thorough investigation of the prototype performance on the target hardware systems should have been performed. Ideally, the prototype software should be created in such a way that it will test the use of all media types on the target hardware which satisfies the *minimum* hardware requirements. If performance is unacceptable, either the minimums must be adjusted (if client allows), media parameters (e.g., graphics dimensions) must be reconsidered, and/or the design simplified (and storyboards revised). An experienced, skilled software developer will understand and appreciate this important process, a process that can potentially save much time and client disappointment later.

## STEP 8: FULL PRODUCTION

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At this point in the project, the storyboards are complete and a software prototype has been demonstrated to the client. Working with the storyboards as a blueprint and the prototype as a base model, you are now prepared to produce the complete IM software application.

### **Project Planning**

The project manager is now in a good position to create a detailed project plan for the remainder of the project. The plan should include a timeline and allocation of resources to specific tasks along that timeline. Planning will require discussing the specified tasks with respective team members to determine scheduling. Team members should be working from the storyboard and should thoroughly understand their development tasks relative to the storyboards. A lengthy team meeting is recommended for information gathering and to coordinate schedules.

### **The Client Review**

Depending on the project and the client, review and official sign-off may be required during production. For example, if audio quality and presentation is particularly important to your IM project, the client may need to be given a periodic review and sign-off of produced pieces. This kind of review option should be offered to the client with the explanation that making changes to produced pieces later in the project could be very expensive. Obviously, if the client wants such a review, this must be factored into the overall timeline.

### **Software Development**

An IM software application can be characterized as a computer program that serves as a control mechanism for the display of and playback of various media. The software allows a user to interact with the target system, e.g., via mouse clicks or touch-screen, to invoke the display or playback of media. Given this, an experienced and skilled IM programmer should be able to create software code in tandem with the development of media, using the storyboards as a specification for coding.

Dummy media can be used by the software developer during initial development, because initially the goal of the programmer should be to create a software application with the functionality, interactivity, and navigational scheme specified by the storyboards. Ideally, you want a software developer who is comfortable with this development approach.

### **Alpha Testing**

Software is typically tested in three stages of development. According to Strauss<sup>4</sup>, alpha is a version that is structurally and functionally complete, but may lack all content. With the beta version, all is complete except for modifications and changes based on usability and test feedback. During omega, all final programming is completed and all data preparation finished.

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<sup>4</sup> Strauss R. (1997) *Managing Multimedia Projects*. Focal Pres

As the media is being produced and the software developed, it should be periodically evaluated by the project manager and instructional designer, and possibly the client. This alpha testing serves the following purposes:

- 1) To verify that the software developer is creating the IM application according to the storyboards as understood by the project manager and instructional designer. This testing stage provides a good opportunity to give feedback to the developer and to discuss problems the developer may be having implementing the storyboard specifications.
- 2) To verify that the software continues to perform acceptably on the target systems. As the software grows and actual media becomes available, the demands on the target system will grow. Periodic testing during development allows for assessing performance and addressing problems, sooner, rather than later.
- 3) To reassess the project schedule. Estimating software development time is a difficult task and alpha testing provides an opportunity for the project manager and the software developer to assess progress and adjust the timeline if necessary.

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### **The *Lawmaker* Experience**

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As mentioned previously, due to the availability of design department interns during a narrow time window, graphics development proceeded simultaneously with storyboarding and the final storyboards lacked detail regarding interactivity. Hence, software development began after graphics were nearly complete and with a somewhat insufficient blueprint.

Graphics production went pretty well. The two design department interns produced the majority of the graphics under the direction of the graphics developer subcontracted by the software developer. One intern created hand drawn, black-and-white illustrations, scanned them and then the other intern colorized in Photoshop. At the insistence of the project manager, a graphics review and sign-off cycle was used in this project.

Because of its extensive content, the *Lawmaker* design required a large amount of audio and video production. The audio/video producer scheduled, coordinated, recorded, and videotaped 44 individuals, resulting in 309 digital audio files and 33 Quicktime movies. Archive video footage was also researched and segments included as content. All digital movies entailed digitization of original analog video. Additionally, the audio/video producer was required to use the chroma-key technique in order to seamlessly integrate video content into the illustrated graphics backgrounds. This is a very neat effect in a multimedia application.

As noted previously, the *Lawmaker* software was developed using Macromedia's IM development tool, *Authorware*. Two programmers were actually involved in the development, one located in Toronto, Canada. Approximately half-way into the software development, due to a software distribution issue with Apple Computer's

Quicktime software (the third-party software required to play the digital movies), the software developer decided to upgrade to the latest version of *Authorware*. This latest version resulted in some unanticipated difficulties in creating software to run on both Mac and Windows computers, which *Lawmaker* required.

Regarding alpha testing, the software developer would not agree to the testing described above, instead providing only written progress reports.

### **What was Learned**

The graphics development process was more complicated than necessary in the *Lawmaker* project because of the decision to use interns while they were available for production work. If possible, production work should not begin until the storyboards have been finalized.

Because of the outsourcing complications, the graphics developer was subcontracted by the software developer. This arrangement made it difficult for the project manager to communicate requirements and demands directly to this critical team player. The project manager was less than satisfied with the graphics developer on this project yet could do little about it. Avoid this arrangement if possible.

Audio/video production overall was a satisfactory effort. Some recording began before the storyboards were finalized and some scripting was not carefully reviewed, which resulted in some rework. Scheduling and dependability were less than satisfactory, making project planning nearly impossible. Use reliable resources.

The inability to alpha test during software development left the project in the dark during this important step. When considering a subcontractor for software development, look for a developer comfortable with the alpha testing described here.

## **STEP 9: BETA TESTING**

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Beta testing begins when all media have been produced and integrated into the IM software. Testing should be performed by those familiar with the storyboards and the subject matter. This testing should be a well organized process with a standard form used for reporting results.

### **Usability**

Usability testing is exercising the software as the target user would to identify problems with interactivity and navigation. The tester should also verify the inclusion of all interactivity and the navigation scheme specified by the storyboards.

### **Performance**

Testing for performance means running the software on the target system(s) and carefully observing the execution speed and audio/video playback. Unacceptable performance is when content is lost. Unacceptable performance may be further defined by interaction times and execution speed, depending on the specific demands of the project.

### **Feedback**

The documented results of these three types of testing must be discussed with the software developer and media producers. Decisions must be made regarding what revising is absolutely necessary and what is possible within the project cost and time constraints.

### **Approval from Client**

Once the software has been revised based on the results of usability and performance testing, the client must “proof” the application to verify all content is presented without error. Any additional client concerns must be subject to negotiation relative to the project deadline and budget.

Reported content errors must be corrected and other concerns addressed to receive final beta testing approval.

## **The Lawmaker Experience**

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The project manager/lead instructional designer was the primary beta tester for the *Lawmaker* project. The software developer provided the evaluation form included in the appendix. Beta testing required nearly two months, testing on both Mac and Windows platforms.

### **What was Learned**

A high price was paid during this step of the project for the lack of alpha testing (as described in **Step 8**). Software was repeatedly delivered for beta testing prematurely, resulting in a poor use of the project manager’s and the client SMEs’ time. Much alpha testing actually occurred at this stage, eventually resulting in a late reworking of the software logic.

Performance testing was particularly disappointing. The software developer essentially failed to develop to the target system specifications during the alpha phase; thus, the minimum requirements steadily increased as the demands of the application grew. Also, performance testing was difficult because Continuing Education does not possess systems that represent the low-end Windows hardware.

Had a more experienced and skilled software developer been a part of this project, the problems noted here would likely not have occurred. If you recognize that your design created in **Step 3** requires significant technical software development, you should try to use a resource who can demonstrate having developed several such IM titles.

## STEP 10: FINAL TESTING

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The production and software development process is essentially complete after the Client Approval phase of **Step 9**. The purpose of final testing is to verify the quality of the software and media once it has been saved in a single location, in a format specified for distribution.

### **Verification and Quality Control**

Because an IM project often has numerous media and application files associated with the final software, these files must be verified after they have been transferred to a single, organized hardware location. Verification is simply the process of making sure the application and media have not suffered damage in the transportation. The application must be exercised thoroughly as with beta testing, and the media examined independent of the application. Also, any installation software that may be a part of the final IM package must be verified similarly. If time and cost permit, this process may reveal last minute problems which can be fixed.

### **The Lawmaker Experience**

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The *Lawmaker* software was to be delivered on CD-ROM. Continuing Education, therefore, was required to create a Master CD-ROM disk from which 7,000 copies could be made. Verification and quality control as described above was carried out by two team members familiar with the application and media. Total time required was nearly twelve hours with no fatal flaws discovered.

### **What was Learned**

Final testing is a rather tedious process, yet requires critical attention. Be prepared to use resources familiar with the application, but preferably not too desensitized by or even involved in, the beta testing step. Before beginning this step, draft a short memo detailing all tasks.

## STEP 11: PACKAGING AND DISTRIBUTION

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Packaging and distribution refer to the delivery system by which the software will be made available to the target users. In the case of a CD-ROM, the package consists of the CD, a CD jacket or jewel case, combined in some fashion with any accompanying print materials. For Web-based or intranet IM, the delivery system is any high-capacity digital medium that can store the IM application and associated media and that can be used to transfer it to a network server.

During project planning, consider the cost in terms of time and money of this step.

### Legal Issues

Prior to mass distribution, certain legal agreements may be required. If copyrighted content is used, permissions must be granted and finalized. If third-party software is distributed as part of your IM software product or if certain software development tools are used, licensing agreements may be required. Explore these issues at your earliest opportunity.

### The *Lawmaker* Experience

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The *Lawmaker* project required numerous copyright permissions for replication of newspaper headlines, articles, video segments, etc. These were handled without delay to the project by a team member with much prior experience.

On the other hand, software licensing became an unexpected problem. The *Lawmaker* software requires Apple Computer's Quicktime software to run. To make start-up of the application as simple as possible for teachers, the decision was made to distribute Quicktime on the *Lawmaker* CD-ROM. This required signing a distribution agreement with Apple Computer. Macromedia, the maker of the software development tool used to create the *Lawmaker* IM software, also required a signed agreement.

Unfortunately, these types of agreements are not easily signed by large non-profit institutions and hence a great deal of time was required to get them signed. Continuing Education should be aware that the University was *not* able to sign these agreements. They were finally passed to the legal staff of the state legislature who worked with Apple and Macromedia attorneys to find wording all parties could agree on.

Regarding distribution, to help advise the client (the legislative committee), an overall distribution plan was offered. This plan is included in the appendix.

### What was Learned

Because the client in the case of the *Lawmaker* project was a legislative committee, no one with knowledge regarding mass distribution existed on the client side. This left Continuing Education with the responsibility of locating a vendor that could duplicate the CD-ROM's and print materials, and package them (see vendor recommendation memo in appendix). This responsibility is a significant burden to an IM project and should not be offered if possible. A more logical IM end product for Continuing Education would be master versions on a convenient digital medium, leaving

packaging, mass production, and distribution to the client. After the *Lawmaker* experience, Continuing Education is at least in a position to recommend a vendor for such services.

In the future, legal staff for Continuing Education should carefully study any software licensing agreements that may be required to develop an IM product. Legal issues may dictate software development choices.

## STEP 12: LONG-TERM SUPPORT

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A software product will invariably have problems undetected during the testing steps that will be discovered by the users. The question then arises, What do you do about those problems? This is an issue of supporting your IM software after it has been distributed.

### **What is Practical**

If possible, as with distribution and packaging, Continuing Education should avoid offering long-term support of IM products. Instead of receiving problem reports from users and offering solutions to those problems, Continuing Education should offer to develop revisions of software upon request of the client, under a new contract that specifies the problems and desired revisions. The client would then have the responsibility of devising a problem-report mechanism for the users of the software.

### **The *Lawmaker* Experience**

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Again, because the client for the *Lawmaker* project was a legislative committee, a compromise plan for long-term support was offered by Continuing Education. It proposed to build a Web site to promote, inform, and provide a support area for *Lawmaker* if the legislature would provide the server for this Web site and would maintain the Web site. Fortunately, a graduate student was available to build the Web site. A complete long-term support plan was also provided to the legislature and is included in the appendix.

### **What was Learned**

Begin discussing the support issue early with the client. In all likelihood the client will not have considered long-term support, which was certainly the case in the *Lawmaker* project.

## RECOMMENDED READING

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The following books are recommended:

### **Multimedia Management**

Strauss, R. (1997) *Managing Multimedia Projects*. Focal Press.

England, E., and Finney, A. (1996) *Managing Multimedia*. Addison-Wesley.

Vaughan, T. (1996) *Multimedia: Making It Work*. Third Edition. Osborne McGraw-Hill.

### **Instructional Design**

Alessi, Stephen M. (1991) *Computer-based Instruction: Methods and Development*. Prentice-Hall.

Schwieb, Richard A., and Misanchuk, Earl R. (1993) *Interactive Multimedia Instruction*. Educational Technology Publications.

Boyle, Tom. (1997) *Design for Multimedia Learning*. Prentice Hall.

Dempsey, John V., and Sales, Gregory C., editors. (1993) *Interactive Instruction and Feedback*. Educational Technology Publications.

*In Your Face: The Best of Interactive Interface Design*. (1996). Introduction by Kai Krause. Rockport Publishers. Distributed by North Light Books.

### **Authorware**

Hooper, S. (1997) *Authorware: An Introduction to Multimedia for Use with Authorware 3 and Higher*. Prentice-Hall

Allen Interactions (1996) *Authorware Models for Instructional Design*. Second edition. Prentice-Hall.

## APPENDIX A: Lawmaker Requirement Specification

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### Purpose:

The purpose of this document is to specify content, functionality and features which must be included in the software design of the Legislative Process CD-ROM project multimedia application. Note, Content items (section 1.0) are listed in order of emphasis within the application, with the primary focus those content items listed under State Government. Therefore, many of the content items listed under the remaining Content headings will possibly be included only indirectly or implicitly in the final design.

### Important Terms:

The following terms will be used throughout this specification and are defined here for clarification relative to this context:

**show:** To use all dimensions of multimedia software to present content information in a highly interactive form. Multimedia dimensions include digital video, computer graphics, animation, text and sound.

**describe:** To use primarily text and graphics to present content information in a mostly sequential slide presentation form.

**access:** To make content information available either through hypertext links to World Wide Web sites or through hypertext links to simple CD-ROM text and/or graphics screens.

**provide:** To make available to the user through the application software interface, e.g., as a software menu item or interface button.

### 1.0 Content

#### Definition:

Content is the information or instructional material to be conveyed by the multimedia application.

#### 1.1 Required Content

The sections which follow correspond to content areas or topics prescribed by the application objective. For each section the required content will be specified as an itemized list and qualified as necessary.

##### 1.1.1 State Government

- 1) The application will show the legislative process from introduction to final action, including the functions of committees involved and the participation of lobbyists, interest groups and the media.
- 2) The application will describe issues and concerns specific to the state of Kansas and show the effect of the legislative process on those issues.
- 3) The application will show the legislative cycle, including the day-to-day responsibilities and activities of representatives during the session.

- 4) The application will describe the House and Senate, including functions of key leaders.
- 5) The application will describe the three branches of government and show their functions and interactions in the context of the legislative process.
- 6) The application will describe the legislative offices which provide essential support to the legislative process.
- 7) The application will show how federal, state, and local governments interact and share powers.
- 8) The application will show the election process, including campaign financing, qualifications, and the effect of political parties.
- 9) The application will show the work of representatives in their districts.
- 10) The application will show the physical environment within which the legislative process occurs.

#### **1.1.2 Civics**

- 1) The application will show the value and significance of voting to Kansans.
- 3) The application will show a model of civic responsibility and the range of civic opportunities available to Kansas citizens.
- 2) The application will show the ability of public servants to “make a difference.”
- 4) The application will provide access to information about community organizations and volunteer groups in Kansas.

#### **1.1.3 History**

- 1) The application will show the history of the Kansas constitution and its amendments.
- 2) The application will show Kansas events and persons of historic significance as they relate to historic Kansas documents and quotes.

#### **1.1.4 Geography**

- 1) The application will describe how Kansas districts are defined and the significance of districts in the legislative process.
- 2) The application will show a demographic map of Kansas districts which will include information about the unique characteristics of each district.

#### **1.1.5 Economics**

- 1) The application will show the State budget in the context of a limited resource, and will show how taxation, choices, and priorities affect the process of deciding a budget.
- 2) The application will show the impact of budget allocations at the local level.

### 1.1.6 Skill Sets

The application will require the user to exercise these skill sets:

- 1) *Critical thinking:*
  - a) Develop abilities for decision making
  - b) Analyze, organize and communicate (supported) information
  - c) Interpret and evaluate data from written and non-written sources, including images, policy documents, print media, timelines and surveys
  - d) Compare and contrast differing sets of ideas, values, personalities, behaviors, institutions, and cultures
  - e) Understand concepts of cause and effect
- 2) *Cooperative learning:*
  - a) Develop abilities for conflict resolution and problem solving
  - b) Identify and express beliefs and feelings
  - c) Develop listening skills
- 3) *Reading:*
  - a) Distinguish between important and less important information
  - b) Differentiate between primary and secondary sources
  - c) Identify point of view
- 4) *Writing:*
  - a) Demonstrate technical literacy and engage in technical writing
- 5) *Data Sources:*
  - a) Interpret physical and political maps, including tables, charts, and graphs

## 2.0 Functionality

### Definition:

The application functionality specified as a *requirement* pertains to certain general actions the software must provide to the user. Most application functions will be determined during the design process and specified in detail by the design specification document.

### 2.1 Required Functionality

The sections which follow correspond to certain functional areas which must be integrated into the CD-ROM application. For each section the required functions will be specified as an itemized list and qualified as necessary.

#### 2.1.1 Testing

- 1) The application will provide a reward system for acquiring knowledge.
- 2) The application will require the user *learn* certain information to advance along the central navigation path.
- 3) The application will provide a mechanism to allow the instructor to restrict the user to a specific set or level of assessments.

#### 2.1.2 Navigation

- 1) The application will provide simple forward and return controls on every display.
- 2) The application will provide access to *orientation* information on every display. Orientation refers to the current path of the user relative to the opening display and the location on that path, all in terms of the avenues available as the application is used.
- 3) The application will provide a means for the user to interrupt the actions of a display (when possible) and return to the previous display when the user desires.
- 4) The application will provide a means to store user history, i.e., what actions were taken during a particular session, to allow for instructor evaluation and to allow user return to point of progress.

#### 2.1.3 Configurability

- 1) The application will provide simple display controls which will allow the instructor to configure it for group or individual "play".
- 2) The application will provide a means to allow for internet access or access to relevant Web pages.

### **3.0 Features**

#### **Definition:**

Features are the design elements that must be incorporated into the CD-ROM application.

### **3.1 Required Features**

The sections which follow correspond to fundamental design aspects of the CD-ROM application. For each section the required features will be specified as an itemized list and qualified as necessary.

#### **3.1.1 Display Options**

- 1) The application will provide a readily accessible help "button" on all display screens where practical.
- 2) The application will provide hypertext links to a subject-relevant glossary.
- 3) The application will provide hypertext links to relevant World Wide Web information.

#### **3.1.2 Look and Feel**

*Look and feel* is a multimedia industry phrase which refers to the overall design style of the CD-ROM application. *Look* being established mainly by the particular graphics and sounds, and *feel* the overall presentation scheme, e.g., game, tutorial, etc.

- 1) The application will create simulated situations for the user which correspond to the realities of the target group.
- 2) The application will maintain a game-oriented design strategy.
- 3) The application will include music and sounds which appeal to the target group.
- 4) The application will feature real people where logic allows, including a diversity of ages, races, etc.
- 5) The application will attempt a graphics style which appeals to the target group.

## APPENDIX B: CD-ROM Application Design Description

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### INTRODUCTION

Many interactive software applications provide instruction through a linear process; the user essentially proceeds from lesson 1, to lesson 2, etc. in a sequential fashion. Often this process is facilitated by a simple FORWARD and BACK control mechanism.

Other applications provide instruction or present information through a “discovery” process. In these applications the user is allowed to branch nonlinearly into various “areas” to “discover” new information or learn new material. Hence the application is primarily exploratory.

This application attempts to use the directed learning aspect of the linear design approach in combination with the free-choice benefits of the discovery model to provide the user with a game-like experience. The intent is to direct the user to progress through a sequence of steps toward a particular goal and to motivate the user by offering a desirable reward to those who reach that goal. The design is not linear, however, in that the user will operate from a "home base" screen and will have to make choices regarding steps to take to reach the desired goal.

### APPLICATION DESIGN

#### Overview

The central objective of the application is to teach the legislative process used in the Kansas state government<sup>5</sup>. Our application will attempt to do so by requiring the user to:

- 1) **Select an issue** relevant to young people in Kansas, on which to base a bill.
- 2) **Craft a bill** based on this issue.
- 3) **Research the issue** to find data that supports the position of the bill.
- 4) **Attend public hearing** by a standing committee.
- 5) **Defend the bill** before a standing committee.
- 6) First and second house actions: **bill amendments** and compromise.
- 7) Celebrate passage and obtain **governor’s signature**.
- 8) Review **implications of the bill as law** after final passage.

The intent of the design is to motivate students to successfully complete steps 1-7 in order to experience the rewards of bill passage and the Governor's signature.

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<sup>5</sup>If possible, the application will also incorporate the content needed to address other learning objectives described in the attached Requirements Specification (included with September 30, 1998 meeting materials).

## Details

The sections which follow describe the application design in terms of the basic interactions the user will experience, from **Sign-In** to **Completion**.

### Sign-In

After an engaging intro/start-up screen animation, the first screen of interaction will require the user to "sign in."

First-time users (discerned by the application) will transition to a tutorial screen. Interaction with this screen will allow the user to: 1) learn the program goal, and 2) learn the mechanics of working with the application. Tutorials will emulate application "play," with several walk-throughs covering a range of details<sup>6</sup>. When a user is ready to leave the tutorial screen, he/she will click the *Control Bar* transition function now labeled "Begin Play."

First-time users will next be required to complete the sign-in interaction. Here, the application will request certain personal information (name, district, etc.) in order to personalize future interactions wherever practical. The sign-in name will also be used to allow a student previously signed in to start the application from the last step completed if play is interrupted.

### The Campaign Ad

Following sign-in, the user will be asked to design a campaign advertisement. In this section of the application the user will be required to:

- 1) **Choose** whether he/she wants to run for a **House or Senate seat**.
- 2) Define his/her personal history, for example, occupation, life experience.
- 3) **Define a platform** from a set of issues, with his/her primary issue indicated.

The user will interact with the application to compose a simple set of audio tracks and video clips into a campaign advertisement. This advertisement will also integrate the user's chosen "identity" information.

Additionally, the screen (or sequence of screens) will present general information about the following:

- 1) The difference in responsibilities of representatives and senators.
- 2) Qualifications required in Kansas to seek a legislative office.
- 3) Campaign finance data.

Please see the attached "Campaign Ad" storyboard for details.

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<sup>6</sup>Use instructions will also be included in the supplemental print materials that will accompany the CD-ROM.

## **Election Results**

Once the user has approved his/her campaign ad, the next screen (or sequence of screens) will be designed to present the user's election results. Animations will be employed to allow the user to experience a vote tally and election updates, and eventually the screen will show the user as winner of the indicated seat for the indicated district.

Please see the attached "Election Results" storyboard for details.

## **The Office**

Having experienced the Election Results, the user will now "Go To Topeka," where the user will be introduced to his/her *Office*. The *Office* screen is the central navigation point for further interactions with the application. From this screen the user will be able to invoke all interactions necessary to complete the steps in the legislative process outlined in the above Overview section. This screen will serve as a home base for all future interactions. Please see the attached "Office Orientation" storyboard for details.

When the user first encounters the *Office* screen, he/she is introduced to all *Office* features. These features provide the mechanisms to invoke all future interactions.

Next, to direct the user to begin pursuing the steps in the legislative process, an *Aide* places a newspaper on the office desk and the user is directed to "Read the Front Page."

A new screen is invoked, a full screen of a newspaper front page. The headline quotes the user's top campaign ad issue as a promise to constituents. After the user has read the screen text, the voice of the *Aide* informs the user that he/she must "Return to Office" to begin work on legislation necessary to fulfill the campaign promise. The user clicks Return to Office and returns to the home base.

Next, the *Aide* suggests that the user check his/her *Day Planner*, a calendar that will guide the user through the legislative process.

## **The Aide**

Throughout the application the *Aide* will serve as a guidance device. The *Aide* will provide the following functions:

- 1) Inform the user, through hints or explicit directions, how to proceed.
- 2) Offer helpful hints to the user in situations where the user must provide a response.
- 3) Provide constructive feedback in situations where the user must provide a response.
- 4) Serve as an information source for content related to a particular screen situation.

The *Aide* will be invoked in one of two ways:

- 1) Automatically. The *Aide* will automatically provide feedback as cited above.
- 2) User request. An *Aide* button will be located on the control bar to allow the user to summon the *Aide* for additional information or directions. If the *Aide*'s information for a particular interaction is essential, the *Aide* button will begin flashing after a certain time lapse and will automatically be invoked if the user does not attend to the flashing after a set amount of time. In this way the user will first be given a chance to click the *Aide* without notice, and then receive the *Aide* information even if the "warning" is not heeded.

The form of the *Aide* is under debate. Two suggestions are under consideration:

- 1) Voice only, where the delivery is crafted to fit the particular interaction and is personable and engaging.
- 2) A caricature (talking) of a legislative staff person, again with a look crafted for each interaction.

### **The Day Planner**

The primary device for directing the user from one step to the next will be the *Day Planner* on the desk in the *Office*. A single click invokes a full-screen display of an open daily planner. The page on the left is a single day, the page on the right, a to-do list.

As the user progresses through the application steps, the day page date will change to reflect a real legislative session schedule. Items on the to-do list page will be dragged to the day page as a means to have the user choose the next step. Mouse-over of to-do-list items will provide additional details where appropriate, for example, items that are steps in the legislative process.

### **Monitoring Progress**

A complement to the *Day Planner*, the **Progress Device**, will allow the user to: 1) see all the steps in the process, and 2) see what steps have been completed.

The graphical form this feature will assume is TBD. Functionality, though, *has* been determined: mouse-over of steps will provide identical information as shown in mouse-over of corresponding *Day Planner* to-do list items, and it is *not* to be readily accessible from the *Day Planner*. The intent is for a user to access this feature/device as a reference; therefore, the user should consider carefully which *Day Planner* to-do-list item to drag next onto the day page.

Current ideas for this feature are a bulletin/white board in the *Office* or a reference text in the *Legislative Research Room*.

In conjunction to this *Progress Device* the current step will also be displayed in a "status window," a display area present on every screen, possibly a top, full-width horizontal margin.

### **Crafting a Bill**

The first *Day Planner* to-do-list item in the legislative process will be **Craft/Write Your Bill**. This sequence in the application will simply require the user to fill in the blanks in a template written to reflect the issue the user has chosen. The intent is to expose the user to the language of an actual bill. Please see attached "Craft a Bill" storyboard for details.

## Bill Introduction and Referral

When the user Returns to Office, from the **Craft Your Bill** interaction, a representation of an actual bill will be shown on the open space of the *Office* desk. The user will be given a preset amount of time to interact with this object, for example, mouse-over changes cursor to finger and user clicks. If the user does not invoke the interaction after the preset time, then the *Aide* says, "I delivered your bill to the Clerk/Secretary, and it was assigned the number SB#. Click the bill on your desk to learn more. Check your House/Senate Real Audio link to hear your bill read."

The interaction with the bill causes a "zoom" to the bill. The narrator (or video clip of Clerk/Secretary) then describes the process of Introducing a Bill<sup>7</sup>, highlighting the new bill number. The *Control Bar* transition function then allows the user to Continue Play. Doing so will transition back to the default *Office* perspective.

Interaction with the desktop computer Real Audio link causes an audio clip to play. The script will contain the language used when a bill is read in the Kansas House/Senate and will incorporate the user's name as bill sponsor, the new bill number, and a bill title befitting the user's chosen issue.

After a brief time lapse, the *Day Planner* day page flips to a new day and then the *Aide* button begins to flash. When invoked, the *Aide* will inform the user that his/her bill has been referred by the speaker/president of the House/Senate to Standing Committee on X or Y for issue X or issue Y. An info box will appear and explain the nature of the standing committee.

## Researching a Bill

Once the user has **Crafted the Bill** and the bill has been **Introduced and Referred to Committee**, the user must prepare to defend/argue/support the bill to successfully move the bill through the remaining steps in the legislative process. This preparation will consist of gathering information that supports the user's position on the chosen issue. The user must access the following resource areas in order to gather supporting information for his/her bill:

### Legislative Research

Other States (interactive map)

Bill History (timeline, etc.)

Numerical Information/Charts and Graphs (desktop computer)

Note:

- 1) **Legislative Research** information will reside in an office that must be "visited"<sup>8</sup> by exiting the home base *Office* door.
- 2) Graphic design for the Legislative Research area should emphasize a "library" look.
- 3) Specifics of content for each category is TBD.
- 4) Data representation model is TBD.

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<sup>7</sup>See *Legislative Procedure in Kansas*, August 1994, pp. 32-35.

<sup>8</sup>Short video clip of actual Capitol hall journey to graphic of Capitol elevator with button choices.

## Public Opinion

Letters (computer email in *Office*)

Phone Calls (*Office* phone or answering machine)

Media (newspaper editorial on desk, streaming video on desktop computer)

Poll Data (report from *Aide*)

Note:

- 1) Need to verify appropriateness of the "Poll Data" category.
- 2) Graphic forms for each category and interactions with each are TBD.

## Lobbyists

Calendar Appointment (video clip of real person)

Phone Call (*Office* phone or answering machine)

Note:

- 1) Could integrate video clips into desktop computer screen for interaction.
- 2) May want to provide for Capitol rotunda interactions.

The user will be directed to these different resources by a variety of application features, including *Office* functions, the *Aide* and the *Day Planner*.

When the user accesses a particular resource, he/she will gather information that supports the user's position on the chosen issue. All information available to the user will be "labeled" with a concise statement. The challenge to the user will be to gather only those data items that relate to his/her issue, either pro or con. These collected data items will be used in future interactions that emulate steps in the legislative process.

A user will collect information by selecting an item from a resource area and placing that item in the user's *Briefcase*. When the item is "loaded" into the *Briefcase*, the item will be recorded under the column heading Pro or Con on a notepad within the *Briefcase*. This *Checklist* will be used in future interactions as the user proceeds through the steps of the legislative process. Internally the application will track the user's selections. This information will be used during future interactions.

## The Briefcase

The user's *Briefcase* will generally reside in the *Office* but may appear iconically in other screens. The *Briefcase* will serve as a storage and retrieval device for the user's supporting argument data. The user may examine and manipulate the contents of the *Briefcase* whenever it is present. When invoked for examination and/or manipulation, the *Briefcase* will likely be represented as a full-screen 3D graphic with locations for the different types of data items available to the user, including text, video, sound, and charts. This "high tech" briefcase may include built-in cell/video phone, fax, and email.

### **The Public Hearing (Standing Committee)**

The user's *Day Planner* will present the user with the opportunity to "Attend Public Hearing by Standing Committee." Here the user will be required to "exit" the *Office* to "visit" another Capitol building location to complete this step.

The final screen transition will show a typical State Capitol building committee room, with the point of view that of a person on the periphery of the committee members. From the central podium, a range of public representatives will provide testimony (good opportunity for video clips) relating to the user's issue. After the testimony completes, the user must decide to:

- 1) Load the testimony items into *Briefcase* as Pro
- 2) Load them into *Briefcase* as Con
- 3) Do not load them into *Briefcase*

During this interaction, the *Aide* will advise the user if the user is not arming his/her *Briefcase* sufficiently. Internally, the application will have a metric for a "sufficiently" loaded *Briefcase*.

Once all testimony is heard (played), the user will be directed to Return to Office.

### **Defending a Bill (Standing Committee)**

Now that the user has adequately loaded his/her *Briefcase* with information about his/her issue, the *Day Planner* will present him/her with the opportunity to "Defend Bill in Standing Committee." Again, the user will be required to "visit" another Capitol building location to complete this step.

For this interaction the screen backdrop will resemble a typical State Capitol building committee room. Unlike the **Public Hearing**, however, the point of view here is from the podium, and a number (4-6) of committee members will be shown sitting at the committee room tables.

The interaction will begin with an audio/video clip of a person representing a standing committee chairman. The clip will speak about the role of the chairman and will then call the meeting to order.

Next, proceeding around the tables, the committee members will be highlighted and a text bubble associated with the member will appear. The text bubble will contain a question the user must answer.

In order to answer the posed question, the user will drag the *Checklist* from the open *Briefcase* and the screen will transition to show the previously created *Checklist* Pro and Con columns. The posed question will be shown on this screen as well. The user will then review the *Checklist* for the best response or defense to the question. Review occurs by the user clicking a *Checklist* item and having the associated research information appear in the original form: video clip, text, audio track or graphic. As each research item appears, the user will have the option to "Use or Do Not Use," as a response to the posed argument.

Once a choice is made, the screen transitions to the original committee room screen, and the user is shown a thumb's up or thumb's down for the member who posed the argument. Thumb's down means the response was not a sufficient rebuttal.

The interaction continues in this manner with all members shown. During the interaction, a Consensus Bar will provide an indication of how well the user is answering the questions. Once the Consensus Bar reaches a certain level, the user will no longer have to answer questions.

The user will be allowed to cycle repeatedly through the members until the Consensus Bar reaches the appropriate level. Each time the user must return to a previously unconvinced member, the *Aide* will supply strong hints to help the user select the correct answer.

The rate of change in the "level" of the Consensus Bar will vary depending on how well a response answers a question, so for those students with perfect answers the process of "convincing" members will end more quickly. For all users, the Consensus Bar will exceed the threshold when the student achieves a certain percentage of thumbs' up.

Once the user reaches a "consensus," the interaction will finish with another clip of the committee chair recommending the bill to the appropriate chamber, with the particulars of the recommendation based on the user's performance. This will be one of the three kinds of recommendations used by the Kansas Legislature.

Having heard the recommendation the user will then be instructed to Return to Office, to continue to the next step.

### **First Chamber Amendments**

After the user's bill has been sent to the House/Senate, the user will see "Committee of the Whole Debate" as a *Day Planner* to-do-list item. Dragging this to-do-list item onto his/her current schedule will direct the user to "leave" the *Office* and visit the House/Senate chamber. The destination will be a screen with the actual Kansas House/Senate chamber as a backdrop.

Here, the intent of the interaction will be to show the user the process of considering and possibly accepting amendments to his/her bill introduced by house members.

On the House/Senate backdrop, the screen will display a relatively large text window. At the top of the window will be shown the user's bill as drafted earlier in the application. An audio track will then "introduce" three or more amendments. Each may be narrated in a different voice to reflect the diversity of Kansas Legislature members. As each amendment is read, the corresponding text (formatted according to Kansas Legislature rules) will appear in the text window below the original bill. Each amendment will be a variant of the same desired change.

Next, a voice vote will be announced for each listed amendment. After each call to vote, the user will be asked to vote yea or nay (clickable choices). This will be an informed choice, with the *Aide* or some feature of the *Briefcase* (visible as "open" in some part of the screen) flashing to alert the user to "hear" an opinion from a particular source (other-member email, lobbyist phone message, or special-interest-group fax) before voting. Internally, the application will save the user's votes to determine future application flow.

After the roll call voting has completed, the text window dissolves and an image appears in its place. This image is a scan of an actual bill (color-coded in Kansas) prepared for transmission to the second house. The text of the bill reflects the roll-call choices of the user. The voice of the speaker or president then announces that the bill (in the form shown) passed the first house. Info windows inform the user that the vote occurred the day after the roll calls and that the bill received a majority of votes in the first house. The user will then Return to Office.

### **Second Chamber Action**

First, between the beginning of this "lesson" and the last, a next day transition mechanism is employed (see *DA: Pursuit of Justice* time-lapse screens). The return point is the *Office* screen.

The next "lesson" or segment then begins with the *Aide* informing the user his/her bill was *messed*<sup>9</sup> to

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<sup>9</sup>The term "messed" is a process term and hence the Aide's informing the user should be accompanied by some form of info window for this term, e.g., a Senate/House Calendar showing the bill highlighted under **Messages from the Senate/House**.

the second House and that the bill has been assigned to Standing Committee X (X being appropriate for issue A). The *Aide* finishes with, "Let's hope we can convince them to pass the bill without amending it."

Once again the user must access the *Day Planner* to invoke the next interaction. The user will see "Present to House/Senate Standing Committee" as a *Day Planner* to-do-list item. Dragging this item onto the day page causes the screen to transition to a display consisting of a template and the *Briefcase*, set in a part of the *Office* where an actual member might draft a speech or presentation, for example, a close-up of the coffee table with a pad used as the graphic for the template. The user will then be instructed to drag information from the *Briefcase* into the template to create a presentation. The *Aide* will then begin a serious lecture regarding the value of a good presentation at this point in the process. He will ask the user to review the list of *Outcomes* labeled Desirable and Undesirable on the note page next to his/her presentation template<sup>10</sup>. Only after the user has performed a mouse-over of all outcomes will he/she be able to begin *filling in* the presentation template.

Once the user is satisfied with the presentation, he/she will then Load *Briefcase*, and then click the *Control Bar* transition function to Present to X Committee. If the template is grossly incomplete, the *Aide* will remind the user to be sure to include certain critical items in the presentation.

The screen will now transition to the previously used Committee Room backdrop where discussion voices are heard followed by a Chairman's voice announcing the bill will be recommended to the Senate/House as is. User can then Return to Office.

Back at the *Office*, the *Aide* congratulates the user on his/her presentation and then asks the user if he/she remembered to send that email to Senator/Representative Powers to remind them of the value of a yes vote on your bill. If the user clicks the desktop computer screen, an email message is shown, the text which urges Senator/Representative Powers to vote favorably. The user must click Send to remove the message from the screen.

Again, our time-lapse transition mechanism is invoked to show the appropriate time between the second house standing committee recommendation and the return to the second house chambers for final action.

The user is now back at the *Office*. The *Aide's* voice excitedly suggests the user log on to the Legislative Internet site to follow the progress of the bill in the second house. A click on the desktop computer (browser area), transitions to full screen simulation (not, emulation) of the actual Kansas Legislative Web site. The user then must click appropriate links to get to heading "Bill History". Here, the design takes some liberties to liven the following steps in the bill progress:

- 1) Debate by Committee of Whole to amend or not amend<sup>11</sup>. Finally, no amendment. *Aide* remarks on how fortunate it is for bill to not be amended.
- 2) A Real Audio Player (trademark issue?) becomes visible on the simulated Web page and the audio playing is the sound of the final vote being taken on the user's bill. Also, the screen shows a facsimile of the actual House/Senate voting board and an animation continuously increments the vote tally on this board. Finally, the animation stops and the count shows a majority in favor of passage. The Real Audio announces the outcome. The *Aide* is ecstatic and tells the user he/she has won! His/her bill is ready for the Governor's signature.

The user is then shown the *Control Bar* transition function "Celebrate Your Victory."

### **Governor's Signature**

Back at the *Office*, a celebration ensues, and the *Aide* excitedly suggests that the user check the day's

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<sup>10</sup>Outcomes are content items listed under Second House *actions*.

<sup>11</sup>Info window reiterates Undesirable Outcome possibility of amendment resulting in Conference committee, resulting in return to first house.

newspaper. Clicking the newspaper transitions to full screen of a newspaper front page with an article describing user's bill's victory. The headline "flashes" and the user is directed to click the headline. This causes a transition to a screen with the actual Kansas governor's office as backdrop. The point of view is over the shoulder, looking onto the desk. A video clip is then shown with the audio portion congratulating the user on his/her achievement, while the video shows a close-up of the governor's hand signing a real bill. The more personal, the more human this segment, the better.

### **Bill as Law Perspective**

The user has now completed the "game," having achieved the goal of successfully moving a piece of legislation through the Kansas Legislature. The final sequence or interaction for the user should: 1) present a review of the steps completed, and 2) inform the user of the impact a bill-as-law has on Kansas citizens.

After the user has experienced the bill signing segment, he/she will eventually return to the *Office*. The *Aide* will then begin speaking. The *Aide* will first congratulate the user on his/her achievement, mentioning how long the process actually took and clearly stating the result. Our *Progress Device* will then be employed as a visual reference as the *Aide* continues. The *Aide* will review with the user the steps that have been completed and summarize the result of each. As each step is reviewed, the *Progress Device* will react in concert.

Also, as the *Aide* speaks, interruptions will occur to which the user must respond. These interruptions may be in the form of email or phone calls received. Each such interruption will present testimony that informs the user of the impact of his/her bill on Kansas citizens.

### **User Control**

The application must provide the user with a set of functions for controlling movement through the application and for controlling generic screen interactions. Here, due to the nature of the design, a control mechanism is more logical than the typical FORWARD and BACK type navigation mechanism. The necessary functions for such a **Control Bar** are:

*exit* Quit the application. Do you want to *save*?

*start over* Back to the log-in screen

*save* Save all information necessary to return to this point in the application in the future

*instructions* Repeat screen instructions (Could individualize for each screen, for example, for Office screen the label would be Learn about Your Office)

*replay* Replay last screen action (audio track, video segment, animation)

*skip* Halt current screen action (inactive on first play)

**Transition Action (Go to Legislative Research, Go to Standing Committee, etc.)**  
Transition to next screen

## APPENDIX C: Lawmaker Budget Estimate

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<u>RESOURCE</u>	<u>COST (DOLLARS)</u>
Project Manager	\$ 33,600
Design Support	\$ 1,600
Misc Consultants	\$ 1,000
Programming Support	\$ 40,000
Graphic Arts Support	\$ 12,000
Video/Audio Production	\$ 20,000
Content Prep	\$ 2,000
Print Production	\$ 10,000
Packaging	\$ 5,000
<hr/>	
<b>Total Project Cost:</b>	<b>\$ 125,200</b>

## APPENDIX D: Evaluation Form

Kimsin a5r		Test date(s)	Problem Description	Steps to Reproduce	TK <sub>n</sub> ToDo	TK <sub>n</sub> Step	TK <sub>n</sub> Office	TK <sub>n</sub> Lib
Room	Step	Problem Description	Steps to Reproduce	TK <sub>n</sub> ToDo	TK <sub>n</sub> Step	TK <sub>n</sub> Office	TK <sub>n</sub> Lib	
Committee	Reviewing briefcase.	Item labeled, "NTSB States with Graduated License Laws for Youth 1998", listed in folders and pro/con list, but nothing shows in open folder when this item clicked.						
Committee	Reviewing briefcase.	In the Testimonial folder (and the pro/con list), there are two problems. The "Mother testimony" is listed twice (and is the same video when played for each item). The second problem is that the Grandfather testimony is not listed.						
Senate	User speaks to bill.	Rather long delay after clicking microphone and begin of audio.						
Senate	User votes with microphone.	First click of microphone, nothing happened. Click again, then Aye, Nay graphics display. Then click either, and continues. Seems it should be: a) at prompt to vote, two little dialogue (as in cartoon bubbles) bubbles appear left and right of microphone.						
Office	Final deliberations.	No problem. Still want to push the idea of letting user also go to House to engage deliberations audio. (House with people graphic)		6.5	16	21.5		1.5
Hallway	Going to Governor's signing.	Guide says, "here's our elevator". Well, whoops, I left something in my Office. Or wait, I need to go to Lib. OK, now back to Elevator. Hmm, doorman says nothing. Hmm, Governor's office is empty.						
Office	After returning from non-action Governor's Office.	Guide says, "You did it!" But I did not due to problems with previous step (see row 11)						
Office	After returning from non-action Governor's Office.	Did not get audio summary with Notes animation in planner						
Office	Click coast to end.	No credits. Probably due to previous problem.						
Library	Anytime	Still need to 'shuffle' CS and DL in data lists. Currently DL at top in group, and CS in bottom in group.						

## **APPENDIX E: Distribution Memo**

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**Date:** May 7, 1999  
**To:** Janet Jones, Legislative Process CD-ROM Special Committee  
**From:** Gary McCauley, Project Manager  
**Subject:** Kansas Lawmaker: A Proposal for Distribution

### **Purpose**

This memo presents a general plan for the distribution of the Kansas Lawmaker CD-ROM to Kansas Middle Schools and other State public education facilities. The purpose of this memo is to offer a recommendation for an organizational means for the delivery of this educational product. In so doing we hope to begin the discussion necessary to work through the details of a more specific distribution plan for our Fall 1999 completion date.

### **Distribution Proposal**

The Kansas Lawmaker CD-ROM is an interactive multimedia software application designed to teach Middle School students the Kansas legislative process. For this reason, we assume Kansas Middle Schools are the primary and majority recipient of this product and therefore propose the following regarding the issue of distribution:

#### **University of Kansas, Division of Cont Ed**

- 1) Responsible for mass production of print materials and compact discs
- 2) Responsible for packaging print materials and compact discs into a single product
- 3) Upon explicit request from KSDE, responsible for the delivery of N units of packaged products, N to be determined by KSDE and the Kansas State Legislature
- 4) Responsible for technical support related to use of Kansas Lawmaker
- 5) Responsible for supporting KSDE and the Kansas Legislature in promoting Kansas Lawmaker to the public

#### **Kansas State Board of Education**

- 1) Responsible for determination of required numbers of units of Kansas Lawmaker for public schools
- 2) Responsible for formally requesting a specific number of units from the production group of KU Div of Cont Ed, with sufficient lead-time (TBD)

- 3) Responsible for coordination and mailing of Kansas Lawmaker to Kansas public schools, other Kansas public education facilities, and upon request
- 4) Responsible for coordinating the promotion of Kansas Lawmaker to Kansas public schools

#### **Kansas State Legislature**

- 1) Responsible for supporting KSDE in deriving numbers of units of Kansas Lawmaker to request for distribution for those entities not in the domain of public schools
- 2) Responsible for supporting KSDE in funding staffing for KSDE distribution responsibilities
- 3) Responsible for providing input into the promotion of Kansas Lawmaker to entities not in the domain of public schools

## APPENDIX F: Vendor Recommend Memo

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**Date:** February 25, 2000  
**To:** Chairman Ralph Tanner, Ben Barrett  
**From:** Gary McCauley, Project Manager  
**Subject:** Mass Production Vendor Recommendation

### Search Results

In early September this year we were informed (see attached) of the Legislative CD-ROM Committee's recommendation for numbers of products to be created for mass distribution. Based on this recommendation, we have requested cost estimates from five vendors who specialize in CD replication and print material packaging. This memo summarizes the results of our vendor search, with the details included as attachments.

We would like to note that we were surprised by the difficulty in finding a suitable vendor for this job. The difficulty seemed to arise from our particular requirements: CD-ROM replication *and* spiral bound print material. What we found is that companies comfortable with creating both components as a turnkey job, typically are not that interested in orders of fewer than 10,000. Our search results are then as summarized in the table below.

Vendor Name	Location	Total Estimate	Comments
Field Force	Kansas	\$20,000.00	Prompt, familiar, and complete.
Corporate Disk	Illinois	\$20,000.00	Prompt, familiar, and complete.
Starbyte	Pennsylvania		Slow to respond. Could not get estimates for print materials in time.
TransMedia Tech	Kansas		Disorganized. Slow to respond.
Quebeccor	Minnesota		Only take orders for 10,000 or more.

**Table 1.0 Vendor Search Results**

### Recommendation

Our recommendation is based on the following factors:

- 1) Our sense of the vendor's familiarity with this type of job
- 2) The vendor's professionalism and responsiveness

3) Total cost estimate

4) Location relative to distribution area (Kansas)

On the basis of the above criteria, **we recommend Field Force** of Lenexa, Kansas for the mass production of the CD-ROM project products.

## APPENDIX G: Long Term Support Memo

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Date: December 13, 1999

To: Chairman Ralph Tanner, Janet Jones, Ben Barrett

From: Gary McCauley, Project Manager

Subject: Long Term Support of *Kansas Lawmaker*

This memo provides an outline for an approach to providing long term software support to users of the *Lawmaker* CD-ROM. The memo also provides an estimate of the costs to provide such support.

### Long Term Support Plan

Users of the *Lawmaker* CD-ROM will inevitably encounter technical problems as they exercise the software in ways that practically cannot be anticipated. For this reason, we suggest an avenue be provided by which users can report these problems and be given some assurance the problems will be addressed.

The outline for our suggested support plan is as follows:

- a) We will include the address of the *Lawmaker* web site on the CD-ROM jacket, under the heading: For Software Support Information.
- b) Within a Support area of the web site, a mechanism to allow users to report problems will be provided. This could be as simple as providing an email address and instructions for describing the problem, or instead, providing a mechanism to post the problem directly to the site.
- c) Periodically, such "bug" reports will be reviewed and problems prioritized in terms of severity relative to software usability. This prioritized list of problems will then be given to a qualified software developer with instructions to estimate the cost to "fix" just the most severe and the cost to fix all. A decision will then be made based on the available budget to have the contractor fix all or just the most severe.

In terms of support from legislative staff, this plan will require:

- a) A person to "maintain" the *Lawmaker* web site as per the November 9th Committee decision. Academic Outreach will provide the initial Web pages for this site.
- b) A person to collect and prioritize reported problems (AOP will be available for consultation to help prioritize).

- c) A person to establish a contract with a qualified vendor (AOP will help identify) to provide the technical expertise necessary to fix the list of problems. This person will need to be aware of the constraints of the available support budget.

### **Long Term Support Costs**

The cost for long term support will depend primarily on two parameters: 1) the duration which defines "long term", and 2) the frequency of problem fixing during the long term time period.

Relative to these two parameters we recommend the following:

- a) The "long term" duration should be determined by the amount of time that is sufficient for public schools to use the Lawmaker software in the classroom as part of the social studies curriculum. Realistically, few schools will have an opportunity to make it a part of the Spring 2000 school semester. Therefore, a complete school year of opportunity will not have passed until May 2001. Our recommendation is then to provide support until May 2001.
- b) Frequency of problem fixing is a tricky question. Ideally, someone should be reviewing reported problems at least once per month. And instead of recommending a regular period for contracting technical support, we recommend someone review reports once per month and then consult with AOP to decide the urgency of addressing reported problems.

Because we cannot realistically anticipate the frequency at which problems will require attention via contracted services, a cost estimate for long term support is difficult to provide. However, as a rule of thumb for this type of project, the cost for software support after distribution can range between 10% and 15% of the total project budget. To date, including costs for 7,000 copies, the total budget for this project is in the neighborhood of \$160k. Therefore, our best estimate of cost for long term support is \$16,000 to \$24,000.

This support-cost amount is likely hard to comprehend. Of course, it could be less than \$16,000, much less if few severe problems are encountered. In any case, let me try to explain by way of example, why the support described in this memo could require such expense.

Typically, a multimedia software developer, after delivery of the first revision of an application, will charge \$75/hr to \$100/hr to address problems not discovered or identified by their client before initial distribution. Let's assume each prioritized list of problems requires 3 to 4, 8 hour days, of the contractors time to understand and then fix the reported problems. This equates to \$1800 to \$3200 each time the contractor is asked to fix a list of reported problems, or on average, \$2500 each time. If the contractor is asked to provide such service, say every 3 months, over an 18 month period, this would be a total of \$15,000.

## **APPENDIX H: *Lawmaker* Storyboards**

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The *Lawmaker* storyboards must be downloaded separately from *The Interactive Multimedia Project* download site under “View or download Appendix H”.