Template for a flexible future

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This paper describes the development of a template that has been used to create interactive electronic demonstrations and experiments for teaching the basic foundations of Psychology to undergraduate students. The template was developed with Authorware and various other multimedia tools and its purpose is to provide an effective and efficient basis for the development and design of electronic teaching material and to build multiple systems (modules) from this one foundation. The template is made up of three element types: (1) structure -- the way content is sectioned and navigated through, (2) function -- a common set of interactions the user accesses, and (3) visual layout -- the way the pages look, including background, buttons, and title. Prototypes have been tested and modified following feedback. It is hoped that by 1999 a wizard can be designed to allow academic staff to create their own modules in a manner similar to the way PowerPoint presentations are developed.

Introduction

If we think of multimedia as the combination of many input channels to a human receiver, we can see that it has been with us for a long time.

In cultures lacking written language, centuries of valuable knowledge were, and sometimes still are, passed on through generations by means of vivid stories and information-carrying rituals. We might call this "natural interactive multimedia" because auditory and visual messages are conveyed through more than one channel of input along with audience participation or interaction.

If the use of multimedia is not new, the ease with which its advantages can now be exploited is.

Audio-visual presentation in the form of printed text, graphics, radio, film, television, and audio/video tapes have progressively improved the quality and quantity of information available to us all. For some time now we have been able to record material, edit it, and study sections at leisure. The opportunity to *control* what is recorded is important but this falls short of *interaction* with that material.

Recently, multimedia presentations have become available in the form of compact disks with read only memory, (CDROMs), giving us control over what contents we wish to access and a choice about whether we wish to interact now, later, or not at all. Macromedia *Authorware* and *Director* are among the powerful tools now available that make the production of such material relatively easy.

Such media can also be linked to a colossal network of information on the World Wide Web (Web) from which , potentially at least, almost *any* information is available. In addition, software such as *Shockwave* has made it possible to place interactive material directly on the Internet (i.e., the Web).

Educational applications

Though the quality and quantity of information available has improved because of new technology, our understanding of how best to use it remains a matter for debate. For those of us eager to exploit what there is for educational purposes, there is much to do in designing and evaluating modern multimedia products.

According to Jones and Jo (1998), there is little doubt that interactive multimedia can help to improve teaching and learning performance in the university system which, they observe, remains steeped in tradition. They suggest that the use of interactive multimedia can offer students a non-linear approach to course material and the freedom to work at their own pace. In addition, when offered via the Internet, teachers and students can interact on-line with, for example, a class homepage.

We agree with these ideas and see particular advantages for distance students whose programs have tended to rely more heavily on written text than is the case for their on-campus counterparts. Multimedia products, the use of which already blurs the distinction between on-campus and distance delivery, may soon make the distinction redundant.

However, at some universities, including our own, there has been strong resistance to seeing on campus students being "lost" as a consequence of becoming reclassified as receiving distance, mixed mode, or flexible delivery. Of course they are not being lost (nor the funding associated with them) but alarmists might be forgiven because important authorities have not been quick enough to recognize the impact that multimedia products can and have had on traditionally defined delivery modes. To date, for example, the on-campus vs distance dichotomy is largely intact.

The current plans for multimedia developments

In the Department of Psychology of Monash University, we are designing CDROMs and Web-based material for students studying by widely differing modes. Some are on-campus at one of five geographical locations where, depending on the campus, they may attend traditional lectures and laboratory classes. Other on-campus students study by "mixed mode" with laboratory classes only and video tapes of lectures and/or CDROMs designed to replace lectures.

Other students study by distance within Australia and attend on-campus weekend or residential schools once or twice a semester for laboratory classes and for access to CDs, and yet another group of students study offshore and receive varying exposure to material depending on their country of residence. As Monash University continues to expand internationally, the need to accommodate "flexible delivery" and abandon the on-campus vs distance dichotomy will intensify.

With such variable programs, our multimedia products need to be flexible in a number of ways. We believe they should be interactive in the sense that they can be used on, or linked with, the Internet but also interactive in a way that allows students to freely navigate, select, and respond to various parts of the material on the CDROM itself. In addition, we need to make our CDROMs flexible in basic format rather than "one off" and therefore hard to change in the future.

The importance of flexibility

We are trying to maintain flexibility with respect to *delivery* and *design*, of the multimedia material we produce because of the rapid rate of developments in both of these areas. Flexibility promises the chance to change content and structure in the future with minimal cost and effort. We also want changes to be incremental, one-at-time as far as possible, in order to see what effects these changes have more easily than would be the case if a bundle of changes are all implemented simultaneously.

Flexible delivery

We have worked on producing several CDROMs with two educational delivery models based on traditional lectures and laboratories. We have done this because one aim in producing CDROMs was to replace such classes with multimedia material while maintaining parity across modes of delivery. However the delivery models evident in the CDROMs are not as restricted as the traditional lectures and laboratories they were designed to replace.

Lecture / demonstrations

These consist of the kind of material to be found in lectures where the goal is to present information, with examples to assist understanding and memory. Though a traditional lecture may consist of nothing but the lecturer talking , a student may also see some overheads, some text or diagrams on a blackboard or whiteboard, and perhaps a section of video. Our lecture/demonstration CDROMs have the same goal but are designed to replace lectures with text, cartoons, graphics, video/audio sections, and self tests. We hope that our lecture/demonstrations offer something more than is to be found in most traditional classes.

Virtual laboratories

Traditionally, laboratory classes are overseen by a tutor and the aim is to give students practical experience in such activities as identifying a research question, hypothesizing an answer, conducting an experiment or study on line, gathering data, and analyzing these data in order to arrive at some conclusion about the research question. The analysis may be done by built in statistical software or by temporary access to packages (such as SPSS or Statistica) stored externally.

There is considerable overlap between lecture/demonstrations and virtual laboratory exercises but generally the latter have a more narrow focus and involve more interaction than the more broad ranging and passive learning experience in lecture/demonstrations.

Multimedia-based techniques are, in principle, sufficiently flexible to shift this way or that according to changing need. However, such flexibility has to be arranged for at the outset.

Flexible design: the template

The core of our design is a *template* which represents an attempt to make as much use as possible of re-usable code and media so that time and money is saved in future productions or modifications. Each CDROM is based on the same template though this is evolving all the time and previously produced CDROMs are updated as improvements in the template are introduced.

The template is essentially a set of selected commands, programmable units, or modules that we have judged to be common to all of the multimedia products we shall need in the near future. For example, in Psychology, there is often a need to present auditory or visual stimuli to an observer who is asked to respond either verbally or manually to those stimuli (e.g., by saying something or pressing a key). Response accuracy and latency are frequently used measures and certain statistical tests are commonly used to analyze data gathered from several participants.

These often-used ways of presenting stimuli and collecting responses can be thought of as *modules* within a multimedia product. Such modules can be made available to an academic content *compiler* who has not had training in basic programming or with authoring tools. Such a content compiler can, however, answer questions about the nature and duration of the stimulus they want presented on the computer screen, what response they want measured, and how they want responses recorded. The compiler can, if we reach our goal, "plug in" their own text, graphics, video clips, and stimulus - response parameters.

Lying behind one system might be an *Authorware* program and behind another, a different program. Where several different systems are required, basing all systems around one template provides a sense of consistency and familiarity for the student using the finished CDROM and the academic compiling the modules.

The modules will have default settings chosen on the basis of experience about what is most likely to be required. However the template must be flexible enough to accommodate changes in the range of settings available beyond those invoked by default mechanisms. One challenge is therefore choosing the appropriate balance between defaults, range of choices within a fixed menu, and perhaps custom-design options.

One danger of a template design is making it easy to produce a limited range of multimedia components, but hard to expand or explore beyond the limits of the template. Thus, the template itself must be flexible as well as the modules within it but not so flexible that the compiler's task becomes one of programming rather than the more simple task of compiling.

However difficult we may find this, we believe that multimedia products that are self-contained, developed in about six months, and with a shelf life of a year or two, will prove uneconomic and unsuitable for our needs.

The benefits of a template design, in contrast, include consistency (familiarity) for users and designers, rapid adjustment of content and design in response to changing needs (and consequent cost savings), and a low level of skill required for a compiler to build their own educational multimedia products.

We are continually assessing a number of prototypes and are gradually moving towards the structural characteristics the final template should have.

Template structure

The structure of a multimedia system is the path the user must follow to view the content. There are three major structures and a combination of these is often used. These structures are:

(1) Linear : (a book-like presentation with information on each turn of a page)

(2) Hierarchical : (a system consisting of an array of menus from which to select)

(3) Branched hierarchical : (similar to a menu system but allowing linking from one page to any other page subsequent to choosing from a menu).

An ideal template will allow the ability to use any of these structures but a combination is difficult to design.

In each of our prototypes a branched hierarchical structure is either used or accessible if the need arises. The content of each prototype has been divided into four major sections. Each section and subsection can be easily renamed but the number of sections has been restricted to four to assist memory and navigation. For example, virtual laboratories have major sections labeled *Introduction, Task, Results, and Summary*.

The sub sections are usually arranged into a sequence of pages accessible via a hypertext contents page and are accessible only following access to the major section.

Functions

The functions within a template design are divided into 3 categories which are:

(1) Navigation: allowing the user to find their way through the content

(2) Utilities: functions the system uses to perform tasks such as file management

(3) Interactions: allowing the user to interact with the content such as a multiple choice question function, or clicking to rotate an object.

The functions require substantial planning and we may not have the final set of functions by the time the template design is complete. However, it is easy to get carried away and include too many functions because they are impressive (whiz bang) rather than because they really serve a purpose.

Each prototype CDROM was used to test varying functions. The basic functions chosen for navigation were "next page", "previous page", "exit" and section selection buttons.

The content presentation functions (part of the Utilities category) includes a system for retrieving media from one digital video file. Because each prototype explores a new virtual laboratory experiment or lecture/demonstration topic, the functions vary somewhat. However each virtual laboratory has in common a loop to present stimuli and request a response that can be judged for accuracy or timed for a latency measure. Also, for all virtual laboratories, results of the experiment or task are recorded and displayed in graphs or tables. Methods of analysis differ however, depending upon the complexity of the data and the research question.

Visual layout

The visual layout of the template is the last design feature to be decided because it depends upon knowing what visible functions and structures there are, and which need to be displayed. We used a number of visual designs in successive prototypes, however, we ended up approximating one which can be seen in an increasing number of multimedia products. As shown in Figure 1, it consists of:

(1) A navigation region: buttons for moving or selecting

(2) A background: a coloured area with the Monash Logo shown

(3) Titles: varying depending on material

(4) Content region: varying depending on material


Image1.gif

The final form of background evolved over successive prototypes as the optimal location of content, titles and navigation buttons became clearer. The background used is a classic design that is intended to be neither intrusive nor invisible.

Some other regions may be required depending upon the type of content to be presented but in general we tried to maintain an uncluttered visual impression and to avoid "dead" regions so that optimal use could be made of limited space.

All prototypes were designed using the strict screen resolution of 640 x 480 pixels. As this is the default resolution on most systems, it is not expected that students know how to change the visual setting to anything greater than that. Another reason for using a minimal resolution is that this restricts the amount of information (clutter) presented in any one page.

The content regions are set so that a limited amount of text can be presented at any one time. This space is on the left of the screen and allows for about 150 words which we plan to test as "about right" with respect to criteria such as being dauntingly long (as a textbook page with no pictures can be) or too short to convey essential concepts. To the right is an area of 320 x 240 pixels in which visual media (e.g., cartoons, graphics, animations and videos) can be displayed. The visual media display area is also an interactive zone (See Figure 2).


Template.gif

Current progress and evaluation

So far we have completed four CDROMs. One lecture/demonstration on the human brain, and three virtual laboratories on (1) auditory thresholds, (2) laterality of brain function, and (3) face recognition. A lecture/demonstration CDROM on visual illusions and a virtual laboratory on the Stroop effect are on the way, and we hope to produce 12 CDROMs under this template by the end of 1998.

The first prototypes were tested on a small group of fifteen students who completed an evaluation questionnaire. We were unable to evaluate the effectiveness of these CDROMs from a teaching learning standpoint because at the time we had no control group for comparison. However, these students judged the material to be presented in an interesting way and found navigation to be easy. We noted criticisms to do with some machines not being able to run the software.

Later prototypes were assessed by 1200 students studying in a variety of modes. Results indicated that performance did not differ in a way that could be attributed to our CDROMs or mode of delivery. This is neither good nor bad news but at least we have no evidence to suggest that multimedia is associated with lower marks.

One group of offshore students who received all available CDROMs and other multimedia material performed better than their onshore peers though this could be explained by a variety of potentially confounding variables.

We are currently designing ways of more accurately assessing the pros and cons of the use of multimedia material.

Future developments

Due to the complex programming behind each module, it is not easy for the average academic to program an entire module, however one possibility is to build a wizard module building kit.

Currently the template is an Authorware file that is the starting point for developing a new module. To expand on this idea we could create an Authorware file that need no further editing. Instead, we store all content (images, video, audio, text) externally in a folder on a CRDOM and along with the external media, an initialization text file that contains information for the Authorware template file. The information would be created by running a wizard program which asks the compiler (developer) a number of questions and provides a number of options. Upon running the template, the information file is read and the template becomes a new module.

References

Jones, V., & Jo, J.H. (1998). Interactive multimedia based on Learning theories to enhance tertiary education. *Proceedings of the 2nd International Conference on Computational Intelligence and Multimedia Applications, Monash University*. 432-437.