

## **Designing interactive videodisc learning materials**

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This paper chronicles a design project which developed interactive videodisc learning materials. Examples are taken from a project which was funded to examine the particular problems of designing for this medium. Some suggestions are made for design consideration in using this technology in education and training.

As with most systematic approaches the instructional design process for videodisc often starts from an identification of needs and objectives for the materials. By way of contrast, the project described here focused upon the attributes of the unique combination of media available with computer controlled videodisc (the so-called 'level III' mode of using the disc, See Lippa, 1984) rather than a specific instructional context. It was thus possible to develop materials which used the attributes of the computer and the video both separately and in combination as interactive video.

The starting point was the learner, and the exploration of the potential and possibilities of allowing the learner to manipulate the instructional presentation whilst maintaining a coherency in the instructional presentation whilst maintaining a coherency in the instruction that would facilitate learning. This broad goal was translated into a series of programs of subprojects developed around a general theme or umbrella idea of instructional resources and instructional resource management. The subprojects included three main areas: firstly generic software development which focused on the design and production of computer software for programming and accessing information on the videodisc, secondly visualisation skill development (this area was chosen because of retrieval problems with the use of visual data bases such as slide collections in resource centres) and thirdly interactive managerial skills development. This third area concentrated on the management of resource centres and the requirement of human relations skills such as interviewing consultation and employee counselling. The use of subprojects also enabled production in smaller 'chunks' prior to the compilation of the materials for disc pressing.

## Generic software development

Two computer programs were designed prior to the development of the disc materials. One was a simple authoring system, enabling the other subprojects to control the type of interaction available to the student. The second was a visual data base retrieval program that would enable the organisation and retrieval of still and motion images from the videodisc, when an instructor was developing interactive lessons.

To minimise hardware costs it was thought desirable to use commercially available controlling boards, commonly available microcomputers and a simple software development language as this would make the final system as widely accessible to novice instructors as possible. The selection of these tools had therefore to satisfy the criteria of cheapness, simplicity, familiarity and robustness. The final combination included a Pioneer Videodisc Player 7820-DVA3, an Apple IIE microcomputer and an ALLEN VMI Communication Card. The driving language available to the user was SuperPILOT. Although the authoring system written to help the initial development of programs accessing the information on the videodisc was actually written in PASCAL, it worked on students' inputs to write a file of SuperPILOT code. This file was then available for editing using the normal SuperPILOT editor. The whole process saved initial development time for the production of external computer programs controlling the videodisc and yet did not create a system which was so unique that novice users would be required to learn a complete authoring system prior to developing materials.

## Instructional design framework

The basic structure of our interactive videodisc authoring system was the 'question episode' (Dennis, 1979). According to Dennis the interaction of students with the CAL materials should include the following elements:

1. An interrogative expression (a question), perhaps accompanied by other statements.
2. An opportunity and a requirement for student input of information.
3. A means of computer interpretation of the student input.
4. A set of computer offered consequences, remarks or replies specific to the student input.
5. A decision algorithm to establish the duration of the episode.

The novice instructor had to designate the number of episodes or sequences in the lesson and once that number had been defined, the authoring system would allow the specification of each episode in turn (Luha and Hedberg, 1984). Within each episode there was a choice of three main modes: Text presentation, Videodisc display and Question, each mode containing a range of prompts. The first of these choices, Text, enabled the presentation of screens of text for description, or screens of graphics written on floppy disc and generated by the computer. In general, if more than one screen was required to introduce a concept then this choice could be used as many times as necessary. The second choice

was videodisc display, allowing still or motion sequences to be presented. This option could be chosen as many times as necessary to develop the concept. Of course Text and Videodisc display could be selected alternately to further amplify the visuals or text. Finally the instructor would choose 'Question'. Not until this final choice would the episode come to a close. After the instructor chose 'Question' a series of specific questions would be asked. Upon completion of all prompts the instructor constructing the program would be taken into the next episode to be at once again presented with the same three choices. The range of question-episode prompts available to the instructor included:

1. The number of allowed attempts at the question (which restricts the duration of the episode).
2. The correct answer to the question (including possible variants presented according to the SuperPILOT matching command). After designating a correct answer, the instructor was then able to include a visual (ie from videodisc) or text feedback and then jump to a specified episode.
3. A nearly correct or common incorrect answer with the same further options as the correct answer.
4. The last attempt provided the correct answer to the student and also specified a branch.

Within the context of these decisions the instructor had a wide range of options, yet the simple lesson needed only a few of these questions to be answered the default response handled most of the routine responses. Once the question-episodes have been established, the instructor could perform alterations using the normal SuperPILOT editor. Graphic and sound files could also be added by including a few simple commands.

### **Visualisation skill development**

The specific learning tasks designed for presentation on the videodisc were organised into a series of productions. The first focused upon the preparation of raw materials which would provide an editing/directing problem for students developing their skills in video production. A role play simulation formed the content information. Each person in the two person conversation delivered a series of set lines using three distinct categories of delivery: a positive delivery, a neutral delivery and a negative delivery. Three shots (from different angles) that would accentuate the positive, neutral and negative images of the person were photographed as each set of lines were delivered. In effect 90 shots were produced. This allowed a choice of 10 shots to actually form the sequence. The levels of possible paths are shown in Figure 1 by the dotted line.

This subproject was designed to enable the student to piece together a sequence of shots and each sequence could be quite unique. By choosing different dialogue lines and different shot types, it was possible to create interesting visual sequences that ran for approximately two minutes and focused upon sequences that would not normally have been considered under the standard rules of editing.

A second visualisation subproject was the development of a visual data base of satellite and synoptic charts of weather. Each weekday for a period of 18 months satellite images of the western half of the Australian continent were recorded on slides. These, together with synoptic charts provided by the weather bureau, were recorded onto 16 mm film, each as a single frame. This produced a small data base with approximately 720 pictures. It also produced two representations of each day's weather - a synoptic chart and a satellite picture. These different representations were used in the production of a geography program about weather forecasting, which was designed on a tutorial structure and tested with first year undergraduate geography majors.

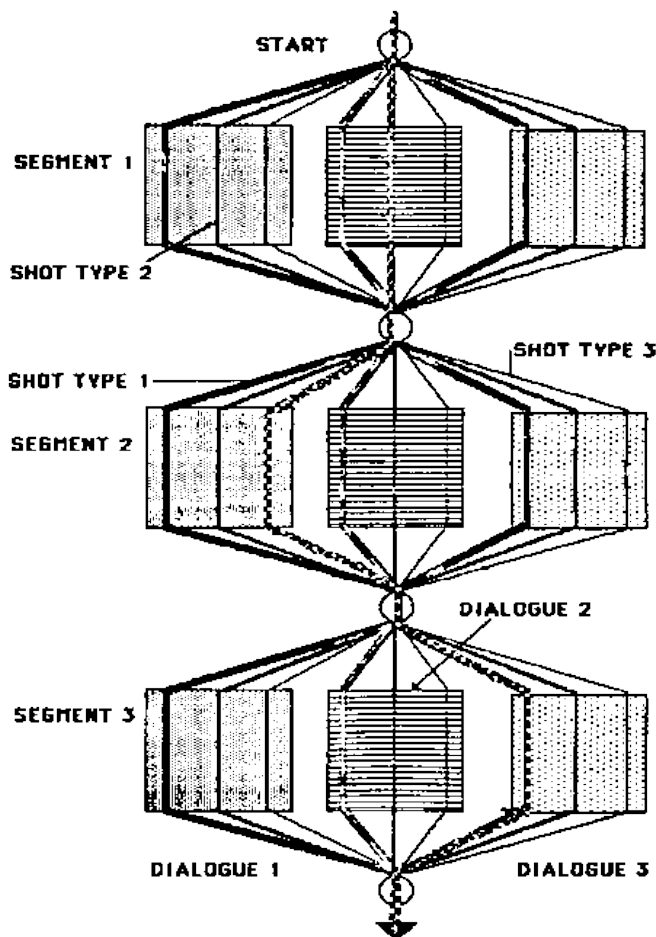


Figure 1: Ad-Direct three levels of dialogue with three shot types

The third visualisation subproject involved the translation or visual images from two dimensions to three dimensions and the reverse. One of the major tasks facing an instructional resource manager is the planning and organisation of work space to enable efficient use of staff and

equipment. An exercise was developed using the capability of the videodisc to show a sequential series of stills (all photographed at eye level and at a standard two metre intervals) to enable the resource centre planner to 'walk through' a space and 'see' what it looks like in photographs in addition to seeing the two dimensional representation on a floor plan (Figure 2).

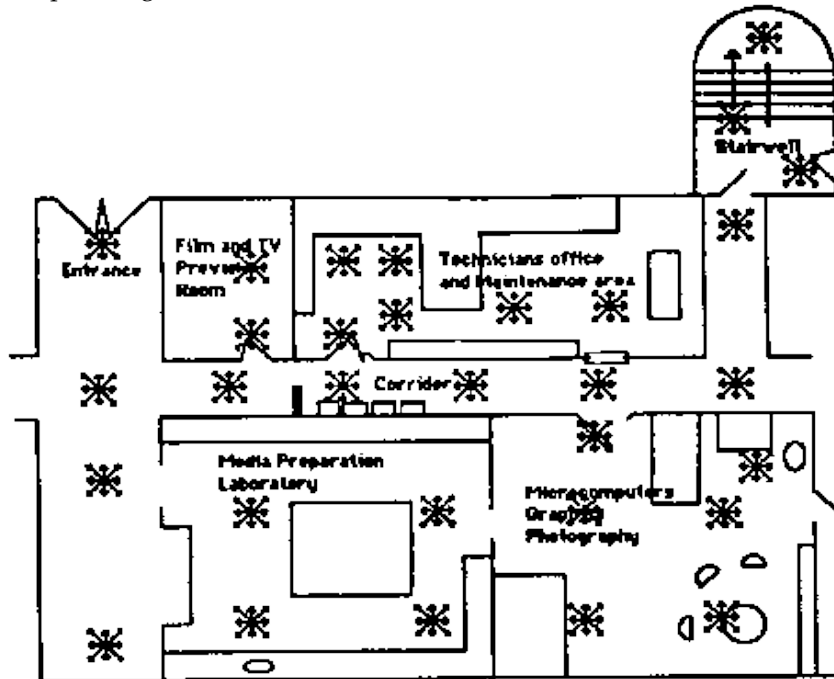


Figure 2: Plan of Media Centre

With this task it is possible to switch backwards and forwards between the two representations and design a work space that has more likelihood of succeeding as a useful work space. This project is still in development and the results are yet to be fully explored.

### **Interactive managerial skills development**

Another major focus of the overall project was the preparation of videodisc materials which would develop the consulting and interviewing skills of students. The development of consulting skills was achieved by simulating a committee meeting in which the student is the fifth member. By responding to the discussion and questions asked by the committee, it is possible to track the path of decisions made by the student as he or she established rapport with the committee. The flow of this program is quite complex and it is made even more difficult by the need not to repeat sections of the program. A series of nine possible end points are provided and the achievement of each is largely dependent upon the consulting style adopted by the student: provider, prescriber, collaborator, mediator (Hedberg, 1980). As the style moves to a more shared experience, ie

collaborator or mediator, the student is asked to become a part of the committee. If the student tends to adopt a more provider or prescriber approach, then the end achieved is non-committal on the part of the committee resulting in a 'don't call us, we'll call you' type of response. The program begins with the dramatised segment introducing the members of the committee to the student. At the end of each segment the student is presented with a series of choices (including the option of making no response). This pattern is repeated until the student chooses an option which leads to an end.

A second social skills subproject used the random branching capability of the videodisc to present an interactive dialogue which simulated the interviewing process. Here the strength of the SuperPILOT language was important in that it enabled the complex matches for the most often used cliché questions of the interviewer. On the videodisc, a series of approximately 13 responses were recorded for each of four interviewees, including two responses to reply to those questions for which no match was possible. A student has to choose which of the four candidates he or she would interview and then ask the questions by typing them into the computer. The response was always a visual and verbal comment by the interviewee thus incorporating non-verbal communication cues such as body language into the interview. The exercise is further complicated by providing students with the written applications of each of the four candidates prior to a decision being made about who should be interviewed. By restricting the number of candidates who can be interviewed and the number of questions that can be asked of each, the student has to determine the best questions for making the selection decision within a fixed duration.

### **Learning task requirements**

All of the preceding examples were derived from a consideration of a series of questions that emerged as the project developed. As one idea was developed it was matched against such criteria as the degree of interactivity involved and the need for manipulation of the visual image. Members of the project development team started to elucidate the design assumptions more formally as a checklist. These learning task concerns might be applied by the instructional designer in determining the suitability of a project for this medium. Briefly summarised they are:

1. Does the task require interactivity?
2. Does the topic really require good visual displays (i. e. better than computer graphics)?
3. Is a complicated branching structure required by the design?
4. Are there requirements for reducing or manipulating some spatial transformations?
5. Is a mix of static and dynamic display required?
6. Is learner control of learning sequence required?
7. Do the objectives require high conceptual level processing?
8. Are there requirements for learners to investigate the temporal sequence of the task?

9. Is learner attitude change required from dynamic interaction with realistic displays?  
(Hedberg, Perry and McNamara, 1984).

The initial concern was with the attributes of each medium separately. Elements such as interactivity, complicated branching and to a lesser extent, learner control over sequencing are commonly accepted as part of any computer assisted instructional program. However, the addition of dynamic and static visual display enabled the students to 'see' events that were not previously possible as part of CAI lessons. The synoptic charts were animated by playing a series of consecutive still frames at a slow speed. This enabled understanding of tropical cyclones in a form not possible with the printed diagrams. The spatial manipulation available to allow students to 'walk' through a resource centre required a high degree of learner control on a program and flexible access to visual images. The temporal processing manipulations available with the multiple levels of shots and dialogue between the two persons in the resource centre allowed the manipulation of meaning and feeling in visual sequences. The interactive realistic displays allowed not only decision making but some feeling about the non-verbal cues that are associated with interpersonal dynamics and attitudes.

## Conclusions

Our strategies can simply be summarised as a set of design heuristics which formed the basis of the videodisc development.

1. *Interactivity of computer and visual tasks.* The task should include a high degree of learner participation preferably driven by what the learner wants to learn rather than by what the instructor wishes to teach. Tasks which rely upon visualisation or realistic cues are obviously highly suited to this medium.
2. *Degree of learner control over sequencing and content.* If the task structure is such that a number of learning paths are possible to one or many possible ends, then this particular medium can be used effectively in either the computer controlled or learner controlled modes.
3. *Need to comprehend temporal relationships.* One strength of this system is the ability of the learner to manipulate the presentation sequence of visuals, both with static visuals which can be replayed in slow motion or for real time visuals which can be joined visually even if not actually following each other in real time.
4. *Need to organise and retrieve large numbers of visual displays.* This type of task is really hinting more at efficiency of storage rather than anything else. Visual images which occupy a small amount of space such as one minute of actual play time can be used for instruction that lasts for a number of hours. The visual limitations of the real slide projector and the number of trays that would be used to hold the same number of images provides ample support for the use of his technology.

5. *Instructor manipulation of the visual presentation of the concept to be learned.* As with the presentation of animated sequences, the computer controlled manipulation will enable the presentation of a concept by juxtaposition of visual images or sequences. Using the concept of the generic disc, different instructors can manipulate the images to suit their own demands.
6. *Learner manipulation of visual information while maintaining sequences coherently.* This is a problem task which while offering great potential and freedom for the learner, requires the designer of the videodisc to place the sequences in logical order on the surface of the disc. Secondly the design should make available conceptually simple computer interfaces (or authoring systems) for the learner to control the presentation and duration.

These concerns go beyond the simplistic media selection algorithms that appear in the texts and attempts to highlight the processes that the interactive videodisc can model and demonstrate. By defining learning tasks in terms of the information processing requirements and the number of alternate paths through the visual materials, these questions will assist the developer in the task of producing well designed instructional materials using the interactive videodisc. The examples presented in this paper go beyond a simple explanation of translating linear design concepts embodied in the existing video technologies to the interactive environment common to computer assisted learning. They hopefully go beyond the simple delivery of instruction to focus upon the learner's active involvement with the process of his or her own learning.

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