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ABSTRACT

The videodisc with random access and large capacity for storage of high quality audiovisual material has the potential of becoming a very effective new medium for individualized interactive instruction at low cost. This medium should be developed carefully, making use of the experience gained in the TICCIT project and the best available instructional psychology and learning theory so that the full potential of the videodisc can be realized. New techniques for lesson development utilizing interactive control of still frames and motion sequences need to be explored. Learner control of freeze frame, slow motion, or fast motion options during motion sequences by repeating or skipping revolutions is possible with the videodisc system, and needs to be evaluated. (Author/CMV)

INSTITUTE FOR COMPUTER USES IN EDUCATION

Possible Applications of Optical Video Discs to Individualized Instruction Systems

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The video-disc technology could make individualized interactive instruction possible at low cost in the home within a few years. The video-disc system will be introduced for home use in 1975 or 1976 and will initially feature the playback of popular movies and helpful advice programs. The extension of this system for interactive instruction is possible if certain capabilities of the system are developed. Control keys, electronics and supporting systems to generate these capabilities need to be specified and integrated into the hardware design of the video disc player and recording equipment.

Specifications for a video-disc instructional system should be based on the type of instructional strategy best suited for individualized instruction. After reviewing considerable instructional research, the TICCIT (Time Shared Interactive Computer Controlled Instructional Television) project at BYU has embraced the principle of learner-control as the best strategy for individualized instruction. Learner-control is implemented in the TICCIT system by providing a special keyboard to each student. In addition to an alpha-numeric keyboard similar to an electric typewriter, TICCIT has another set of keys that provide the following learner-control functions: GO, Skip, Back, Objective, Map, Advice, Help, Hard, Easy, Rule, Example, Practice. Most of these functions could be implemented using a video-disc system, with the addition of a keyboard and associated electronics required for component retrieval and playback.

To be useful for interactive instruction, a video disc system must have the following capabilities:

1. Each revolution (frame) must have an electronic address.
2. Each revolution must be coded to identify it as: (a) part of a motion sequence, (b) a still frame to be displayed until a new address is input, or (c) a still frame to be displayed for a given number of revolutions.
3. The system must switch automatically from motion mode to freeze frame mode when a type-B still frame code is encountered.
4. The read head must be moved automatically to any location on the disc immediately (within a half second) after an address is input from a keyboard or counter.

With these capabilities an instructional system could be developed that would utilize lesson files similar to TICCIT (i.e., Generality, Help, Instance, Practice, etc.). However, unlike TICCIT, most of the instructional material could be motion sequences with accompanying audio. This capability represents a very important improvement over TICCIT. The video disc could contain motion segments interlaced with still frames as shown in figure 1. The still frames provide learner control points where branching to other lesson components would occur. The player would continue to display the still frame until an address was input as demonstrated in figure 2.

We visualize four levels of complexity for a video disc instructional system. In a very simple system the addresses of logical branching options, including multiple-choice questions, could be displayed in a "menu" on a still frame. After a motion sequence is displayed a still frame would appear. The student would then input the desired address by setting a counter or by using a numeric keyboard similar to the modern electronic calculator. These "menu's" plus a lesson map with addresses of major lesson components would provide an adequate but somewhat tedious learner-control system.

In a more complicated system, disc addresses implied by the learner-control keys would be read from the video disc into a small local memory unit so that pressing a learner-control key would operate the read arm directly. Each key would receive appropriate addresses from the disc whenever a still frame was encountered. Thus the student would only have to press the desired key for branching to occur. Multiple-choice responses would branch him to a feedback message or remedial loop for additional instruction.

A third level of sophistication might include the addition of a magnetic read/record head and an oxide strip on the disc so that a record could be made of the strategy used and answers given. When the student completes the lesson on a given disc, he returns it to a distribution center that reads and then erases the magnetic strip. Computer analysis of the student's magnetic record could be performed rapidly and knowledge of test results and advice for lesson review could be provided in a computer printout summary.

None of the above configurations involve the use of a computer on line; thus a fourth system configuration might be the integration of the video disc with a TICCIT CAI system. This type of system could provide greater flexibility for student interaction and response processing. For example, the TV screen could be "split" so that part of the screen would be devoted to motion sequences and still frames coming from the video disc while the rest -- say the bottom eighth -- could be devoted to student input and TICCIT-type instructional material. A combination of the video disc and an on-line minicomputer would be more flexible for a large learning center that could justify the additional costs for the computer. It should be noted, however, that by having the bulk of the presentation material at the individual disc players, a great savings in computer capacity is established and a small computer like the Double Nova used in TICCIT could probably handle ten times as many terminals. It is also possible to utilize telephone lines for extending the distance from computer to terminal for some community applications of this system.

The first, simple system described above is not recommended because the student must input 5-digit addresses. These same large numbers must also appear on the still frame "menu's." Input errors and the drudgery of handling these large numbers would likely be frustrating and discouraging to the student. The first three video disc systems appear to have many of the features now requiring a computer as in the TICCIT system, but the advantage would be that the system could stand alone for home use. Advanced integrated packaging of the video disc player and TV might permit systems 2 and 3 to be portable for use in off-campus housing. Home study courses could include the rental of such a unit as part of the tuition costs. The fourth system requires a minicomputer on-line and provides the greatest flexibility for instructional material. It also allows more motion sequences and audio than is presently available in the TICCIT system. However, it permits only limited on-line modification of courseware, since the material on the video disc cannot be altered after pressing. A comparison is given in Table I of the learner-control and other features of the TICCIT system and these four configurations of the video disc system.

In summary, the video disc with random access and large capacity for storage of high quality audio-visual material has the potential of becoming a very effective new media for individualized interactive instruction at low cost. This media should be developed carefully, making use of the experience gained in the TICCIT project and the best available instructional psychology and learning theory so that the full potential of the video disc can be realized. New techniques for lesson development utilizing interactive control of still frames and motion sequences need to be explored. Learner-control of freeze frame, slow motion, or fast motion options during motion sequences by repeating or skipping revolutions is possible with the video disc system and need to be evaluated. Finally, this new technology will be available soon and promises to provide a quantum jump in instructional media capability by combining the best features of motion pictures, still frames, and audio into a fast random-access system. We must begin now to extend the video disc playback system for individualized interactive instruction by coordinating the courseware development with the software and hardware development.

TABLE I
Comparison of TICCIT and
Video Disc System Configurations

Learner Control and Misc. Features	TICCIT	Video Disc System Configurations 1	2	3	4
1. Pacing	yes	yes	yes	yes	yes
2. Sequencing	yes	yes	yes	yes	yes
3. Feedback	yes	yes	yes	yes	yes
4. Elaboration	yes	yes	yes	yes	yes
5. Lesson Map	yes	Limited	Limited	Limited	yes
6. Test Results	yes	no	no	Delayed	yes
7. Advice	yes	no	Limited	Delayed	yes
8. Records	yes	no	no	Delayed	yes
9. Answer Processing	yes	no	Limited	Limited	yes
10. Input Strings	yes	no	Limited	Limited	yes
11. Motion	Limited	yes	yes	yes	yes
12. Audio	Limited	yes	yes	yes	yes
13. Change Speed	no	yes	yes	yes	yes
14. Stand alone	no	yes	yes	yes	no

<u>FIGURE 1</u>

Video Disc Information Stack

Time (minutes)	Motion Program Content	Still Frame Program Content
1 1/2	Lesson Introduction	
		← Lesson Hierarchy
3/4	Seg n Generality	
		← LC Options menu
3 3/4	Instance File (Each instance is separated by a still frame)	Addresses of Help, Practice, Test or Hierarchy.
5		
2 1/2	Help File	Address of next eg, Practice, Test, or Hierarchy.
2 1/2	Practice File	Address of Feedback message.
10		
		← Test Instructions
2 1/2	Test File	Address of Correct Answer, Test Inst.
		← Correct Answers
2 1/2	Feedback File	Address of next Practice item, Help, Test.
15		
3/4	Seg (n-1) Generality	
//	Additional Segment Files	Addresses of Segment Components
1/2	Summary	
40		

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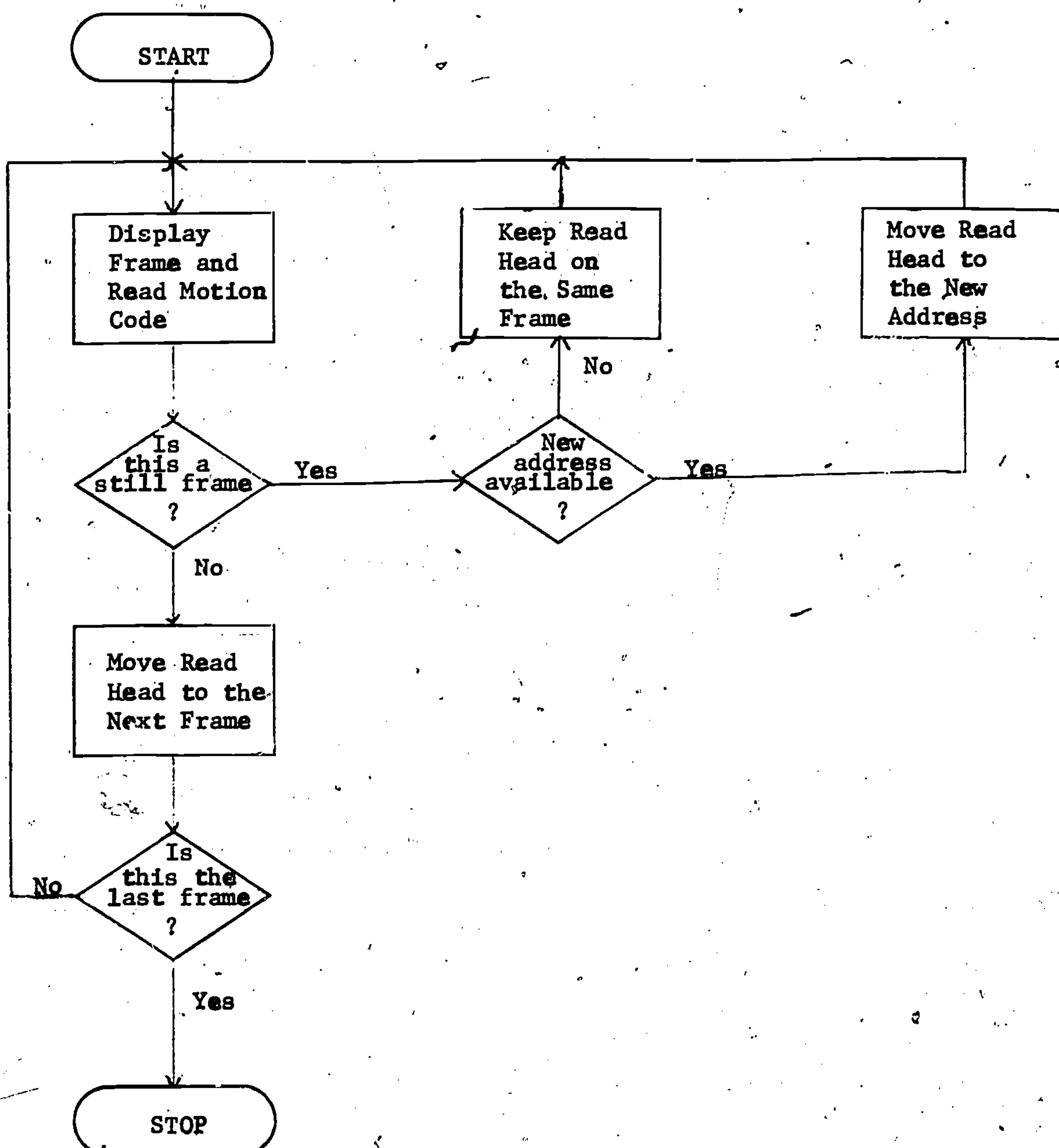
FIGURE 2

Video Disc System for Instructional Use



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