

Videodisc/Microcomputer Technology in Wildland Fire Behavior Training¹

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Abstract: Interactive video is a powerful medium, bringing together the emotional impact of video and film and the interactive capabilities of the computer. Interactive videodisc instruction can be used as a tutorial, for drill and practice and in simulations, as well as for information storage. Videodisc technology is being used in industrial, military and medical applications for training, sales, education, and information systems.

A project is underway to demonstrate the application of interactive videodisc instruction to wildland fire management by producing a program on wildland fire behavior.

In recent years, fire research has developed a large body of complex information. Proper wildland fire management and use requires a thorough understanding of combustion, fire behavior, fire ecology and history, fire economics, fire effects, and prescribed fire practices.

Large areas of valuable resources and human lives are often at stake during prescribed fire and fire suppression activities, making thorough, up-to-date professional training

essential. Because safety is such an overriding concern, adequate training is mandatory to reduce risk.

Most fire management organizations require approximately 40 hours of formal training as a basic prerequisite to any entry level suppression position. The curriculum includes fundamentals of fire behavior, fire suppression, fire organization, tool and equipment use, and safety. Fire behavior is central to this curriculum, and a subject taught by all fire management agencies. Fire behavior has proven to be a stable, well developed course of study; and a complete, multi-level instructional package has been developed by the NWCG, which is the training standard in fire behavior for all NWCG agencies. For these reasons, fire behavior was chosen as the topic of this project.

The project involves using existing fire behavior curricula in an interactive videodisc/computer training system. This disc will supplement existing courses in wildland fire behavior, and will include materials produced by NWCG on introductory, intermediate and advanced fire behavior. In addition, elements from existing courses on fuels inventories, debris prediction, and prescribed fire will be included on the program (Jenkins and others 1985).

The objective of this project is to demonstrate the application of interactive videodisc instruction to wildland fire management by producing a program on wildland fire behavior. This training package will not replace existing instructional materials, but will supplement current training materials. The project is funded by NWCG and is being

¹Poster paper presented at the Symposium on Wildland Fire 2000, April 27-30, 1987, South Lake Tahoe, California.

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administered by the Boise Interagency Fire Center. Division of Training, Bureau of Land Management, U.S. Department of the Interior.

INTERACTIVE TRAINING AND INSTRUCTION

Basic principles of interactive design must be clearly understood in order to realize the benefits that can occur through the use of an interactive training medium. To provide useful interaction between the learner and the instructional program, intellectual options should be provided that allow users to actively make decisions and be subjected to their consequences (Bosco 1984). For example, an incorrect calculation of a fire's rate of spread in a given simulation may result in inappropriate tactical response to the incident. Learners make choices, and the system responds, sometimes in surprising ways. An interactive videodisc lesson should allow learners to "create" their own training experience. In this context, it can be defined as: A form of computer and videodisc-based instruction, which allows learners to intervene and make frequent decisions about the content of the lesson and the way it is delivered.

The instructional system responds instantly to learner input by providing relevant, previously designed instructional cues, reinforcement, and feedback segments related to desired concepts, comprised of computer text and graphics, still and motion video, with or without audio. The scope, sequence, rate, style, duration, level, and medium of instruction is, to a large degree, determined by a dialogue between the learner and the system.

The linear, presequenced format of most traditional instructional formats such as texts, workbooks, films, or slide/tape presentations treat all learners alike, and do not allow the learner to actively take part in the choice of sequence or content of a lesson (DeBloois and others 1982). The quality of interactive instruction in combination with the sophisticated video/audio capabilities of television make this medium a potentially powerful tool for instruction.

Interactive video is a powerful medium, bringing together the emotional impact of video and film, and the interactive capabilities of the computer. Development of interactive videodisc instruction has, to a large degree, mirrored computer-assisted instruction or CAI).

Like CAI, interactive videodisc instruction can be used as a tutorial, for drill and practice and in simulations, as well as for information storage.

DESIGNING INTERACTIVE VIDEODISC INSTRUCTION

The process of designing, writing, directing, and producing an interactive videodisc/computer lesson in wildland fire behavior is similar to the basic design and production of an instructional film. However, the major challenge is integrating of various media, designing the dynamic relationship between user and the system, and working with a modular, rather than linear medium (Daynes 1982).

INSTRUCTIONAL MATRIX

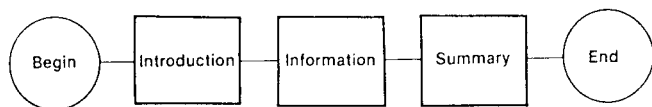
A content "matrix" for the instructional package in wildland fire behavior was initially developed from a careful analysis of program goals and objectives, existing course materials, learner characteristics, and the various forms of media used within the disc to be selected. This matrix lists the appropriate instructional segments classified by topic and intended learner group in a matrix structure. The matrix thus acts as a "map" which guides the designer in creating the dynamic flowchart which represents the interactive branching training program.

Interactive instruction is designed to be modular and nonlinear, with hundreds of preplanned options available to learners based on prior knowledge of their unique interests, abilities, feedback preferences, primary language ability, and learning styles (fig. 1).

BRANCHING

Videodisc interactivity is made possible through a process called branching. A branching program has alternate tracks for rapid and slow learners, can follow up certain responses in detail, allow learners to see only the materials they need or want to see, test learners on the comprehension of the materials, allow learners to repeat material or to have remedial work when needed, and effectively pose a question without demanding one unique, correct answer. Although branching has been extensively used in computer-assisted instruction, there

Linear



Interactive

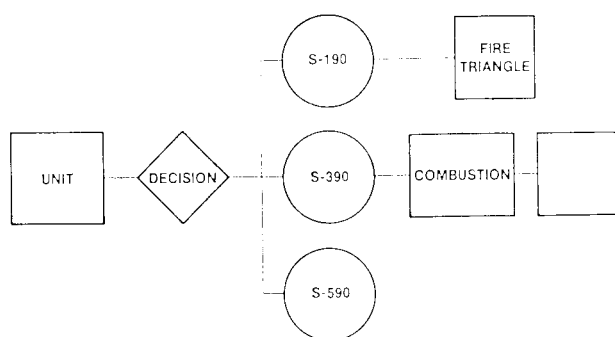


Figure 1--A linear program has a presequenced format, but an interactive program allows learners to make choices.

have been weaknesses in the quality of video imagery and search time for sequences, which have proved to be somewhat disruptive to learning. The introduction of videodisc technology has been an obvious and practical solution to these problems.

FLOWCHARTING

The branching system developed for the instruction must be graphically represented as a flowchart. The flowchart depicts all instructional events included in the wildland fire behavior training program for the various specified audiences. The flowchart shows each instructional frame, both still frames and motion sequences, all branching options, menu driven and under program control, all "help" routines, all test items, and dedicated jump forward and review options.

The procedures used in flowcharting interactive instruction are similar to those

used in any flowcharting operation. Symbols are similar, with a few variations that allow for easy identification of the nature of the instructional frame, whether it is still or freeze frame, or motion sequence. A sample flowchart is shown in figure 2 to demonstrate the complexity involved in the development of an interactive lesson in wildland fire behavior.

SCRIPT, NARRATIVE WRITING, AND GRAPHICS

After the major elements of flowchart construction are completed, scripts and narratives must be written, including all text, computer and quiz screens, and test items. Special terms are used to help integrate the various media, and keep track of hundreds of instructional segments which will be used to individualize instruction for the variety of learners who will use the disc. Scripts and storyboards are then drafted and reviewed for content, style, and feasibility; graphics, animation, and special effects are also planned at this time. Formative evaluation and revision is also appropriate at this stage of design.

PRE-PRODUCTION

The preproduction phase of an interactive videodisc is very similar to that of a film or videotape. However, some steps are unique to the videodisc medium, including mapping the "geographical" layout of the disc, writing of the accompanying computer program, and locating the simple time code numbers for the video frames from the master tape. These steps must be completed before the final production and the mastering of the videodisc (Daynes 1982, Nugent and Christie 1982).

Production details will not be discussed here, as basic production for videodisc is almost identical to that of other media such as videotape or film. Once a master videotape of the training materials is edited and contains all instructional sequences, the tape is sent to one of five mastering houses, where the visual images and audio are transferred onto a videodisc.

HARDWARE AND SOFTWARE CONSIDERATIONS

Interactive videodisc training is oriented toward the development of learning stations for individuals and small groups. Learning environments for interactive instruction can be

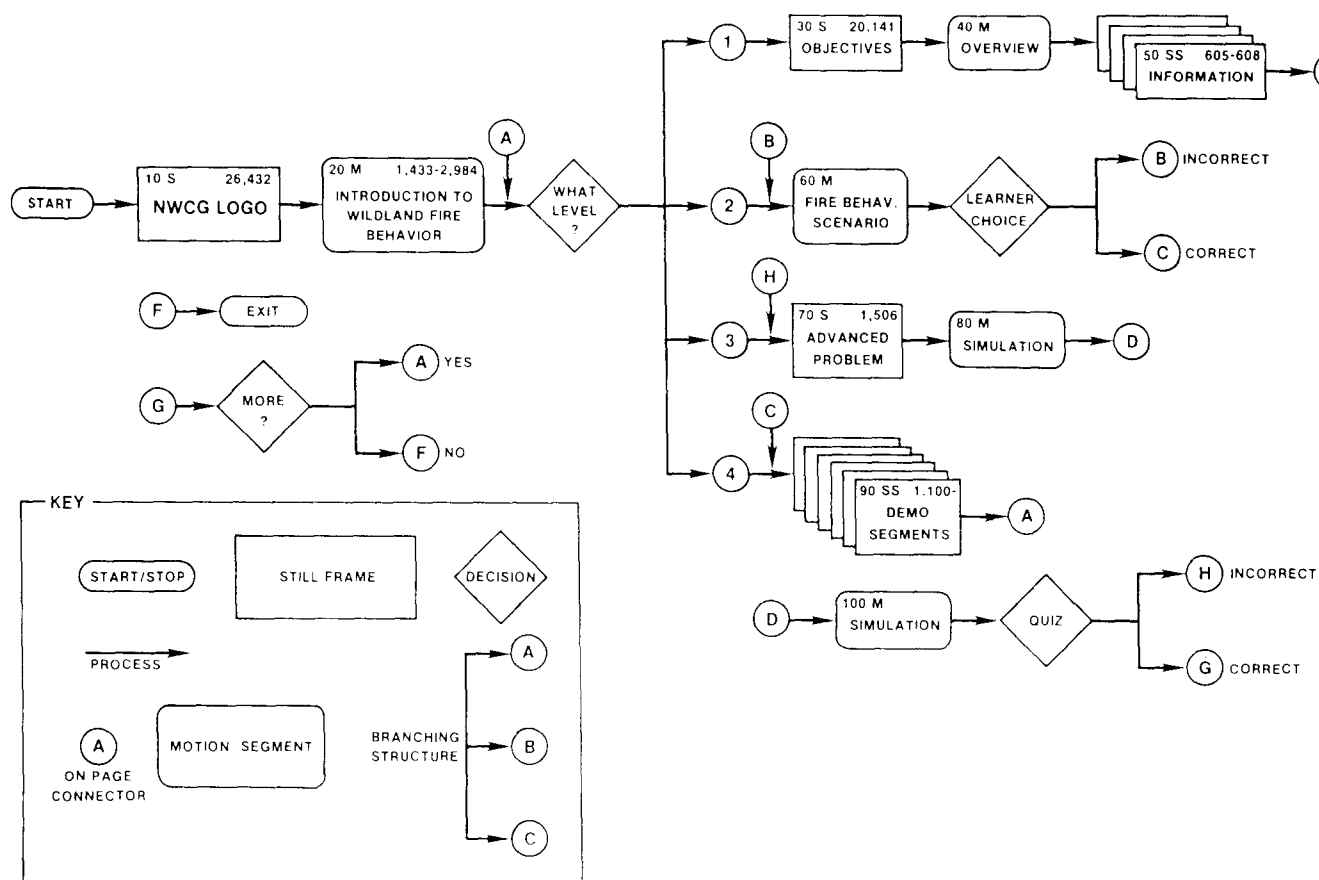


Figure 2--A sample flowchart showing the complexity of the development of an interactive lesson.

any location where an individual or small group can access a computer, which, in turn controls several peripherals, including a videodisc player and monitor (fig. 3). Input to the computer can be through a touch screen, light pen, or keyboard. The video output from the computer, as well as video/audio from the disc appears on a single screen or two separate screens. The delivery system chosen for this project uses one screen, allowing both video from the videodisc, and text over the video, which is generated by the computer. "Windows" of video can be opened to illustrate a point described by computer text or lettering can be written over a video image.

The hardware configuration selected for this project includes an IBM PC computer, Pioneer LD V-1000 video disc player, and a Zenith color monitor. Programming is done using an authoring system called "Quest."

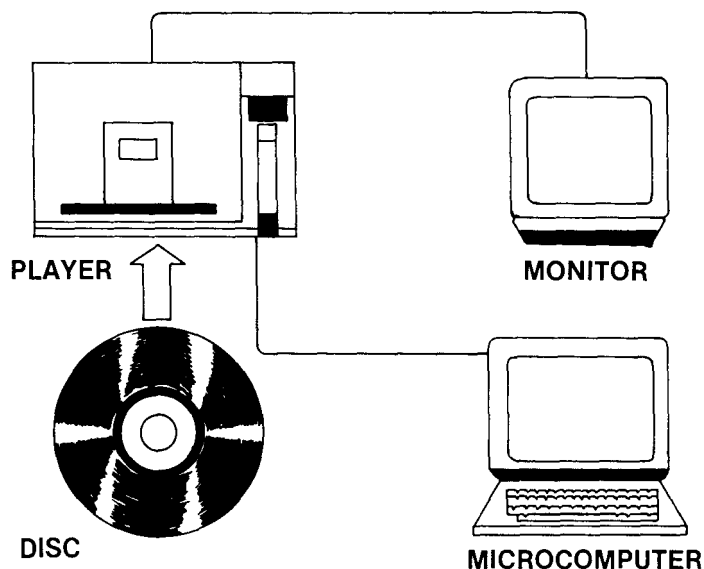


Figure 3--Hardware components of an interactive videodisc/microcomputer system.

EXPECTED BENEFITS

Interactive videodisc technology has proven to be a powerful educational tool, using computer-based learning systems that can display high-quality video imagery, provide rapid access to images, and utilize quality audio. The individualized, self-paced format represented by videodisc instruction focuses on learner needs, rather than predetermined pace and sequence. A learner is able to choose among a variety of instructional options, and learning is directed according to their performance and measurements of their understanding. Interactive videodisc allows learners to have remedial work when needed, or skip ahead if prior mastery is demonstrated.

Other benefits of using interactive systems include these: the use of programs by either individuals or small groups, flexible scheduling of training, the portability and ease of transport of instruction to remote training sites, and the savings of training costs at a fraction of the cost of traditional training methods.

Recent studies in the comparison of videodisc instruction to traditional methods of instruction have shown numerous advantages from the use of interactive videodisc. Such factors such as: savings in actual learning time, higher mastery rate, and favorable response to the medium all prove to be significant factors in the use of interactive instruction. Other cost related benefits include: less time away from the job, reduced travel/living expenses for training, reduction of classroom instructors, and use in remote training stations (Ebner and others 1984, Glenn and others 1984).

Fire behavior training naturally lends itself to the videodisc medium. Because of the huge storage capacity of a videodisc, beginning, intermediate, and advanced fire behavior training courses can be placed on one disc, allowing the learner to seek remedial help when necessary, or go on to advanced material when desired. Fire behavior simulation exercises can also be included, where learners can apply their knowledge of fire behavior in life-like scenarios requiring management decisions. Such simulations are more versatile and

"transportable" than previously developed fire simulators, and allow use at small or remote centers, or for individual use for review or training. The incorporation of tutorial lessons, as well as drill and practice, test items, and information storage make interactive videodisc an efficient, space-saving medium for instruction. By providing training at a fraction of the cost of traditional methods (not including development costs), interactive training systems may become a powerful training tool for fire managers and personnel.

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