Our paper describes the origin, development, and planned testing of an interactive computer/videodisc project at Northwestern University. This multimedia project is a team effort. Kenneth Janda, professor of political science, teaches the course that will test the product. He also is co-author of an American government textbook published by Houghton Mifflin, which sponsored the videotape that is the basis of the videodisc. Richard Johnson, audio-visual technician in the College of Arts and Sciences Language Laboratory, edited the videotape and supervised the creation of the videodisc in the production facilities of Pioneer Corporation of America in Carson, California. William Parod, senior programmer/analyst in Academic Computing and Network Services created the prototype of the hypercard stack that students will use to access the images on videodisc. Each of us will describe his particular contribution to this on-going project.

Pedagogical Considerations
by Kenneth Janda

Years ago, when I was a high school student, I enjoyed seeing films in my history class because they were more entertaining than an hour with the teacher. I suspected that my teacher liked showing films because they were more relaxing than an hour with his students. While the class watched the films, students and teacher struck a non-aggression pact, passing the time together in a pleasant pursuit under the guise of education. Perhaps that explains why I never showed a film in class through my first twenty-six years of teaching political science to college students. Not only did I question whether students really learned more from watching a film than they got from an hour of lecture or class discussion, but I also felt it was cop-out on my teaching responsibilities.

The Video Encyclopedia

I changed my attitude and practice when I discovered The Video Encyclopedia of the Twentieth Century, an outstanding collection of film clips and video footage on prominent personalities and events in American political history, produced by the CEL corporation.¹ This rich collection of source material, consisting of thousands of memorable segments depicting our social and political culture, is available on some eighty videocassettes or on some forty videodiscs. The collection is exceptionally well-documented and thoroughly indexed, which invites instructors to be selective in choosing and showing film segments that take only a few minutes of class time. The video format, especially the videodisc format, facilitates selecting material for class viewing. These features persuaded me to show portions of The Video Encyclopedia to students in my large lecture course on American Government and Politics in 1987--the first time I ever violated my principle and used "movies" in class.

Among the events I showed to my students were film clips of the demonstrations at the 1968 Democratic National Convention in Chicago (right outside this building), to set the stage for my lecture on "unconventional political par-

¹ CEL Educational Resources; 515 Madison Avenue, Suite 700; New York, NY 10022.
ticipation"; portions of the 1973 Senate Watergate Hearings, to begin our discussion of the Constitution basis of our political system; and the speaking styles of Presidents Roosevelt to Reagan, to provide background for my analysis of presidential popularity. These film clips had been pulled from the videodisc collection, edited onto videotape, and projected on a large screen for viewing during class periods by about 200 students. In no case did the videos consume more than twenty-five minutes, and most of the selections took only about ten minutes at the start of each period.

Students clearly enjoyed these videos, and their reactions prompted the production of a ninety-minute videotape on American politics from material in *The Video Encyclopedia*. The videotape was prepared with the assistance of Richard Johnson in Northwestern's Language Laboratory and Ethan Cosgriff, a graduate student in political science. My publisher, the Houghton-Mifflin Company, sponsored its production to provide the videotape to colleges that adopted our American government textbook, *The Challenge of Democracy*.² As described in the Houghton Mifflin *Video Guide*, the videotape contains film clips on five topics:³

1. The Watergate affair
2. Political parties and campaigns
3. The presidency
4. Civil rights and equality
5. The Vietnam War

Although the videotape is only ninety minutes long, it contains hundreds of separate film clips, and retrieving any particular segment from videotape is somewhat difficult. If the material on American government selected from the many videodiscs of *The Video Encyclopedia* were restored to videodisc format, I mused, the segments could not only be accessed instantaneously, but the videodisc could be accessed through a computer program, making for a multimedia learning environment.

Our Proposal to Apple Computer

Because Northwestern lacked adequate facilities for multimedia teaching, I joined with a colleague in Academic Computing and Network Services, Phil Galanter, in submitting a proposal to Apple Computer in December, 1988. Because I was still uncertain of the role of media in the classroom, we proposed a controlled study of the effectiveness of a multimedia application using Apple's hypercard program to access images on a videodisc that contained our material on American government. Our design called for evaluating the multimedia approach against two alternatives: (a) traditional discussion methods and (b) "conventional" computer-based learning techniques. The study would be based on approximately 240 students expected to take my class in American government in the spring quarter, 1989. Apple Computer funded our proposal by providing seven Macintosh SEs and resources to purchase seven Pioneer 4200 videodisc players and suitable monitors, but the grant came too late to implement the study in 1989, so it will be conducted instead in 1990.

There are other controlled studies of the effectiveness of interactive videodiscs in teaching college-level subjects,

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notably the work of Stanley Smith and Loretta Jones in teaching chemistry at the University of Illinois. Studying both a preparatory course for students with low placement scores and a second-semester course for engineering majors, they sought to determine how well students learned from their video lessons and how much they liked them. They state, "In all cases, we noticed significant gains for the students using the videodisc lessons." Even accepting their results, chemistry is not political science, and there is still room to question whether the multimedia approach transfers well from the physical sciences to the social sciences.

Data from my own experience with showing videos in the lecture hall raises those questions. Both in 1987 and again this spring, I used four electronic techniques in teaching my American government class and evaluated the videos against the three others—(1) projecting my lecture notes during class using MORE, an outline processing program; (2) providing full-sentence outlines of my lectures on a mainframe computer for printing out within hours afterwards; and (3) communicating with students through electronic mail. In both years, approximately 90% of the students liked the videos (defined as "whether the process improved the course for you, and if you’re glad it was used"). which essentially tied the videos with the printed outlines and placed the videos far ahead of the projected outlines and electronic mail in popularity. But when asked to choose which of the electronic processes was *most important* in "significantly improving" their ability to learn, students chose the videos *third* in both years, ahead of only electronic mail, which was tried by only a small proportion of students. Are videos liked merely because they entertain, or do they serve some grander pedagogical purpose?

The Research Design

In brief, the research design in the Apple proposal was as follows: Janda will lecture for 50 minutes three times a week (Monday, Tuesday, and Wednesday) to all 240 students. His lectures will complement the text, and students will be tested—as usual—over the content of both the text and the lectures in midterm and final examinations. Therefore, all students will be tested twice for their understanding of American government.

The three variations in teaching approaches will occur in the small weekly "sections" that all students are required to attend. These sections will be supervised by four graduate Teaching Assistants, each of whom will meet once each Thursday or Friday with three sections composed of approximately 20 students. Each of the four TAs will use a different method in teaching each of their three sections:

1. **In discussion** sections, students will read a supplementary text that presents opposing "point of view" on each topic (e.g., party reform, aid to the Nicaraguan contrast). The TAs will lead class discussions based on these opposing viewpoints. Short quizzes will assess the students' understanding of the issues involved. The discussion sections constitute the "control groups" against which to judge the effects of the two following types of technology-assisted sections.

2. **In computer-based** sections, students will use three different microcomputer programs distributed with *The Challenge of Democracy*. (All three programs operate on Macintosh and DOS computers.)

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5 Jones and Smith, p. 85.

a. *MicroStudy* (developed by Delta Software) is a computer program that assists students in learning the material covered in *The Challenge of Democracy*. Students will be shown how to use this program in the first meeting of their section, and they will be invited to use it to extend and review their knowledge of American government throughout the course. How much they actually use *MicroStudy* and how useful they find it will be evaluated through questionnaires.

b. *IDEAlog*, is a program designed at Northwestern by Dennis Hartman, Kenneth Janda, and Jerry Goldman to explain the framework for analyzing ideologies set forth in *The Challenge of Democracy*. Intended for completion at one sitting, *IDEAlog* will be introduced in the second meeting of the course. Students' reactions to it will also be judged through questionnaires.

c. The *CROSSTABS* program, produced at Northwestern by Philip Schrodt and Kenneth Janda, teaches students how to do original research on major topics in American government. Recognized as "Distinguished Software" in the 1987 EDUCOM/NCRAPTAL competition, *CROSSTABS* involves students in quantitative analysis of two self-contained data sets: one on voters in the 1988 election and the other on members of the 100th Congress. Their use of *CROSSTABS* will extend throughout the rest of the quarter, and they will submit a paper based on their research. Reactions to *CROSSTABS* will again be judged by questionnaires.

3. In multimedia sections, students will be quickly introduced to a hypercard stack designed by Philip Galanter and programmed by his associate, William Parod, to access images on videodisc. Their stack uses clippings from *The Video Encyclopedia of the Twentieth Century*. By keying the video images to the content of *The Challenge of Democracy*, their stack encourages students to study their text by stimulating their interest in the subject. Students in multimedia sections will prepare for their weekly meetings by using the hypercard stack in a laboratory equipped with enough Macintosh/videodisc workstations to serve the 80 students enrolled in the multimedia sections of the class.

As in traditional discussion sections, the TAs will lead discussions based on texts and images retrieved by the hypercard stack. Only this time, students will be not be reading from a book to prepare for the discussion; they will be engaged in a multimedia learning process. To facilitate post-experiment comparisons between the two experiences, the students will again be given short quizzes to assess their understanding of the subjects discussed. Of course, their quizzes will differ from those in the traditional sections, because the hypercard material will not necessarily reflect the points of view expressed in the supplementary text read by students in the traditional sections.

We are now engaged in planning to implement this research design when the course is offered in the spring quarter, 1990. We have already created the videodisc, described next, and are building the hypercard stack, described later.

**Creating the Videodisc**

by Richard Johnson

Probably the best means for delving into technical parameters of *The Challenge of Democracy* video production, is through understanding these issues do not exist in a vacuum. In fact, the most useful way of exploring this subject is conceiving of technical and aesthetic issues as different sides of the same coin.

An important point of consideration before plunging into any of the technical intricacies of production is knowing what is to be communicated and how this is going to be accomplished. A striking theme, served up with verve, functions like a building's foundation. Solidly constructed, a captivating framework can be put up around it. Bereft
of this base, the endeavor becomes tenuous; incapable of sustained balance, it collapses on itself. No matter how generous a budget, this factor can never subsume a weak, initial concept. By the way, the reverse is also true. It's difficult to build an Eiffel Tower from good intentions and thin air. Once an organizing, thematic principle is arrived at, issues revolving around technological parameters can be explored.

Choosing the videodisc format

One of the most tantalizing options is choosing which videodisc format to present on: CAV or CLV. While both modes can be utilized for playback or interactive computer applications, there are notable distinctions between them.

CAV is an acronym for Constant Angular Velocity. Assigning one video frame per track, the program begins at the disc's center and is carried along 54,000 circular tracks laid out sequentially to its outermost edges. Due to this image management, any portion of the program can be searched and referenced to the exact frame. In addition, this set-up offers freeze frame, still-step analysis and multi-speed control. The deficit side of this operation is program time. Each side of the disc holds just 30 minutes of material.

CLV stands for Constant Linear Velocity. In contrast, this technology allows a total of 60 minutes of programming per each side. This is accommodated through placement of one frame per track at the disc's center and increasing this capacity up to 3 frames along the outer edges. Unlike the CAV disc which spins constantly at 1,800 rpm, the CLV disc begins with this rate, but slows down to 600 rpm during the program to keep playback motion constant. The tradeoff with this increased program content is loss of sophisticated search and access control. The CLV disc offers none of the control options inherent in the CAV format. Instead, program points can only be located through pinpointing of elapsed time, with slight shifts in accuracy.

Obviously, if a production suffers because the narrative flow is interrupted as the disc is turned over, the CLV format should be considered. But, if the original program is planned in 30 minute increments, or there's a logical segue from one side to the next, the dexterity control CAV technology affords might be a decisive factor. Whichever path proves more appealing, program time in both formats is prescribed exactly. Only 30 minutes, 0 seconds and 0 frames are available on individual sides of the CAV disc. And 60 minutes, 0 seconds and 0 frames of material can be handled on each side of the CLV disc. Neither format allows any content spillover or margins for error. While editing a 3/4" master for either format, precise timing must be accounted for and adhered to. This constitutes everything encompassing the presentation, from seconds of black preceding the initial fade-in, to closing moments of darkness in the concluding scene.

Although we could have recorded the entire ninety-minute videotape of material for *The Challenge of Democracy* on two sides of a single CLV videodisc, we decided to opt for the more precise control of the CAV format when working with hypercard. Therefore, our material covers three sides of two CAV discs, with precious few frames to spare.

Choosing the production facilities

Another issue linked to program content and production technique is deciding which production facility will be engaged for mastering and videodisc replication. Arriving at this choice before entering production or post-production expedites the whole venture. By allowing informed decision making to occur beforehand, critical junctures can be negotiated smoothly and budget allocations can be comfortably made. In principle, organizational and manufacturing structure governing most videodisc production facilities remain the same. In the details though, they
can vary considerably. Not only are the formatting requirements, production process steps, electronic signal standards and technical strictures not uniform across facilities, they probably are not interchangeable.

For instance, one mastering facility may accept an edited 3/4" master provided it conforms to their formatting standards. Such specifications might include prescribed areas of black in lead-in and lead-out sequences, test signal displays for both audio and video and program running time. However, another site may employ equipment incapable of processing the 3/4" format. Instead, they may require this master be transferred to 1-inch tape stock with a different set of format considerations and the inclusion of time code.

Likewise, the amount of consulting and support staff a facility can render potential clients will vary from one production house to another. Some facilities offer both national and local representatives specifically trained in the verities of videotape to videodisc production. These people may even have the option of setting up periodic meetings at your office with engineering staff members in tow. Other concerns may divide these tasks among different personnel, with an account manager handling general queries, the business office fielding budget queries and their technical staff addressing production and post-production issues. Within this context, face to face meetings might be relegated within the base of operations.

The key to resolving this issue is information. The outstanding facilities avail themselves with both personnel and publications for answering questions related to software and hardware. Pioneer, for example, distributes an excellent primer, the Pioneer LaserVision Videodisc Production Guide Book. This publication succinctly documents production intricacies as well as taking a common sense approach to technical jargon. Booklets of this nature are generally accompanied with rate sheets so fiscal expenditures can be projected too.

 Choosing the videotape format

Since The Challenge of Democracy videotape production was created with professional replication and distribution in mind, we mastered the videotape in 3/4" format--rather than in the 1/2" format in which the Challenge videotape is distributed. However, an even larger 1-inch format is standard for producing the videodisc master. The larger format is also the broadcast industry standard, and equipment and affiliated costs are prohibitively expensive. Although VHS and Beta incarnations are continually upgrading their technology, their signal quality doesn't hold up over the long run.

The advantage of 3/4" lies in its widespread utilization spanning both broadcast and industrial applications. To date, half a million units are scattered across the nation facilitating the exchange of tape and services. To insure that the highest quality signal is maintained throughout the production process, 3/4" videocassettes rated as broadcast quality should be employed for source tapes and edited masters. This grade of tape is available through all the major tape manufacturers. It features higher grade recording oxides for greater signal clarity and denser backing for repeated and prolonged use.

Whether the more sophisticated time code system or the omnipresent control track configuration is enlisted for creating a 3/4" master, a time base corrector should be considered an essential tool to this operation. Since the electro-mechanical videotape recording and playback processes are imperfect by nature, signal errors are endemic. No matter how well VCRs are maintained, these problems will crop up. A time base corrector eliminates these deviations by positioning itself between the SOURCE and EDIT VCR. Taking the signal emanating from the SOURCE tape, it electronically re-aligns and combs out signal errors before dispatching them into the EDIT deck. New digital technology and refinements now allow each frame of the video signal to be subjected to this treatment. In addition, these electronics allow color correction, noise reduction, image sharpening and video gain adjustments to be easily made.
Dealing with field dominance

An all too common problem a time base corrector will not ameliorate is Field Dominance mixing. Basically a single frame of video represents a composite of 525 lines, divided into even and odd lines. This sorting of the signal is referred to as even and odd, or 1st and 2nd fields. On videotape, these fields are recorded against one another in a 1-2, 1-2 patterning. This is known as 1st field dominance and represents the standard for most videotape formats. Occasionally, the inverse pattern occurs, with the 2nd field leading, followed by the 1st, forming a 2-1, 2-1 course.

Field Dominance becomes a critical concern when both patterns are randomly intermixed during editing. A 1-2, 1-2 pattern, followed by a 2-1, 1-2, 2-1 set spells disaster. Translated this means one half of the picture is tacked on the wrongly corresponding side of another. Besides producing an unstable edit, this situation manifests itself as a momentary whip pattern appearing on screen between edit points. If this condition goes uncorrected on the master, not only will these problems appear on the videodisc, it will also affect the disc's ability to freeze. Instead of producing a clear, constant image, the picture will jitter due to the laser reading 2 different half-images.

The only way to circumvent this problem is preventing it from occurring. A qualified video engineer must go through and align all the associated production and post-production equipment for 1st Field Dominance. With this accomplished, editing can proceed with impunity.

Exploring the technology

Lest all these technological issues and their ramifications prove daunting, I found them eminently negotiable in working with the people at the production facilities of Pioneer Communications of America. It also helps to do research and have an adequate support staff at home. Remember, the production process is logical and scientific in nature. Technical solutions lie in an analytical approach. Aesthetic concepts, on the other hand, pose a thornier tack. Failed common wisdom always asserts that all ideas are old hat and everything has been done before. Plainly, this isn't true. If it were, the arts would be perfected and there would be no need for new, expressive forms.

Demonstrating the Hypercard Stack
By William Parod

The hypercard stack is still under development, and it is not a good usage of time to write about this week's version. Instead, I will rely on demonstrating to the audience in attendance how the program operates, using text and script written for a portion of the Watergate unit on side one of the Pioneer LaserDisc for The Challenge of Democracy.