Interactive Multimedia: A Tool for Government Transformation

DAVID E. BARBEE
Institute for Technological Solutions

RONNIE B. LOWENSTEIN
Consultant

As government agencies are faced with having to do more with less, interactive multimedia may provide solutions. In this paper some of the challenges are discussed, the nature of interactive multimedia is illuminated and its potential as a tool for production, information, performance support and learning is explored. Government programs using interactive multimedia are briefly described. And finally a strategy is outlined for implementing multimedia solutions that highlights both opportunities and pitfalls.

Tighter budgets — Fewer personnel — More work...
Increasingly these are the facts of life throughout government. Managers in Departments such as Labor, Agriculture or Education, or in agencies like the Environmental Protection Agency or General Accounting Office are being asked to “do more with less” in these times of rapid societal changes, shifting cultural paradigms, and a pervasive technological revolution.

Like their counterparts in business, many government managers feel overwhelmed by the realities of:

- exploding knowledge and information,
- the changing nature of work,
- fewer and less qualified workers,
- shrinking resources, and a
- demand for more and higher quality products.

Working under such conditions, administrators frequently find themselves operating in a crisis mode, making decisions on solutions before they’ve had an opportunity to analyze problems and alternatives comprehensively. Too often, they perceive technology as the quick-fix or panacea for their problems. Such a response is usually not informed by the experiences of the past taken within the context of reasoned planning for the future.

An example:

One of the authors was recently approached by an agency near the end of the fiscal year when “the use it or lose it syndrome” had struck! The managers were expected to make decisions on hardware and software procurements that could not be adequately researched and analyzed with the few days given. While they did manage to
put together a list of computer equipment, peripherals, and software that they hoped would provide a degree of flexibility, they were frustrated... They realized that this equipment may not be replaced for a decade or more, rendering any mistakes of judgement quite costly.

The full potential of multimedia technology can only be realized when a thoughtful and systematic approach is used. Proper analysis of a situation is important at the beginning with a full statement of the problem, a fresh look at potential solutions, and a carefully considered implementation strategy for solving the problem. As a colleague of ours says, “In government that ain’t easy.”

With respect for the multiple challenges and constraining conditions government decision-makers face, we propose three actions:

• First, they need to release the crisis mentality that mires us all in the limitations of the past;

• Second, in its place, adopt the Chinese perspective that recognizes the duality of ‘crisis.’ There exists in every crisis both danger and opportunity.

• Third, appreciate multimedia as tools that have the potential for transforming crisis situations into opportunities of success.

In this paper we will: briefly explore some common challenges managers face; “illuminate” the nature of multimedia; discuss the uses of multimedia in government; identify exemplar multimedia programs in government; and finally, suggest what government agencies can do to capitalize on the potential of multimedia technology.

**Exploring the Challenges Within Climates of Change**

Leaders in government, business and society, in general, are faced with some significant challenges, including:

• *exploding knowledge and information:* the volume of information produced in our society continues to accelerate geometrically;

• *the changing nature of work:* increasingly work is information-based, requiring manipulation of multiple symbol systems, greater mental and less physical activity, with workers being given increased responsibility, authority and control over their own work;

• *fewer and less qualified workers:* according to demographic projections, by the year 2000 the majority of the entering work force will be minorities and women;

• *shrinking resources:* regardless of the Administration in the White House, the trend is toward making do with less. The Department of Defense has perhaps the greatest challenge as we shift to a post-cold war economy; and

• *a demand for more and higher quality products:* consumers are demanding more and higher quality goods and services, both of companies and of government.

An example:

Like other agencies, for the past several years, the General Accounting Office has been responding to the U.S. Congressional request for more and higher quality reports. Like other agencies, GAO has had to create them with fewer staff and more limited resources per report.

In response to the challenge of producing more reports more efficiently and effectively than in the past, the GAO has initiated an ambitious automation project. They recognize that to achieve the long-term benefits of automation, they need to initially make a substantial, up-front investment of scarce resources. Part of that investment will cover costs of training personnel, not only on how to use new computer programs, but also on new behavioral patterns for GAO evaluators. To properly document the effects of this innovation and to effectively describe its findings, the GAO is adding videotapes to some of its Congressional reports, all without proportionate increases in personnel or overall budget.

One can imagine Congress in the near future enjoying these graphic reports so much that they will request graphic reporting of conditions and conclusions in future GAO reports.
Changing Climates: The New Paradigm

We are living in the midst of a cultural shift in human work and activity. Our world views or paradigms are shifting to accommodate a move:

- from the industrial to the information age;
- from a top-down, manager-controlled activity to less hierarchical, worker-controlled activity;
- from procedural to problem solving work;
- from direct, hands-on control of work, to remotely-monitored and controlled work;
- from directed, controlled individual work, to cooperative creative work as a member of a team;
- from controlled access to free access to information; and
- from a focus on teaching to a focus on learning.

In those companies, agencies and organizations that have made the shift, workers appear empowered and demonstrate a high level of productivity. They are in a mode of continual learning and innovation. They seem to transcend the fixed world view and are willing and able to change.

They use sophisticated tools to:

- gather, process, evaluate and communicate information;
- assist with job performance, guiding their thought processes, not just their hands;
- access learning experiences as and when they need them; and
- assist them in communicating with customers, fellow workers, and intelligent machines and systems.

Changing Climates: A Revolution in Technology

We are also living in the midst of a technological revolution that serves to facilitate the paradigm shift. Tools and full technologies of information, performance support and learning are now available: computers, videodiscs, compact disc read-only memory (CD-ROM), Digital Video Interactive (DVI) and other compression systems, artificial intelligence, hypermedia and other tools can enhance our personal learning and productivity. The trend is toward smaller, cheaper, faster and more powerful technologies with larger storage capacities and full multimedia capabilities that provide increasing ability to manipulate video, voice, text, and graphics either together or individually.

“Illuminating” the Nature of Multimedia

A Little History. The ambiguity of the term ‘interactive multimedia’ reflects the dynamism of the computer technology field. A brief historical perspective is offered to provide a foundation for understanding the nature of interactive multimedia.

In the 1960’s several technological breakthroughs were made that laid the basis for the multimedia technologies of today. Two noteworthy attempts to couple the computer with the audiovisual equipment to establish an interactive environment are exemplary:

- O. K. Moore developed a computerized interactive learning environment, the “Talking Typewriter,” to help children develop self-concept; and
- IBM’s 1500 system, a computer which allows individual access to a drum of more than a thousand slides. It was used by midshipmen at the U.S. Naval Academy to learn damage control by accessing pictures of shipboard emergencies and solving practical problems via the computer.

It was not until the late 1970’s and 1980’s, with the advent and popularization of the microcomputer, that multimedia began to become cost-effective. In the last decade, rapid progress has been made toward the development of fully interactive multimedia information and learning environments, principally using videodisc as the multimedia storage medium.

Five years ago few of us could have imagined that we would be able to produce and edit our own interactive movies using Macintosh’s “Quick Time” or “Video Toaster” from Commodore Computer. Nor would we have anticipated that we would be able to do this on equipment and software that sells for less than $10,000. As with all new systems, they are not as easy to use as the advertising would lead us to believe.

If you were operating a multimedia computer right now, instead of dealing with this printed page, you would be able to point and click on “Quick Time” with your mouse and get a short audiovisual demonstration of what it is and what it can do. Alas, without the multimedia computer, you are just going to have to be satisfied with having to read these stationary printed symbols to grasp the concepts.

Currently, multimedia is a moving target, with new developments coming on line with increasing speed and
has theorized in a triangular model “I-T-E: A Model of Reciprocal Determinism,” that there is a reciprocal, dynamic, and interdependent relationship between individuals (I), technologies (T), and their environment (E). Other social learning researchers (Sticht and Mikulecky, 1984) further underscore the importance of the functional context of successful application.

The implication for any multimedia advocate is to define multimedia applications in the fuller contexts of our offices and agencies, and NOT in isolation. A multimedia solution effective for the Army may not be suitable for the Environmental Protection Agency. Nor may the same application be suitable from one office to another within the EPA.

Exploring the Uses of Multimedia in Government

This section focuses on five ways multimedia can serve a government agency, as:

• a production tool;
• a tool for collecting, storing, and retrieving information;
• a tool for securing help, advice or assistance;
• a learning tool for individual workers to use in acquiring new knowledge or skills; and
• a tool for transformation.

We will describe each of these uses of multimedia in more detail in this section.

Multimedia: A Production Tool

Currently, the common computerized tools of production used in government agencies are limited to word processing, and database and spreadsheet programs. As capabilities of multimedia develop, and markets sufficiently expand and mature, desktop publishing and desktop video will gradually become more available along with other even more sophisticated uses of multimedia.

By its inherent nature, multimedia technology has a capability to appeal to multiple senses, stir human emotions and significantly affect behaviors. In time, government agencies will exploit the full range and communication capability of the multimedia technologies to apply such productivity tools for our information age tasks. Some agencies are already positioning themselves for the future:

• The General Accounting Office is developing an auto-
mated report development system. It may be considering multimedia capabilities, but due to costs they may reserve them for future expansion.

• The Environmental Protection Agency (EPA) is planning for the development of multimedia capabilities in their training programs in the Training Institute, in enforcement and in other areas of the agency such as underground storage tank inspection, pollution control, and others.

Multimedia’s ability to assist us in analysis, persuasion, reporting, and other functions common to government work, places it high on the list for consideration as a new tool of production.

**Multimedia: Tool for Collecting, Storing and Retrieving Information**

Government workers can make better use of the vast amounts of information now available. This information is increasing at a geometric rate and expanding beyond text to include pictures, sound, graphics and video. Increasingly the new multimedia tools will expand and improve a worker’s ability to store, retrieve, and use such information. Multimedia will help us:

1. Store relevant and timely information (audio, visual and text) in a manner to facilitate its rapid retrieval on the demand of a worker. This information should enable individuals and members of work teams to better do their jobs.

2. Provide for continuing updating of the information that is stored so that it is timely accurate and relevant to the worker and the tasks that s/he is performing.

3. Store the most used information within the system on hard disk, CD-ROM or other media, with lesser used information accessible from other sources by modem.

4. Provide a capacity for “intelligent” searching, to enable workers to secure and format this relevant information as rapidly and easily as possible.

5. Permit workers to establish and maintain local databases of information for their own day-to-day use.

6. Supply each worker with the tools (hardware and software) necessary to use information efficiently and effectively. [Barbee, 1991]

**Multimedia: Tool for Securing Help, Advice or Assistance**

Multimedia may be used for securing help, advice and assistance when a behavior change (learning) is either not possible or not required. They are used to improve the performance of workers by assisting them in making decisions, performing complex physical tasks or in performing tasks that require both physical and mental activity that lends itself to such assistance.

The need is growing for government workers to learn new skills and acquire new knowledge as and when desired. Help, advice and assistance can be acquired through the Help screens, checklists, algorithms, decision trees and expert systems in the multimedia system.

Following are the characteristics of these help, advisory and assistance tools [Barbee 1991].

Sometimes referred to as Performance Support Tools, they:

1. Are under the control of the worker.

2. Assist the person in performing a physical or mental task or activity related to his or her job.

3. Do not immediately demand a “change of behavior” on the part of the worker; they are not a learning system.

4. Are conveniently available to the worker when and where he or she needs it.

5. Are easy to use, requiring little or no effort in “learning” how to use it.

6. Are self corrective, helping the worker to make the most effective use of it that is possible under the circumstances.

7. Are often, but not always, portable. Sometimes they are built into a machine that the worker is operating, maintaining or repairing. [Barbee, 1991]

**Multimedia as a learning tool.** New methods of multimedia training can deliver learning as and when it is needed and provide the flexibility and cost-effectiveness required of the future. This is perhaps the greatest potential of use of multimedia.
But, in order for us to capitalize on this potential, we have to begin to focus on learning, not on teaching or traditional training. This requires a significant shift in our thinking as trainers as illustrated in Table 1.

Multimedia: Tool for Transformation

Multimedia has a substantial role to play as we move from a manager-hierarchical-control of information to worker empowerment, where learning, information and performance support is available as needed at the work station or work site on worker-demand.

In addition to helping government workers become more productive, multimedia applications have the potential to:

- **Improve administrative functioning**—“automating the SF52” (personnel action form). Opportunities abound throughout government to reduce paper, improve information processing and rethink and streamline the work of the agencies.

- **Improve operational functioning** by “automating the development of policy papers and reports to Congress.”

  In addition to improving the production of these papers and reports, multimedia can enhance their quality by making available to policy analysts and other experts, automated “agents” (computerized assistants) who can assist with research and analysis tasks. Unlike their human counterpart, these computer agents/programs serve in a tireless capacity at any hour of the day or night.

- **Improve top level decision making**... “making the most reasoned, informed and wisest policy decisions possible based on accurate and relevant information, analysis and consideration for the projected consequences.”

  Automated agents working with vast quantities of information and sophisticated tools can assemble alternative “what if” scenarios heretofore not feasible.

- **Improve public education.** To fully accomplish their mission, agencies, like the Departments of Labor, Commerce and Agriculture and the Environmental Protection Agency are finding that they must educate the public. Multimedia kiosks and other interactive systems are an important part of this strategy.

  Those agencies that are positioning themselves to harness the potential capabilities of interactive multimedia will reap benefits with their internal functioning, as well as with their external public relations. This will be particularly true as multimedia finds its way into libraries, communities, and homes.

Exemplar Multimedia Programs in Government

Following are brief references to some government multimedia applications. The list represents only a few of the many government “toes” that are being dipped in the stream of multimedia. A current reading of that stream reveals a wide breadth of interest, but shallow depth of experience.

- The Department of Labor’s Center for Advanced Learning Systems promoted a competency-based, individualized and multi-mediated program of learning beginning in 1984.
- The Environmental Protection Agency is training underground storage tank inspectors using interactive videodisc and is planning the development of full multi-mediated learning, information and performance support stations.

  One planned EPA project involves a system that helps personnel manage asbestos, monitor radiation, and control pollution. Called the “Learning, Information, and Performance Support System (LIPSS),” this system includes a database for the information, job aids or expert systems for the performance support, and tutorial. Why Not Let Auditors Help?,” Journal of Systems Management, 37:36-40, May 1986.

  Nicholas, J.M., “User Involvement: formation about the EPA requirements for containing asbestos in his or her building s/he can use the LIPSS multimedia station to find the information, get help in determining a containment strategy appropriate for the situation, or learn the skills that s/he needs to implement the strategy.

  - The Department of Defense has made significant commitments to interactive multimedia, for example: the Army developed a technical standard and procured more than 15,000 interactive videodisc terminals over the past decade.
<table>
<thead>
<tr>
<th>FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>course outlines</td>
<td>competency specifications</td>
</tr>
<tr>
<td>group testing of content</td>
<td>individual testing of competence</td>
</tr>
<tr>
<td>testing of knowledge using paper/pencil</td>
<td>testing of competence through scenarios, simulations and interactive techniques</td>
</tr>
<tr>
<td>training delivered to groups at central location</td>
<td>learning environments established at the worksite</td>
</tr>
<tr>
<td>training delivered at a fixed location</td>
<td>learning available where needed</td>
</tr>
<tr>
<td>group paced</td>
<td>self paced</td>
</tr>
<tr>
<td>available on schedule</td>
<td>available on demand</td>
</tr>
<tr>
<td>group standardized approach</td>
<td>individually tailored approach</td>
</tr>
<tr>
<td>“automating the past” by continuing what we are doing only doing it faster</td>
<td>reanalyzing the need and developing a new solution now possible because of the new tools and techniques</td>
</tr>
<tr>
<td>segregating training from job performance</td>
<td>incorporating performance support tools acting as advisors/agents with learning environments</td>
</tr>
<tr>
<td>education and training delivered principally by text and talk</td>
<td>multimediated, interactive learning environments</td>
</tr>
<tr>
<td>learning by reading and listening</td>
<td>learning by doing through simulation and other techniques</td>
</tr>
<tr>
<td>instructor or teacher control</td>
<td>learner control</td>
</tr>
<tr>
<td>linear and sequential access to information</td>
<td>random, on demand access to information</td>
</tr>
<tr>
<td>teacher centered didactic approach</td>
<td>learner centered approach where the strategy is matched to the learning style of the individual</td>
</tr>
<tr>
<td>a vision of human learning and performance restricted by text and talk</td>
<td>a vision of human learning and performance incorporating varying modes of perception and performance</td>
</tr>
<tr>
<td>a concept of the mind as a container to be filled with knowledge and skills</td>
<td>the mind as human potential to be developed through its own activity</td>
</tr>
</tbody>
</table>

Table 1: Moving from a Teaching Culture to a Learning Culture
• The U. S. Navy, has used interactive videodisc learning systems to simulate difficult-to-teach procedures that require fine discriminations of sonar operators (is the blip or sound a school of fish or an enemy submarine?).

• The State Department is using multimedia to improve internal communications. They combine pictures with text messages for delivery to stations throughout their headquarters in Washington, DC. This approach has been so popular, they are planning to put Macintosh computers in their nearby Virginia offices.

• The U. S. Air Force Academy uses multimedia to facilitate the learning of foreign language. Cadets interact with scenarios on videodiscs that simulate life in other cultures. They are confronted with real life problems that require language facility to solve them.

• Over the last decade, the U. S. Army developed a standard and has procured 15,000 terminals to provide interactive training in a variety of areas from recruit training and basic job skills, to tank gunnery and training of medics.

• The Department of Agriculture uses multimedia to provide farmers with information on new techniques of farming. Their County Extension Service uses interactive learning and information stations to help farmers and ranchers learn anything from strawberry raising to cash flow management. They are also installing kiosks in shopping centers and other public locations to provide information to the public.

• The U. S. Postal Service is deploying several hundred CBIT (Computer-Based Interactive Training) platforms to use throughout the regions in training personnel in skills needed as the Postal Service continues to automate.

• The General Accounting Office has been considering a similar approach as they automate their report writing. To date, they have elected not to incorporate learning, information, and performance support into their system.

• The Horace Mann Learning Center at the U. S. Department of Education is planning a thrust into multimedia for learning systems. They have procured several platforms to provide hands-on experience with the systems before expanding the system more broadly.

• The National Library of Medicine, in cooperation with Time Life, Inc., has produced an interactive videodisc series of case studies to use in medical education to provide realism in doctor-patient, doctor-nurse and other interactions. The programs use voice recognition to strengthen the realism of the simulation; there are no menus, interaction occurs at the direction of the learner with wait states where the learner may respond with a variety of voice commands.

• The National Gallery of Art collection has been archived on videodiscs, enabling users to retrieve images at will.

• The entire collection of the Library of Congress is being archived on optical discs for storage and access. They have also been instrumental in developing CD-ROM discs on such historical topics as the Civil War.

Numerous agencies have made substantial investments in archiving print documents and developing CD-ROM discs, including the U. S. Geological Survey, NASA, Agriculture, Customs, State Department and, of course, the Department of Defense. Investment in interactive multimedia is not as great.

Eventually, there will be technology transfer from the public to the private sector and among public agencies. Multimedia products produced by government, but useful for other purposes, will be made available to the public through the National Audiovisual Center (part of the U. S. Archives). George Ziener, Director of the National Audiovisual Center reports an increasing flow of multimedia titles into their collection for such distribution.

### Suggested Strategy for Government Managers

What can individual government managers do once they realize that multimedia technology can help them respond to the challenge of “doing more with less?”

Strategies for introducing interactive multimedia involve change. They are multiple, non-linear, and overlapping. While none alone will guarantee an easy road to success, our experience suggests the value of each of the following approaches:

- Adopt an “innovation perspective” on multimedia;
- Establish a vision of interactive multimedia;
- “Put your toe in the water” and transform your vision into a winning application;
- Promote the vision within the agency; and
- Use a systems approach in your implementation plans.

**Adopt an Innovation Perspective.** Overall, recognize that taking a proactive leadership role in introducing and implementing multimedia applications represents major innovation in an organization. Innovations must be visioned, developed, introduced and incorporated as
part of a new environment.

There are many barriers to innovations. Favorable economic conditions are necessary, but not sufficient. Researchers have repeatedly found that the human factors and the sociology of an institution are equally significant. (Lowenstein, 1988).

Consider four categories of factors affecting agency response to multimedia innovations:

- **technological capabilities** Evaluate the technical compatibility of the hardware and software of the new system with existing systems, along with the familiarity the staff has with the technologies.
- **market issues** Consider costs carefully. Because, multimedia markets have been slow to develop, costs of development tend to be relatively high. There are two possible ways of reducing costs: (a) develop interagency agreements to share costs for developing programs where there is substantial common need, as in basic skills, writing, automated distribution of information, etc.; and (b) amortize the cost of development over the life of the multimedia product rather than paying for it out of a single year’s operating budget.
- **production issues** Recognize that the design of effective multimedia programs and even re-purposing will require a range of specialized multi-disciplinary talent and a substantial investment of time which will force many agencies to turn to outside contractors.
- **attitudes of the people involved** Assess the current climate of your organization to determine the comfort level staff will possibly have with new equipment, terminology and new ways of dealing with each other.

Consider different “sales” approaches; some administrators/managers might be easier to “sell” on innovation when it is introduced incrementally, where a smaller system can be added to as budgets and familiarity/user-comfort permit.

Beware of a tendency to be blinded by technological “sizzle”, inviting one to implement new tool systems because of their allure, and not because the technology will solve a real problem.

**Establish a vision of interactive multimedia**

- A view of multimedia should acknowledge its dynamic and ever-evolving nature. Continue to read and experience the potential of multimedia. Such exposure will help one become aware of what is available. Also, participate in workshops and join formal and informal groups that extend our networks and understandings.
- Recognize that the importance of context to the successful application of interactive technology is essential. Maintain the big picture and view multimedia as a tool box serving a strategic plan.
- Promote a cultural shift in your agency that will empower the individual government worker. Modify agency policies to facilitate any necessary changes in the existing culture of your organization; promote opportunities of communication; reward risk-taking efforts; provide staff with sufficient time and resources for (re)training throughout the process.

**“Put your toe in the water” and transform your vision into a winning application**

Find real problems to solve that are compatible with multimedia solutions. Situations that lend themselves to cost-effective multimedia solutions include those where:

- interactivity is essential to best use;
- emotional impact is needed;
- random access to multimedia material is essential;
- different sensory exposure alters the experience and that alteration is important to the result;
- simulation of life experience is important;
- effective multimedia communications are essential to the user;
- the message to be conveyed is itself a multimedia communication;
- the user needs to experience sound, motion, stills, graphics, text or other digital information in some combination; and
- people need information, performance support and learning in the day to day performance of their jobs.

**Promote the vision within the agency**

Design communications throughout the agency that portray multimedia as a tool of production, information, performance support and learning.

Design workshops and seminars to powerfully convey the potential of multimedia by structuring them as interactive information or learning environments.

Promote a climate in the agency that encourages risk, rewards risk takers, and promotes continuous change as a way of life. Help personnel understand the need for a cultural transition. Alter management policies and provide resources to effect the needed changes. Encourage staff to experiment with new ways of working to
improve productivity.

**Use a systems approach in your implementation plans**

Engage in comprehensive and coherent planning in which you:

- Define goals and objectives in measurable terms
- Delineate constraints
- Establish measures of effectiveness
- Synthesize alternative solutions
- Establish cost elements
- Perform a cost-effectiveness analysis
- Evaluate on a continuing basis, providing feedback to the system for making positive corrections.

Without systemic planning, it is easy for an agency to get out of synch as they move ahead in one area of change and lag in another. A recent example is illustrative.

A government agency has initiated the development of an automated system to improve the production of their products; unfortunately, they have maintained their traditional training system and methods to train their personnel in its use. There is no way that the existing training system can handle the workload. When untrained personnel try to use the system, it will probably fail to achieve all the efficiencies that it was designed to produce.

**Summary**

In this paper some common challenges managers face in government have been identified. We propose that they not be constrained by the traditions of the past, but rather that we look to the new fruits of the technological revolution to provide them the capabilities they need to meet those challenges. We have then tried to illuminate the nature of interactive multimedia, delineate its uses in government, and note some exemplar government efforts. Lastly, we have suggested approaches that will enable government managers to harness interactive multimedia as tools to transform their agencies.

Interactive multimedia is a reality. Its potential power to persuade, inform, educate and help us become more productive in our jobs is substantial. To pursue strategies that incorporate its use requires courage, commitment and patient, goal-directed, tenacity. It is not for the faint of heart.

**Acknowledgments**

We would like to thank the following persons for their assistance in preparing this article: Anna Doroshaw, Training Specialist, Environmental Protection Agency; Marty Gardiner, Training Director, O.I.G., U.S. Department of Justice; Anne Lancaster, Senior Partner, Trans Lingua Communications; and George Ziener, Director, National Audio Visual Center, U.S. Archives

**References**


