HyperCASE® Application:

The Visual Interactive Management Simulator

Fluent Machines, Inc.

Rev. 0.1

by

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Bachelor of Science Degree in Electrical Engineering
University of Pennsylvania
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Submitted to The Sloan School of Management
in Partial Fulfillment of the Requirements for the Degree of

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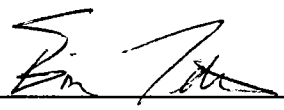
Signature of Author 

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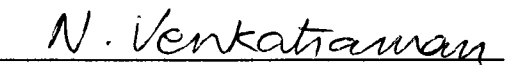
Certified by 

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Abstract

While some work has been done in the area of interactive multimedia presentations for classroom applications at many levels, little has been done specifically in the area of business school teaching methods. What has been done has aimed at turning the classic "paper based" business school case directly into an interactive application of similar design and structure.

This thesis examines the power of providing video input and interactivity to the student. A new teaching environment was developed from the ground up which directly capitalizes on this power. The result is a management simulation exercise that puts the student in a situational setting similar to that which is likely to be encountered in a management position. It allows the user to see the situation first hand while being called upon to make real decisions concerning the health of a genuine enterprise.

This learning environment is called The Visual Interactive Management Simulator (VIMS), and serves as a new way to approach business teaching. It has been built around the development of a young company called Fluent Machines and has been created as a proof of concept. The case on Fluent is presented both in interactive form and traditional paper based form and then compared. The hope is that this project will spurn new ideas and will be built upon in the future.

Thesis Supervisor: N. Venkatraman
Title: Associate Professor of Management

Dedication

To Sue, whose love, patience, and support
helped get me through.

Acknowledgement

I would like to thank the people who helped me put this project together. Assistance came in many forms from strategic to technical to spiritual.

Professor N. Venkatraman - His help in determining how the project should look, as well as his open mind to last minute ideas made working with him a pleasure.

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Dan Mayo - Dan's help was instrumental in my completing the project. His ample assistance from the software side was instrumental.

Jonathan Harber - Jonathan helped ignite the original spark in me.

The Management Team at Fluent Machines, Inc. - Dave Nelson, Dick Meise, Neil Ferris, Larry Pape, Prem Uppaluru, Dave Backer, and Ames Abbott - Gave me full reign of the company, allowing me to capture some of the truly interesting stages in the development of what's sure to be a blockbuster.

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CHAPTER I.
OVERVIEW

As technology becomes more pervasive throughout our society, it will enter new domains. Over the past decade, this has indeed happened at various levels of formal education. Computer technology has started to enter the classroom environment for a wide variety of applications. Among the most interesting of these applications are Interactive Multimedia presentations which allow students the chance to study a subject using text, video, sound and graphics, and access information at the user's discretion. Interactive applications have been developed for a wide variety of applications from history to law studies, but they have been especially well received in medical school programs where complex procedures can be viewed and learned in a visual and interactive way[1]. Interactive Multimedia productions will continue to evolve over the near future. As the technology matures and system prices decrease, we will undoubtedly see important applications improve and gain wider acceptance at all levels of education from primary grade school to graduate school to on the job training.

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[1] Tom McMillan, "Interactive Video Bolsters", Computer Graphics World, May 1990.

Other programs such as business school curricula will increasingly rely on such formats. A prototype interactive multimedia production is presented here as an illustration of how such a tool may look in the near future. It is called the Visual Interactive Management Simulator (VIMS), and it could profoundly change the way the business school case is written and used.

The aim of this thesis project is to create and present an interactive multimedia case developed for the field of management. The intent of this tool will be for use in management education programs such as The Sloan School. The thesis consists of this paper and an interactive multimedia demonstration. The paper examines the state of multimedia technology and applications, and investigates how this functionality can be transferred to the classroom environment. It also presents a "traditional" version of a business school case study. The interactive portion of the project presents this same case in the new VIMS format as a demonstration of a way to enhance the learning process over conventional means.

The case study that the simulation is built around is based on Fluent Machines, Inc., which is located in Framingham, MA. Fluent is a small rapidly growing computer peripherals company developing tools for the IBM PC based multimedia market. The computer based case will contain two unique features that cannot be captured in a paper based case:

First, it will take a cross disciplinary view of the senior management's role in a small growth company. It will focus in parallel on the problems of planning technology, marketing, and financial strategies, and will capture

some of the key decision making processes in a robust manner for the user to experience first hand.

Second, the framework of the project will be set in a situational environment such that the user can make his/her own strategic planning decisions based on the personal input received from the various key company personnel. In this sense, the management decision making process is modeled requiring the user to make real decisions based on inevitably incomplete information.

Background: Multimedia

The state of high technology, by definition, is constantly changing. Many projects throughout the country are underway in computer and information technology examining how computers can be made more useful to more people, how they can be made easier to use, and how they can be made to take advantage of the steadily growing compute power that is continuously being made available by developers. Bill Gates, in his address to the Sloan community entitled "Information at Your Fingertips", stated that most current PC users don't come close to taking full advantage of available computing power. He went on to explain that the true power of computers is in doing complex information processing rather than simple word processing or spreadsheet editing. One of the uses he mentioned that can exploit this power was multimedia computing.[2]

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[2] William Gates; Address to The Sloan School: "Information at Your Fingertips", November, 1990.

The development and use of interactive multimedia tools is a topic being studied by many research labs, both at the corporate and university level, to develop ways to allow users to interact with information rather than just passively absorb it. It is a widely held belief that well designed interactive multimedia computer environments and applications can greatly enhance all phases of computer usefulness and human productivity. While multimedia tools will be powerful in their own right, interactive applications are currently being developed which actually involve the user in the viewing or learning process.

The key to interactive multimedia is activity. Animation, sound, and video add energy and life to static graphics and cold words. Movement captures attention like no still chart or graph can. Formal education and employee training are the primary early targets for this technology since end users can learn more and learn faster with it.[3]

Multimedia technology and applications will change the way people produce and deliver information of all types. It is estimated by some experts that within 5 years, multimedia will become a core desktop technology with personal "authoring tools" available for users to create their own productions.[4] The most profound effect of this intertwining of technologies

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[3] Russ Lockwood, "Multimedia in Business-The New Presentations", Technology, 1990 (pp. 116-118).

[4] Dwight Davis, "Intel and IBM Share Their Multimedia Vision", Electronic Business, Nov 13, 1989.

on the organization will be enhanced productivity. The primary benefit of using multimedia is that it can provide access to vast arrays of information using the most efficient means of display for any particular piece of information. Picture the mechanic learning what different sounds in an engine signify, the sales trainee meeting various people and learning how to deal with them without actually sacrificing accounts, or the retail customer who is able to traverse the entire inventory of a department store visually via computer.

By the mid 1990's, a new, more powerful generation of PCs will replace the current generation, offering powerful and friendly graphical environments.[5] Along with the increased function and capacity of processors and networks, multimedia will permit users to be part of a meeting anywhere as long as they have access to video conference call lines. Proponents of the new technologies hope to broaden the machines' processing capabilities instilling them with an information handling bandwidth much higher than in today's machines, making them more involving than television and easier to use than video games. New computers will have increased functionality over time. Apple's new line of Macintosh machines, introduced in October 1990, has a microphone built in which allows users to digitize sound directly[6]. NExT has a 256 MByte optical disk drive or up to 1.4 GByte hard drive available allowing for massive, fast storage of data.[7]

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5 Ibid.

6 Robert Haavind, "Groupware: Addressing a Need for Improving Productivity", Electronic Business, Sept 17, 1990.

7 Ed:Dr. R. Weissman, "Next on Campus", Fall, 1990, vol.2 Issue 1. (pp.16-17).

Multimedia is currently a hot topic to developers, users, and investors because potential applications seem limitless. Unfortunately, the term multimedia can mean different things to different people. Multimedia computing will be defined here as encompassing all of the technology that allows various media such as sound, video, graphics and animation, numerical spreadsheets, and text to be used in the same environment in an unlimited number of combinations in order to enhance the user's learning or viewing experience.[8]

While there are a many cases where interactive multimedia applications have been adopted to provide competitive advantage in the classroom and commercial marketplace, the newest technologies and applications still exist primarily in the research labs and beta test sites where large computer resources and experimental projects can be used together while this young industry decides which standards it will adopt.

The Basic Advantage

Just adding full motion video to the computing environment is a valuable addition to the computer. If a picture is worth a thousand words, then how much is a video sequence worth? Having access to video from any source can be the difference between a textual description and seeing for oneself. This can be particularly useful when an author wants to have full

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[8] Tony Reveaux, "Multimedia in the '90's - Macintosh Leads the Way", Boston Computer Currents, May, 1990 (p.1).

control of the details of a situation or scene and does not want to leave important pieces of information up to the imagination of the reader.

Multimedia computers will be powerful tools for transferring information among people simply because the more human senses that a new experience is exposed to, the greater the rate of retention. The oft-quoted axiom holds that we recall 25% of what we hear, 45% of what we see and hear, and 70% of what we do.[9] The larger the number of senses involved in experiencing something new, the greater its cognitive richness; the more impact it will have on the viewer. Interactivity allows learning by discovery rather than explanation. This form of learning is so valuable because it provides the student the freedom to experiment, and access to instantaneous feedback.

Add Interaction

By adding well designed interactive applications to this environment, the user can become engaged in realistic simulations that can accurately model inaccessible real situations. Interactive capabilities will suddenly allow the user to enter choices or solutions to problems that may be presented by the program. Interaction thus has three primary advantages over passive presentation: first, it will require the user to actively think about the situation the program is presenting, second it will give immediate feedback to the user

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9 R. Ross, "Technology Tackles the Training Dilemma", High Technology Business, Sep, 1988.

on the quality of an answer or reaction, and third the user can travel at any pace and replay the simulation as many times as desired.

The True Power

It is easy to see the true power of this technology: it can involve the user like reading, classroom teaching, or group formats simply cannot. This involvement can be done in numerous ways. For example, in an open information setting, the user is able to access a piece of information at any time in any order. This means that each user can theoretically get information out of a source much more easily than having to proceed linearly through conventional media like print or magnetic tape.

A second fascinating use is the situational setting. This is an interactive application that places the user in a "virtual" situation that the user must make real time choices about not unlike an "adventure" computer game. Robust examples of this come complete with time constraints and life-or-death pressures.[10] The user can be in a dangerous situation gaining valuable real time experience without actually being in danger, or be part of meetings with top managers without getting in the way.

There Are Limitations

As these types of applications gain widespread acceptance they will not be without limitations. The largest limitations will be legal confrontations

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[10] Craig A. Lambert, "The Electronic Tutor" Harvard Magazine, Nov 1990 (p. 43)

such as copyrighting, royalty, and ownership issues[11]. Several of these conflicts are being fought currently and will surely continue to grow in number in the near future. This tells us that as information becomes more useful and adaptable it may also become more difficult to own or protect. Perhaps this is the logical result of becoming an information society.

Also, there will always be people against the new uses of technology. This is especially true when it comes to education. For example, some teachers and parents in Texas fear that video based tools in elementary education will add to illiteracy.[12] If programs are designed with purpose and foresight, problems like these can be easily avoided.

The State of the Technology

International sales of multimedia software and hardware (including PCs used for multimedia applications) are expected to grow from $400 million in 1989 to as much as $17 billion by 1994.[13] Analysts clearly view multimedia as the next wave of computer applications to overtake personal computer users much like desktop publishing did in the late 1980's. Multimedia products include among other things authoring software, audio and video capture boards, and related hardware. Authoring software is the environment in which a user builds a multimedia presentation. It provides

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[11] J. Daly , "Multimedia: A Royal-ty Mess", Computerworld, Feb 1989 (p. 42).
[12] Michael Allen, "Texas Approves a 'Textbook' on Videodisks" Wall Street Journal, Nov 13, 1990.
[13] William Welty, "Creating Multimedia" Analyst Report. Volpe, Welty, and Co., Dec 6, 1990.

the ability to simultaneously use the independent media together by controlling video discs, importing still images, and making and playing digital sound, text, and animation. Audio and video capture boards are additional cards that fit into existing computers to allow images to be downloaded from video sources (TV, cameras, or VCRs) to the computer database.

Merging various technologies requires the cooperation of development personnel as well. A barrier slowing down development of well designed applications for this technology is the requirement of the close interaction of the video and computer industries. While analog videodisk technology has helped in this capacity, there is a long way to go. Rob Lippincott of Lotus believes that merging the mindsets of the video producers and the programmers will become the key aspect of this development effort.[14]

There is currently a shift underway in the way multimedia presentations are actually implemented which is due to the advancement of storage technology. The systems commercially used today are designed as a series of different machines such as videodisk players, CD players, a personal computer, sonar detectors, keyboard, infrared touch screen, and audio speakers. These units are built commercially as "kiosks" where the microcomputer merely controls the other display equipment. Companies such as ByVideo in Sunnyvale, CA manufacture these units for commercial

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[14] Op. Cit. Davis.

use. The technology has been available for at least five years, but the units, which range in price from $25 thousand to $90 thousand are too expensive to be used on a large scale.[15]

New methods are currently being developed which make the computer the sole storage, control, and display device rather than the controlling centerpiece among other specialized equipment. However, before this can happen new techniques must be developed to allow for the digital storage of the vast amounts of data contained in video images. These techniques, known as compression/decompression (Codec) algorithms, are being developed while digital storage capacity simultaneously continues to increase. When all media can be stored in the computer, system costs will drop as external playback equipment is no longer required.

Limitations of the Current Technology

One of the problems with the technology today is that current PCs simply can't handle many high quality video images. Video is the main hurdle currently. Storing and displaying video taxes the computing and storage capabilities of today's personal computers since it is so data intensive.[16] An efficient method to store, manipulate and communicate these vast quantities of information cheaply is needed. Full motion video which consists of displaying 30 still frames per second (fps) strains the

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15 Interview, Mary Ann Gunderson, Byvideo, Inc., Nov 26, 1990.
16 Michael Alexander, "Data Storage: Grace Under Pressure" Computerworld, Jul 9, 1990.

strongest microprocessors and quickly fills the largest of hard disk drives. This partly because each pixel in a high quality image can be one of 16.7 million colors, requiring 24 bit per pixel resolution which translates into about 25 Mbytes of storage per still picture.[17] One second of uncompressed full motion video would require 750 MBytes of storage.

Compression techniques are algorithms that reduce the amount of information needed to create a particular picture. The idea behind image compression involves representing only a fraction of the pixels available stripping away unneeded data for faster image processing. One pixel can be used to represent many of its neighbors. There are other algorithms that exploit the way the eye perceives visual stimulae which help save valuable disk space as well.

New Image Technologies

There are two competing image storage standards which are both backed by top electronics companies. They are Digital Video Interactive (DVI) and Compact Disk Interactive (CDI). A third standard proposed by the Joint Photographic Experts Group (JPEG) is also getting a hard look. Some analysts predict DVI will win big in the business markets by being marketed by computer manufacturers as a peripheral device, while the portability of a small, dedicated CDI system has advantages in the consumer market.[18] The large installed base of PCs gives DVI an advantage overall.

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[17] Ibid.
[18] Op. Cit. Davis.

The Forces Behind Multimedia Hardware

Several large computer companies are pushing for the adoption of DVI as a worldwide standard. Intel, IBM, Microsoft, and Lotus are some of the powerful backers of DVI. Intel acquired DVI technology from GE in October 1988 for $25 million.[19] CD-I is the competing standard put forth by N.V. Phillips GL of the Netherlands and Sony of Japan. Many experts, however, agree that DVI is destined to become the de facto standard since it has much wider, general applications. JPEG is also gaining momentum. It represents the highest quality image for the highest price.

Intel and IBM plan to jointly establish a development center to further develop multimedia hardware and software. IBM is clearly using multimedia as a way to be perceived as being on the forefront of the latest that microcomputing has to offer. Yet adding specialized hardware to soup up PCs will be expensive. Michael Braun, VP of multimedia, states that IBM is not ready to say what the minimum multimedia PC will ultimately look like or when it will be delivered, but IBM is marketing a new PC platform today. Of course it has offered a platform, called InfoWindow, that has served as the backbone for kiosk multimedia systems for nearly five years. InfoWindow consists of a dedicated IBM PC, with video controller, display hardware, and color touch screen monitor. More than 600 interactive video disk based

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[19] Ibid.

courseware modules built on this platform currently exist (largely for the medical and related fields).[20]

Microsoft views DVI as a new information medium that will be in the same league as print, radio, and television. On November 28, 1990 Microsoft laid the foundation for the "computer of the future" by announcing its plan to develop a multimedia software platform around Windows, and has the backing of IBM, AT&T, and six other large computer makers.[21]

Doug Camplejohn, Video and Multimedia Product Manager at Apple Computer, says that Apple has a different strategy towards multimedia. Apple sees multimedia as an evolutionary process. Each new generation of machine has more capability to put new forms of power into the hands of the user. The LC and Si have microphones built in for example.[22] It is an emerging field that will evolve, not a one time shift that will be adopted immediately. Their long term strategy is different than that of IBM, who is trying to show leadership in this dimension by promoting specific multimedia products on a large scale.

Other hardware manufacturers are getting into the game as well. DARPA recently selected Sun Microsystems and TI to develop a multimedia video workstation for displaying video, graphics, still images, full motion

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20 Op. Cit. McMillan.
21 G. Zachary, "Microsoft's Multimedia Approach", Wall Street Journal, Nov 28, 1990.
22 Interview with Doug Camplejohn, Product Manager, Apple Computer, Nov 1990.

video, and text on a high definition screen.[23] And the Next machine seems to have been designed specifically for multimedia applications. It has an optical drive option, high resolution graphics and sound capabilities, and built-in video compression cards.[24] There is much work being done by developers and universities across the country for this platform. The pace of development is accelerating faster than ever.

Applications Today

When it comes to applications for this technology, training is the first use that most people think of. According to Pradeep Singh of Microsoft, "Training is the be all and the end all of where full-motion video can be really valuable in business applications".[25] Maybe so, but others are banking on other applications including desktop media for presentations, corporate messages, project planning and visualization, desktop video mail, and product demonstrations. A study conducted by the University of Southern California and sponsored by 3M discovered that while 47% of professional presentations include paper handouts and 13% use overhead transparencies, the most effective presentation aid is video followed by product samples and computer based aids and slides. [26]

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[23] Op. Cit. Lockwood.
[24] Op. Cit. "Next on Campus".
[25] Op. Cit. Davis.
[26] Op. Cit. Lockwood.

High Level Formal Education

Several advanced degree educational programs are currently investigating the power of interactive multimedia as a formal learning tool. Work is currently underway at the following institutions:

MIT	Harvard
USC	U of Cincinnati
U of Massachusetts	NYU
Dartmouth	U of Iowa
Stanford	U of British Columbia
U of Pennsylvania	

As well as many other locations.

MIT has traditionally been a pioneer in such technologies. The Interactive Cinema group at The Media Lab has many projects currently under development that put the reader in the position of control. The Elastic Charles and other presentations in the "elastic" series are computer based "magazines" that let the user fully determine what material and in what order a presentation is viewed.[27] The HyperCASE® was also developed there as a framework for how business school case study may utilize these technologies.[28]

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27 The Elastic Charles - A Multimedia Magazine, Interactive Cinema Group, Professor Glorianna Davenport, MIT Media Lab, 1988.

28 Jonathan D. Harber, HyperCASE®: A Framework for Interactive Multimedia Case Study, Master's Thesis, MIT, June, 1990.

Various schools at **Harvard University** also have interactive media programs underway. At Harvard Law School for instance, Dan Burnstein developed an interactive video lesson called Search and Seizure that puts the student in actual crime and courtroom environments where split second decisions must be made based on the situation at hand and the user's background knowledge. Burnstein states, "It's not a religious experience, but it's close to it... ".[29] The system is also capable of providing feedback to the user on the decisions he made.

The Perseus Project is another interactive video endeavor at Harvard headed by classics professor Gregory Crane. The focus of this project is the study of ancient Greece by allowing the student to "walk around" ancients sites from multiple points of view.[30] The Kennedy School of Government also has an interactive simulation tool, used for the study of crisis management. Based on the disaster at Three Mile Island the interactive simulation requires the student to decide and act for himself as if he were the manager in charge of the plant on March 28, 1979, the time of the nuclear emergency. This simulation is one of the most impressive examples of a situational case. It uses actual ABC news footage and is based on thousands of pages of testimony from several task forces. The scenario rolls in real time adding a sense of urgency that mere reading does not; it allows the player "windows of opportunity" in which to gather information from key people. The exercise also incorporates a sophisticated "scoring" mechanism based on

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[29] Op. Cit. Lambert (p. 44-46).
[30] Ibid.

several different points of view providing rich, immediate feedback to the user. According to Craig Lambert, "The unfolding case has extraordinary complexity and creates emotional as well as intellectual tension." [31] Three Mile Island was used as a model for The Visual Interactive Management Simulator.[32]

At the University of Cincinnati an interactive videodisk courseware module called Managing the Experience of Labor and Delivery teaches student nurses the basics of childbirth in a "live" situational environment making it as close to real life as possible.[33] The health care field is using interactive multimedia lessons as an effective way to handle the ever increasing complexity of health care. This profession is especially attuned to the benefits of multimedia due to the explosion of scientific knowledge and the importance of making sure all students absorb the required information. Interactive sessions such as this one also contain the benefit of time. For example, a 24 hour labor can be compressed into a 2 hour learning experience that actively involves the student.

Other important segments developed for the medical profession include Macblood developed at the University of Pennsylvania to teach pediatric blood cell morphology, The Hippocrates Project developed at the NYU Medical School which spans most of the subjects covered in medical

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31 Ibid.

32 Based on Interview with Tom Fletcher, author of "Three Mile Island - A Stress Management Case Study", Harvard Kennedy School of Government, Mar 1991.

33 Op. Cit. McMillan.

school, and Difficult Diagnostic Cases developed at the University of Iowa's College of Medicine to illustrate the fact that data in the real world are often messy. At the Dartmouth Medical School The Informed Patient was developed to help the patient with the choice between surgery and watchful waiting.[34]

Formal Education At The Elementary Level

Everyone will learn better with well designed multimedia aids such as these. Younger students will be especially attuned to these "new" techniques. The issue of bringing a videodisk based curriculum program as an approved substitution for the conventional textbook is currently being watched very closely around the country as Texas has just adopted such a program.[35] It should be noted that one of the strongest arguments against multimedia tools in the elementary school curriculum lies in teachers' fears that these tools might "further inhibit the development of reading skills in a generation of students already notorious for their short attention span and addiction to television". Maybe so, but it is just as possible that learning tools such as these may incite the learning potential in these same students.

Researchers at Stanford University are also experimenting with bringing videodisk technology into the classroom. They state that the videodisk is particularly effective at bringing hard-to-capture complex visual events closer to the student in forms suitable for learning. A theatrical

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[34] Ibid.
[35] Op. Cit. Allen.

performance or an erupting volcano are examples of such events which are easier to experience "first hand" than to read a description about. The technology allows students to interact with the medium by selecting a particular event, repeating and analyzing specific movements or sections, comparing different parts of the work, and intervening with the work itself in specific ways. The Shakespeare Project at Stanford is an interactive program that uses Apple's Hypercard and videodisk to teach students interactively about the performance arts.[36]

Other Applications

The power of this new set of enabling technologies is certainly not limited to formal academic education. While several early adopting corporations have seen the potential of multimedia for training, sales and marketing, and general communication, other companies are starting to see the potential value of such a set of information tools.

Industrial Interaction

Several corporations have begun to use multimedia systems as ways to enhance communications to employees, to train workers and to help marketing programs become more effective. Home Savings of America, one the the country's largest savings and loan institutions, and Norm Reeves Honda in Southern California have introduced interactive multimedia information systems that link images with data processing. Infotechnology,

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[36] Op. Cit. McMillan.

the financial quote service, decided to blend news reporting from the Financial Network News, which it owns, into its quote service to spice the report up. This allows the financial analyst the ability to watch the news and research stock information simultaneously on the same piece of hardware. Ford Motor Company currently uses optical disk technology to train mechanics. Interactive video disk systems are even making their way into the banking community, for the use of training. One of the first such programs is called Sales Challenge and has been used by various banks such as Sovran Financial Corporation in Norfolk, VA. to improve face to face selling skills of its loan personnel by showing how to handle certain marketing situations.[37]

Information Services.

Several organizations have used interactive systems to help with the customer service information that tends to be repetitive such as directions and attractions for visitors and information gathering and service selection in hotels. Hertz car rental has just introduced an interactive viewing system aimed at helping customers with information about the area they are in once they have obtained a car.[38]

At the World Financial Center in New York City, multimedia kiosks are used to direct visitors around the large complex of shops and attractions. In the City of Boston, Massport uses similar systems in Logan Airport to

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[37] Shimon-Craig Van Collie, "Bank Technology Teachers", Bankers Monthly, Sep, 1990.
[38] Site visit, Logan Airport, Nov, 1990.

show visitors what and where some of Boston's key attractions are. Marriott Hotels also uses different types of interactive customer systems. Customers can check out, order meals, and see what is happening in the hotel and around town through the system in their room which is ported through their televisions.[39]

Retail Interaction

The most aggressive programs developed to date have been in the retail sector were many companies have used these concepts as strong marketing tools.

J.C. Penney, a company which has traditionally been on the forefront of retail Information Technology use, is currently working on an aggressive program to develop a multimedia information system that will transmit product information and images across a private television satellite network to customers.[40]

Steelcase has been a strong supporter of the benefits of multimedia since 1988.[41] The company decided to aggressively exploit the power of an Apple based multimedia system in order to successfully introduce a new non-traditional office furniture line.

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39 Ibid.
40 M. Mandell, "Playing with ITV", High Technology Business, Mar 1989, (p. 48).
41 M. Fitzgerald, "A Dilemma Made for Multimedia", Computerworld, Feb, 1990.

Florsheim Shoes is a manufacturer and retail store chain producing and selling men's shoes. Florsheim has an interesting and advanced interactive video system called Express Shop (one of the kiosk systems designed by ByVideo, described above) in each of its stores. This system allows the customer to view the entire product offering which consists of approximately 250 different models of shoes in a variety of ways. Jim Claren, product manager for Express Shop states that about 90% of Florsheim's retail outlets have an Express Shop terminal on the premises and that the system will be 5 years old in July.[42] He states that the machine is a tool that allows the sales personnel to sell more increasing each store's revenue by 35 - 45% and the bottom line by 3 - 5%. These benefits are achieved primarily by allowing the customer direct access to the company's million shoe factory inventory in each store while actually only stocking about 300 pair per store. But that isn't where the real value of the interactive system is. Three quarters of the disk is devoted to sales training. Claren said that the only reason the system has been successful is that the enthusiasm of the people make it work. Productivity goes up, and jobs are not threatened since the system was designed as a tool and not as a salesperson. The main benefit of this system is that it allows a customer to browse quickly and effectively through the entire stock. The novelty of the system also helps bring customers into the store.

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[42] Interview, Jim Claren, Product Manager, Florsheim, Dec 6, 1990.

The Uses Are Unbounded

The range of applications that multimedia technologies can be applied to are nearly endless. From entertainment, to education and training applications, to sales and marketing tools, this technology can eventually be used anywhere a set of information needs to be transported or used. Competitors in this field are still determining which technologies will emerge as standards. Until this happens and electronics and computer hardware and software companies enter the mass markets, the marketplace will primarily consist of existing professionals and early adapters. At this stage, experimentation plays a vital role in the research labs and forward thinking classrooms and corporations.

CHAPTER II.
THE VISUAL INTERACTIVE MANAGEMENT SIMULATOR

An interactive multimedia management case was developed as part of this thesis. It can be seen at the Interactive Cinema Group, fourth floor of the MIT Media Lab.

History

The Visual Interactive Management Simulator (VIMS) grew out of a need to bring to the classroom the reality of the high level decision making process that actually takes place in industry. This format shows that key decisions in the development of a company are as much made from experience and "gut feel" as by the formal modeling and financial analysis techniques that are taught at top business schools. The idea behind the simulator is to create a prototype "simulation environment" that can eventually be used in the core curriculum because it can teach better than any other method or tool.

Background: The HyperCASE®

The Harvard Business School case is a standard upon which many business school programs are based. However, many professors and students believe that cases using text only are too limiting and primitive. It is not the most efficient way to get certain points across to the reader, yet this format has been used to study business situations for over fifty years. The interactive multimedia case could bring more richness to the experience by allowing the

user the opportunity to "see" or even be part of the situation described by the case.

The concept of HyperCASE® was created in 1990 as a way to bring more richness and functionality to the business school case analysis task.[43] It employed certain analysis tools such as Porter's "Five Forces" worksheet [44], and positioning maps, as well as some very interesting software utilities such as "Sheet Builder" which allows the user to interface with the quantitative figures in a case. An example was presented where feedback was automatically given to the user as certain "rules" which were set up in the spreadsheet were violated while allocating resources for next year's budget. That project presented a framework for making the standard business school case into an interactive case.[45] While it involved the user more directly in the process than the standard case is able to, it keeps the same format of the case, namely, a situation is described, a problem is presented, and the user must think of a way to solve it using various analysis frameworks. This environment allows more efficient information gathering and provides computerized versions of classic management analysis tools utilized in the standard case format.

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[43] Op. Cit. Harber, HyperCASE, 1990.
[44] Michael E. Porter, Competitive Strategy, (p. 368), The Free Press - A Division of Macmillan Publishing Co., Inc. New York, NY., 1980.
[45] Op. Cit. Harber, HyperCASE, 1990.

Purpose of The VIMS

The purpose behind this development effort is to demonstrate a prototype of one possible architecture that could be effective in enhancing the teaching capability of the business school case. It is to act as a proof of concept of an interactive decision making process which attempts to move beyond the traditional translation of the text-based case to further empower the student by allowing him to "learn by doing".

While this prototype is not in classroom ready form, it shows some of the teaching power of the interactive case method. This project builds upon some of the work performed by Jonathan Harber at MIT in 1990. Harber's environment offered a set of analysis tools, both qualitative and quantitative in nature that allows the student to selectively choose information of interest, use video as a source of new information and expert advice, and capture his thought process for later use.

The Visual Interactive Management Simulator (VIMS) takes a different approach to the case method. It intends to place the user inside the case by involving him in the decision making process in a real time model rather than asking him to analyze a situation solely as a basis for class discussion.

VIMS is a role playing scenario that puts the user in a situation that forces him to make critical decisions. This version is essentially a qualitative exercise rather than quantitative largely because the decision making process at Fluent Machines did not tend to utilize formal quantitative methods. The

process instead relied on years of experience in the fields of computer technology, product development, and company building held by the senior management team. This process usually involved some or all of the senior managers and other key personnel discussing the decision at hand, brainstorming about possible solutions, and deciding by consensus on the course of action.

The success of the decision making method used at Fluent depends on the mangers having vast and somewhat dissimilar backgrounds and expertise, and personalities able to compromise and reach conclusions. The group of managers at Fluent qualified strongly in that respect. The VIMS approach can work especially well in this scenario. The premise is that "learning by doing" is in many cases the most effective way to learn a complex skill or function. This is a concept studied in great detail by Seymour Papert and his group, "Epistemology and Learning", at MIT's Media Lab. His views are documented in this group's most recent publication, "Constructionist Learning", which is an analysis of new techniques to improve the formal learning process. Papert, in the introduction, states:

> "Better learning will not come from finding better ways for the teacher to instruct but from giving the learner better opportunities to construct". [46]

This is one of the premises upon which the VIMS is built.

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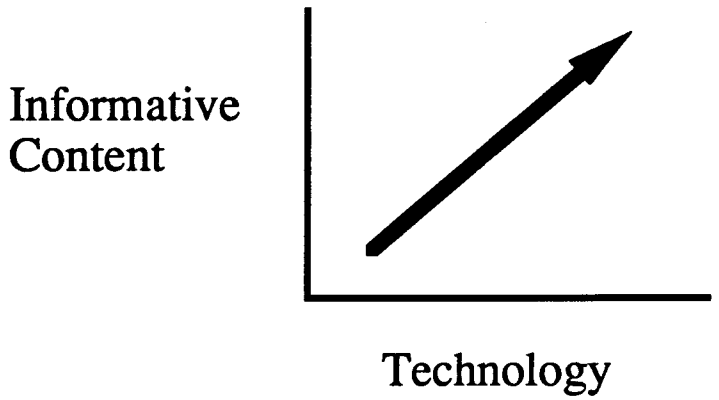
46 Seymour Papert, "Constructionist Learning", Introduction, Ed: Idit Harel, April, 1990, MIT Media Lab.

The goal of the VIMS is to demonstrate four main points. One, that decisions made by managers are often based entirely on experience and "gut feel". Two, that there is usually not enough information available to make tough decisions, especially ones dependent on future events. An original intent of the VIMS was to make the simulation environment a multi-generation decision format so that the user would have to "live with" his decisions over time and see the impact that an important decision can have on later decisions. Three, that decisions in most companies, especially smaller ones are truly "interdisciplinary"; that is, marketing, finance, and technology issues , for example, can have a strong effect on one another. This is a point that is often ignored in the "subject" oriented approach to business school teaching where the overlap of various subjects tends not to be stressed. The fourth point is that video can be an extremely important medium to document interpersonal communication, especially meetings or arguments where non-verbal communication contributes a significant portion of the message. The case also intends to simply follow the early development of an interesting technology based company from the ground floor and document it for the future. It is certainly not known at this point whether the company will even survive let alone prosper in the years to come.

How this Project fits into "The Big Picture"

The VIMS attempts to combine valuable content from a business school teaching perspective with the power of interactive technology to be truly interesting and useful to the student. While Harber , in the creation of HyperCASE®, offered some fascinating ideas for the interactive case in the

way of software technology, VIMS tries to add more in the way of specific case content. This content was achieved at the expense of implementing many of the advanced analysis tools or furthering the technical capabilities introduced by Harber, but it is intended to be used as a workable prototype rather than merely a framework. The intent is to make significant progress in both technological capability and as subject content over time (see figure-1 below). The VIMS is offering another possibility in the way the business school case may look in the future. If goes beyond the traditional case format, hopefully opening the way case study is written and used.



(Figure - 1)

The Anatomy of The VIMS

While some of the ideas of the simulator are presented through selective "screen dumps" in the appendix, the point of the project is best presented through its actual use. The architecture of the project was designed to lead the user through a simulated decision making process that was actually faced by the managers at Fluent. The environment was designed to match the reality of Fluent's situation as closely as possible.

The managers at Fluent allowed most of their high level meetings to be videotaped which helped illustrate many of the issues they were dealing with. In fact, the only meetings which were not allowed on tape were board of directors meetings. The timeframe of this simulation covers a four month period starting in January, 1991, and ending in late April. This proved to be a very interesting period of time for the company in terms of its development. In January, a new CEO was hired and brought on after an exhaustive six month search. While this new CEO, Dick Meise, came from running another high technology startup, Fluent's technology was new to him, so he started by having to learn the details of the business from the ground floor. This became a good opportunity to bring the user of the simulation into the story of the company.

During that four month period, the five key managers faced some difficult issues that needed immediate attention, including technology, financial, and marketing issues. This was another good opportunity to capture a key point of the simulation: the key issues currently on the table represent many aspects of strategic and tactical formulation, and many management disciplines are indeed tightly intertwined. For example, the technology issue is in many ways dependent on the financing strategy. The company is cash strapped and must quickly raise its second round of venture financing. The result of the technology decision is likely to impact the success of the financing strategy dramatically. Similarly, the feasibility of the technology options depends on the amount of cash the company expects to have. Each issue has repercussions into the others in similar ways.

The user actually has four decision to make, the three strategy issues (technology, marketing, and finance strategy), as well as which order to make the decisions. This version uses simple binary (yes/no) decisions, however, in the future it can be expanded to cover more complex and creative solutions.

How the VIMS Works

The student is initially briefed on the current situation as of January 1991. Access to a variety of information about the industry, the company, the product, the finances, and the management team at Fluent is available at any part of the decision process. A diagram of the architecture of the game is presented in Figure-2 below.

Once the basics of the situation are understood, the user is faced with a listing of the decisions to be made. The first decision will be to figure out what order to make the three strategy decisions. If the financing decision is made before the technology decision for instance, a unique scenario will be faced. Also, once the user chooses a decision to make, that decision must be made before moving to the next decision (more advanced programming techniques can ease this restriction in the future).

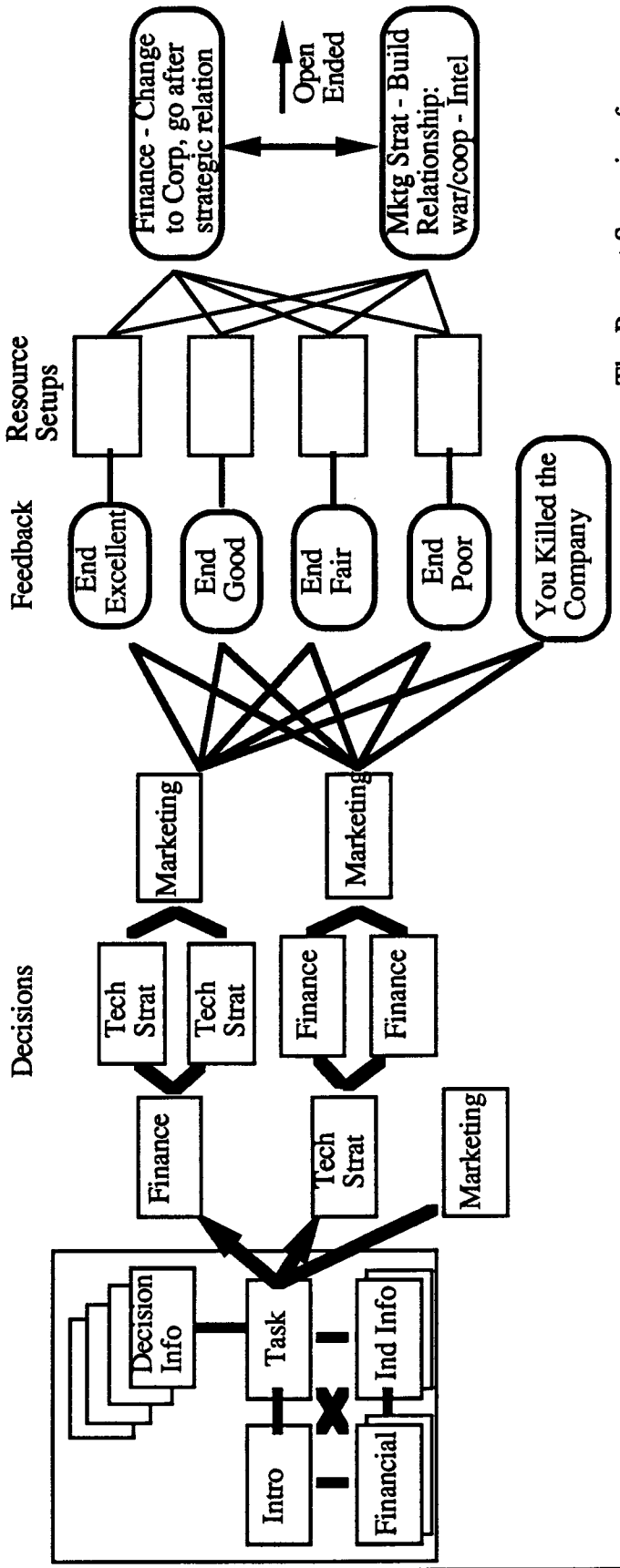

Finance - Change to Corp, go after strategic relation
Open Ended
Mktg Strat - Build Relationship: war/coop - Intel
Resource Setups
Feedback
End Excellent
End Good
End Fair
End Poor
You Killed the Company
The Present Scenario - for further generations or discussion
Decisions
Marketing
Marketing
Tech Strat
Tech Strat
Finance
Finance
Finance
Tech Strat
Marketing
Decision Info
Task
Ind Info
Intro
Financial

Figure-2

Fluent Machines: The First VIMS Application

Fluent Machines, Inc. was chosen as the prototype company for this project for a variety of reasons. Not only is the company building products to compete in "multimedia markets", but much of the core engineering talent comes from MIT's Media Lab, so there is an inherent interest at Fluent in helping with this type of application. The issues that the company was facing during the initial span of this project were also very interesting. These issues provided an excellent example of where this type of architecture could be used. Also, the company was still young enough such that the entire management team was concerned with most of the key decisions, thus the interdisciplinary decisions were considered together. While Fluent represented a great example for this project, another strong reason for following them in particular is because they let us.

The Design Process

Designing an interactive multimedia case adds significant complexity to the story or case creation process. On top of obtaining the necessary facts and company history, the interactive casewriter must also make media choices. If video is chosen to accentuate a point, many hours of footage must be shot in order to obtain a few minutes of usable material. In some cases the author will have to "stage" the video segments to obtain the required feedback or event. Tom Fletcher, researcher at Harvard's Kennedy School of

government likened the interactive creation process to "producing five screenplays all at once".[47]

The design process was shaped significantly by the current state of storage technology. The video footage was constrained to 29 minutes, the amount of time allowed on one videodisk. While this limitation restricted the amount of information that could now be presented by video, it also forced a selective use of that medium. If this constraint was larger, as it is sure to be in the near future with better technology, the project would undoubtedly look and work very differently. While this limitation forced conciseness, it also required cutting some valuable background information.

One aspect of the simulation involved providing the user with some sort of immediate feedback such that the likely effectiveness of the decisions could be gauged. This choice required creating a "closed environment" such that the user is forced to choose from a series of decisions rather than formulate those solutions independently. The benefits and pitfalls of this approach are obvious. It was decided that the ability to provide the user with this feedback was worth the expense of giving the user total freedom in creating solutions. This is one of the major departures from the traditional case study approach.

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[47] Interview with Tom Fletcher, Harvard Kennedy School of Government, March, 1991.

Platform Decisions

The interactive design process starts with a platform decision. What hardware and software will be used to drive the presentation? In many cases, this decision is limited to what is available. Current technology and availability makes the Apple Macintosh a strong candidate and the one chosen for the development of the VIMS. The software decision should be based on the type of presentation being designed. A story line designed in decision tree format is most suited for a "card stack" based package that allows the user to choose situations and move easily to new ones. Hypercard and Supercard are two such packages. The VIMS was designed using Supercard version 1.5. If the environment is to be largely numerically oriented, a spreadsheet based programming environment such as Wingz makes good sense. The first HyperCASE® prototype was written using this software package.[48]

Media Decisions

Once the platform is decided upon, the media decisions must be made. When should video be used - text, audio, graphics...? Since the case was not produced by a professional team, the media choices were kept simple. Text was used to describe simple situations about the game software, or details about the user's immediate situation. Video footage was used to show people and the interactions between them. It can be a good way for a user to identify

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[48] Op. Cit. Harber.

a character in the case because he can associate a visual picture with him. In some cases, single person interviews were used to provide more information.

A matrix of the media decisions for the VIMS is listed in Figure-3 below. These decisions were visualized before the project was started, but were not finalized until near the end of the development process. This is due largely to the uncertainty of how issues would develop at the company and how certain segments would turn out in the lab.

VIMS
MEDIA DECISIONS

CONTENT	TEXT	GRAPHICS	MOTION VIDEO	SPREAD SHEET	AUDIO	STILL IMAGE
Game Introduction	X	X			X	X
View of Company			X			X
Financial Info				X		
Meetings			X		X	
Background Info						
Product Demo			X		X	
Meet Managers			X		X	X
Game Instructions	X	X				
Feedback	X		X		X	
New Information	X		X			

Figure-3

Financial information in the VIMS is provided through "static" (non-alterable) spreadsheets, and some graphics are used to provide information to the user. This revision of the program has been kept simple in terms of the

sophistication of the graphics employed and the simulator software. It is hoped that these details will be improved upon in future work.

Building the Storyline

Modeling reality with this type of application can be extremely difficult. The two largest concerns are keeping it open for creativity, and managing the complexity of multiple decisions or generations. The more options or decisions included in the simulation, the more the author must manage the decision process. This management is only necessary if a scoring or feedback mechanism is used. If the purpose of the presentation is simply to present information and have the user create a solution from scratch (similar to the traditional case method), there is no need for the author to control or even provide choices for the user.

It can be quite difficult to model an"open" decision making process such as this. While the Fluent case is a relatively simple example of a decision tree architecture with only four decisions, it still needed to cover the 16 possible choices the user could make. Some of this complexity was avoided by combining outcomes, but the complexity of many decisions must be managed efficiently in larger scenarios, so that the possibilities do not get out of hand. The level of complexity increases exponentially as new options or decisions are added.

Other Features

One of the goals in making the VIMS was to provide some immediate feedback to the user after he finishes making his decisions. Providing a

scientific scoring solution to a decision tree format like the VIMS could be the subject of an entire research project itself. The VIMS only approached the issue of scoring in order to illustrate the potential usefulness of direct feedback.

Adding More Features

There is a series of other details and functionality that can be incorporated into a project like the VIMS to make it more robust, realistic, and enjoyable. One of the exciting aspects of working in this environment is the seemingly limitless possibility of adding more detail and functionality. A more full set of options extending off of each decision is one way to expand the realism of the game. Adding better color and artwork to each screen and better quality video would enhance its visual appeal, while there is a wide range of functionality that could be added through the software. Functions like "live" spreadsheets that allow the user to allocate future resources, "hypertext" that allows a user to dynamically traverse through stacks of text based information, dynamic information of external events which change uncontrollable variables like the state of competing products, and the ability to perform quantitative decision analysis all could be added today to increase the complexity and realism of the game.

The Current State of the Simulator

Today, the VIMS works through one full generation of decisions (the four decisions mentioned previously). It incorporates analog video clips through use of a videodisk, and provides the user with feedback based on the set of decisions he made. The storyline of the game continues past the

feedback point to show the user the "current" state of the company. The user is now four months into the job as "CEO". The new critical situation facing the company, namely, how to build a key corporate relationship is then presented and left as an open ended issue to be resolved and discussed. The user is left with not knowing the final status of the critical second round of financing, and not having secured the corporate deal yet. Fluent's new product is scheduled to ship in two months with some key decisions made, but some new ones still to be resolved.

CHAPTER III.

FLUENT MACHINES: THE PAPER BASED CASE

An example of a text based case on Fluent Machines is presented as a basis for comparison with the interactive simulation version.

Introduction to the case

Most business decisions must be made based on good business judgement. The following is a business simulation exercise where you will be called upon to decide the future direction of a start up concern and then be forced to live by those decisions in the future. You will take the point of view of Dick Meise the company's new president who must decide along with the key managers the short and long term policies of the company.

The following issues that you as the user will see are actual issues that the management at Fluent Machines encountered during the company's second full year of operations. It by no means covers all of the important issues that were encountered during this time, only a select few that make up a slice of time in the history of the company. The simulation has been designed to illustrate some of the real issues the senior management of a small growing company might face at a given point in time. It is hoped that the user will utilize concepts acquired in business school in conjunction with innate skills and experience acquired throughout a lifetime.

Fluent Machines
Cross Section of a High Technology Startup

I. Scenario

Dick Meise, the CEO of the fledgling Fluent Machines Corporation, sat back, looking across the busy, open room that housed the cluttered desks of all 26 employees not sure what to do next. He was in the middle of a myriad of sticky situations that all needed his attention and the attention of the senior managers equally. It was his job to prioritize and delegate. He knew that the results of the next few decisions that had to be made were key to the future success, even survival, of the company. He also suspected that the order in which he made these decisions and subsequently executed them could have important effects on the future direction of the company's strategy since these decision had strong interrelations to each other. Finally, he knew that these decisions had to be made soon so that the strategic direction of the company could finally be reset and the next set of milestones completed.

Neil Ferris, the Vice President of Operations and Treasurer, turned to Meise to remind him of the meeting with the four senior managers this afternoon. They would be discussing the same topics that had been on the agenda for the last few weeks. Today they hoped to start reaching some conclusions.

Three major strategic issues were on the table. They were all considered vitally important to the future of the company, and each one had strong impact on the other two issues. They all had to be addressed as soon as possible, but it was unclear which issue should take precedence. Each issue represented a key business discipline: Financing strategy, Technology strategy, and Distribution strategy.

Meise got up to get another bag of popcorn before the 3:00 meeting with his management team.

II. Introduction / Background

Meise had just come into this position six weeks ago from Banyan Systems, Inc., a successful PC based network software startup that he had run. While that company was in a related business, networks, many of the engineers at Fluent spoke a different technical language. This was a new world: a world exploring the integration of computer technology and video technology and the related markets that this capability would undoubtedly open up.

History of the Company

The company was formed in January of 1989 and was "self seeded" by Dr. David Nelson. Since that time, the focus of the company has changed along several dimensions. The original focus was to provide end users with a full system capable of allowing the creation or "authoring" of "multimedia" presentations. That focus has changed to provide technical subsystem and software solutions for users to capture high quality video images and use them in various ways. The true visionary behind this venture, David Nelson, just gave up the role of CEO so that he could concentrate his energies where they belong -- behind the technical vision of the company, driving development.

Background: Dr. David Nelson

Dr. Nelson, the Chief Scientist and founder of Fluent, announced the birth of the company the day he resigned from Apollo February, 1989. He brought with him Neil Ferris to act as the treasurer and to run day to day operations. Together they assembled a small development team consisting of the best computer hardware designers from Apollo and the brightest video engineers from the MIT Media Lab. The new team worked out of Nelson's house for half a year putting the initial business plan together, building the team, arranging the first round of financing and developing the technology and strategy that would allow Nelson to "do it again".

Dr. Nelson began his career as a pioneer of sorts at Digital Equipment Corporation where he helped design the now famous VAX architecture. He went on to be one of the early employees at Prime Computer, and then he helped start Apollo Computer. His focus has generally been to push the technical capability of the "new generation" of computer hardware. The VAX defined a new class of computer called the Minicomputer. It was more efficient for many problems and less expensive then the mainframe pioneered by IBM in the 1950's.

He then became one of the key engineers behind the development effort of a new minicomputer company in the Boston area called Prime Computer. After 8 years at Prime, Nelson moved to co-found Apollo Computer which was pioneering the concept of the workstation, a powerful desktop computer capable of solving complex engineering problems. The invention of "virtual memory" allowed for such power gains in such a small package.

The Other Senior Managers

Neil Ferris, Larry Pape, and Prem Uppaluru are the three other senior managers, vice presidents of Finance and Operations, Marketing, and Engineering respectively. Pape and Uppaluru have been with the company for less than six months, but they each bring expertise in their respective fields.

Changing Vision

During the first year of the company's existence several key actions took place. One of the most important milestones was the putting together the formal first round financing of the company. Another was the introduction of Fluent's first product, the FM-1, a multimedia authoring system complete with IBM compatible PC, lots of memory, a microphone, video camera, and other peripheral equipment, and the "authoring software" which gave the user the ability to edit his digital video productions. Also, several key management and technical personnel were added to the list of employees.

The original business model followed that of many successful technology based startups in that the company packages core technology as well as products built on that technology to meet the needs of several horizontal market segments.

Evolution to the Current Plan

During the past year, the managers decided to shift out of the "systems" business and into the "subsystems" business (circuit boards that fit into existing PCs), eventually getting into the software only business. The software business tends to provide higher margins than hardware for the manufacturer. Software seems to be the safest startup segment of the computer industry today.

Now, a year after raising its first formal round of startup capital, the company is looking for its next round of financing from external sources.

Fluent Machines now employs a total of 26 employees including management, support staff, and two sales representatives. The second product is currently under development and is scheduled for introduction to the marketplace in June of 1991. As this product evolves, a strategy must also be developed around the limited resources of the company's marketing organization.

III. The Industry and The Market

Many companies are currently exploring the opportunities involved with merging video and audio technologies with the computer environment. Some companies focus on the development of these technologies, while others concentrate on developing applications using this type of technology.

Fluent's business plan states: "Digital video in the desktop computing environment is expected to be one of the fastest growing segments in the

computer industry during the 1990's."[49] While the decade of the 1980s saw the advent of the graphical user interface and the acceptance of computers by new users, these user interfaces will evolve to incorporate digital video and audio expanding the utility of current business applications and creating new ones. "Inteco, a computer industry research firm, forecasts a $14.9 billion market for video/audio PC-based systems by 1994."[50]

Many supporting technologies are being developed concurrently with digital video technologies. Some of these include: High speed PC local area networks, new image compression chips, high resolution displays, and high capacity memory devices. Similarly, several key industries are driving the development of digital video/audio capabilities from several directions:

- Personal Computer manufacturers are searching for new value added technologies to boost profits in the highly competitive low-end computer market.

- Telecommunications Equipment manufacturers are looking for new digital applications to justify new high bandwidth services that handle large data rates, like ISDN and SMDS. Networked video is the main application of interest for these companies.

- Broadcast and Publishing companies are searching for ways to satisfy a growing demand for interactive information services by merging video footage with other media services and marketing the resultant product.

According to many industry experts, digital video will fully replace analog video this decade as the standard broadcast and communications foundation. This will allow for the efficient storage, manipulation, and transmittal of vast amounts of video information. Specifically, when video makes its way into the desktop computing environment, it will "convey human qualities, present motion images of remote places, and explain

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[49] Fluent Machines Business Plan, Jan 1991, Not published.
[50] Ibid.

complex procedures." It will also change the way personal communication is conducted. Video communication will be possible when the appropriate advances in computer architecture, compression algorithms, and telecommunication services are implemented.[51]

Multimedia

David Nelson and the mangers at Fluent have very strong beliefs about the direction of multimedia and how products currently being developed at Fluent will fit into that direction:

> "Sight and sound are the major senses used for human communication. Fluent's products support these vital senses by making digital audio and video standard data types in computing, telecommunications, and publishing applications. Fluent enables the seamless integration of audio and video information with standard computing applications such as desktop publishing and spreadsheets, and supports development of new multimedia applications such as on-line help, point-of-sale/point-of-information kiosks, computer-based training, video post production and desktop videoconferencing."[52]

> "...Full motion video and sound mean that the user has the ability 'to pop up a window [on a workstation] and see Peter Jennings live on the evening news,' Nelson says. Or it permits a user to experience a complex medical procedure via videotape, such as the suturing of an artery during open-heart surgery."[53]

> "Nelson believes it's too early to tell how far multimedia technology will go. 'I truly believe that this is generational- a major push for the '90's and not just another tweak of computer technology. This is a technology that will become ubiquitous and commonplace in five to eight years,' he concludes. However, he cautions, 'trying to understand in 1990 all the applications for it is like trying to project the applications of the Macintosh user interface in 1982.'"[54]

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51 Interviews with all Senior managers and Fluent Machines Business Plan, Jan-Apr 1991.
52 L. Curran, "Nelson Works on Multimedia", Electronics, March, 1990.
53 J. Vaughan, " Multimedia Start-up taps i960", Electronic Design News, Mar 21, 1991.
54 Ibid.

Fluent's architecture will help satisfy the growing demand to integrate digital video and audio into business and professional applications that allow people to communicate better. Video/audio mail, videoconferencing, interactive video kiosks, various education scenarios, and new generations of business presentations are such applications.[55]

Digital Video

The main problem with storing pictures, still or moving, on the hard disk of a computer is that each picture at video quality uses a huge amount of memory. Much work is currently underway to address this problem from different angles. Some of these companies are looking at new ways to store massive amounts of data on such media as compact disk. Other companies are investigating techniques to reduce the amount of data needed to be stored in the first place. The human eye tends to be very good at "smoothing out" incomplete visual data. That is, it extrapolates images when necessary. Certain data in a detailed picture can therefore be omitted without a person noticing a degradation in image quality.[56]

IV. The Market Opportunity

> "The emerging market for interactive digital video applications is expected to grow explosively during the 1990's, driven by the merger of computer, telecommunications, and digital video technologies. This growth will be fueled by user demand for applications which communicated more effectively, and by several industry trends supporting the commercialization of digital video: emerging standards for video compression/decompression, rapidly improving price/performance for desktop computers and peripherals, and availability of cost-effective application development tools."[57]

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55 Op. Cit. Fluent Business Plan, Jan 1991.
56 Interview, Dr. David Nelson, Feb 1991.
57 Op. Cit. Fluent Business Plan, Jan 1991.

Current Applications

Today, several applications of this technology are being put into practice. They include:

- Computer Based Training /Education
- Video/Audio Mail
- Interactive Information Kiosks
- Desktop Video Conferencing
- Desktop Presentations

Current Beta Sites

The company currently has six beta test sites for its next product. One is an advertising firm in New York. They believe in the use of the technology:

> "In a focus group, a raised eyebrow means everything. We need a way of going beyond analyzing cold numbers and really understand what the marketplace is telling us. Fluent is helping us redefine how an ad agency can do its job."[58]

First Product: FM-1

The company's first product, the FM-1 was introduced to the marketplace in the summer of 1990. This product was a multimedia authoring and presentation system consisting of an IBM PC or PC clone, peripheral hardware including speakers, a large hard disk drive,... and two printed circuit boards which hold the proprietary added value of Fluent, namely the compression/decompression algorithm allowing for the handling and storage of digitized full motion video, and an audio/video overlay algorithm allowing audio signals to be sent in concert with video information.

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[58] Lieber-Katz, quote from Fluent Business Plan, Jan 1991.

V. Existing Marketing Strategy

"The company's marketing strategy is focused on building strategic relationships with key industry players to expand distribution and extend technology. In addition, Fluent will market its products through selected third party distribution channels such as VARs to leverage markets and applications." [59]

Fluent's current general marketing strategy involves two steps: One, "Establish strategic relationships with key industry players and early adapters to seed and expand the market", and two, "Establish a multichannel distribution capability to leverage 'multiple level products and technologies'".

1. Strategic Relationships include ongoing development, financing and marketing talks with Intel, Olivetti, Nynex, Lotus, University of Lowell, MIPS, and Hewlett Packard.

2. Multichannnel/Multiproduct Distribution means that Fluent's principle products, which can be inserted into PC expansion slots for instant use by customers, can also be adapted into multiple product forms based on the core technology. Products were designed so that the software, hardware, and microcode are "compartmentalized", that is, separable to address diverse customer requirements. The channels targeted by the company include :

OEMs - PC Manufacturers who want to license Fluent technology as part of the core product line offering.

Systems Integrators - Can build and offer a turnkey solution on a variety of platforms.

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[59] Op. Cit. Fluent Business Plan, Jan 1991 (p.11).

VARs - Would add a specific application and resell it along with Fluent's products and the system as a full solution. See table-1 below for complete breakdown:

Product	Channel
FM Syst	OEM, Integrators, VAR
Boards	OEM, Integrator
Tech	Telecomm, OEM, Broadcasters...

Table - 1

This gives the company the ability to approach members of different channels with varied product offerings.

Pricing

The price point of the two circuit boards to be introduced this Spring (AVOC and CODEC) is high compared to other products on the market, but the performance and quality far exceeds anything on the market today, or currently being developed (known by management). The board set will sell this spring for about $3500 while IBM is selling similar functionality for as little as $2000. The next generation of the Fluent product will shrink this board set into one board by incorporating custom designed circuitry (ASICS - Application Specific Integrated Circuits), thereby drastically reducing this price point in volume. But that plan is at least 15 months away.

The Exploitable Advantage of the Company - The Product

Fluent provides the support circuitry to support many of the standards that are currently being developed in the area of video digitization.

> "Fluent has designed a *video system architecture* as the sustaining foundation for current and future products. Implemented in PC/AT compatible circuit boards and software, this architecture can handle input, process and display of multiple simultaneous windows without impacting the host personal computer's performance. This capability differentiates Fluent from

> companies which offer add-on video products. Fluent's engineering team draws on substantial experience from the MT Media Lab, the world's leading research facility in digital audio and video technologies."[60]

The compression algorithms developed at Fluent will merge still image, motion image, and teleconferencing standards, while handling extensions to the environment as they evolve. The goal of the company is to become the leader in digital video technology.

The product offering is currently a set of two printed circuit boards and accompanying software that can be added to existing PC compatible platforms to allow for full motion video capture and display from a variety of video input sources (TV, Tape, Camera, Video Disk, Hard Disk...)

Current Product and Technology Positioning

Computer video is the furthest entity on the functionality/time graph since the advent of television. Digital video/audio technology can be divided into five levels of product development: Silicon, System, System Software, Development Environments, and Applications. Fluent's strength is located in the three middle sections, System, System software, and Development Environment. They act as the technical link between silicon chip manufacturers and applications developers.

VI. Technical

> "Desktop Video, The Problem: Bringing full-motion video to the desktop requires a system that can process enormous quantities of data in real-time, and sustain very high data rates continuously. Standard personal computers lack the processing power, bus bandwidth, and I/O capability required to do the job."[61]

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60 Company Biography, Fluent Machines, Mar, 1991, press information.
61 From: Fluent Machines Press Release, Mar, 1991.

Fluent has designed a video system architecture which processes and displays digital audio and video in standard desktop computers. This capability allows these pieces of data to be handled and presented as a "standard data type", like numbers, text, and graphics are commonly displayed today. The architecture handles multiple streams of digitized data without impacting the performance of the host PC, a feature that differentiates Fluent's techniques from other third-party video products.

Fluent will become a "supplier of enabling technology for full motion video and sound to the computer industry".[62] The idea is to make this technology as easy to integrate as spreadsheets are today. The company uses a technique that it has developed on its own called sub-band coding which is more suitable in an interactive computer system than region coding which is the basis of Digital Video Interactive (DVI), Intel's approach to the problem.

> "Nelson points out that 'full motion video and sound is a real time problem that would normally require dedicated bandwidth if existing compression algorithms were used'. He calls sub-band coding 'the next generation because of its adaptability to systems that can't deliver real-time dedicated bandwidth,' which is difficult to do in an interactive system."[63]

VII. Current Financing Status

A total of $4.75 million has been invested to date including $1 million by the founding team and $3.75 million by the first round investors. These investors include a combination of traditional venture capital funding, and corporate investors. The Venture Capitalists include:

Applied Technology - Early stage information technology based ventures.

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62 Op. Cit. Vaughan.
63 Ibid.

Aeneas Venture Corporation - Private investment arm of the Harvard Management Company.

And the corporate investors include:

NYNEX - Working on video network technologies

Olivetti - Integrating Fluent products into their own PCs.

ASCII Corporation - Japan's largest independent developer of business and game software.

First Round Financing

In the first quarter of 1990, several investors including venture capitalists and corporate investors provided a total of $3 million for the purpose of building and marketing the first product, the FM-1. With the "burn rate" scheduled to be about $3.2 million over the year, this round was designed to last about a year. This relatively short time horizon was designed into the financing plan by the first round investors in order to give them the ability to evaluate the effectiveness of the management team over a short test period before more significant sums of money are sunk into the venture. It also allows them to exert some control over the development of the company by offering participation in the next round only if the first round "milestones" or goals are met.

THE MAIN ISSUES AT THIS TIME (Q1, 1991)

1. Technology Strategy

Windows versus OS/2 - The original strategy of the company was to bank upon the success of the OS/2 operating system by IBM. The decision to back this platform was necessarily made with incomplete information about the state and potential success of the new operating system back in 1989. In fact, the operating system failed in its initial push with respect to expectations. Instead, Microsoft Windows version 3.0 has been the graphical windowed environment of choice for PC users. Of course not all PCs currently in use can automatically run Window 3.0 as is. Each PC needs 4 Megabytes of

internal Ram and a 40 MByte hard disk drive. This can represent a substantial investment to most of the PC users who run on less powerful machines.

Stay with OS/2

This switch in market acceptance has put Fluent in an interesting predicament. On one hand, if they stick to the original plan of developing for the OS/2 platform, they will be able to reach the market with their next product according to the original plan. This will show the current investors that the management team can stick to a plan and deliver. It also puts the company in the position to eventually exploit the success of OS/2 which still has a reasonable chance of eventually succeeding due to its technical advantages and the continued strong backing of IBM.

Go with Windows 3.0

On the other hand, making the switch now to Windows 3 will virtually guarantee a platform universally accepted by the PC marketplace for the near to mid term time horizon at least. However, making the switch in operating system platform so late in the development cycle is bound to have adverse effects on investor confidence, employee focus, and financial plan.

Investors

While the current investors will undoubtedly question the foresight of the management team, what is more critical to the company are the perceptions of would be second round investors. In general this shift could be viewed as positive or negative depending on the point of view. New investors could question the competence of the management, or could applaud them for being able to change so radically so late in the product development cycle. This perception will most likely impact the investment decision more strongly than any other.

Internal Focus

This switch in technology strategy will also affect the internal structure and focus of the company. Items to consider are morale of the engineers and

support personnel, especially those who worked hard on the OS/2 platform, and the redistribution of human resources. at least three new engineers with Windows 3.0 programming experience will need to be hired quickly. Where will they be found? They will adversely impact the financial plan by close to $250,000 in an unexpected increase in headcount. This will of course, further harm the credibility of the managers to new investors. Will any existing engineers have to be let go? If not, substantial investment in retraining those with specialized skills will have to be made.

Development Plan

The product set under development, the two board set was scheduled for introduction to the market at the CES show in late June, 1991. Will the shift in platform impact this critical introduction date, at the biggest show of the year, if not a strong shift in focus and resources will have to be made. In addition to the product announcements in June, press announcements scheduled for next month will also have to be readjusted to reflect the new technology strategy of the company.

2. Financing Strategy

Venture Capital versus Corporate Capital. (This issue is a simplification of reality. In reality a combination of both sources of funding is both possible and probable. For the scope of this simulation exercise however, we will assume that due to limited time and resources, the management must make the conscious decision to focus on one type over the other since they each required a different strategy).

The management is in such need of its second round of financing, that it has taken out a *bridge loan* from the first round investors to cover expenses at hand. (A bridge loan usually puts the lender in a good position to exercise stock options to acquire more shares of the firm.) Due to their urgent need for a second stage, the management must quickly decide the best way to obtain this funding in the least amount of time possible while getting the best deal for the company (themselves, as major shareholders) as possible.

Venture Capital Lead

Of course, there are pros and cons to each option. While some people question the value added by a venture capitalist, it is generally agreed that the good ones bring experience and valuable contacts to the table. Should the management decide to concentrate predominantly on venture capital, they are in essence subjecting themselves to short term control and constraints which can benefit the company in the long run. Venture Capitalists like to use "milestones" as checkpoints of the management's ability to adhere to a business plan. Setting up and following this plan can often limit the mobility that a startup company enjoys early on. In addition, by taking on a good venture capital lead investor for this round, more money will probably be raised overall, both in this round and in subsequent rounds. By relying more heavily on a corporate investor as the lead, the company may be sacrificing future funding rounds. Having a strong Boston based lead investor for the first round, it makes good sense to concentrate on attracting a strong California firm to lead the second round. With minimal presence in California currently, it could prove costly in dollars and time to extend this "road show".

Corporate Partner Lead

By looking at a corporate partner as the *lead investor* of the next round, management risks raising less money overall than by the alternative. However, there is also the promise of getting a better price for the stock that is issued, venture capitalists tend to demand much more when leading the round. Also, there could be less active control by the corporate partner. This is enticing to the management team that does not want to be encumbered by excessive milestones and outside control. Establishing valuable corporate partnerships can often take less time to get the deal through because there can be fewer hoops to jump through in terms of drawing up the documentation and agreeing upon it. And, most compelling, corporate partnerships often lead access to important new resources such as distribution channels, key technology, or manufacturing capacity or expertise in addition to the capital raised.

The decision at hand is to decide which of these is more important to pursue first. It is quite unlikely that all of the necessary funding will come completely from one of these sources however.

3. Marketing Strategy

Key accounts versus Any Accounts. There will be a lot of pressure during the first two years to meet the revenue plans as outlined in the *business plan* .

The issue stems from a severe limitation of resources once again, in the way of sales and support personnel. Today, the marketing and sales *organization* consists merely of two regional sales representatives, one in the east, and one in the west. If their time is split among an unfocused target of potential customers, too much energy will be lost in trying to win small orders. Also, the service and sales support organization is even smaller. If their limited time is spent satisfying too many "insignificant" customers, they will quickly become overwhelmed.

On the other hand, with too closed a field of vision, not only can valuable business and market positioning be lost, but a lack of revenues due to long purchase cycles can threaten the very life of the business itself. There is also the risk of focusing on the "wrong" key accounts. In such a new market, it may be difficult to identify the key players, and the early adapters. It is also likely that this list is constantly changing. By ignoring the "little guy" the company runs the risk of missing key relationship opportunities or glimpses at emerging technology which could be important.

This issue in marketing stems from a larger issue which is the problem of identifying and satisfying the right market. Much of this problem stems from the fact that these are new or emerging markets which have not yet been built. The issue at hand is how to best use the existing sales force such that within the financial and time constraints, with the product at hand and limited custom ability, how to reach that market with such limited resources.

Summary of the Situation

Dick Meise and the management team must make several decisions before they can determine their next set of goals. Meise has come up to speed smoothly over the last six weeks and is now ready to lead the team in the decision making process. They must decide the Finance decision, the Technology platform decision, and the Marketing strategy. And they must make sure these decisions are made in such a way as to minimize overall disruption to the current flow of the company while maximizing the future potential of the business.

CHAPTER IV.
COMPARISON OF THE TWO FORMATS

A paper based version of the Fluent Machines case was presented in order to offer a base of comparison against the visual interactive version. While both versions are only in prototype form and they are not up to the exacting standards of the cases seen in the classroom, the core content is present. While the VIMS version is best seen through demonstration, some "snapshots" of the key aspects of this version are presented in the appendix.

Traditional Case Method

The standard case method has been a full or partial portion of most of the country's business school programs for decades, so professors and students know exactly how to utilize them; they are comfortable. These cases are easier to write than interactive cases, and students know how to read them and how to analyze the material in them. It tends to be easier to read text from a written page rather than a computer screen, and if a student wants to skip ahead, or reread a section, he knows exactly where he is at all times, and he can move at any pace he wishes.

The main problems with this format are that it can be extremely boring to read, it can be confusing if a complicated process or product is being described, and it falls short of modeling the manager's real decision making process in many ways. The text based case, like any piece of writing is linear in nature; it is designed to be read from beginning to end with an occasional

reference to an exhibit in the back of the case. Every student is exposed to exactly the same information in the same way. While this may make leading a class discussion from the material easier to do than otherwise, it does not necessarily make the learning process easier or realistic.

VIMS

The simulation format allows the user to get to know the situation and the people better than he could by simply reading a case. The video can present group dynamics and personal body language that can be difficult to capture in text alone. Also, a well written interactive simulation can model the real decision process that the student is likely to face as a manager. A format like the VIMS can place the reader into the situation allowing for role playing; to get involved in the situation at hand rather than simply being an outside observer.

One drawback of this simulation environment is the predetermined set of solutions. This format can stifle very creative solutions that the author might not have thought about while creating the game. One solution to this is to make the user play within certain bounds which in a sense follows reality, but another way around the problem is to provide a large number of potential solutions. The problems with this approach is that with more unique solutions, the complexity of the game architecturally increases very rapidly. Of course this format can be utilized without limiting the user, simply as a way for him to absorb information so he can create his own strategy. In this sense, the interactive case can follow the traditional case

structure and serve as an interactive information source and presentation tool.

Interactive case creation may require the services of a broadly talented production team to merge professional quality video, well written software, and cases with high levels of informative content. From a realistic point of view, this may cost considerably more than the conventional means. For that matter, using the productions will add significant costs to the process as well. Interactive cases or other educational productions will not gain widespread use until powerful desktop machines are commonplace in the classroom. This is one reason why such productions will find their ways into private graduate level curricula before the mainstream, and is one reason why the first applications were developed for medical schools and why exploring top business schools is an excellent environment to target now.

Analyzing and Understanding Fluent Machines

The VIMS Fluent case puts narrow bounds on the first set of four decisions, but presents the the second set of issues, the strategic relationship formulation, as an open ended one providing the basis for class discussion. Thus it offers two interesting aspects. The first set of decisions are essentially binary decisions that the user must choose between. In four decisions there are 16 possible combinations (order is important). These 16 possibilities were broken down into five classifications, from "excellent decisions" to "you killed the company". These classifications make immediate feedback to the user possible thus enhancing the payback of the simulation experience. The student can find out results while still emotionally involved in the situation.

Some of the major pros and cons between the two types of case formats are summarized below in Figure-4. It should be noted that the major cons against the use of interactive cases are familiarity of the technology, and costs. Both of these negative aspects are currently improving with time.

UTILITY OF CASE FORMATS

KEY CONCEPTS	TRADITIONAL TEXT BASED	INTERACTIVE MULTIMEDIA
Familiarity - Students	Good	Growing
Familiarity - Faculty	Excellent	Poor
Expense - Writing	Low	High
Expense - Using	Low	High
Visual Impact	Fair	Excellent
Information Retention	Good	Excellent
Access to Information	Good	Excellent
Process Description	Poor	Excellent
Openness	Good	Fair - Good

Exhibit - 4

After the user receives this initial feedback regarding how the company actually dealt with those situations, he is placed into the "current" scenario. Here he sees where the new dilemma the company faces and is left with the open ended question of what to do about it. This part can act as the basis for class discussion that students are used to.

Developing a true understanding of the company and the decisions it faces can't be done completely without knowing the key people involved and understanding their decision making process and their interactions.

The Original Conception

The VIMS was originally going to include many generations of decisions for the user to face, such that the latter set of decisions would be based upon earlier decisions. This would force the student to "live with" the decisions that were made earlier on; a much more realistic feedback device. However, the space and complexity requirements became large factors in this design. The videodisk limitation of 29 minutes and the exponential increase in number of results with the number of issues limited the scope of this project. However, the original goals are certainly attainable in a project such as this using today's technology. A slight redesign of the simulation architecture and more experience in interactive case development is really all that is needed to enhance this prototype.

Student Feedback

The VIMS has been demonstrated to a number of people including business school students. The feedback has been generally favorable. Many observers were very enthusiastic about the interactive nature of the simulator, and the immediate feedback provided. Some students were disappointed that this project was not yet ready for the classroom, and all observers provided useful feedback to me as to how it could be improved or enhanced. Overall, it created excitement and incited the imagination of a few people, which after all was the project's first goal.

CHAPTER V.
THE FUTURE

The Direction of Interactive Multimedia Case Study

These projects and many like them will continue to be created as prototypes gaining in both content and technology over time. They will become more "polished" and more feasible as they get shown in demonstrations in the lab and in classrooms. Over time, adequate computer hardware will be developed by vendors and purchased by academic programs so the capacity for students to run interactive cases as part of their course work will exist. Until that time more prototypes will be made and boundaries pushed until they become part of the core course work in the top programs in business schools, other graduate programs, and eventually into the public school systems nationwide and worldwide. There is little doubt that these technologies are coming to all levels learning in both the classroom and on the the job. The question is simply when.[64]

Technology

With the current state of technology being such that many disparate pieces of hardware must interact with one another, producing a multimedia presentation is not a trivial matter. It currently takes bringing expensive

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[64] James Higgins, "TV in the Classroom", Business Week, December 10, 1990.

equipment and professional staff consisting of many specialized skills together to produce one work. The huge expense is certainly a limiting factor.

Many industry experts agree however, that as the technology makes its way to the desktop in the form of affordable hardware the end user will have a much greater ability to produce useful interactive works himself. The vision includes an active market for "clip video art" which will parallel today's graphical clip art for desktop publishing. Users will be able to shoot their own video sequences and digitize them directly from their cameras when compression algorithms become mainstream. Today one must press a videodisk which can be written-to only once and costs up to $300.

New tools for this budding industry are constantly under development. Startup companies like Avid and Fluent are building computer based "editing studios", while companies like Macromind and Silicon Beach are creating software based"authoring tools" to allow users to link the various media together in one environment.

Applications

Future applications can seem limitless. One has to only daydream to imagine what the future of this technology may bring. Several peripheral technologies will surely get a boost from developments in this field. For instance, videophones and videoconferencing will directly benefit from the development of compression technology and wide bandwidth communications. The face of internal corporate networks will change

dramatically with the advent of interactive video and sound pushing even more people to work more often from the home.

Perhaps we will see electronic shopping malls where shoppers can browse through dozens of stores while sitting down and retailers can save money on expensive store space. Or maybe we will see learning workstations that become the standard in all aspects of formal and informal education in schools and on the job. But one thing is for sure, while the current state of the technology is still infant, we will be seeing a lot more of it from the boardroom to the classroom very soon.

Resistance

One of the largest barriers that this or any technology faces is resistance to change by people. While many people can see the benefits of such technology, others fear the worst. Some parents and teachers vehemently oppose the use of videodisk technology in public schools in Texas fearing that it may lead to illiteracy. Even a professor at Harvard Business School stated he would never use such technology since, although he hadn't seen the latest applications, "knew it couldn't be as effective as his current methods".[65] These attitudes and ones like them represent the greatest hurdle that new technologies face in getting into the classroom, from the elementary to the graduate level.

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65 Interview, Professor not to be named, Marketing Department, Harvard Business School, Mar 13, 1991.

Conclusion

We have seen that interactive multimedia is a hot topic today for some very good reasons. Many real and useful applications have been developed over the past five years that have proven the viability and power of the new media. We have examined some of the projects and specific companies and institutions behind the projects both in formal education and the corporate environment throughout the country.

Many people have been waiting for applications which let the end user exploit the full power of his desktop machine to enhance all aspects of information gathering and processing. Interactive multimedia tools may make this possible. This paper has examined some of the progress that has been made and some of the directions we are headed with interactive multimedia which will unlock a new power in end user computing: true ability to absorb and use information in the most efficient ways possible. If this power is harnessed in well planned ways, it has the potential to have a profound impact on the way this culture disseminates information at all levels affecting our entire educational system and eventually, the way business itself is conducted. Papert states:

> "There has been endless discussion about defining and classifying the ways computers are used in education: as tools, as tutors as programmable machines, as mathematical engines... In my view there is really only one issue: will they be used to make education even more technical or -- paradoxically -- less technical and more human?"[66]

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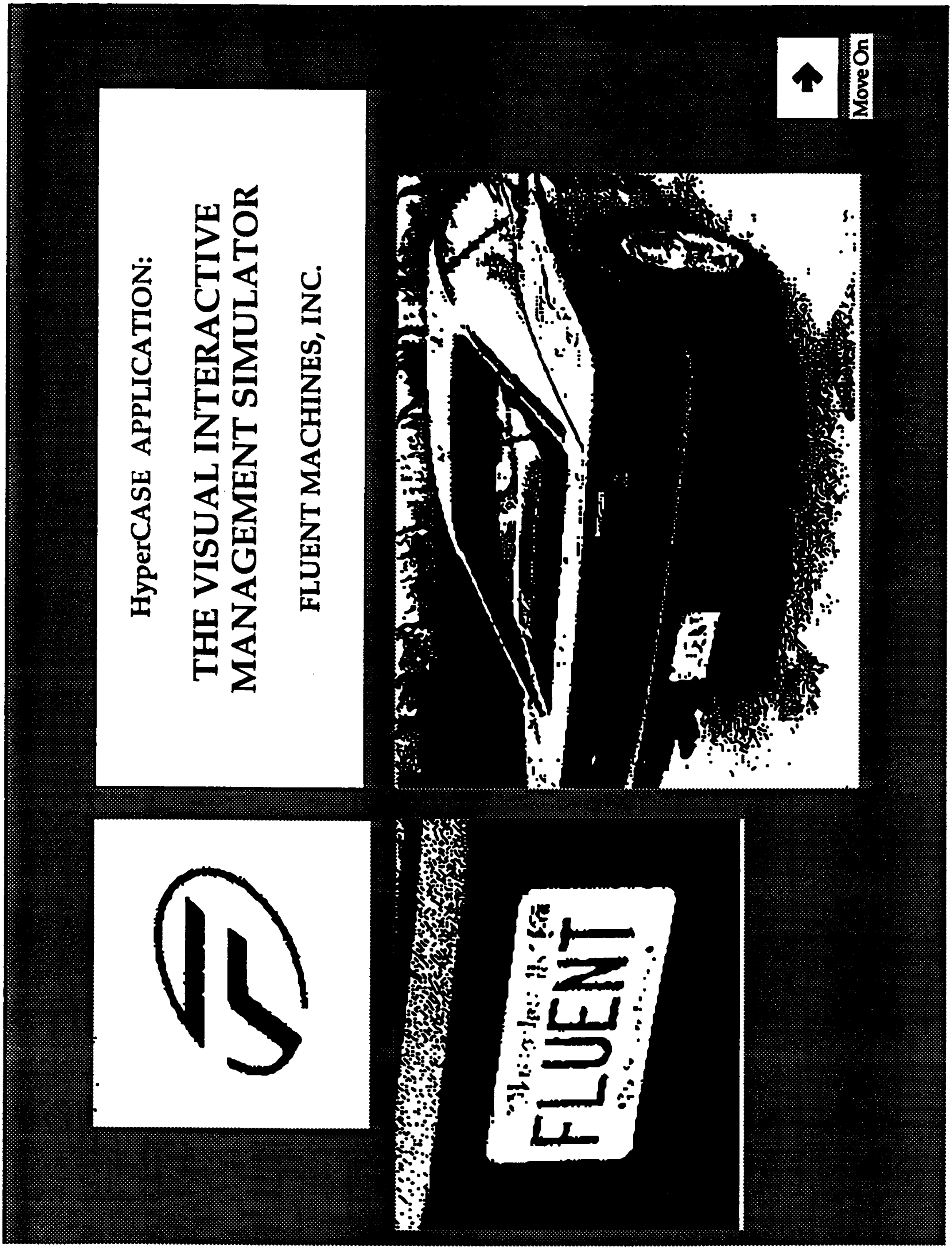
[66] Op. Cit. Papert.

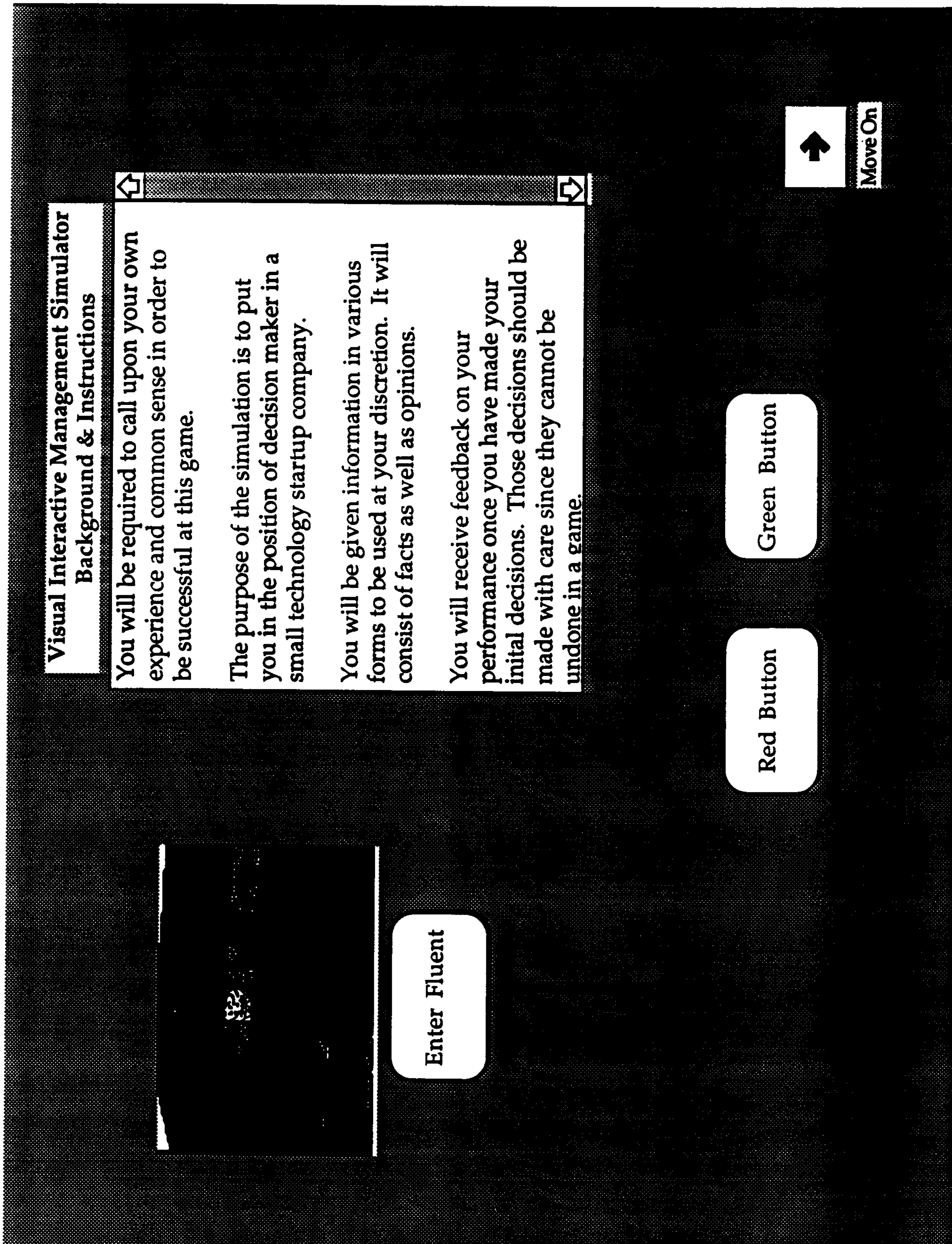
CHAPTER VI.

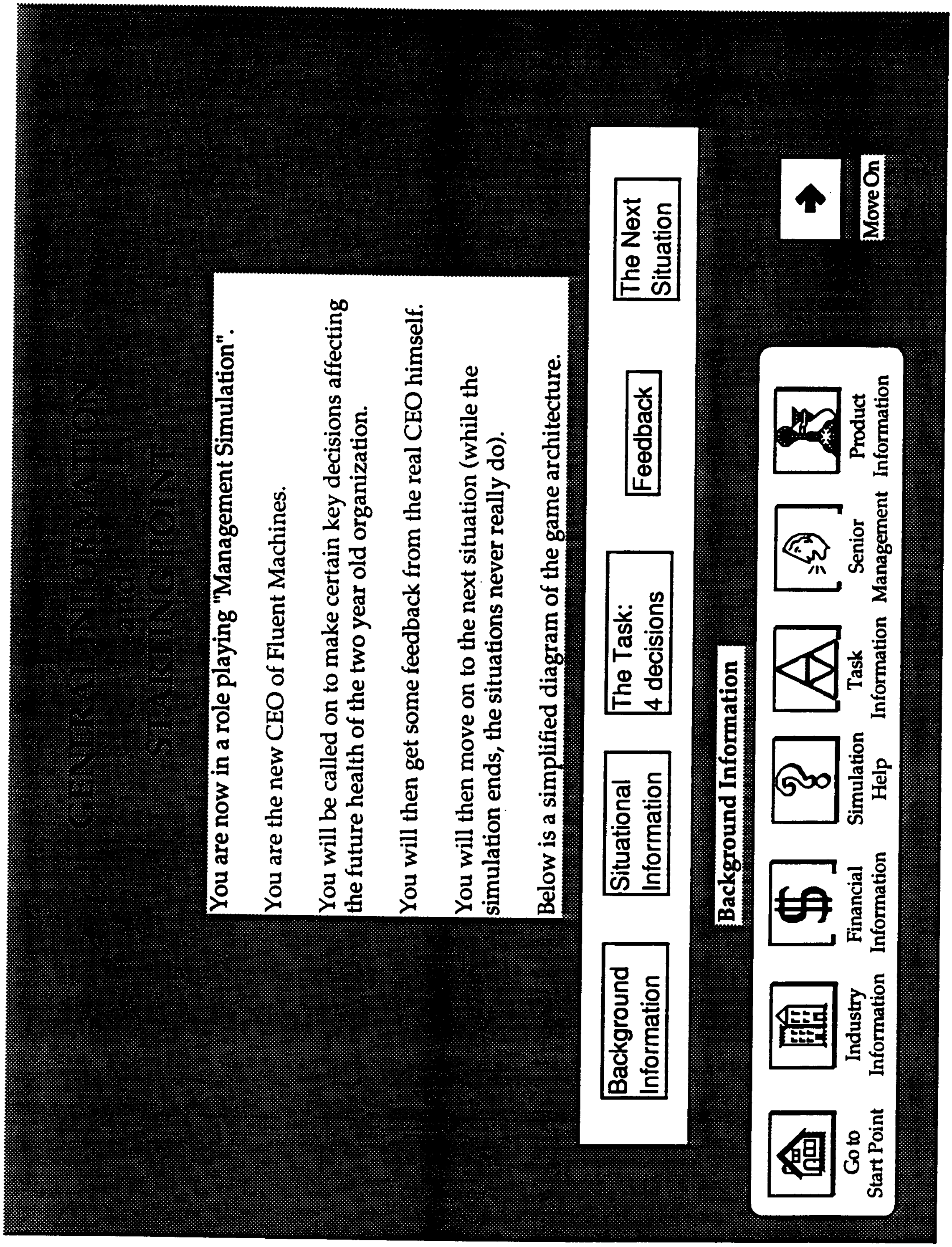
APPENDIX - A Static View of The VIMS

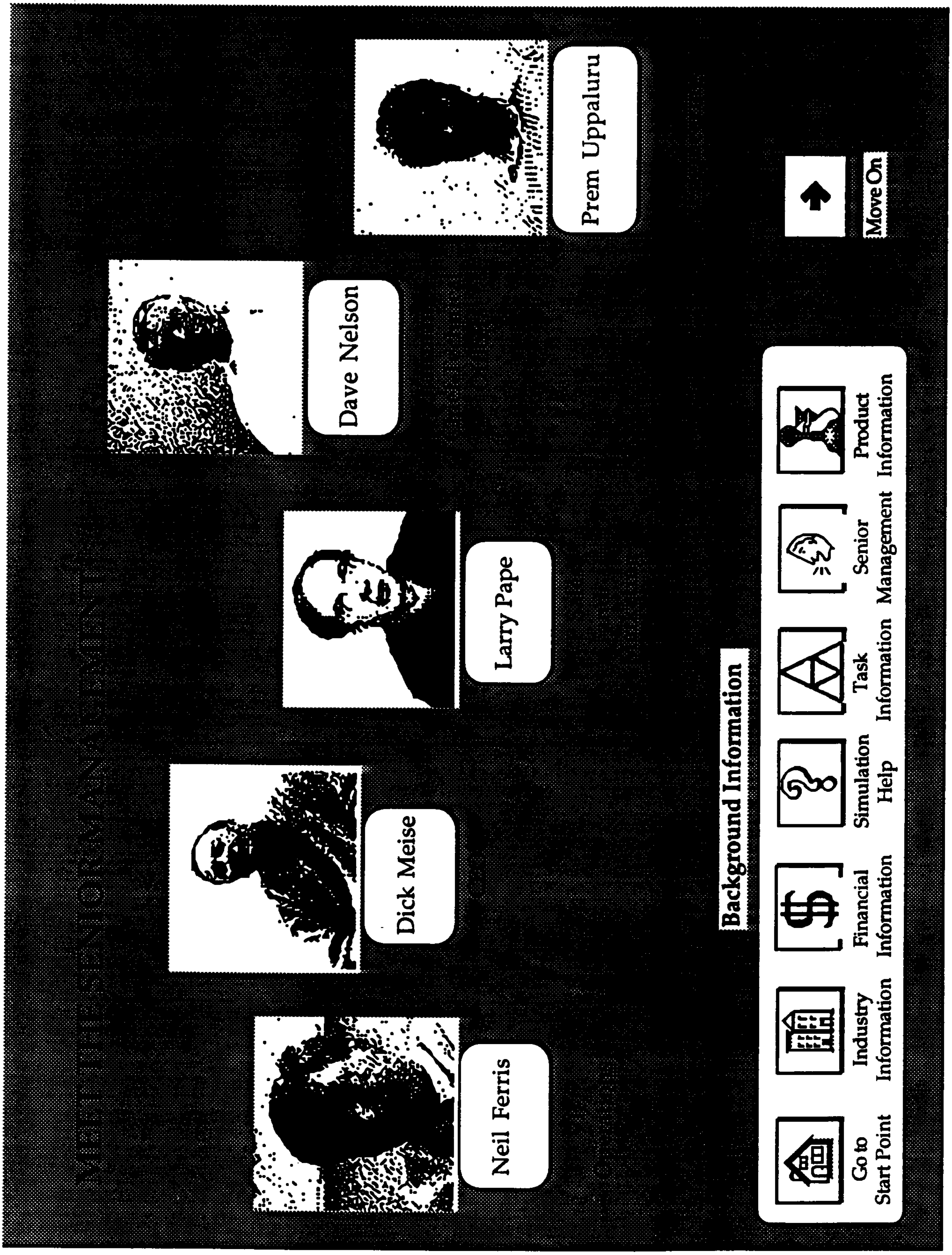
The following pages show some selective screens from the Visual Interactive Management Simulator. A feel for how this application is used can be gleaned from these pages, but you are invited to view the simulator directly for yourself. It's object and means will be much more clear when seen and used.

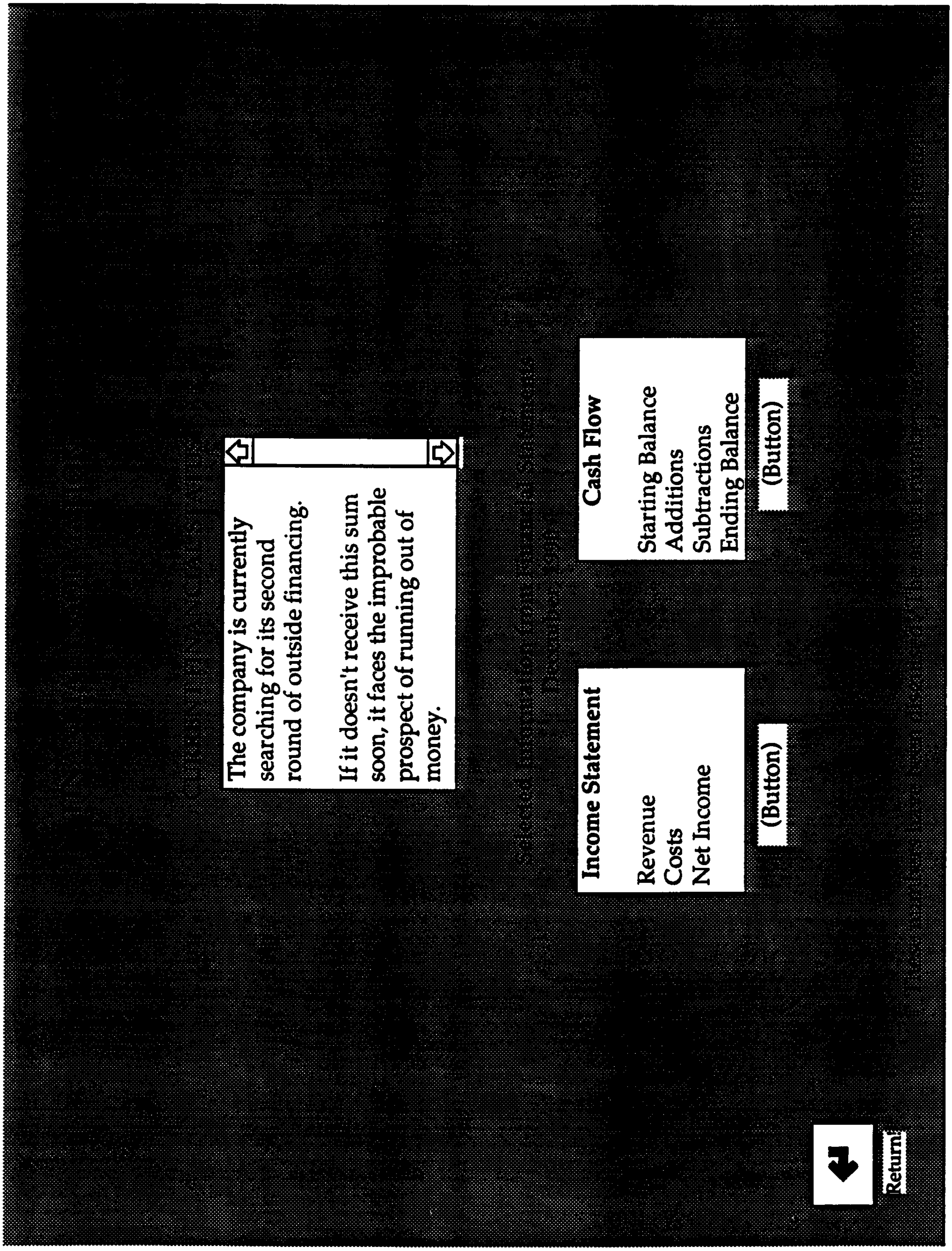
1. Start Point
2. Background Information
3. The Decision Pyramid
4. The Strategic Issues
5. Feedback
6. The Next Scenario
7. The End Card

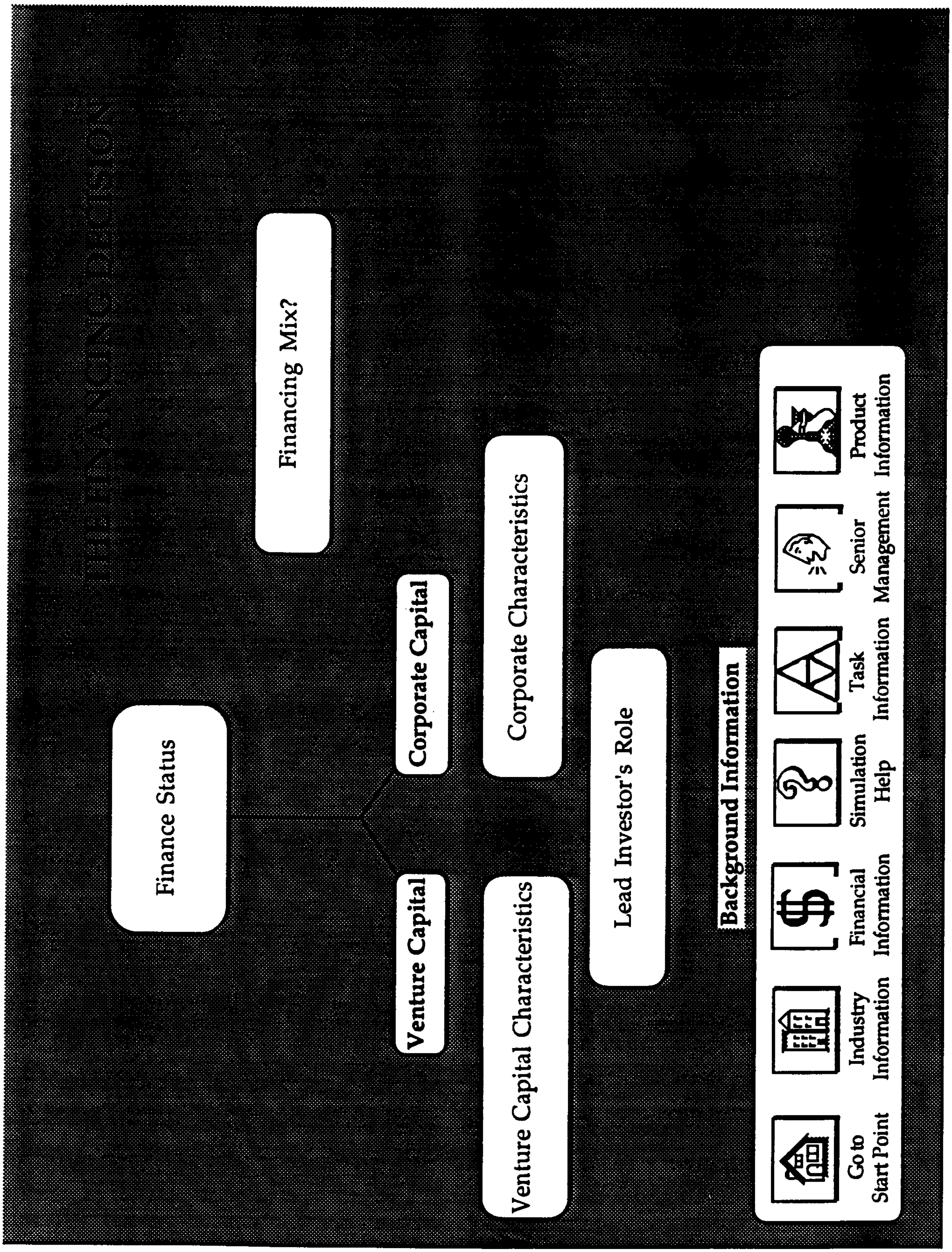

HyperCASE APPLICATION:
THE VISUAL INTERACTIVE
MANAGEMENT SIMULATOR
FLUENT MACHINES, INC.
Move On
FLUENT

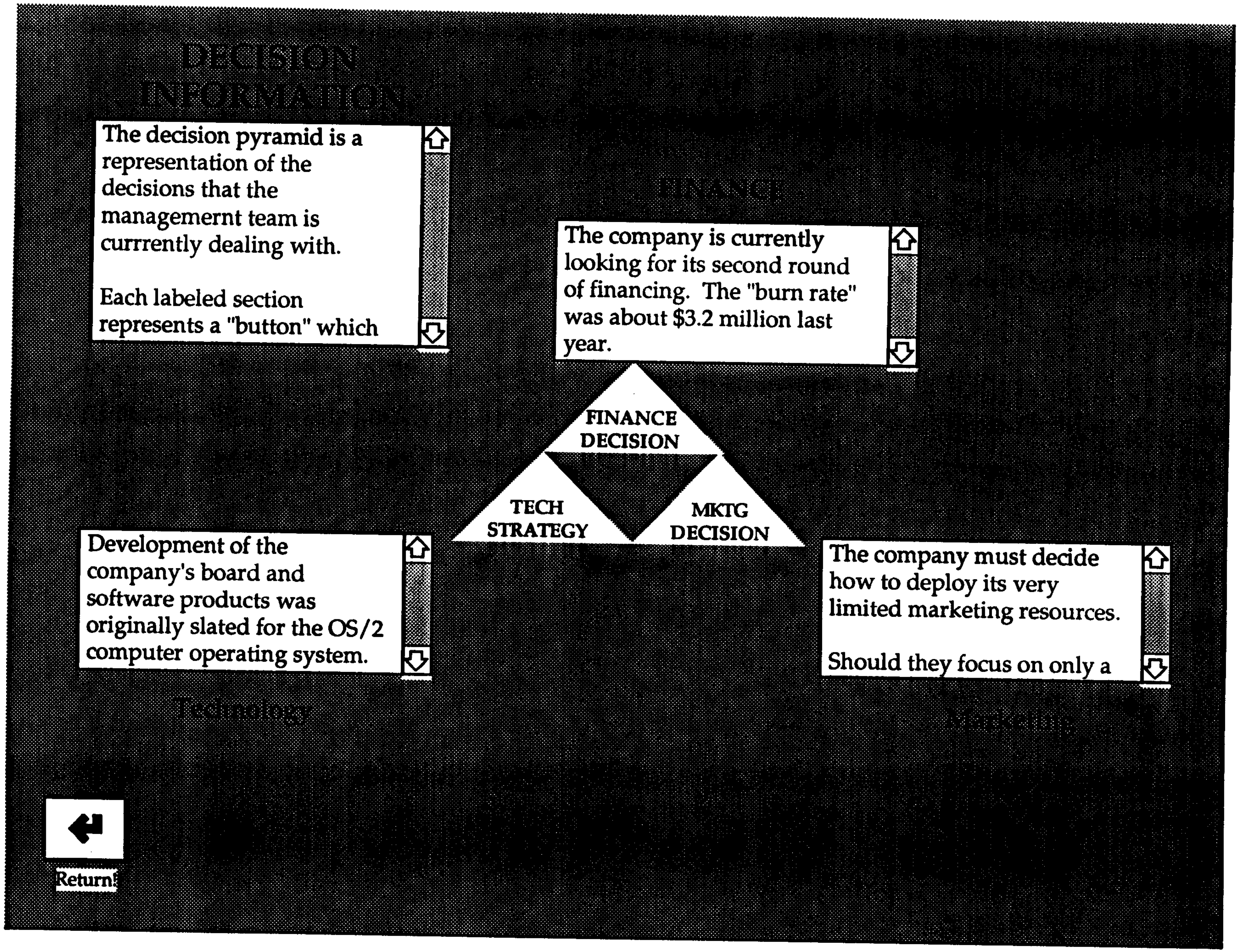

Visual Interactive Management Simulator
Background & Instructions
You will be required to call upon your own experience and common sense in order to be successful at this game.
The purpose of the simulation is to put you in the position of decision maker in a small technology startup company.
You will be given information in various forms to be used at your discretion. It will consist of facts as well as opinions.
You will receive feedback on your performance once you have made your inital decisions. Those decisions should be made with care since they cannot be undone in a game.
Enter Fluent
Red Button
Green Button
Move On

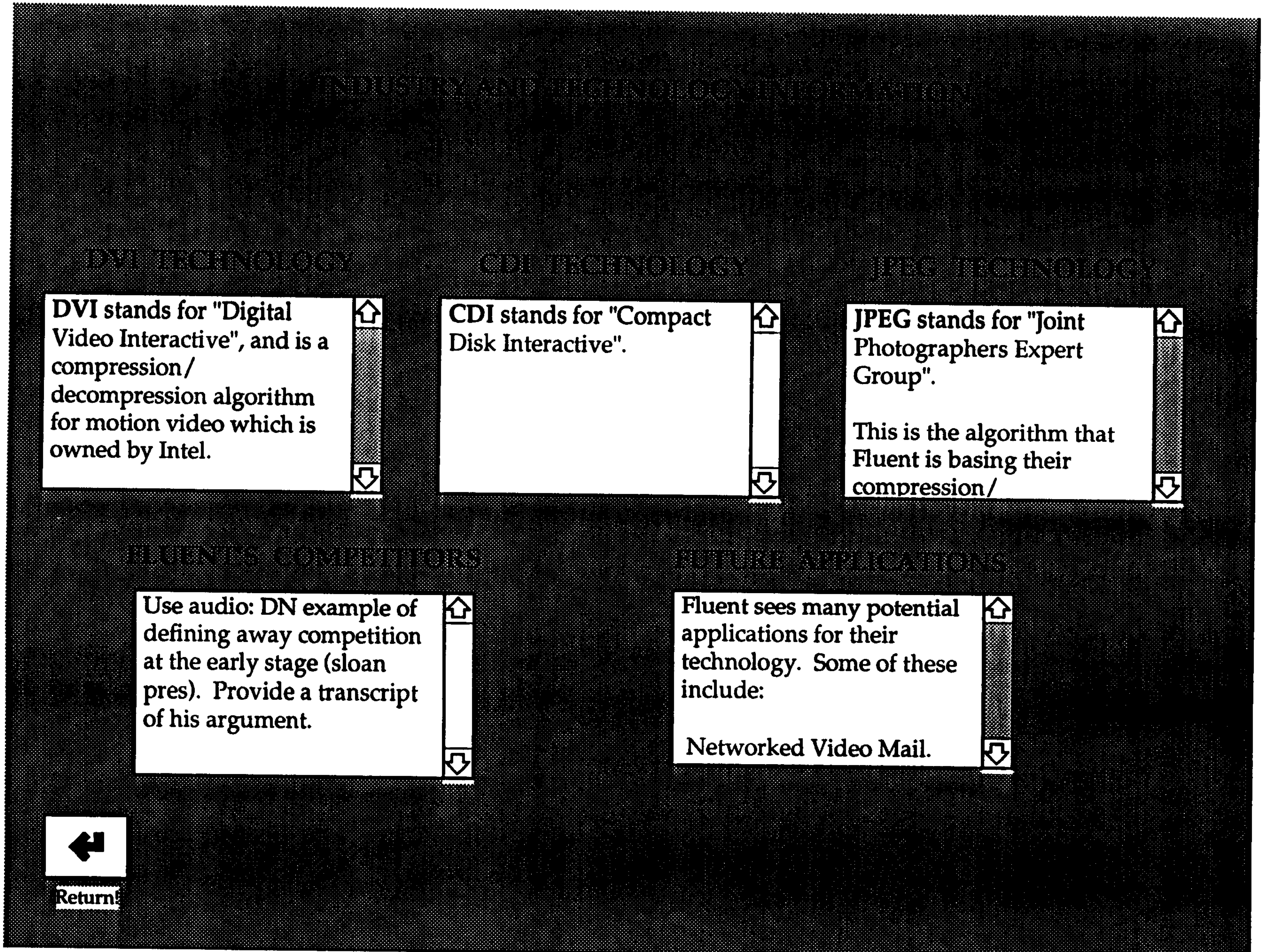

GENERAL INFORMATION
and
STARTING POINT
You are now in a role playing "Management Simulation".
You are the new CEO of Fluent Machines.
You will be called on to make certain key decisions affecting the future health of the two year old organization.
You will then get some feedback from the real CEO himself.
You will then move on to the next situation (while the simulation ends, the situations never really do).
Below is a simplified diagram of the game architecture.
Background Information
Situational Information
The Task: 4 decisions
Feedback
The Next Situation
Move On
Background Information
Go to Start Point
Industry Information
Financial Information
Simulation Help
Task Information
Senior Management
Product Information

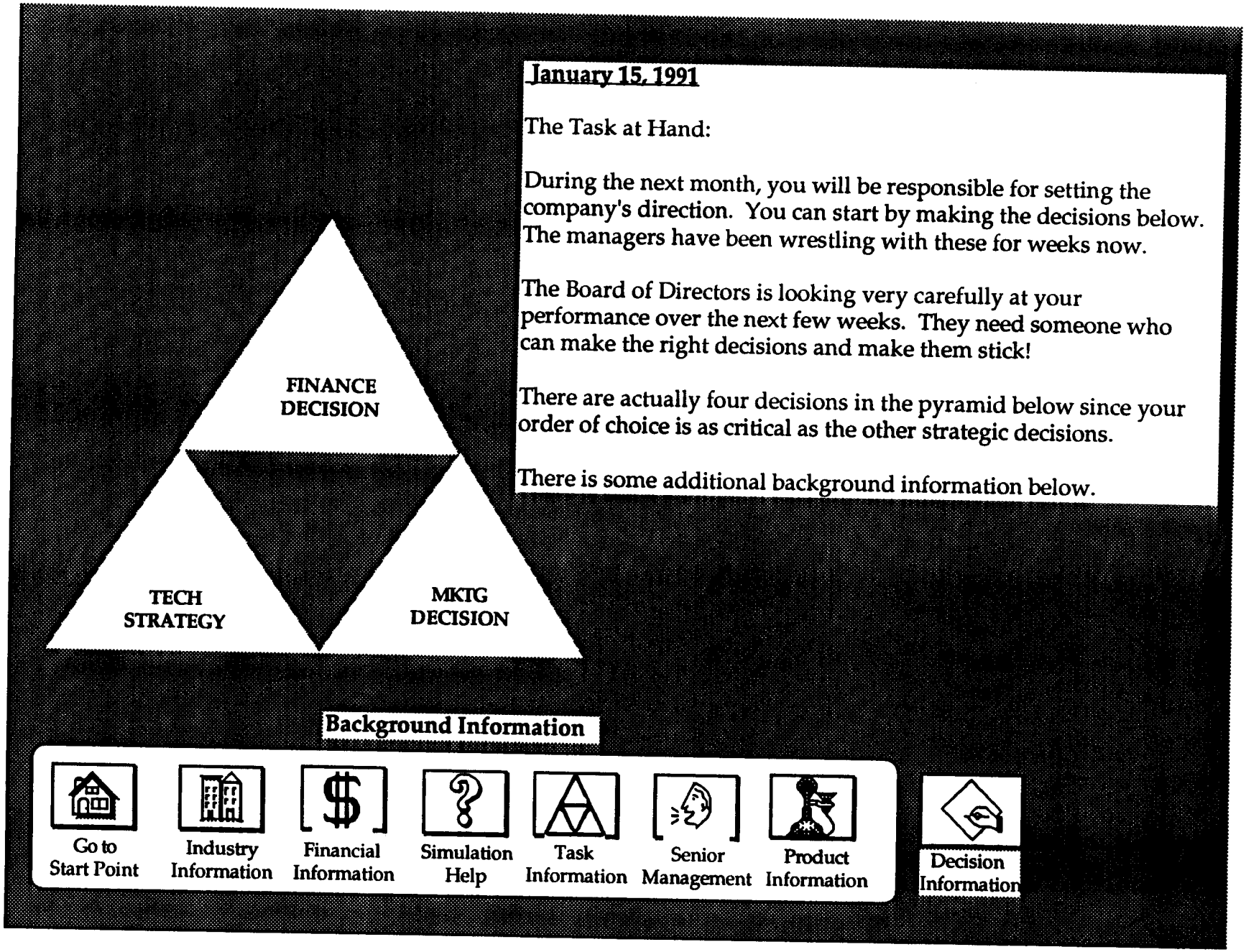

Neil Ferris
Dick Meise
Larry Pape
Dave Nelson
Prem Uppaluru
Move On
Background Information
Go to Start Point
Industry Information
Financial Information
Simulation Help
Task Information
Senior Management
Product Information


The company is currently searching for its second round of outside financing.
If it doesn't receive this sum soon, it faces the improbable prospect of running out of money.
Income Statement
Revenue
Costs
Net Income
(Button)
Cash Flow
Starting Balance
Additions
Subtractions
Ending Balance
(Button)
Return

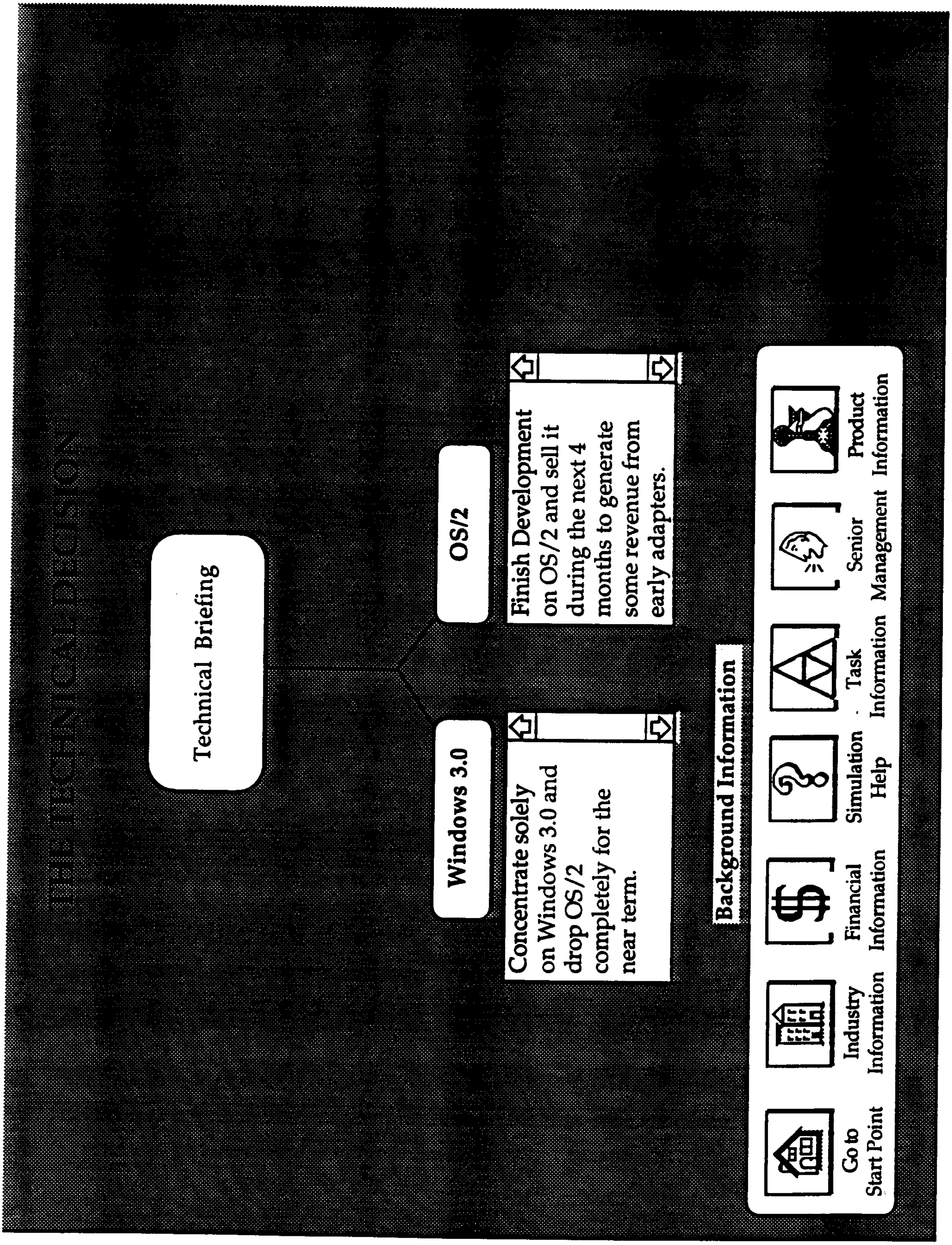

THE FINANCING DECISION
Financing Mix?
Finance Status
Venture Capital
Corporate Capital
Venture Capital Characteristics
Corporate Characteristics
Lead Investor's Role
Background Information
Go to Start Point
Industry Information
Financial Information
Simulation Help
Task Information
Senior Management
Product Information

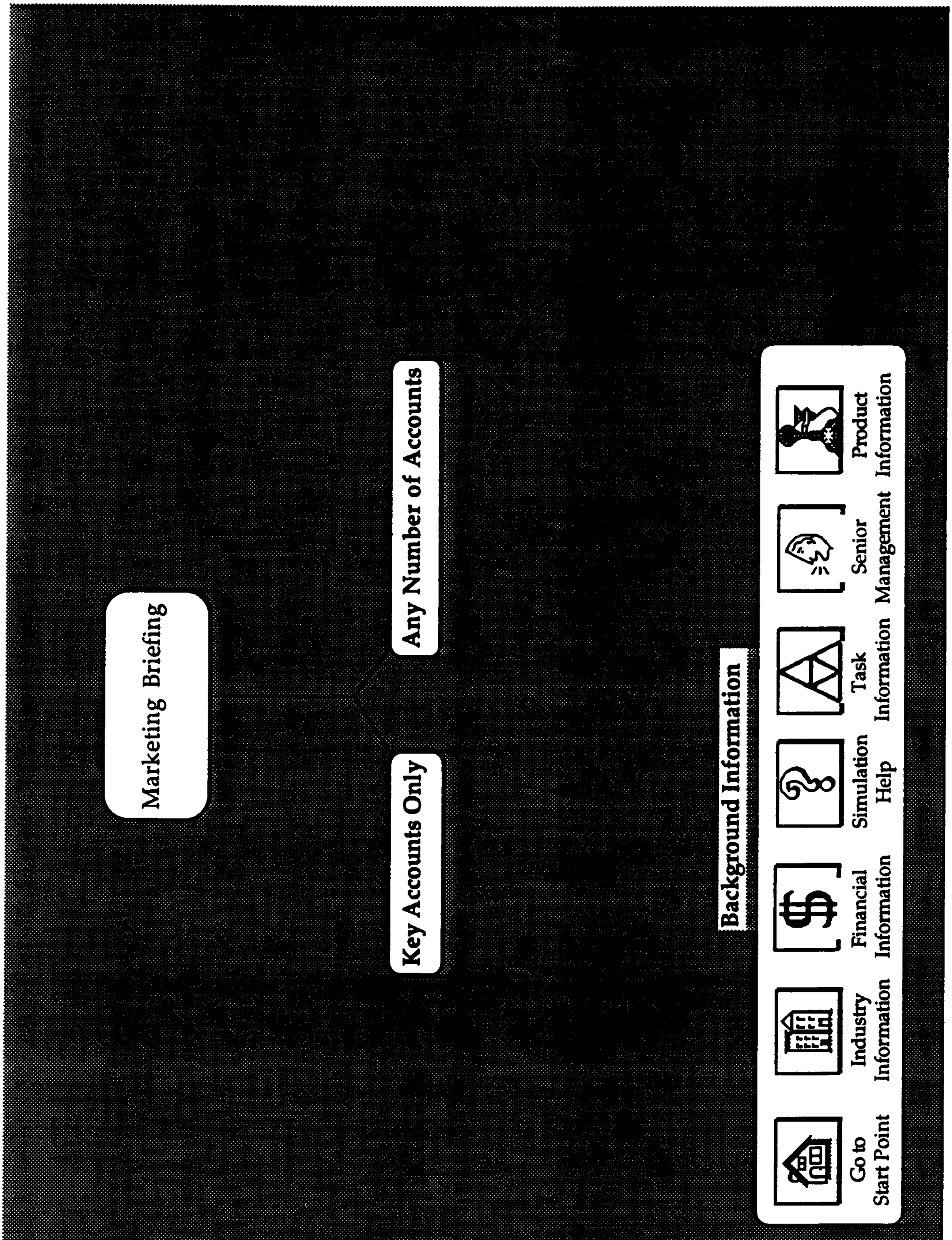

DECISION INFORMATION
The decision pyramid is a representation of the decisions that the managemernt team is currrently dealing with.
Each labeled section represents a "button" which
FINANCE
The company is currently looking for its second round of financing. The "burn rate" was about $3.2 million last year.
FINANCE DECISION
TECH STRATEGY
MKTG DECISION
Development of the company's board and software products was originally slated for the OS/2 computer operating system.
The company must decide how to deploy its very limited marketing resources.
Should they focus on only a
Technology
Marketing
Return


INDUSTRY AND TECHNOLOGY INFORMATION
DVI TECHNOLOGY
DVI stands for "Digital Video Interactive", and is a compression/ decompression algorithm for motion video which is owned by Intel.
CDI TECHNOLOGY
CDI stands for "Compact Disk Interactive".
JPEG TECHNOLOGY
JPEG stands for "Joint Photographers Expert Group".
This is the algorithm that Fluent is basing their compression/
FLUENT'S COMPETITORS
Use audio: DN example of defining away competition at the early stage (sloan pres). Provide a transcript of his argument.
FUTURE APPLICATIONS
Fluent sees many potential applications for their technology. Some of these include:
Networked Video Mail.
Return



Eric R. Zetlin


THE TECHNICAL DECISION
Technical Briefing
Windows 3.0
OS/2
Concentrate solely on Windows 3.0 and drop OS/2 completely for the near term.
Finish Development on OS/2 and sell it during the next 4 months to generate some revenue from early adapters.
Background Information
Go to Start Point
Industry Information
Financial Information
Simulation Help
Task Information
Senior Management Information
Product Information


Marketing Briefing
Key Accounts Only
Any Number of Accounts
Background Information
Go to Start Point
Industry Information
Financial Information
Simulation Help
Task Information
Senior Management
Product Information

Excellent Decisions!

You have made some excellent decisions. We won't
know for some time whether they were the right ones,
but that was what we decided to do a month ago.

You can keep your job...

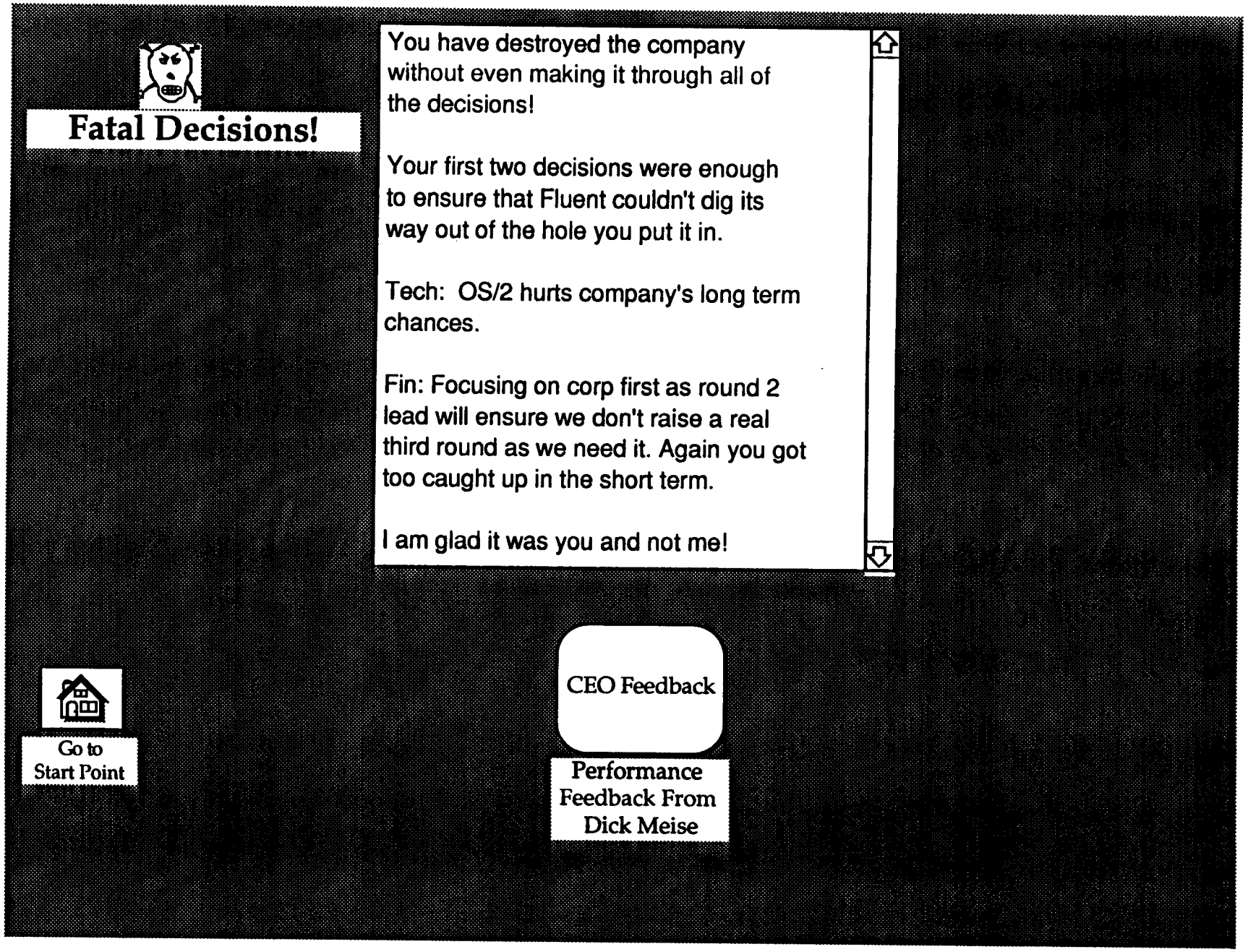
for now!

The bad news is you are not done yet!

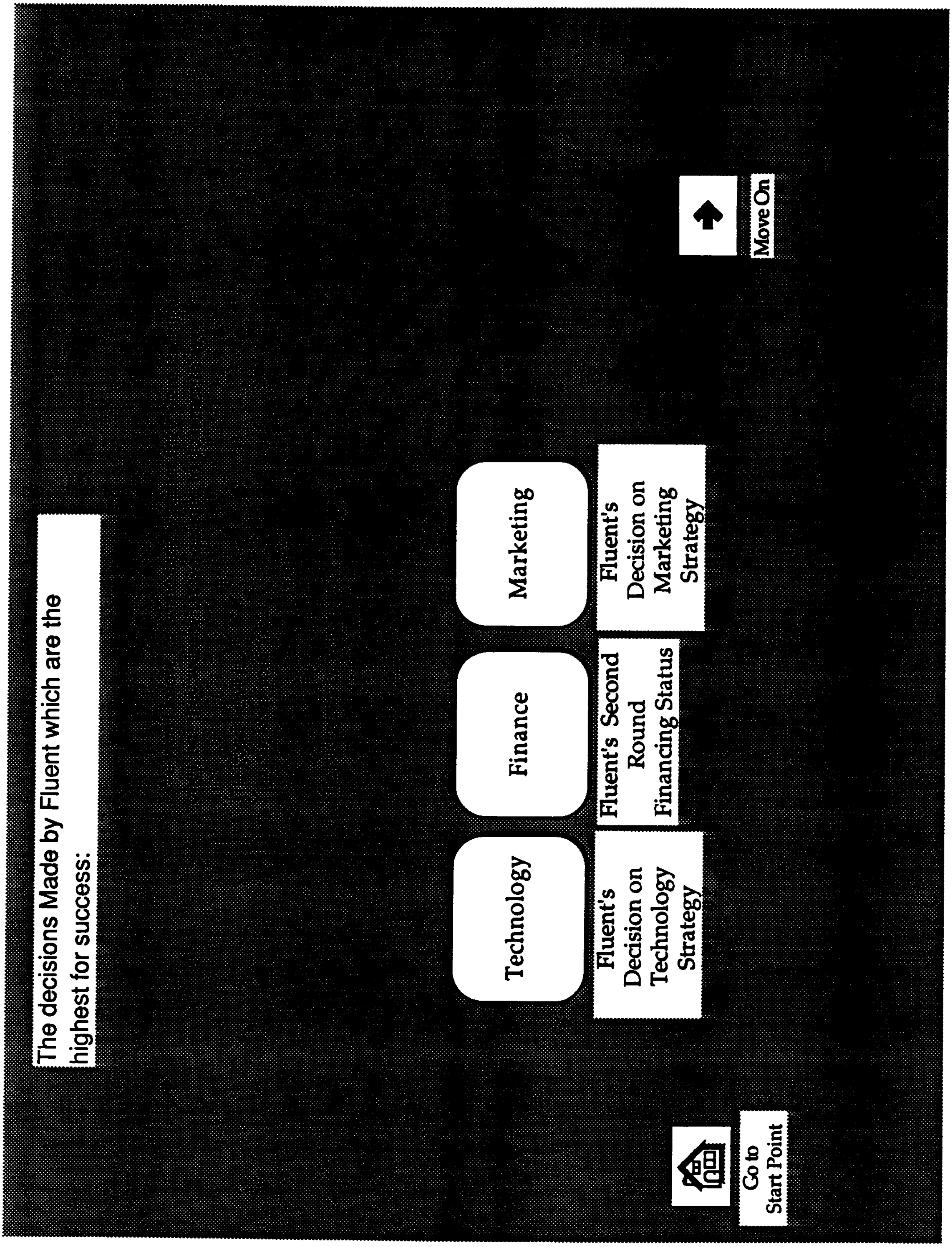
CEO Feedback

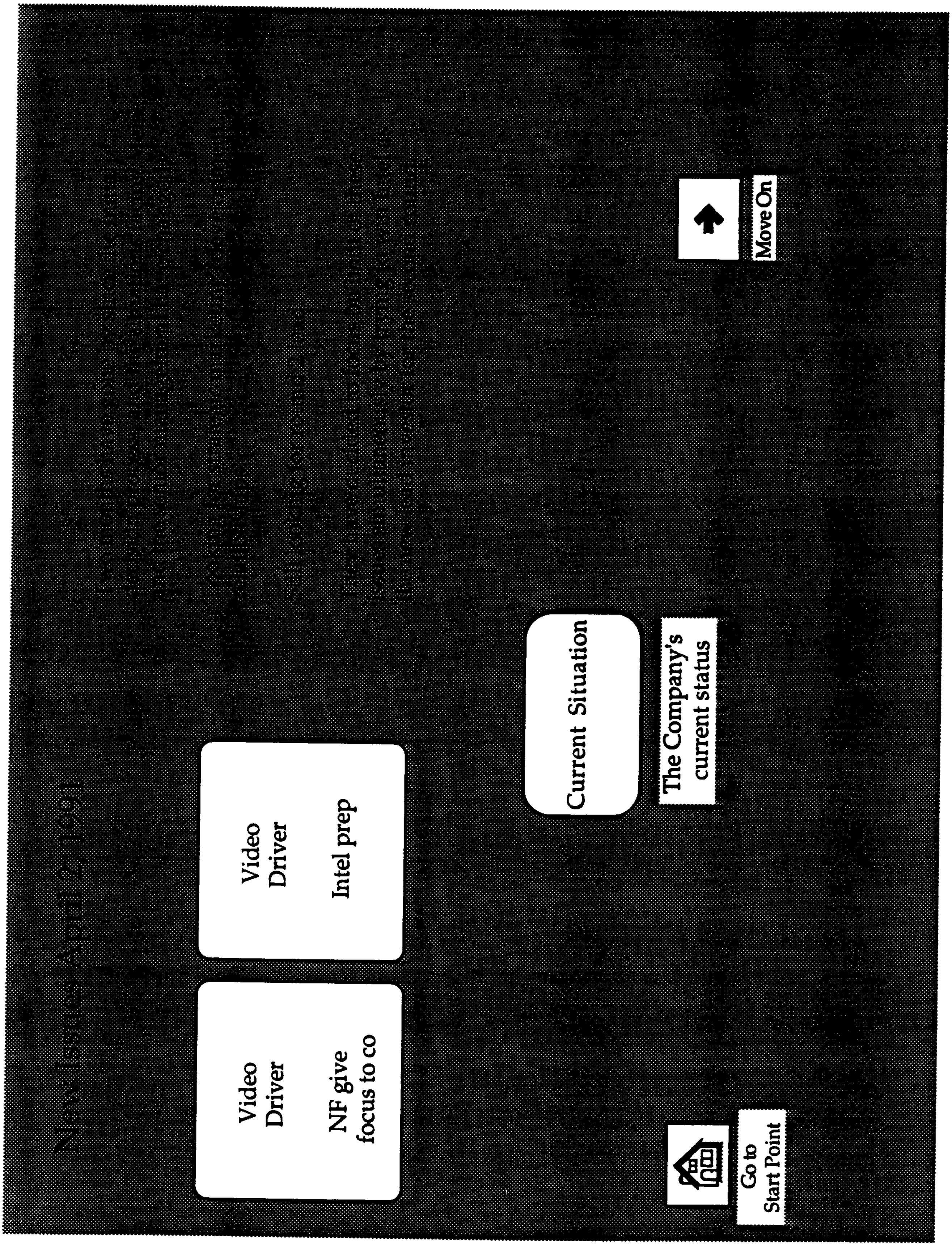
Performance Feedback From Dick Meise

Go to Start Point



Eric R. Zetlin


The decisions Made by Fluent which are the highest for success:
Technology
Finance
Marketing
Fluent's Decision on Technology Strategy
Fluent's Second Round Financing Status
Fluent's Decision on Marketing Strategy
Go to Start Point
Move On


New Issues April 2, 1991
Video Driver
NF give focus to co
Video Driver
Intel prep
Current Situation
The Company's current status
Go to Start Point
Move On

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