HyperCASE™
A FRAMEWORK FOR INTERACTIVE MULTIMEDIA CASE STUDY

by

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Submitted to The Sloan School of Management
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HyperCASE™
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ABSTRACT

Education serves to provide understanding of the universe around us. Since the
beginning of time, man has drawn abstractions from the world to communicate ideas
and teach concepts to others. Generally, learned concepts or theories can later be
applied to real situations.

Learning through case study inverts the educational experience. As opposed to using
some medium to represent concepts, case study presents a series of situations and
leaves the task of abstraction for the reader.

This thesis will describe limitations of current case study methodology and define
requirements for a more effective learning paradigm. While research in education has
opened doors for new genres of teaching, advances in technology have also provided
exciting new forms of media.

HyperCASE, a new framework for case study based upon interactive multimedia
computing technology, will be proposed. A HyperCASE study of "The Emerging
Multimedia PC Industry" will be offered as "proof-of-concept."

THESIS SUPERVISOR: N. Venkatraman

TITLE: Assistant Professor Of Management
DEDICATION

To Mom, Dad & Grandma.
To my best friend and brother, Steven.
To Ahn.

Thanks for helping me get this one!
ACKNOWLEDGEMENT

Professor Glorianna Davenport
In her classes and as my thesis reader, Glorianna has been inspirational. She has sparked my creativity and curiosity and has helped to open my eyes to the world of media. Her time and interest in my thesis were above and beyond all of my expectations. I am truly indebted.

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I felt honored to work with both Glorianna and Venkat. I look forward to maintaining contact with them in the future.

Behind every major project is also a handful of gurus, assistants, and last minute favors. For this, I also owe special thanks to:

John Botti
Hans Peter Brondmo
Stephen Buerle aus
Carlos Reategui.
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**EXHIBITS:** HyperCASE Interface

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CHAPTER 1

Limitations of Current Case Methodology for Management Sciences

As a business school student, often called upon to learn through case study, this author has become disenchanted with current case study methodology and media. The predominant model is the Harvard Business School case. These cases, consisting of 10 to 20 pages of text, describe an industry, a company, or some situation within one of those environments. Below I enumerate some problems inherent with this format.

Interpretation

Many managerial decisions must be based upon non-verbal, non-quantifiable cues. Human characteristics, for example, can often make the difference. One wants to ask: "Is this individual trustworthy?", "Is he articulate?", "Can he command the respect of others?". Through current case study, such information is conveyed in direct statements of fact. The task of interpreting an individual's character traits is performed by the case writer, not the reader. An understanding of remote places, events and intricate processes can also be important in managerial decision making. Reading textual descriptions of such data types deprives the reader of the opportunity to draw his own conclusions.

Objectivity

Any publication or representation of reality must by definition carry some subjectivity from the author or artist. Even if the author provides unaltered data as collected, he must choose a search path to collect that data and he must choose which information to include. In a case study, one would like to get as close to the objective reality as

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possible in order to allow the student to form his own viewpoint, untainted by author biases. Current case media makes this difficult.

Linearity
Case study conveniently packages information for the reader. We begin on page one and read through till the end. Not only does this force the author's cognitive mapping on the reader, but the reading process has little likeness to the way we search for and collect information in the real world. When researching a topic, bits of information provide us with clues that can lead down multiple search paths. In the real world, it is up to the researcher to decide which path to follow and when to follow it.

Interactivity
The Harvard case model provides information in a static medium. Case study need not be passive, unilateral communication. When preparing a case, one should be able to interact with it, testing assumptions and receiving comments.

Perspective and Role Play
There is never one side to any coin. Current case study often provides only a singular perspective to a situation and therefore leads the reader to confuse perspective with fact. In addition, dialogue based upon a single perspective usually boils down to black and white conclusions. As no two people see the world through the same eyes, issues are confronted and resolved by parties with different perspectives and goals. Ideally, one would like case study to simulate this environment by providing multiple perspectives. Through role play of multiple perspectives, a more true to life discussion of an issue can evolve.

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Scope & Comprehension

Most case studies today have a narrowly defined scope. One reason for limited scope is the desire to highlight a particular concept. Another reason, which I feel drives the constraint, is our limited time and our overloaded memory capacity. The richer our active data set, the more meaningful is our analysis and discussion. Therefore, one would like to have an environment in which comprehension comes easily and information can be reviewed quickly.

Engagement

Disregarding the more philosophical problems with the current case method, an equally grave shortcoming is that they are boring. One reads over a hundred cases in the first year of many masters programs. A more effective form of case study would engage and entertain the reader, bringing him into the material.

Migration Path From Case Study to Reality

As one would expect from a methodology so far abstracted from reality, current case study, as a framework, does not present a smooth transition to real world problems. If case study were to truly prepare us, one should be able to replace the limited data set with live feeds to the world and use the same framework to analyze and understand reality.

This thesis will discuss ways to improve upon these enumerated problems by proposing a new framework for case study, HyperCASE, based around interactive multimedia technology. A computer software prototype will show feasibility of this
framework, and the first HyperCASE will be produced on "The Emerging Multimedia PC Industry."
CHAPTER II

Cognitive Science, HyperText, Multimedia, & Hypermedia

The notion of developing representations which better correspond to human cognitive processes is not new. Cognitive scientists have laid "foundations for investigating human dynamic inference capabilities" and have marked "directions of inquiry into the complex [process of] storage and retrieval of knowledge."¹ Kuhn described "paradigms" as a representation of the body of scientific knowledge and as an evaluation of scientific progress. Minsky defined "frames" as structures which embody knowledge and the methods which allow us to use that knowledge. Schank and Abelson outlined "Scripts, Plans, & Goals" as a cognitive scheme which enables people to understand an environment or situation. ²

In parallel to such work on the issues of representing and storing knowledge, there has been deep exploration into means of interacting with knowledge sets through various media. The invent of the computer has propelled this movement. A computer possesses the ability to manipulate many of the tools which humans use to communicate (i.e. text, speech, and visual cues). In 1945, Vannevar Bush described a computer system which would emulate the human process of research.

"There will be a tool which will would allow people to retrieve information from computers in the same way this is done with human memory..... The human mind [he said] operates by association."³

This is recognized as the first description of "hypertext," a literature format in which a reader can navigate through information by use of association of knowledge chunks.

¹ Harbor, Jonathan D., "FA: Artificial Intelligence Applied to Faculty Advising," Wesleyan University- The Honors College, Middletown, CT, 1986
² Ibid., Harbor, 1986

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It was Ted Nelson who, in 1965, invented the term "hypertext" to describe such a non-linear literature. Some eighteen years after Bush's publication, Engelbart extended the concept of hypertext retrieval to include symbolic representation. He describes a system in which

"...the symbols with which the human represents the concepts he is manipulating can be arranged before his eyes, moved, stored, recalled, operated upon according to extremely complex rules—all in very rapid response to a minimum amount of information supplied by the human..."1

As computers and media technology have advanced, it has suddenly become easy to manipulate video and audio data. Videodisc technology connected to a computer allows for random access to full-motion analog video and audio. Conklin describes the next wave of information representation and retrieval as "hypermedia," applying the concepts of hypertext to multiple media sources:

"As videodisc technology comes of age, there is growing interest in the extension of hypertext to the more general concept of hypermedia, in which the elements which are networked together can be text, graphics, digitized speech, audio recordings, pictures, animation, film clips, and presumably tastes, odors, and tactile sensations." 2

The terms "hypermedia," "multimedia," and "interactive multimedia" are used synonymously in this document. However, the importance of interactivity in hypermedia should not be overlooked. Since hypermedia is proposed to more representative of human mind processes than other media, one should interact with a hypermedia system in an equally human manner. Andy Lippman of the MIT Media Lab's Paperback Movies Project defines a model for computer multimedia interactivity.


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He isolates five criteria which must be implemented in order to capture interactivity as we are accustomed to in normal discourse. These are 1) Interruptibility: each party in a conversation must have the ability to interrupt and change the course of the discussion, 2) Granularity: one must be able to move between macro and micro when searching for content, 3) Limited-Look-Ahead: one should have an idea of the directions possible, 4) Graceful degradation: when a system fails or is unable to understand its condition, it should handle the situation without crashing an application or breaking a conversation 5) The appearance of infinity: though all information cannot be contained in a single source, it must appear that date is limitless. A hypermedia application must be interactive.

In 1987, Apple Computer began distributing HyperCard™, a software program for their personal computers which finally gives the power of hypermedia authoring to the lay user. Since then, other software companies have incorporated hypermedia capabilities into their products. As interactive multimedia publications become prolific, issues of multimedia authoring must be addressed. In Chapter 1, "Interpretation" and "Objectivity" were isolated as two problems with "mono-media" case study. Hooper, of Apple Computer, has documented early use and acceptance of multimedia and indicates that multimedia may be a means for minimizing these problems.

"One must acknowledge how the form of a medium affects that which is communicated...." "Multimedia titles will provide a particular point of view on a topic as well as the raw materials to examine these points of view and to constitute an individual point of view." 

1 Lippman on Interactivity, Macuser, March 1989

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HyperCASE, a hypermedia environment, will add "numbers" to its definition of hypermedia. With the introduction of yet another medium, new types of interactivity and expression will be explored. As Hooper noted about multimedia:

"... it is difficult to imagine exactly what kinds of communication will be afforded by [such] presentation formats ..."  

HyperCASE will show how hypermedia can be used to create a computer environment for industry analysis and case study which more closely resembles human processes and practices than does traditional case study methodology.

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1 ibid Hooper, 1990

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CHAPTER III

HyperCASE: A Framework for Hypermedia Case Study

HyperCASE uses the power of hypermedia to define an improved framework for business case study. HyperCASE is comprised of four major sections (see Exhibit A). These sections provide the general framework for strategic analysis of an industry or company. From any place in the application, one can jump to each of these four sections by clicking on its respective icon.

I. Competitor Analysis
II. Industry Applications
III. Industry Experts/Advice
IV. Strategic Tools

Is defining how to analyze an industry and its competitors, Michael Porter identifies two types of data: "published data and those gathered from interviews with industry participants and observers." ¹ Sections I, II, & III contain such data. By navigating through HyperCASE, applying the Strategic Tools of Section IV to analyze the data of Sections I, II, & III, a student learns the methods for industry research and analysis.

Competitor Analysis

The Competitor Analysis section offers an in-depth look at individual companies in an industry. The Competitor Analysis screen (Exhibit B) has a button for each of the companies included in the HyperCASE. Each button is attached to a HyperCALC™ spreadsheet which contains company specific historical financial data (Income Statement, Balance Sheet, Cash Flow Data). For publicly traded companies, this data is currently available in electronic format from data services such as


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Disclosure™ and Compustat™. In addition to the Company's historical financial data, one can browse through other data types in various media through the four HyperCALC™ buttons (Exhibit B. ii). These are:

1) **Company Representatives**
   
   This button provides interviews with corporate representatives. Each interview is accompanied by the background of the speaker and a transcript of the interview.

2) **Products**
   
   The products section provides demonstrations of the Company's products and allows the user to read product brochures.

3) **The Press**
   
   Articles from industry magazines and clips from broadcast media which relate to the Company are available through this section.

4) **Annual Report**
   
   Publicly available corporate documentation, such as the annual report, are accessible in this section. Other relevant SEC filings, such as 10Ks, 10Qs, 8Ks, etc could also be provided here.

II. **Industry Applications**

The Industry Applications section provides examples of a market's growth and services in use by customers or other industries (Exhibit C). When performing a strategic marketing analysis, it is important to understand how customers use your products, competitors' products and product substitutes.

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1 Disclosure™ is trademark of Disclosure Corp, and Compustat™ is a trademark of The Standard & Poor's Corporation.
III. Industry Experts/Advice

The Industry Experts section attempts to provide "objective" advice on industry trends and participants (Exhibit D). Information can never be completely objective since the editor or collector of information decides subjectively which information to publish and which questions to ask in order to evoke the information. However, by providing interviews with prominent individuals without ties to specific industry participants, a reader can begin to judge the credibility of information and derive a subjective viewpoint. For most examples, one would like to hear from representatives of industry organizations as well as noted experts on economic trends and financial considerations. Also pivotal in researching an industry is hearing the voice of the customer. HyperCASE generalizes "Expert" information requirements into three categories:

1) Industry Expertise  
2) Economic and Financial Expertise  
3) Customer Representation

IV. Strategic Tools

The Strategic Tools section provides management tools to help perform a strategic analysis on an industry (Exhibit E). Most of these tools are taken directly from well established and accepted methodologies which are currently taught at leading management schools. As a student browses through a HyperCASE, he can use the strategic tools to help crystallize his understanding of the industry's structure and of the relative strengths and weaknesses of its participants. These tools neither provide nor recommend answers to strategic questions, but rather provide a framework in which the student can arrange his own opinions. Each of these tools calls for student input and can print out an exhibit indicating the students analysis. In this capacity, the line between viewer and author is challenged. Though these tools, in their current state, only allow a student to create an exhibit, one could easily imagine the power of

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creating dynamic links between the tools and underlying spreadsheets. When the shape of a "Life Cycle Diagram" is altered, for example, the assumptions for financial projections of a company could reflect the changes. Below are explanations of several of the tools included. For further explanation, please refer to the original texts cited.

**Industry Forces Diagram** - Developed by Michael Porter of the Harvard Business School, this tool provides a framework for describing the structure of an industry in terms of 5 Forces (Exhibit E.i).\(^1\)

1. Potential Entrants (Threat of New Entrants)
2. Substitutes (Threat of Substitute Products or Services)
3. Suppliers (Bargaining Power of Suppliers)
4. Buyers (Bargaining Power of Buyers)
5. Industry Competitors (Rivalry Among Existing Firms)

According to Porter, the profit potential of an industry can be estimated by analyzing these forces and their inter-relation.

**Value-Added Chain** - This provides a framework in which one can analyze a company's strategic strengths and weaknesses along the multiple stages in the development of its products (Exhibit E. ii). Mapped out in this fashion, the degree of vertical integration within an organization becomes apparent as well as opportunities for forward or backwards integration. According to Arnoldo Hax, the value chain also helps identify shared resource opportunities within a company.\(^2\) Sharing functional resources within a company or across strategic business units provides opportunities for increased efficiencies.

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Strategic Group Map - Also described by Porter¹, this analysis provides the basis for market segmentation (Exhibit E. iii). One must choose mutually exclusive axes which are differentiating factors in the marketplace. The most appropriate axes, according to Porter, are those which describe "key mobility barriers," or those strategy attributes which impede movement from one industry group to another. Next, one places the industry participants in this map within the defined space and one may surmise as to the movements of each participant within the space. Groupings should emerge which help explain industry characteristics.

The strategic tools described are by no means meant to be exhaustive. Industry analysis, according to Porter, aims to unveil "the structural features of industries, the important forces causing them to change, and the strategic information ... about competitors."² The tools included in the Strategic Tool Box are examples of current practice to ascertain these industry characteristics. As management theory evolves, one would ideally update the Strategic Tool Box used for industry analysis.

¹ Ibid, Porter, 1980
² Ibid, Porter, 1980 p. 369
CHAPTER IV

HyperCASE Tools & Functionality
The development of HyperCASE required building a single environment which could allow a professor, student, or other user to interact with Numbers, Text, Graphics, Audio, and Full-Motion Video. Within the HyperCASE environment, the line between author and viewer is often crossed. A viewer can browse information in a non-linear path, he can interact with the information through a variety of Strategic Tools, he can alter or add to the information, and he can create his own representation of the information using a set of Building Tools.

CASE Building Tools - One can reckon the information body in a HyperCASE to a snap-shot of an industry at a given moment or over a period of time. Though this information is arranged in a structured framework, one can imagine that an infinite number of cross sections could be made of the data world, each with relevance and each highlighting different concepts.

This is the essence of traditional case study design. To teach a concept, a case writer will look to the real world to provide situational examples. The writer will “slice” through the set of data available to script a cohesive, bounded view of the real environment.

Using the Build-CASE tools in HyperCASE, a case writer, professor, student, or other user can make his own slice of the HyperCASE to illustrate concepts and pose new questions. A template has been created (CASE-Template) to help guide a case writer in producing an easy to use case study with a standard HyperCASE interface.
(Exhibit F is an example of a HyperCASE built using the Build-CASE tools). Using the Segment-Builder, the Sheet-Builder, the Cell-Link, and the Link-Tool, an author can begin to fill in the CASE-Template and link it to spreadsheets (HyperCALC™), video segments, or other text. With minimal effort, other than creativity, the professor can author a fully accessible interactive multimedia case study which focuses on his viewpoint and interest in the data set.

Many of the HyperCASE multimedia programming constructs build upon The Elastic Tools, built for The Elastic Charles project. Unfortunately, The Elastic Tools, based around Apple's HyperCard, provide little power to manipulate numbers. As HyperCASE uses numbers as an important medium, it was necessary to have the full power of a spreadsheet in addition to video and authoring tools. Therefore, HyperCASE building tools were developed to allow a professor or student to create multimedia spreadsheets including links to text, video, and other spreadsheets, all without ever entering a programming environment.

**Video Controller** - Lippman has highlighted "Interruptibility" as a prerequisite to achieving interactivity which approximates human discourse. The first step in reaching this goal with HyperCASE was to allow a user full control of a videodisc player (see Controller Interface in Exhibit G). From within the environment, available functions include Stop, Play, Step Forward, Fast Forward, Reverse Play, Reverse Step, and Rewind. It is important to allow the viewer this control such that he is not forced to watch or listen to information when he does not so desire.

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Additionally, in searching through a HyperCASE, one must be able to review video information such as interviews which can be rich with data and difficult to follow. It is important to note here what specific information types are better presented in video format than in other formats. In general, video is a better means than other singular media for conveying:  
- Human Characteristics & Interactions
- Complex Processes
- Remote Places
- Events

Segments and the Segment Builder - A HyperCASE allows the reader to browse video information by referencing segments. A video segment is defined as a sequence of linear video with a begin point, an end point, and a context which justifies its grouping. Pictorial Icons, or PICONs, allow a viewer to watch a segment by clicking within the area of the PICON (see Exhibit C). The picture which makes a PICON pictorial is chosen by the author from the video data in the underlying segment.

In addition to allowing its readers to watch video in a non-linear path by referencing PICONs, HyperCASE tools also allow the viewer to create their own PICONs which are linked to new video segments. The Segment Builder allows the viewer to set beginning and end points and then choose a picture and a name which he feels is representative of the segment. Segment Builder then combines that information into a PICON which when clicked upon, will cause the video device player to play that segment. The user has the ability to then place this PICON within a HyperCASE or HyperCALC™ spreadsheet.

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Linking Tools - Hypertext, as named by Ted Nelson, defines a metaphor for presenting textual information in a manner which corresponds the human process of association. When we read a body of text, certain words may cause us to reflect on related thoughts. Hypertext provides the ability to covertly include such links in a document by defining "Hot Words." Ideally, one would like the same capability with any media format. When analyzing a spreadsheet, we may want to jump to similar spreadsheets or to other analyses of the same company. When watching video, we likewise may like to delve deeper into concepts raised by the material or jump to another topic. In explaining their Elastic Tools, Brondmo and Davenport describe "dynamic links in temporal media." Links are created which explicitly define relational paths between segments of video.

"Links are used to associate content related chunks with each other and ultimately to navigate between them. Some indication that a link has been associated with a chunk of information must present itself to the user. The user has the option of following the link or ignoring it." 1

To provide this possibility within HyperCASE, a linking tool was created which allows for a segment to be linked to another segment, to multiple segments, or even to a spreadsheet. A link consists of a start point (LinkStart) and end point (LinkEnd) within a segment. It also includes the name of a segment (LinkName) to be linked to. When watching a linked segment, when we reach the LinkStart, a PICON representing the LinkName will appear superimposed upon the playing video. This establishes a cognitive link for the viewer without disrupting his concentration. If the viewer decided to pursue the path of this new cognitive link as opposed to continuing to watch the linear video, he merely clicks on the PICON which will commence play of the linked segment. If the viewer disregards the link, it disappears.

1 ibid Brondmo, Davenport, 1989
HyperCALC™ Sheet Builder - As declared earlier, HyperCASE stresses that numbers are an important element in a definition of multimedia. Solely providing the ability to access numbers, however, is insufficient. To provide an environment which will be engaging and powerful, one must be able to interact with numbers in at least the same capacity as is possible in the singular medium of a spreadsheet. Therefore, HyperCASE provides the full calculating functionality of WingZ™ to the user and to the author. The Sheet-Builder Tools enables the author to create a new HyperCALC™ spreadsheet with a link back to the CASE and to any of the four HyperCASE sections (Exhibit F.1 shows an example of a HyperCALC™ spreadsheet). As the Sheet-Builder forces the author to extend the Sheet-Template when writing a case, HyperCASE ensures that the interface of new sheets is consistent such that a user will understand how to travel from a sheet to any point in the HyperCASE, regardless of the author.

HyperCASE CELL-Link Tools - Though many early multimedia applications have been built which allow users to interact with "sight, sound, and motion," 2 HyperCASE puts a heavy emphasis on numbers. Not only can a user interact with numbers, but the numbers themselves can interact with other media. Using the CELL-Link Tools, rules can be established which link conditions to actions. For example, threshold levels can be placed on a cell value which when met, can drive a relevant video segment to be played on the monitor. (In Exhibit F.1, when the variable SOFTWARE RATIO drops below 50%, a video segment discussing the need for

1 WingZ™ is a spreadsheet package marketed by Informix Software, Inc.
software development is played). The action does not impede the user from leaving the cell above the threshold level, but rather provides some "expert" advice or reminder regarding the decision.

This is perhaps the most novel concept of HyperCASE. Numbers, unlike other media, are dynamic and have scientific properties. Spreadsheet users, which include many business school students, are already used to using numbers and operands in a spreadsheet to express subjective analysis of a set of data. They also already understand how to set rules within a spreadsheet to drive a numerical analysis (i.e. Lotus's 1-2-3™: @IF (a2>a3, 1980,1990) )\(^1\). However, after the spreadsheet "crunches" the numbers, it is still up to the user to express the results in other media (i.e. words) and draw conclusions. By providing the ability to link conditions in a spreadsheet to other media such as video, CELL-Links Tools help to close the gap between numbers and their interpretation.

**Cell-Links As Active Agents**

This thesis will try to define a smoother path from case study to reality (see Section: Migration Path From Case Study To Reality). When HyperCASE is linked to live feeds as opposed to pre-assembled data sets, it will become extremely important to have "agents"\(^2\) which will pro-actively inform the user of important information and events as they occur. CELL-Links can be though of as independent agents. For example, if my HyperCALC™ spreadsheet is linked to my portfolio of stocks, when one of the issues drops by 10%, I would like to know. Since I can not personally

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1 1-2-3 is a trademark of Lotus Development Corporation.
monitor all information streams simultaneously, I have a broker who calls my attention to such market movements. Soon, HyperCASE will inform me before my broker.
CHAPTER V

Future Development of Tools & Functionality For HyperCASE

HyperCASE Write-Up Tool

Case study would not be case study without case "write-ups." A write-up is business school lingo for a paper which analyzes a case study. Current case study methodology asks students to submit textual documents (sometimes with exhibits) which provide their analyses and insights. With the power of interactive multimedia, HyperCASE offers the student a more powerful and creative environment for creating a "write-up." Much like the Case-Building Tool for professors, the Case-Write-Up Tool would allow a student to author a document with links to video text, and spreadsheets. In addition, the write-up can include links to the student's analysis in the strategic tools section.

Rolling Transcripts and Hard Copy

Transcripts of video data are provided with PICONs. However, there is currently no synchronization between the two media. When a student is watching the video, the transcript should "roll" with the segment. If one desires a "hard-copy" print out of a case or case write-up, the PICON will not provide much information since its link is inactive on paper. Therefore, when a hard-copy of HyperCASE is produced, one should have the option to translate PICONs into the underlying textual transcript.

Return Track

It has been argued in this thesis that providing a non-linear search path is desirable in a framework for case study. However, when one branches from one segment of information to another, there should be a clear means for returning to previous
segments. The current implementation requires replaying a segment from its beginning. Other systems, such as The Elastic Tools, have used a "Return" metaphor to go one step backwards. HyperCASE should include a similar metaphor.

**Editing Facility for Segments**

When segments are built, they are not built in stone. A user should have the ability to delete, modify, and copy segments.

**Glossary of Terms**

Performing an industry analysis can result in a lengthy list of new terms and definitions. A glossary of terms, containing information pertinent to the industry and to strategic analysis, should be available from anywhere within the environment. As each term in the glossary would represent a concept or information "node," such a structure would be well suited to allow for hypertext links within HyperCASE.
CHAPTER VI

HyperCASE Technology

Hardware - HyperCASE was developed on a Macintosh II computer accessing an LD-V4200 LaserDisc player. A Colorspace II video overlay board was installed in the Macintosh to allow graphics-over-video on an adjacent NEC monitor. The Macintosh environment was chosen because of its emphasis on graphical user interfaces and its flexibility to mix multiple media types. Additionally, packaged software available on the Macintosh is well suited to the needs of this project.

VideoDisc Technology

VideoDisc was chosen as the current most appropriate video storage device for HyperCASE. It provides random access to high-quality analog video. There are two types of videoDisc currently available: constant angular velocity (CAV) and constant linear velocity (CLV). The Pioneer 4200, as a CAV, is constrained to approximately 30 minutes of full-motion video and audio per disk side. (CLV allows approximately one hour per side). Therefore, the hours of video footage of interviews and demonstrations had to be severely edited to adapt to the storage medium. Ideally, one would like to have numerous hours of video indexed and readily available in a video database. Larger video capacity can minimize the amount of subjective editing required in producing a videoDisc, thus helping to deliver data which approaches objectivity. As digital video and compression technology evolve in parallel with continued achievements in mass storage capabilities, a HyperCASE environment can

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1 A trademark of Apple Computer, Inc.
2 A trademark of Pioneer.
3 A trademark of Mass Microsystems, Inc.
become richer in the scope of video data available. Such an environment will pose new and important questions about the nature of representing, organizing, and accessing large reservoirs of video data.

**Packaged Software** - HyperCASE was designed around WingZ™, a spreadsheet developed by Informix Software, Inc. WingZ's rich graphics capabilities, complete spreadsheet functionality, and powerful programming language make it the perfect candidate for the foundation of HyperCASE.

**Software Development** - WingZ™ programming language, "HyperScript™," allows a developer to reference functions external to the program. Software drivers were written in "Think C" to send commands through the RS32 port of the Macintosh to a videodisc player. Using these external "C" routines in combination with HyperScript and spreadsheet data, HyperCASE was implemented.
CHAPTER VII

"THE EMERGING MULTIMEDIA PC INDUSTRY" HyperCASE #1

To prove the HyperCASE concept, a HyperCASE was built for the multimedia personal computer market entitled "The Emerging Multimedia PC Industry." Representatives from key industry participants were interviewed, industry applications and products were researched, and relevant public data was collected. A videodisc was pressed with approximately 1/2 hours of edited video and audio. Each of the sections of HyperCASE was loaded with information pertinent to the multimedia PC industry. In each section, data was further categorized to match the industry.

Below are descriptions of the industry participants selected for the Competitor Analysis section, the categories and examples used in the Industry Applications section, and the expert data chosen for Industry Experts. As Strategic Tools are consistent across industries, I will not elaborate on the tools in this section.

I. Competitor Analysis

The types of companies included in the competitor analysis were segmented into two dimensions: Hardware/Software and Domestic/Foreign. In many respects, these could be considered separate, interrelated markets. However, when trying to derive a corporate strategy, it is necessary to isolate possible new entrants as well as potential strategic partnerships. This grouping does not imply that there are not other equally valid ways of segmenting the market. On the contrary, as noted in Chapter III, a strategic group map has been provided in the Strategic Tool Box which allows the reader to segment the market as he sees fit. The corporate descriptions below are

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neither thorough, nor exhaustive. Each of the industry participants has capabilities and products far more extensive than those described. In addition, many other companies could also be included in the list of competitors. The companies represented, however, are sufficient to gain experience in using strategic management tools and techniques to perform an industry analysis.

**DOMESTIC HARDWARE**

**International Business Machines (IBM)** - IBM, a diversified computer and computer peripherals manufacturer, is working closely with Intel and Microsoft to develop multimedia PC's with digital compression. All IBM and IBM "clone" personal computers rely upon Windows' operating systems (MS-DOS and Windows). IBM recently introduced a proprietary product line, the PS/2, which attempts to provide a richer graphical interface than the previous PC line. Microsoft is also the developer of the operating system software for the PS/2 line called OS/2.

**Intel Corporation** - Intel, a chip manufacturer, is marketing a technology called Digital Video Interactive (DVI). The chip allows for real time decompression of digital video. As a service, Intel will compress customers digital video to fit on a CD-ROM disk. Using Intel's Pro750 DVI system, the user can retrieve and manipulate the digital video.

**Apple Computer, Inc.** - Apple develops and markets personal computers. The company has been most successful in marketing to the education and creative professional markets. Apple's Macintosh product line provides an integrated environment of text, graphics, audio, and animation in an environment with rich graphical user interfaces. Apple's architecture is proprietary and all systems software is developed in-house.

**Commodore Computer,** Commodore manufactures and develops a series of graphics related personal computers. Most noted for the Amiga model, Commodore is attempting to revive the struggling company with the introduction of the Amiga 6000, a multimedia computer.

**NeXT.** - Previously the founder of Apple Computer, Steve Jobs founded NeXT several years ago. NeXT manufactures a graphical, object-oriented workstation. With a CD-ROM drive on all NeXT machines, they also have strong audio capabilities.

**Sun** - Sun develops and market profession workstations for the engineering market. Their computers, running under a Unix environment, provide high quality graphical capabilities.
Fluent Machinists, Inc. - Fluent is a Massachusetts start-up company founded by Dave Nelson (previously the founder of Apollo Computers). Fluent is developing a series of boards to be used with IBM compatible personal computers. Fluent’s products provide compression and decompression algorithms to store and manipulate digital video.

Avid Computers - Avid Computers is a start-up in the Boston area. Avid sells a high-end digital multimedia workstation primarily targeting the professional video editing market. Avid’s product combines massive electronic storage capacity with A/D conversion and Avid software.

C3 - C3 (spoken C Cubed) is a California start-up designing and manufacturing a digital compression and decompression silicon chip set.

Mass Microsystems - Mass Micro markets mass electronic storage devices and video overlay boards. Colorspace II, Mass Micro’s first video overlay board, is used in conjunction with an Apple Macintosh computer to convert graphics to TV format (NTSC) in order to superimpose graphics over video.

DOMESTIC SOFTWARE

Microsoft - Microsoft is a systems software company based in Redmond, WA. Most well known for its IBM PC and PS/2 operating systems (MS-DOS, Windows, and OS/2), Microsoft also develops applications for Apple computers such as word processors, spreadsheets, and other utility tools.

MacroMind - MacroMind, a young software company located in Northern California, markets Director™, a multimedia authoring and presentation tool.

Lotus Development Corporation - Lotus is an applications software company located in Cambridge, MA. Best known for its 1-2-3 spreadsheet product, Lotus also markets a wide range of business applications software. In recent years, Lotus has begun marketing financial information through One Source™, a CD-ROM based product.

Informix Software, Inc. - Informix markets WingZ™, a graphical spreadsheet and Online™, a relational data base product which is accessible through WingZ.

Owl - Develops and markets Guide™, a hypertext document processor.

Oracle - Develops and markets relational database products.

Silicon Beach - Markets SuperCard™, a multimedia authoring environment that extends the concepts and functionality of Apple’s HyperCard.
FOREIGN

The Sony Corporation - Headquartered in Tokyo, Japan, Sony develops and markets a wide range of home and professional electronic products. Most noted for its television sets and video equipment, Sony has more recently entered the computer workstation market in Japan and continues to be on the leading edge of development in HDTV and most media technologies.

NEC - NEC, headquartered in Japan, is a fully integrated electronics corporation. NEC's product scope includes computer chips, telecommunications equipment, home electronics, and professional systems.

Nintendo - Nintendo develops and markets a home entertainment system for video games. With close to 20 million units installed, Nintendo has the largest share of the home video game market.

Phillips N.V. - Phillips, a Dutch company, manufactures and markets a wide range of electronics equipment. Phillips, along with Sony, is pioneering the charge for CD-I (Compact Disc Interactive) as a standard for digital video.

II. Industry Applications

To simplify market analysis for the user, I have segmented multimedia industry applications into three groups: (Exhibit C)

1) Point-Of-Sale or Kiosks

Multimedia kiosks are generally stand-alone units whose purpose is to either sell, or to inform.

The World Financial Center kiosk is an example of an information and guiding facility. Pedestrians can approach the system and search for information on restaurants and shops in New York's World Financial Center. A tailor-made map will be provided to help guide you to your destination.

Florsheim Express Shop is an example of an in-store multimedia system used as a sales device. As the cost of retail space has escalated, it has become expensive to carry a large inventory of shoes. Using interactive multimedia technology, Florsheim is able to provide its customers with the ability to browse through the entire product line without having the products on the premises.

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2) Educational Multimedia
Perhaps the most common use to date of interactive multimedia systems is in education and training. Multimedia's ability to engage a viewer makes it an excellent format for learning tools.

**ABC News media** - ABC News has recently started marketing interactive documentaries. The product allows ABC to re-cut footage from the video archives and bundle the material with software based around HyperCard. The software runs in a Macintosh environment.

**Veralex** - Veralex, in conjunction with The Harvard School of Law, produces and markets a series of interactive legal training tools. Law students interact with the system to practice such skills as negotiation, trial tactics, and deposition skills.

3) Entertainment
In addition to purely functional applications, multimedia is proving to be well suited for games and entertainment.

**TurboGraphX** - This home video game set is marketed by NEC. The unit, sold in stores around the country, has a built in CD-ROM drive which holds game software. Each disk allows the user to play a different game. Nintendo, a competing product without CD-ROM, already has U.S. market penetration of nearly 20 million units.

**The Elastic Charlie** - This prototype multimedia magazine was created by the MIT Media Lab's Interactive Cinema Group. The product, delivered by combination of CD-ROM and videodisc, allows a reader to explore through multiple media, the history and events of the Charles River in Boston.

III. Industry Expert/Advice
This section, as described above, tries to provide perspectives from the various fields one would draw from in analyzing an industry (see Exhibit D). For the Emerging
Multimedia PC industry, one would like to draw from the knowledge of experts in Media, Finance, and Technology. Media experts could comment on implications of multimedia PC's for new entertainment and media formats. Technological gums could spot possible substitutes or "show stopping" technological hurdles. Finally, economists and financiers could provide insight on the feasibility of success given economic constraints.
CHAPTER VIII

Strategic Issues in The Emerging Multimedia PC Industry

In researching and entering the HyperCASE information, many strategic issues arose. Each of the following has been isolated as an excellent candidate for a HyperCASE topic within The Emerging Multimedia PC Industry data world.

Digital Video Standards - There is confusion in the marketplace regarding which standards will define a digital video market. Standards boards such as ISO have suggested JPEG, a standard for digital video stills, and M/PEG, a standard for digital motion video. Before widespread development can occur, the industry must clearly set standards to minimize development risk.

Hardware Platforms - A new entrant into the multimedia market must decide between a series of development platforms, both hardware and software. Currently, Apple's Macintosh and IBM's PS/2 lines are proprietary architectures thus leaving PC compatibles, Unix workstations, and other special purpose environments as potential platforms for systems development.

Software Platforms - Microsoft, the major systems software developer for IBM and IBM compatible personal computers, has been somewhat unclear in articulating a product strategy. Microsoft DOS is the low level operating system for the PC. Recently Microsoft has released Windows 3.0, an updated extension of DOS which has met rave reviews by the industry. At the same time, Microsoft is marketing OS/2, a supposedly more powerful graphical environment developed for IBM's PS/2 line and
aimed at igniting the PS/2 market. Programs developed in one environment will not necessarily port to the other.

**Systems vs. Components** - Entering the hardware business, a company must decide whether to develop systems or components. Many large and wealthy corporations, domestic and abroad, are committed to developing systems. However, the major players have had little success launching a multimedia product and customers are unwilling to piece together components on their own.

**Vertical vs. Horizontal Marketing** - Whether developing multimedia software or hardware, one has to decide to either approach a market niche or attempt to create a mass market product. As a market has yet to develop, targeting a vertical segment could promulgate products and concepts more quickly. However, focusing too much on one segment could be at the risk of losing share in a much larger market.

**Intellectual Property, Copyrights, and Business** - The multimedia software revolution is coming at a time when the law is having great difficulty sorting out intellectual property issues involving computer software. Major software developers and publishers are monitoring the market not only to make sure that their products have not been illegally misappropriated, but also to ensure that the "look and feel" of their products has not been violated by competing products. Multimedia personal computing and telecommunications developments could possibly place rich authoring and publishing power into the hands of every computer user. Without bold court decisions clearly setting guidelines for developers, one must be particularly careful not to violate intellectual property rights.
Hardware vs. Software Development Trade-Offs - When developing for a new market such as multimedia, it is questionable whether one can choose between hardware or software. As was seen in the VCR market, powerful hardware without software is a losing proposition. Likewise, without a distribution system in place for consumers to use software products, software developers will be hesitant to develop.

Home vs. Office - Most participants in this emerging market seem to make a strong distinction between the home and the office markets. Distribution, product attributes, and even end-use is drastically different. Again, one must decide to either focus on one, or attempt to develop a product which can span the gap.
CHAPTER IX

HyperCASE Migration Path from Case Study to Reality

Case study, as discussed earlier, takes a "chunk" of reality to allow meaningful discussion within a classroom environment. HyperCASE, though providing a richer, dynamic information environment, still provides only a bounded moment of time. This constraint, however, need not exist. As a computer based program, HyperCASE can be linked into live feeds from the outside world. For example, spreadsheets already have the capability to access real time stock quotes and news services. A reservoir of historical financial information is provided through time share systems and CD-ROM products from several data vendors. It is a natural extension to imagine the "Broadband Telecommunications Society of the Future" in which HyperCASE has access to broadcast stories from networks such as FNN and ABC. As one can see, the "bounded snap-shot of reality" which we associate with case study needs not be completely bounded by scope or time. A linked hypermedia environment would provide access to dynamic sets of data which are continually changed and updated. Therefore, using the HyperCASE environment, one has a natural migration path from case study to reality.

HyperCASE as Real World Management Tool

If the framework defined in the HyperCASE environment can be shown to be helpful in analyzing a representation of an industry, then it should indeed be equally effective as assisting managers in strategic analysis of their own industries. By using a HyperCASE to analyze an unrelated industry, a manager will be able to extract the tools and methodologies needed to perform strategic analysis on his own company's behalf.

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Conclusions

Current case methodology is limited by its medium. By using interactive multimedia technology, case study becomes a dynamic, rich, engaging experience. Chapter I defined limitations with current case paradigms. HyperCASE, an implementation of interactive multimedia case study, addresses each of these problems. Interpretations of human characteristics and events are left to the viewer. A student chooses the information he wishes to view and in the order he wishes to proceed. Data is available from multiple perspectives such that each reader need not defend the same participant in discussion. Perhaps most importantly, the HyperCASE environment is engaging to a viewer and provides a natural preparation for real world industry analysis.

As was discussed, the HyperCASE framework can be effective for managers in analyzing their own industries and companies. Interactive multimedia is therefore effective as a case study methodology for business education and as a real world management tool.
EXHIBITS

HyperCASE INTERFACE

A - HyperCASE - Main Screen

B - Competitor Analysis Section
   i. Apple.CALC
   ii. Apple.CALC - Company Representatives

C - Industry Applications Section

D - Industry Experts Section

E - Strategic Toolbox
   i. Industry Forces Diagram
   ii. Value-Added Chain
   iii. Strategic Group Map
   iv. Life-Cycle Diagram

F - Apple.CASE
   i. Apple1.CALC - The R&D Case

G - HyperCASE Video Controller
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NOTE: These figures are not Apple Corporation's real financial data.

Exhibit B.1
Phil Shiller
Phil is a "Techno Rambo" in the Business Multimedia unit of Apple Computer, Inc.

TRANSCRIPT:
At Apple, we're broken up into Apple

Mike Liebhold
Mike Liebhold is a Manager of Hypermedia Research in the Advanced Technology Group.

TRANSCRIPT:
By now, you have familiarize yourself with the multimedia industry. Based on your understanding of trends in the marketplace, design an R&D project for the digital video group by adjusting the assumptions in Apple1.CALC.

Apple Computer is a leading manufacturer of personal computers. Over the years, Apple has been extremely successful in the education and "creative professional" markets. Management believes that multimedia computing, based on digital video technology, will help to company to break into the home and office markets.

You have recently been hired from a leading business school in the Northeast to establish a digital video products group. You were chosen by Apple because of your extensive experience prior to business school, and because of your expertise in managing R&D.

To find out about the structure of Apple and about the potential for a business marketplace, a meeting has been set up between you and Phil Bihlier from the Business Applications Group. To get acquainted with Apple's technological staffing and to help gain perspective on the marketplace, Mike Liebold has agreed to brief you.

Apple has allotted 100 professionals for your "Head Count." As you sit back at your desk trying to make sense of what you have heard from various industry sources, you realize that you must develop a budget plan for the digital video R&D group.
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Exhibit F.1
Bibliography


Davenport, Glorianna, Discussion.


Harber, Jonathan D. "FA: Artificial Intelligence Applied to Faculty Advising," Wesleyan University-The Honors College, Middletown, CT, 1986.


