Home of the Future
Planning Service

Software Strategies: The Home Computer and Videogame Marketplace

Report No. 83-3
December 1983

An Executive Service of the Yankee Group

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the YankeeGroup 89 Broad Street, 14th Floor, Boston, Massachusetts 02110, (617) 542-0100

April 19, 1984

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Dear Subscriber:

Enclosed you will find the long-awaited "Software Strategies" report. This is our final publication from the 1983 report series.

I would like to call your attention to the following revisions and corrections. You will find a colored dot on pages ii, iv, v, 3, 6, 7, and 135. These tables are incorrect and are updated by the enclosed packet of tables. We have indicated the changes on the new tables by an asterisk.

We apologize for the inconvenience and hope that you enjoy the report. Please feel free to contact us if you have any further questions.

Sincerely,

Michele Corbeil

Michele Corbeil
Account Manager

Table ES-1 and Table 1-1

THE HOME VIDEOGAME MARKET

Consoles	1981	1982	1983	1984
Atari 2600	3.10	5.10	3.00	1.80
Atari 5200	--.--	0.25	0.95*	0.70
Colecovision	--.--	0.55	1.10	0.50
Intellivision	0.72	1.10	0.35	0.15
Odyssey	0.60	0.40	0.20	0.05
Other	0.20	0.15	0.10	0.05
Total Units (M)	4.62	7.95	5.70	3.25
$ Millions	$577	$1,320	$540	$263

Software	1981	1982	1983	1984
Units (M)	34.5	60.0	75.0	65.0
$ Millions	800	1,500	1,350	1,100

December 1983

Source: the Yankee Group

Table ES-2 and 1-2

U.S. COMPUTER SALES TO THE HOME BY VENDOR AND MACHINE (000s)

	1982	1983
High End (+$600)		
Atari 1400/1450	--	--
Apple IIe	85	170
Apple IIc (port.)	--	--
Macintosh	--	--
IBM PC	1	50
IBM PCjr	--	--
TRS 80 I/III/4	50	105 *
Mid Range ($200-$600)		
Atari 800	140	125
Atari 800XL	--	40 *
Atari 1200XL	--	50
Commodore 64	40	815 *
Commodore 264/CV364	--	--
Coleco Adam	--	50
Low End (-$200)		
Commodore VIC-20	485	900 *
TI 99/4A	395	1400 *
Atari 400	220	155
Atari 600XL	--	70 *
TRS 80 Color	150	275
Timex 1000	525	525 *
Timex 1500/2068	--	120
Sinclair ZX80/81	150	--
Others	15	70 *

March 1984

Source: the Yankee Group

U.S. COMPUTER SALES TO THE HOME BY INSTALLED BASE AND DOLLAR VALUE*

(000s)	1980	1981	1982	1983	1984
High	116	145	141	342	1,260*
Medium	3	155	180	1,115	3,250*
Low	25	60	1,940	3,570	785*
Total Units	144	360	2,261	5,027	5,265*
Installed Base	144	504	2,765	7,792	13,057*
Total $	$278M	$393M	$1.4B	$1.9B	$3.1B*

* excludes portables

March 1984

Source: the Yankee Group

TABLE 5-3
MARKET SHARE BY UNITS OF COMPUTER VENDORS TO SCHOOLS

	1982	1983	1985
Apple	38%	39%	32%
Tandy	35%	30%	24%
Commodore 20%	20% *	24%	24%
Atari	5%	3%	6%
TI	2%	2%	---
IBM	---	---	10%
Other	---	2%	4%

December 1983

Source: The Yankee Group

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EXECUTIVE SUMMARY

In 1983, sales of computers to the home grew by over 200% to about five million units, yet losses by major vendors totaled over $1 billion. Such enormous losses, in an exploding market and by large companies seasoned in the vagaries of consumer behavior, are without precedent in the annals of American business. Shakeouts are a normal corollary of most rapidly growing businesses, but typically occur on a significant scale only when growth slows or actually declines.

The videogame business, both coin-operated and home, has also had its share of casualties. In the arcade arena, both coin-drop and manufacturing revenues plummeted for the entire industry. Major arcade operators count themselves lucky if revenues are within 20% of 1982 levels. On the home front, the shakeout has been even more severe. Mattel, Entex, and Starpath are out of the hardware business, and companies as large as Timex and as small as Spectravideo are struggling. Even companies such as Milton Bradley, which tried to approach the industry on a niche market and peripherals basis, have been severely affected.

Game console sales for 1983 are down to five million units from about eight million in 1982. Cartridge sales are up to about 75 million units from 60 million in 1982, but revenues are flat at $1.5 billion. (See Table ES-1) There is a 20 million-plus cartridge overhang on the market, and closeout cartridges at prices below $10 and even $5 will clog the pipelines well into the second quarter of 1984.

The software market essentially is a derivative or dependent market -- it is driven by the size of the hardware installed base, and its possibilities are shaped by the technology and performance characteristics of that base. Because computers and videogames emerged at around the same

Table ES-1
THE HOME VIDEOGAME MARKET

Consoles	1981	1982	1983	1984
Atari 2600	3.10	5.10	3.00	1.80
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Colecovision	--.--	0.55	1.10	0.50
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Total Units (M)	4.62	7.95	5.70	3.25
$ Millions	$577	$1,320	$540	$263

Software	1981	1982	1983	1984
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December 1983

Source: the Yankee Group

time, there has been a tendency by industry analysts to see home computers as merely expensive game consoles. According to extensive Yankee Group research, however, almost 50% of low-end computer purchasers do not even own game controllers (vs. over 90% in the mid-range). Programming and education, not entertainment, are the pervasive reasons for their purchase. Further, there are wide variations among different brands, different price categories, and among different categories of users (age, occupation, sex) within the household. (Tables ES-2 and ES-3 give the Yankee Group's breakdown of the various price categories, unit sales and installed bases.)

Following on the heels of the convergence/crossover of the game and home computer markets in 1983 is the convergence of the home and personal computer markets. Defining these two markets has always been difficult, and has typically hinged on distinctions, either singly or in combination, of pricing, performance, distribution, or applications. In reality, the distinction was not one so much of "business" vs. "home" computers as it was one of "functional" vs "pseudo-functional" computers.

The current home computer market does not have a sound foundation at the mass level because it is not delivering adequate functionality and, therefore, real utility. The shift to 64K-plus computers and low cost peripherals in 1984 (whether packaged as a system or not) marks the beginning of a product cycle that has long-term growth prospects, rather than the unstable prospects of a market based on the current generation of product. The exit of TI signals a significant diminishing, if not an end, to the round of price wars. In 1984, the Yankee Group expects the home market to be price sensitive but not price driven.

Reinforcing this shift to system sales, higher prices, and real functionality is the entry of IBM and Apple in a

Table ES-2
COMPUTER SALES TO THE HOME BY VENDOR AND MACHINE

	1982	1983
High End (+$600)		
Apple II/e	85	170
IBM PC	1	50
TRS 80 I/III/4	50	115
Other	5	7
Mid Range ($200 - $600)		
Atari 800	140	125
Atari 800XL	---	70
Atari 1200XL	---	50
Commodore 64	40	820
Coleco Adam	---	50
Low End (-$200)		
Commodore VIC 20	485	950
TI 99/4A	395	1,450
Atari 400	220	155
Atari 600XL	---	85
TRS 80 Color/Micro	150	275
Timex 1000	525	545
Timex 1500/2068	---	120
Sinclair ZX80/81	150	---
Others (NEC, Spectravideo, Tomy, etc)	15	40
Total	2,261	5,027

December 1983

Source: Yankee Group

Table ES-3
U.S COMPUTER SALES TO THE HOME BY INSTALLED BASE AND DOLLAR VALUE* (December 1983)

'000	1980	1981	1982	1983	1984
HIGH	116	145	141	342	2,050
MEDIUM	3	155	180	1,115	2,425
LOW	25	60	1,940	3,570	2,630
TOTAL UNITS	144	360	2,261	5,027	7,105
INSTALLED BASE	144	504	2,765	7,792	14,897
TOTAL $	$278M	$393M	$1.4B	$1.9B	$2.95B

* = excludes portables

(For machines included in high/medium/low price classifications, see Table 1-2.)

Source: The Yankee Group

significant way into the consumer side of the home market. Both companies (and Tandy) already wave a strong presence in the business-from-home and work-at-home markets with their existing product lines.

Although revenues from software, the "razor blades" of the computer industry, will surpass those of hardware by the end of the decade, the size of the major software vendors is still surprisingly small. The leading independent software vendors for example, each had revenues in the $10-$40 million range in 1982, and in the $30-$70 million range in 1983. By comparison, Activision had revenues of $125 million in calendar year 1982, before declining to around $90 million in 1983. (See Table ES-4.)

For all the successes of the independent software vendors, the companies generating the largest revenues from software remain the computer hardware companies. Of these, IBM is the clear leader, with estimated 1983 revenues from microcomputer software of over $200 million. The advantages for the hardware companies are clearly established distribution, a lead time in developing system and (key) application software, brand recognition, and leverage in advertising, marketing, etc.

Definition of Major Markets

The categories for computer software in the home are evolving continually. The following is the Yankee Group's classification of the products currently on the market. Revenue and unit estimates for each category are provided in Table ES-5.

- System/Utility. This category is small, but essential, because without system software (i.e., operating systems, programming languages, diagnostic programs, etc.), the computer cannot function. At the consumer level there is a trend to bundle the necessary system software, or to build it directly into the ROM memory in the machine, as in BASIC.

Table ES-4
REVENUES OF SELECTED SOFTWARE PRODUCERS

Vendor	1982 -$M-	1983 -$M-	Chief Products
Activision	125	90	Pitfall, Decathelon, etc.
Atarisoft	n/a	75	-----
Broderbund	3-5	7	Choplifter, Bank St. Writer
Commodore	18	63	Infocom Series
Digital Research	22	46	CP/M, CP/M-86, Concurrent CP/M
Hesware	0	10	Omnicalc, Heswriter
IBM	80	250	Third Party Software
Information Unlimited	4	7	Easywriter
Lotus Development	0	40	1-2-3
Micropro	25	36	Wordstar
Microsoft	32	70	MS-DOS, Xenix, Basic
Parker Brothers	75	110	Star WArs, Q-Bert
Peachtree	9.5	18	Accounting
Software Arts	2	6	TK Solver!, VisiCalc
Tandy/Radio Shack	53	77	Superscript
VisiCorp	36	53	VisiCalc, VisiOn

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Source: the Yankee Group

Table ES-5

ESTIMATED REVENUES BY SOFTWARE CATEGORY
FOR THE HOME MARKET

	- $ Millions -				
	1980	1981	1982	1983	1984
Entertainment	3	18	157	405	710
Education*	neg.	4	25	73	240
Business/ Productivity	5	16	53	135	195
System	2	6	26	50	73
Home Budget/ Improvement/ Misc.	neg.	2	11	22	65

* Home educational market only

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Source: the Yankee Group

- Entertainment. Games have been associated with computers since the earliest days. They constitute the single largest market for home computer software. Although many of the titles are simply games brought over from the arcade and home consoles, there is also a significant market unique to computers for text and strategy games. Entertainment programs are used by more members of computer-owning households than any other software category, and constitute the largest aftermarket, in unit terms, across all brands and price classifications (see Table ES-6).

- Education. This is the fastest growing home market and, even more so than entertainment, is tied to the presence of children in the home. It frequently is confused with computer "literacy" which is the skill of programming, not an applications market. Education is the first market after entertainment and business software that has been able to establish a separate marketing identity for retailers.

- Business/Productivity. This is the most developed market, in terms of range and quality of software, and covers a number of distinct product areas aimed at professional users. These include spreadsheets, database managers, word processing, graphics, and telecommunications software. This is the only category of software used in the home that is still distributed primarily by computer specialty retail outlets.

- Home Business/Personal Budgeting. Originally limited to "make-work" applications such as checkbook balancing and recipe filing, this category has improved to the point where is it beginning to offer real utility. It includes both simplified versions of professional level programs (word processing, mail lists, spreadsheets), and programs in such areas as tax preparation, personal time scheduling, and household budgeting.

- Self Help/Miscellaneous. Essentially a residual category, this covers "how to" programs on everything ranging from repairing computers to learning a foreign language. Because it is relatively undefined, it has had difficulty getting retailer support, but clearly offers significant growth potential over the longer term.

Table ES-6

COMPUTER PROGRAMS PURCHASED
OR RECEIVED WITH CONSOLE BY SOFTWARE CATEGORY
AND COMPUTER PRICE CLASSIFICATION, 1983

		[---- Price Classification*----]		
Category	Average	High	Medium	Low
Entertainment	1.2	1.4	1.8	1.1
Education	0.5	0.7	0.7	0.5
Home Budgeting	0.3	0.5	0.2	0.3
Business	0.3	1.5	0.3	0.1
All Programs	2.3	4.1	2.9	1.9

Note: Averages are weighted for all owners using zero for those not buying the specific class of software.

* For machines included in each price classification, see Table 1-2.

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Source: the Yankee Group

The Game Software Market

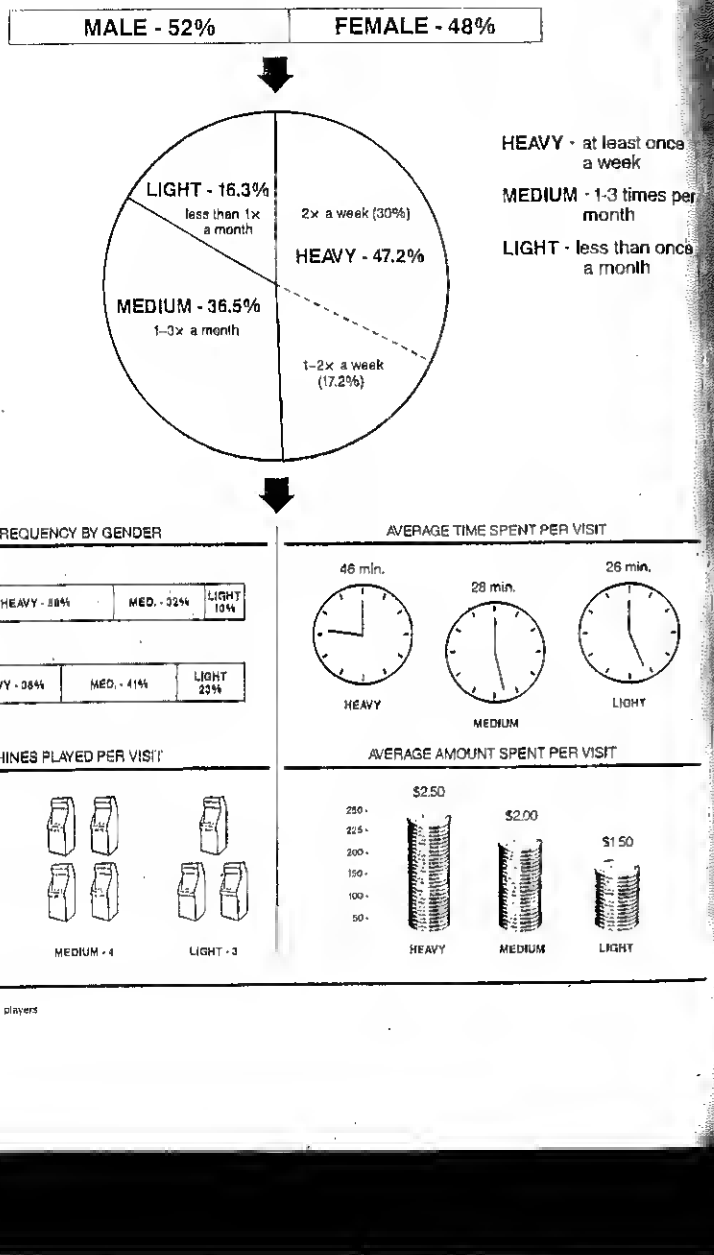
The game software market is in a transitional phase. Apart from the standard litany of industry problems ranging from approaching saturation to competition from computers, there are two factors which make 1983/1984 a transitional phase. First, there is a desperate effort by arcade manufacturers in particular to force a technological breakthrough (preferably using videodisc technology) that will allow designers the creative freedom they need.

Other technical advances are being realized in the new generation of graphics chips that will soon be flowing from companies like Intel, Motorola, General Instrument, and Amiga.

The second major consideration is finding the game industry's true market level. 1983 has seen a fallback from 1982 levels, particularly in the arcades, with a decline of around 60% at coin-drop and around 85% at the arcade manufacturing level. The current decline in videogame interest and revenues is part of a redefinition of the industry in terms of its core participants, the serious gameplayers (see Table ES-5).

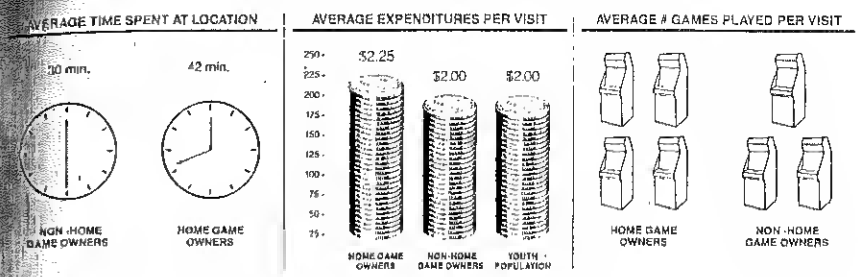
This group is obviously much smaller than the fad market, but it is still likely to be substantial. Moreover, as the industry moves through its technological rite of passage (the equivalent of the shift to sound in movies, or from mono to stereo in records), its ability to reattract larger numbers of (occasional) players should increase dramatically. However, even once the videogame industry cuts its technological teeth, and matures in artistic terms, it will continue to experience the revenue volatility of other entertainment industries, such as film and records, which rise and fall with seasonal regularity.

FIGURE ES-1
PATTERNS OF COIN-OP GAMEPLAYING
AMONG U.S. YOUTH (13 - 17 YEARS)



* 1983 Gallup Poll of video game players

FIGURE ES-3
OWNERSHIP OF A HOME VIDEOGAME CONSOLE
AND PATTERNS OF COIN-OP GAMEPLAYING



* 1983 Gallup Poll of video game players

Software Pricing

The following factors are forcing software prices down:

- the proliferation of vendors and titles, and the glut of product in the videogame market;
- the fact that mass market retailers are not as committed to maintaining high margins as the computer specialty stores;
- the falling price of hardware consoles, which makes consumers unwilling to pay $35 to $50-plus for a software program when they are paying only $50 to $200 for the console;
- simplified and low-cost versions of high-cost programs;
- economies of scale from mass production -- for example, Commodore has gone from four-inch to five-inch wafers with significant cost savings; and
- ability to amortize development costs over an increasingly large installed base.

Advertising and the Cost of Entry

One of the most critical issues for companies contemplating entering the consumer software market is the rapidly rising cost of entry. The current success story is Lotus Inc., which has managed to make its innovative "1-2-3" program an industry standard in a few short months since its full launch. However, Lotus spent $1 million in three months, and $3 million in its first year to establish its dominant position. The national launch of a first rate title in the crowded videogame market costs about $1 million in advertising. With the current downturn in the market, even licensed arcade "hits" (such as they are) cannot ensure publishers the massive sales of 1981 and 1982. In 1982, for example, Coleco earned about $11 million on a single title, "Donkey Kong." The top arcade

titles in 1983 that Coleco has licensed, such as "Time Pilot" and "Mr Do," will not earn anything near the revenues of the earlier hit, despite massive advertising and a larger installed hardware base.

The Cutting Edge of Software Development

Despite the limitations of the current generation of "user friendly" interfaces, they represent a critical step forward in the mass diffusion of computers. The metaphor approach focuses attention on the issue of "learnability," which may be defined as the ability of the user to quickly gain a conceptual mastery over the product that allows progress from simple initial exploration to more complex subsequent uses. As computer use and ownership move further and further away from the existing computer community towards naive and first-time users, learnability or "intuitive obviousness" become increasingly important. Building on a user's prior experience and understanding is the easiest and fastest way to productive use of the computer.

Though use of functional "metaphors" has greatly advanced the "user friendliness" of computers, they still represent only the first link in a long chain of software evolution. It will take many thousands of man-years of software development before computer usage is sufficiently flexible to become customized so that every "personal" computer is in fact "personal" to its primary user. Major advances in artificial intelligence and natural language interfaces will be necessary for present goals to be realized.

The Educational Software Market

Until late 1982, educational software developed relatively slowly, compared to the development of entertainment, business/productivity, and self-improvement software. The educational

software that existed was directed primarily toward school use, with occasional modifications for the home. During 1982, several textbook publishers such as McGraw-Hill and Scott, Foresman tentatively tested the waters, and decided that the electronic education market was well worth pursuing. Not only is educational software a logical extension of textbook publishing, it also represents an opportunity -- albeit a risky one -- for the traditionally staid publishing industry to give itself a much needed financial shot in the arm.

By first quarter 1983, most of the major textbook publishing houses, as well as several trade publishers (e.g., Simon & Schuster, and Doubleday), had entered the field, and computer vendors were gathering them avidly into their respective folds.

The Yankee Group estimates that total educational software sales accounted for about $80 million in 1982, or 10% of the total home/personal software dollar volume at retail, of which approximately $55 million was school software. In 1983, the Yankee Group estimates that educational software accounted for about $150 million in sales, divided almost equally between the home and school markets. (Both educational and business software had smaller shares of the total industry in 1983, with entertainment, system and home business making up the difference.)

By 1985, the Yankee Group believes home educational software will have outpaced school programs by almost 100%. (See Table ES-7.) During 1984, the home market for educational software will surpass the school market in unit terms. 1983 was a transitional year for the market, as many new players joined the ever-expanding roster of authors and publishers. Early and mid-1984 should see a flurry of acquisitions and joint ventures as the market nears a saturation point (widespread duplication of program subjects and a glut of titles), especially in terms of new entrants.

Table ES-7
Educational Software Market: 1982-85

(in $millions)

	School	Home	Total
1982	55	25	80
1983	77	73	150
1984	125	240	365
1985	170	330	500

Source: The Yankee Group

Electronic Education

So far, the approach to electronic education has been to complement and supplement (to a limited extent) the traditional curriculum. Most school software cross-references one or more textbooks, with documentation suggesting ways to the teacher to incorporate the text on the screen with that in the book.

McGraw-Hill, which had 10 educational programs on the market by first quarter 1983, has concluded that software alone is not enough; it must be integrated with print-based, computer-oriented materials. The publisher will be placing strong emphasis on developing print and electronic learning products at the junior high level initially, and subsequently for elementary school students.

There are four broad categories of publishers for the school market:

1. Mom and Pop operations -- former educators who market their own products, often through mail order. Most programs are considered of poor quality and do not sell well;
2. Cottage industry software developers -- small (under $3 million) companies such as Edu-Ware (Agoura CA) and PDI (Greenwich CT) that have acted quickly to meet specific needs, such as curriculum enrichment or remedial programs;
3. Small- to medium-sized publishers -- such as Milliken, and Sterling Swift (Austin TX), that built early positions, but are now facing increasing competition;
4. Big publishers -- McGraw-Hill, Random House, Scholastic Inc., etc., which have large stables of authors and more capital to invest in new products.

Size of the Market

In 1982, educational software sales into the home (edutainment) were around $25 million. The Yankee Group expects 1983 sales to almost triple, to nearly $73 million. By mid-year 1984, home education software will have outdistanced school software, and will continue on that course until the market is divided approximately 70% to 30% between home and school software by 1985.

While reports of the educational software market's explosion thus far have encouraged myriad companies to develop and market products, almost none has shown a profit. Although electronic education revenues range as high as Houghton Mifflin's $8 million in 1983, product development and marketing costs usually have exceeded sales.

Still, the Yankee Group believes that educational software is potentially a profitable mass market category, depending on:

- significant product innovation;
- attractive pricepoints;
- brand and author recognition;
- broader advertising exposure;
- retailer understanding of, and commitment to, the category.

Software Distribution

Several elements distinguish computer software sales from videogame sales, including:

- pricing;
- sales support;
- marketing;

- end users;
- computer use vs. game console;
- level of documentation.

The Yankee Group believes that no single kind of outlet will emerge pre-eminently across the computer software field, but rather that several competing channels will co-exist, each marketing according to its individual strengths. Mass merchants and record stores, for example, are likely to specialize in Top 40 or "hit" computer and game software, with computer hardware and software specialty stores handling the more complex applications packages, backlists, simple but slow-moving lines, etc.

Table ES-8 shows the Yankee Group's estimates of market share by distribution outlet for each category of software. In 1983, the first full year of operation for many software specialty stores, they were able to garner a respectable percentage of software sales in each category. The Yankee Group expects their share to grow in 1984, providing competition mainly to computer stores, specifically in entertainment software. 1984 will also see the erosion of mass merchants' market share in entertainment programs as software downloading for permanent home storage emerges as a new form of distribution.

The Emergence of Software Specialty Stores

Software specialty stores can be divided into two groups: those that sell software (and accessories) only; and those that also sell the full range of hardware, including computer consoles, printers, disk drives, joysticks, etc.

In early 1983, there were fewer than 10 software chain operations and perhaps three times that many independent

software stores. By yearend 1983, the existing chains were expected to have tripled their number of stores, and there were almost twice as many franchise operations as there were in mid-1983. (See Table ES-9)

Table ES-8
Software for Home Computers:
1983 Market Share of Distribution Outlets

	Ent'mt.	Home Mgmt./ Productivity	Educ.	Self-Imp./ Misc.*
Mass Merchandisers/ Discounters	45%	20%	35%	15%
Department Stores	15%	12%	8%	11%
Computer Stores	16%	35%	25%	40%
Software Stores	9%	10%	10%	15%
Mail Order	5%	18%	10%	10%
Catalog Showrooms	4%	2%	4%	3%
Misc. Stores**	6%	3%	8%	6%

*Includes programming, "how-to," and personal programs (e.g, recipes).

**Includes book and record stores, drugstores, audio/video stores, grocery stores.

Source: The Yankee Group

Table ES-9
Software Specialty Store Franchises*

Existing Store/Chain	Number of Stores in Mid 1983	Yearend 1983***
ComputerLand**	5	50
Information Please!	1	9
Microcon	6	21
The Program Store	7	24
Programs Unlimited	18	50
Software City	12	100
Software Emporium	2	26
Softwaire Centres International	20	50
New Store/Chain		
Computer Center	--	7
CompuShack	--	20
Micro Concepts	--	5
Software Galeria	--	30
Softwareland	--	8

* Inoludes company-owned stores and franchises
** ComputerLand Satellite stores only
*** Dealer projections

Source: The Yankee Group

The explosion of software specialty stores has come about for several reasons, including relatively low start-up costs; proliferation of software titles beyond the means of existing outlets; high margins (30%-40%); and because the stores have served as an entry point into the computer retailing industry for those who had previously missed the opportunity.

Computar Books, Magazinas and Catalogs

There are approximately 3,000 paperback computer-related titles now in print, and bookstores expect every home computer buyer to purchase three to five of them this year. A Yankee Group survey of the major computer book publishers showed a 100%-plus increase in new titles from 1982 to 1983. The emphasis is clearly on programming or computer-specific titles, targeted mainly to the computer hobbyist reader who is eager for information.

This unslakable thirst for computer information has fueled the magazine industry as well. No one is certain of the exact number of computer magazines available (any number cited here will be obsolete at the time of publication), but reliable estimates put the total between 160 and 175.

The Problem of Product Visibility

One of the most difficult and important problems for the computer software industry is bringing the product before the potential user. Other retail software products all have a market mechanism for exposing consumers to the product -- videocassettes and discs have movie theatres, records have radio, videogames have arcades. So far no satisfactory mechanism has been found to solve the two aspects of this problem: lack of massive product visibility and limited hands-on access to the product for evaluation.

The Yankee Group expects the use of mail order for software to rise with the entry of major catalog publishers and direct mail vendors such as Sears and American Express. The new entrants will bring improved product presentation and evaluation, sophisticated list management, financial strength, and overall marketing skills.

In an examination of the software retailing industry, it is important to consider the source of the products -- the publishers. For many retailers, software represents a dramatically new approach -- the difference between manufactured products and published products. Marketing published products requires an understanding of issues such as copyright, piracy, licensing and royalties, as well as product identification with individual authors rather than anonymous manufacturers. These factors would appear to make a strong case for the role of bookstores and record stores as viable distribution channels, but they do not necessarily give these outlets the edge against the greater experience of specialty store retailers, and even mass merchandisers.

The Role of the Distributor

In 1982, about 60% of U.S. software sales went through distributors. Much of this dollar volume was from third-party publishers, and the remaining percentages were divided among the major computer manufacturers who published and distributed their own software. Chief among these were TI and Atari, both of which have initiated policies which have alienated third-party authors and which may result in lowering their respective market shares significantly over the next two years.

The national software distribution for the consumer market is shared by three distributors and several rackjobbers. In addition to these major companies, there are a growing number of small local distributors and national distributors that

focus on a specific segment of the industry, such as Soft Kat (Van Nuys CA), a national distributor of educational software.

Electronic Distribution and Publishing

The Yankee Group has tracked the development of electronic publication and distribution in a number of previous reports. For many purposes, electronic publication and distribution is essentially the same activity, but for purposes of conceptual clarity, the Yankee Group defines publication as the accessibility of software programs, but only on-line, or in volatile storage e.g., Control Video Corporation's Gameline service or Mattel's Playcable. Electronic distribution is defined as the availability of a non-volatile copy of the program to the retailer or end user, e.g., the various product offerings by Xante (Tulsa OK), Romox (Campbell CA), and Cumma Technology Corporation (Sunnyvale CA).

While both of these features could be combined into a single service offering non-volatile distribution to the home/end user, to date the various electronic teledelivery services offer either non-volatile distribution to retail, or volatile publication/distribution to the home.

The Yankee Group believes that the economics and convenience of electronic delivery of software and services are so overwhelming that it is only a matter of when, not if, it will significantly displace more conventional methods of distribution. However, as noted in previous reports, there are a number of factors apart from economic and technological feasibility that influence the speed and scope of teledelivery services. These include the changed nature of the product, problems associated with billing and payment, and the psychodynamics of the shopping experience itself.

Clearly however, in 1984, there will be a major thrust by various vendors to make electronic delivery a commercial reality.

In the home environment, the rising installed base of computers, and the declining price of modems are attracting companies eager to launch products as soon as critical mass is reached. Although a variety of competing delivery channels are still being tested (telephone, cable, DBS, FM sideband, etc.), several companies, including Atari/Activision, Coleco/AT&T, and The Games Network (now TGN Inc.), will be testing on-line game services in 1984. The various videotex offerings by Knight-Ridder, Times Mirror and Keycom will move beyond pilot testing into limited commercial testing in 1984, and CompuServe will be adopting a much more aggressive stance.

The Yankee Group therefore expects the next two years to offer rapid advancement in the area of teledelivery, although none of the current contenders have yet shown products that are clearly destined for success. Home of the Future will be closely monitoring developments in this fast moving field through a series of special reports on electronic publication and distribution in 1984.

CHAPTER ONE
OVERVIEW OF THE COMPUTER AND VIDEOGAME MARKETPLACE

I. Market Success; Financial Debacle

In 1983, sales of computers to the home grew by over 200% to about five million units, and yet most of the major vendors, hardware and software, lost money, a great deal of money. Atari, Mattel and Texas Instruments alone accounted for combined losses in excess of $1 billion in 1983, and the latter two are now out of the business. Such enormous losses, in an exploding market, and by large companies seasoned in the vagaries of consumer behavior, are without precedent in the annals of American business. Shakeouts are a normal corollary of most rapidly growing businesses, but typically occur on a significant scale only once growth slows or actually declines.

The videogame business, both coin-operated and home, has also had its share of casualties. In the arcade arena, both coin-drop and manufacturing revenues plummeted for the entire industry. Third-ranking Sega sold off its arcade division to Bally, which itself saw profits drop 79% for the first nine months of 1983 to $17.3 million. Williams had fourth quarter losses of over $5 million on revenues of $5 million, and is now also in negotiations with Bally; Cinematronics is in Chapter 11, and venture startup Simutron has faded away. Major arcade operators count themselves lucky if revenues are within 20% of 1982 levels.

On the home front, the shakeout has been even more severe. Mattel, Entex, and Starpath are out of the hardware business, and companies as large as Timex and as small as Spectravideo are struggling. Even companies such as Milton Bradley that tried to approach the industry on a niche market and peripherals basis have been severely affected. Imagic, one of

the stars of 1982 with revenues of $75 million, is now reduced to a holding operation liquidating inventory; Fox Videogames has been closed down; Data Age is in Chapter 11; U.S. Games, Zimag, Games by Apollo, and others, are no longer around. Even Activision, the blue-chip of the game startups, and one of the best managed companies in the industry, announced third quarter losses of $2.9 million, down from profits of $8 million at the same time last year, with a further loss projected for the final quarter of 1983.

Game console sales for 1983 are down to five million units from about eight million in 1982. Cartridge sales are up to about 75 million units from 60 million in 1982, but revenues are flat at $1.5 billion. (See Table 1-1) There is a 20 million-plus cartridge overhang on the market, and closeout cartridges at prices below $10 and even $5 will clog the pipelines well into the second quarter of 1984.

Obviously, the apparent convergence of the videogame and home computer markets was at least in part responsible for the declining fortunes of some computer vendors, such as Mattel and Atari, that were in both markets. What is noteworthy, however, is that in the midst of the markets' turmoil and financial disaster, new entrants continue to emerge, hoping to find their niche and fortunes. The potential markets for interactive electronic entertainment and home terminals are both so huge that entrepreneurs and companies continue to be attracted, even in the face of unmistakable risks.

This report focuses on the dynamics and trends of the home computer and videogame software markets. There are large areas of overlap in these markets, and both are evolving rapidly -- in technology, distribution, pricing, marketing, etc. The software market essentially is a derivative or dependent market, in the sense that it is driven by the size of the hardware installed base, and its possibilities are shaped by

TABLE 1-1
THE HOME VIDEOGAME MARKET

Consoles	1981	1982	1983	1984
Atari 2600	3.10	5.10	3.00	1.80
Atari 5200	--.--	0.25	95.00	0.70
Colecovision	--.--	0.55	1.10	0.50
Intellivision	0.72	1.10	0.35	0.15
Odyssey	0.60	0.40	0.20	0.05
Other	0.20	0.15	0.10	0.05
Total Units (M)	4.62	7.95	5.70	3.25
$ Millions	$577	$1,320	$540	$263

Software	1981	1982	1983	1984
Units (M)	34.5	60.0	75.0	65.0
$ Millions	800	1,500	1,350	1,100

December 1983

Source: the Yankee Group

the technology and performance characteristics of that base. 1983 has been an especially tumultuous year. The withdrawal of Texas Instruments (which by yearend 1983 had the largest installed base of any single model of computer in the U.S.), and the concurrent entry of IBM will exert a powerful influence over the market's direction in 1984. Therefore, it is necessary to provide a brief overview of the home computer and videogame hardware markets as a context for the detailed analysis of the software market that follows.

II. 1982/83 -- Convergence of the Videogame and Home Computer Markets?

In the last quarter of 1982, fueled by a series of price cuts and rebates, the home computer market exploded. Suddenly price competitive with videogame consoles, home computers rode to success on the back of the technology (video chips, ROM cartridges), distribution (mass merchants, catalog showrooms) and software of the videogame market. They were able to achieve this extraordinary growth because retailers and consumers were prepared for computers as simply a new kind of multifunctional game console. Based largely on software sales for the 16K-and-under mass market computers, which leaned overwhelmingly towards games, this conventional wisdom emerged: the home computer market consisted of essentially three segments -- a high-end "professional" market, a low-end "game" market, and a currently limited, mid-range "elite consumer" market.

Clearly this perception captured something of the truth of the situation. Nevertheless, the entire phenomenon of computers in the home turns out to be far more complex than vendors and retailers had anticipated.

To begin with, software sales turn out to be a poor indicator of how and by whom computers are used in the home. Games are indeed the most popular application among computer owners, and have a significant appeal, even among IBM Personal Computer (PC) and Apple II/e owners.

However, according to extensive Yankee Group research, almost 50% of low-end computer purchasers do not even own game controllers (vs. over 90% in the mid-range); programming and education, not entertainment, is the pervasive reason for their purchase. This is true of both anticipated benefits and uses, as well as actual uses six to nine months after purchasing. Moreover, although gameplaying is the most widespread application for home computers -- not least of all because it is the most accessible for novices -- other applications, such as programming, word processing, education, and productivity/ business, are used more frequently and for longer periods of time.

Further, there are wide variations among different brands, different price categories, and among different categories of users (age, occupation, sex) within the household. (Tables 1-2 and 1-3 give the Yankee Group's breakdown of the various price categories, unit sales and installed bases.) None of this is all that surprising perhaps, but it does complicate enormously the simple vision of low- and mid-range computers as essentially sophisticated game consoles.

Clearly the convergence, or at least the overlap, of the game and home computer market is a critical part of the dynamics of both. Atari failed to see this convergence, or, for strategic reasons, opposed the trend too long and paid the price in seeing its dominance of both markets rapidly erode, as competitors such as Coleco and Commodore trampled over its carefully planned pricing and positioning schedules.

TABLE 1-2
COMPUTER SALES TO THE HOME BY VENDOR AND MACHINE

	1982	1983
High End (+$600)		
Apple II/e	85	170
IBM PC	1	50
TRS 80 I/III/4	50	115
Other	5	7
Mid Range ($200 - $600)		
Atari 800	140	125
Atari 800XL	---	70
Atari 1200XL	---	50
Commodore 64	40	820
Coleco Adam	---	50
Low End (-$200)		
Commodore VIC 20	485	950
TI 99/4A	395	1,450
Atari 400	220	155
Atari 600XL	---	85
TRS 80 Color/Micro	150	275
Timex 1000	525	545
Timex 1500/2068	---	120
Sinclair ZX80/81	150	---
Others (NEC, Spectravideo, Tomy, etc)	15	40
Total	2,261	5,027

December 1983

Source: Yankee Group

Table 1-3

U.S COMPUTER SALES TO THE HOME BY INSTALLED BASE AND DOLLAR VALUE* (December 1983)

'000	1980	1981	1982	1983	1984
HIGH	116	145	141	342	2,050
MEDIUM	3	155	180	1,115	2,425
LOW	25	60	1,940	3,570	2,630
TOTAL UNITS	144	360	2,261	5,027	7,105
INSTALLED BASE	144	504	2,765	7,792	14,897
TOTAL $	$278M	$393M	$1.4B	$1.9B	$2.95B

* = excludes portables

(For machines included in high/medium/low price classifications, see Table 1-2.)

Source: The Yankee Group

Equally clearly, however, the computer phenomenon is about computers, not higher-priced alternatives to game consoles. It is important to recognize that the apparent crossover of the videogame and computer markets disguises the emergence of two simultaneous and overlapping, but distinct, phenomena -- the emergence (and relative decline) of the dedicated game console market, and the emergence of the market for computing power in the home. Home computer vendors like Atari, Timex, and Texas Instruments may be experiencing serious financial difficulties, but their difficulties are different in kind, as well as degree, from those besetting the home videogame industry.

III. 1983/84: Convergence of the Home and Personal Computer Markets

Following on the heels of the convergence/crossover of the game and home computer markets is the convergence of the home and personal computer markets. Defining these two markets has always been difficult, and has typically hinged on distinctions, either singly or in combination, of pricing, performance, distribution, or applications. In reality, the distinction was not one so much of "business" vs. "home" computers as it was one of "functional" vs. "pseudo-functional" computers.

The overwhelming majority of computers sold into the home in 1982 and 1983 have been of the 16K-and-under variety. While some of these models can be upgraded with greater or lesser difficulty and cost, and while with enough diligence and ingenuity the machines can be made to perform a variety of tasks, the fact is that except as game-playing and computer literacy machines, the 2K-16K mass market computers have very limited utility. This limited utility arises from four different factors:

- microprocessor and memory limitations. The first generation of computers in the home suffers from the constraints of 8-bit processors and limited memory. Of these, memory size is the more important, although microprocessor speed, and the inability to address more than 64K of memory without using bankswitching techniques, are significant issues. With only 16K or less of memory, however, only the most elementary programs can be run, and none of the new "user friendly" and "integrated" software that is emerging from breakthroughs in the business market can be used.

- console only sales. In an attempt to achieve volume economies of scale rapidly, vendors and retailers concentrated on the console-only sale as a way of lowering the price of entry into computing. This approach has been very successful at one level, because unit volume has soared. At another level, it has created problems because consumers have been hyped on a presumed utility that a limited memory, CPU/keyboard terminal cannot provide. To maximize a computer's utility, it needs five basic components: CPU/keyboard, display, mass storage, printer, and modem. Clearly, not every user will have a need for a printer or modem. Nevertheless, a computer's utility is directly related to the degree to which it is a "system" rather than simply a CPU/keyboard, and most especially, ths degree to which it is capable of "communicating," as well as functioning as a standalone.

- sophisticated vs. naive users. The same computer in the hands of a novice and "hacker" obviously has very different utility. In the business market, as late as 1982, IBM and Apple sold 16K entry-level versions of their personal computers. However, apart from the fact that the overwhelming majority of these computers were upgraded at the time of purchase to at least 48K of memory, their users typically were relatively knowledgeable and/or diligent in extracting real productivity from the machines.

In the consumer market, first-time users do not have the same productivity motivation to work through complex manuals and operating instructions to make their 16K units useful.

- software limitations. The software available for most mass market computers through 1983 has been very limited in its scope, power, ease-of-use, and usefulness. Applications such as word processing and spreadsheets take more than 16K, and attempts to scale down educational packages (for example, Control Data's "Plato" series) for home use have been less than successful for these low-end machines.

During the last half of 1983, these limitations changed significantly as more powerful machines were introduced at lower price points; the lines between home and personal computer are blurring rapidly. Several factors have brought about the change:

- shortcircuiting the novelty market. At the beginning of 1983, vendors such as Commodore (with the Ultramax), Timex (TS1000), TI (99/2), and a host of would-be competitors (Video Technology, Unisonics, Sanyo, etc.) had products designed for the 2K "computer literacy," "student," or "novelty" market. Above these were the 16K "mass market" computers, and above them the 64K-and-up "professional" or business computers.

  Because of the pricing wars between TI and Commodore, these distinctions rapidly became obsolete. The 2K computer has been replaced by the 5K-16K computer as the entry level, "literacy" product, and, driven by Commodore, 64K computers have become the mass market computer. After June 1984, the Yankee Group expects the home market to be dominated by 64K-plus computers.

- shifting from console to system sales. Coleco's entry into the home market with the "Adam" computer signals a trend that the Yankee Group believes will be very

significant in 1984. This trend is a twofold shift in product positioning and pricing. Rather than the hype of 1983, and the emphasis on games and computer literacy (programming) as the primary motivations for purchase at the mass level, vendors increasingly are focusing on real utility and applications. The most important of these applications are word processing and education, but others, such as database accessing and electronic mail, also are starting to emerge. Vendors cannot provide this utility for $100, however, and the Yankee Group expects to see a reversal of the exclusive focus on pricing that characterized the market in 1983. It therefore expects to see the $500-$1,500 segment of the home market show a major boost in 1984, as vendors and retailers move to system rather than console sales and the average value of consumer hardware investment rises. This is not to say that all home computers will be packaged as systems, but that an increasing number of sales will be system sales, and that even where the computer is not packaged as a system, consumers will be educated through advertising and word of mouth about the advantages of fully configured systems, and will be more willing to make the investment, piecemeal if financially necessary.

Some retailers have expressed reservations about the "system" sale approach, arguing that it is harder to make an initial sale of $500 than it is to start lower and have peripherals sold as add-ons. Their main reservation, however, is that to date the consoles have been sold at or near cost while the peripherals have reasonable margins (25%-30%). Packaging computer and peripherals as a system poses the threat that the system will be discounted and that margins on the total package will therefore be significantly smaller.

These are real concerns, but overstated. The Yankee Group believes that after the punishing (and unnecessary) losses of 1983, all the vendors except Commodore will focus in 1984 on

market positions other than pricing. Features, ease-of-use, range and quality of software, peripheral availability, system packaging and after-sales service and support will all become ways of marketing products at a premium.

Further, from the retailer standpoint, the system sale is just the start. In most cases the initial sale will still not include peripherals such as modems, joystick controllers, "mouse controllers," digitizer and touch pads, voice/speech modules, music synthesizers, dedicated monitors, etc. All of these, plus accessories such as cables, diskettes, slip covers, storage boxes, etc., provide a potentially lucrative aftermarket for retailers even with (discounted) system sales.

The current home computer market does not have a sound foundation at the mass level because it is not delivering adequate functionality and therefore real utility. The shift to 64K-plus computers and low-cost peripherals in 1984 (whether packaged as a system or not) marks the beginning of a product cycle that has long-term growth prospects, rather than the unstable prospects of a market based on the current generation of product. The exit of TI signals a significant diminishing, if not end, to the round of price wars. In 1984, the Yankee Group expects the home market to bs price sensitive but not price driven.

Reinforcing this shift to system sales, higher prices, and real functionality is the entry of IBM and Apple in a significant way into the consumer side of the home market. Both companies (and Tandy) already have a strong presence in the business-from-home and work-at-home markets with their existing product lines. However, the official entry of IBM into the consumer end of the market with the PCjr, and Apple's expected responses in 1984, mean that the two most visible and successful of the "personal" computer vendors will become

or presences in the consumer side of the home market.

Their entry will increase the legitimacy of home computing, and will provide a level of pricing and product stability that the market sorely needs. The entry of IBM in particular is sufficiently important to merit being analyzed in some detail.

IV. The IBM PCjr : Targeting the Elite Consumer

With the PCjr, IBM continues its aggressive adoption of a microcomputer product strategy that depends heavily on the use of outside hardware and software vendors. Taking its Personal Computer strategy a step further, IBM is supplying only the design specifications and some chips (notably certain VLSI and custom video chips) for the PCjr. All manufacturing for the machines is being done by independent contractors and subcontractors.

Teledyne will be responsible for assembly of the PCjr, using IBM designs and IBM-owned plant, but using Teledyne facilities (Lewisville TN) and labor. The infrared keyboard has been subcontracted to two outside vendors; the slimline disk drives are multiple sourced; the modem has been subcontracted to IBM specifications; and the new thermal printer is from Cannon of Japan. The microprocessor is the Intel 8088; the sound chip is from Texas Instruments (TI76496), and chips from AMD and Motorola, among others, abound. Technical specifications for the PCjr and its peripherals are listed in Table 1-4.

A. The PCjr Hardware

The most novel feature of the PCjr is the infrared keyboard, which uses two infrared diodes on the front of the

TABLE 1-4
TECHNICAL SPECIFICATIONS FOR THE IBM PCjr

Microprocessor: Intel 8088

Memory: 64KB RAM, expendable by user to 128KB RAM; 64KB ROM

Mass Storage: One slimline 5-1/4" doublesided drive with 360KB capacity. Space and power provided for only one disk drive in System Unit. Reads and writes single- or double-sided diskettes. Drive is user installable.

Keyboard: Detached infrared keyboard with 62 rubberdome carbon contact "Chiclet"-style keys, including function and cursor control keys. Powered by four AA batteries. Range 20 feet, weight 22 ounces excluding batteries, tilts at 5-12 degree slope. Can be connected to back of System Unit by optional cord.

ROM Ports: Two adjacent ROM cartridge ports housed under the disk drive, each capeble of supporting a 64KB program.

Interfaces: Cassette, two joysticks, keyboard, modem (RS 232C), diskette, light pen, direct drive video, composite video and television. Extra unused port labeled "L" for future interfece.

Expansion Bus: single I/O bus loceted on right side of drive; suiteble for eddltional diskdrive, memory, etc.

Internal Expansion slots: three slots; 64KB memory end display expansion; internal modem; disk drive controller.

Graphics: Three modes: low (160 X 200 X 16 colors); medium (320 X 200 X 6 colors); high (640 x 200 2 colors), with two levels of luminescence available in medium and high resolution modes.

December 1983

Source: the Yankee Group

keyboard linked to an infrared receptor card located behind a hole on the front panel of the console. Range is 20 feet, but strong ambient light can disturb the signal. When more than one PCjr is used in the same room, it is necessary to use the modular jack keyboard connector cable. The keyboard uses rubberdome carbon contact (rather than the more common capacitive) technology, and consists of 62 "chiclet" or calculator-style keys. The use of contact, non-sculptured keys is mandated by the limited power of the infrared keyboard, according to IBM -- the keyboard is "powered down" when a key is not being struck to save energy. In addition to the cursor control and 10 specifically designated function keys, all keys are programmable. None of the keys is labeled on the keycaps, which is disconcerting, especially for non-professional typists. Use of the non-standard, rectangular keys does, however, allow IBM to provide paper keyboard templates for the more popular applications programs.

The Yankee Group believes that, while the infrared keyboard is an attractive feature, especially in the home (where a large television set frequently is the display device, and distance is desirable), it is not at the forefront of consumer concerns. Besidee, consumers buying the PCjr at between $700-$1,300 are precisely the kind of consumers who will buy a dedicated television set or monitor for the unit rather than tie up the family'e 19" Sony. The infrared keyboard's appearance on the PCjr is therefore as much a result of IBM's desire to show off proprietary technology (and differentiate the junior from the senior), as it is to meet a real consumer need. The keyboard definitely is a disincentive for purchaeers who intend to use the unit for extended periods of time, for applications such as word processing. Third-party vendors will have a field day providing alternative 62- and 83-key typewriter-quality keyboards for the PCjr.

B. Enhancement Slots

The PCjr has three enhancement slots: for the 64K/80 column card, the 300 baud modem, and the disk drive. The jr has space provision for only one built-in (360K) disk drive, and the power supply does not support a second floppy disk drive.

The most obvious gateway to the future for the jr is an I/O expansion slot on the side of the unit that could support cards for additional memory, additional disk drives (including a hard disk drive), parallel printer, etc. At the back of the jr are a number of special connector ports (including two joystick ports and an RS232C), although they all require a special connector cable ($25) for standard DB 25 shell pin connectors. Each of the ports is coded alphabetically (e.g., C = cassette) so that first time users will not have difficulty making the correct connections. There is also a mysterious "L" port at the back of the unit that IBM is coy about identifying, beyond saying that it is for "later" peripheral connections.

The jr also has two ROM ports located below the disk drive, each capable of accepting a 64K ROM cartridge (128K in total), although the largest program IBM has introduced so far is a 32K ROM Basic.

C. Graphics

The PC's graphics modes have been improved. The jr offers three modes: low (160 x 200 x 8 colors x 2 levels of luminescence); medium (320 x 200 x 8 colors x 2 levels of luminescence); high (640 x 200 x 2 colors x 2 levels). The high level graphics modes are only available with the 128K version of the jr. To maintain compatibility with the PC, the jr does not offer "sprites" in hardware, although through software, between three and seven "multiple pages" or graphics levels are available, depending on memory capacity of the machine.

On the PC the self-diagnostics come on a diskette; on the jr they are built into the unit's ROM. Also in ROM is a "Keyboard Adventure" program using graphics, sound, and color to teach first time users the features of the keyboard. The PCjr comes with a 12-month warranty.

D. Software

PCjr software runs under DOS 2.10 (a new operating system), and is thus "essentially" compatible with most existing IBM software for the PC and XT, subject only to the memory and mass storage requirements of larger programs. Under DOS 2.10, the jr will even run a hard disk drive, provided it has an independent power source and can be attached through the expansion I/O slot. IBM announced 23 programs with the PCjr, eight of them from third-party vendors including: Sierra On-Line (Homeword, an introductory, icon-based word processing program, $75); The Learning Co. (three educational programs, $35/$40); Information Unlimitsd Software (Easy Writer 1.15, $175); Software Publishing Corp (pfs:File, $140, and Report, $125); and The Image Producers (Time Manager 1.05, $100). Turtle Power, an IBM Logo program ($50), was also announced. Only the 32K extended Basic and four games were announced on cartridge. Another software program, Personal Communications Manager ($100), in conjunction with the IBM internal modem, provides single key access to various database services such as The Source and Dow Jones.

Documentation for the PCjr is almost certainly the best on the market. The Guide to Operations booklet and Basic primer are easy to read, color coded, with a multiplicity of clear diagrams, and color illustrations (interestingly enough, featuring children almost exclusively).

E. Distribution

IBM initially is limiting distribution of the PCjr to the existing network of its national accounts program (mainly for the institutional education market in this case), IBM product centers and independent dealers. PCjr demonstration units are scheduled to be in at least 1,000 outlets by December, when orders will be taken for delivery in the first quarter of 1984. (There appears to be reason to believe that IBM is experiencing some difficulties in production which delayed the actual product availability, originally scheduled for November 1, 1983.) The Yankee Group believes that during 1984, IBM will pursue discussions with Sears about the introduction of the PCjr into its 850 "A" stores, possibly in a special computer boutique.

F. Analysis

One of the major advantages IBM enjoys over many of its competitors in the business microcomputer market is that, unlike DEC, Wang, Data General, Xerox, etc., IBM is seen as a serious and legitimate microcomputer vendor independent of its mini-to-mainframe computer line. Even though these other companies have good microcomputer products (some offering even better price/performance than the IBM PC), they have thus far positioned their microcomputer products merely as entry products for their existing businesses, rather than attempting to establish them as independent product lines in the manner of a Tandy or an Apple.

Obviously, IBM enjoys an enormous synergy by virtue of being in every computer market, and of having a complete computer "environment" where others have only product lines. A large part of its success clearly is attributable to its ability to lead users step by step into the IBM garden. Nevertheless, the IBM Personal Computer also has established

itself as a powerful and attractive product in its own right, even in markets (e.g., small business and home) that are not driven by the advantages of accessing an IBM host environment.

Similarly, in the PCjr IBM has made a commitment to the high-end of the home market that will establish the company and the product as serious contenders. The PCjr is attractive enough in its own right to create a successful beachhead for IBM in the elite consumer market, quite apart from the unit's attractions for the professional and educational markets. However, there are a number of factors that make IBM's likely impact in the consumer market very different from the Personal Computer's impact in the business arena.

1. The Target Markets

IBM is targeting the PCjr at three specific markets:

- the business-from-home and work-at-home market, including the professional worker who wants or needs IBM PC compatibility, who wants to access an IBM host, or who might need a "transportable" unit. (IBM has stated that its own research indicated that in 1982, 40% of all IBM PCs in the U.S. migrated between home and office at least one weekend a month.)
- the "elite" consumer market. Buyers in this category have diverse needs, including both the productivity applications of the work-at-home market as well as the entertainment/educational/programming applications typical of the 16K mass market machines. Despite the overlap of applications, elite consumers form a distinct and motivated market. (See below).
- the institutional educational market. Thus far, IBM has had limited presence in the educational market, not least because the PC is too expensive to achieve mass penetration, and educational software has been lacking. However IBM has monitored

the market closely, engaging in several important field trials, and is now ready to court this market aggressively. Although the educational market is bureaucratic, support-intensive and not very profitable, IBM, like its competitors, recognizes the leverage available at many levels by having a significant presence in the this market. Already a number of educational institutions, primarily at the college level, have placed orders in the 1,000-2,000 unit range.

2. Production

By the first quarter of 1983, IBM had already produced more PCs than the company had expected to produce over the entire life of the product. Yankee Group estimates that in 1982 IBM shipped about 150,000 units; in 1983 about 550,000 units, and that in 1984 production will be in the 1.5 million range. The PCjr was 18 months in the making, and although IBM is approaching the consumer market very cautiously, it clearly has large ambitions. Little is known as yet about the production capacity of the IBM/Teledyne facility in Lewisville, but the Yankee Group believes IBM will be hard pressed to exceed production of 600,000 units in 1984, including units originally scheduled for shipment in 1983. Apart from "ramp up" and quality control issues, component shortages (which will affect the PC as well), from chips to disk drives, are likely to inhibit production. Yankee Group projects demand well in excess of IBM's potential production in 1984, creating a large potential market for PCjr clones.

3. Impact on the Home Market

The PCjr may be IBM's first computer designed specifically for the home, but it is certainly not intended to be a mass market computer, and the company's ambitions are limited almost exclusively to the upper 25% of the home market. IBM will

certainly use the PCjr's $669 entry-level price in its marketing campaigns to draw in potential buyers, at which point the dealer will try to upgrade them to the $1,269 enhanced unit. (This move is reminiscent of IBM's strategy with the PC, which came out first in a 16K, $1365 version, which was discontinued after about six months in favor of a 48K unit with one built-in disk drive selling for substantially more.) IBM has indicated to its dealers that it expects them to order a 5:1 ratio of enhanced to basic versions of the PCjr. This means that the vast majority of PCjr sales in 1984 will be system sales of about $1,500-$2,000. While there is a significant market for $1,500 IBM machines, that market is clearly much smaller than the one targeted by such units as the Commodore 64, Atari 800XL, and Coleco Adam.

In its entry into the business microcomputer market, IBM, contrary to early expectations, did not adopt a premium pricing strategy, but went head-to-head with then market leaders Apple and Tandy. In its entry into the home market, IBM has positioned the PCjr somewhat differently. The jr offers improved price/performance by comparison with a similarly configured PC, and competitive, but not aggressively competitive price/performance by comparison with the Apple IIe and Tandy Model 4.

However, by comparison with the mass market computers like the Commodore 64, Atari 800XL, and Coleco Adam, the PCjr, for all its features, is significantly overpriced. IBM is therefore effectively providing a price umbrella under which the new generation of 64K-plus home computers can be positioned. As is discussed in the next section, the markets for "personal" and "home" computers are converging, and the PCjr's introduction confirms that trend.

IBM is (rightly) terrified of mass market distribution and loss of control of the product and pricing that are

characteristic of these outlets. The relatively small size of IBM's target market in the home, coupled with its limited distribution outlets and expected production constraints, means that even at its most successful, the PCjr's impact will be nowhere near as extensive -- in direct market share terms -- in the home market as the PC has been in the business market. However, IBM's impact will obviously go far beyond its market share.

In order to compete against its rivals who offer better price/performance in the home market, IBM will emphasize value and utility, not price or technology. In particular it will stress:

- product continuity;
- software quality;
- expandability and upgradability within the IBM product line;
- somewhat compatible access to the IBM host environment;
- pricing (and margin) stability;
- ease-of-use and superior documentation;
- servicing and support.

IBM's entry will continue the legitimization of the home computer market signaled by the trend toward system sales and real utility. The introduction of the jr will undergird the trend to standardization around the Intel 8088 microprocessor and MS-DOS operating system for the home market as well as the office. IBM intends the jr to be a relatively "open" system like the PC (though note the non-standard connector pins at the back of the jr), and will make the technical reference manuals for the machine available to all interested third party hardware and software suppliers.

4. Is the PCjr Aimed at the Business Market?

Currently, the PCjr is not configured as a business machine. It has limited memory and expansion slots, and does not yet have the capacity to run the top business application programs (e.g., Lotus 1-2-3, which takes a minimum of 192K of memory to run). Moreover, the unit supports only one disk drive, and the keyboard is not conducive to serious business usage (e.g., heavy word processing).

However, the Yankee Group believes that this situation will change. By introducing a machine aimed at the home that is substantially compatible with the PC, IBM is confirming the perspective that the home is an extension of the office in the 1980s. It will not take long for third-party software houses to understand this subtlety, and by the end of 1984, most of the popular PC programs will have a version that runs on PCjr. In its current configuration, the PCjr is best suited to education, home financial services, games, electronic messaging, and database access. The first group of software programs and peripherals which IBM supports for the PCjr will reflect this priority. Indeed, the Yankee Group anticipates some interesting announcements in on-line services (probably through IBM's Information Network) by late in 1984 or early in 1985 -- software downloading, software sampling, electronic mailboxes, videotex services, etc.

5. Impact of the PCjr on the PC

IBM obviously spent a great deal of time positioning the Pcjr so that it would not significantly cannibalize sales of the PC itself. The jr essentially is a complement to, not a low cost replacement of, the PC. Elite white collar workers may buy a PCjr for the home, but they will not make extensive use of it in the office. On the other hand, first time users, at school or home, are likely to eventually migrate up to a

PC. While IBM improves the PCjr, it will also enhance the PC, and continue to maintain a reasonable price/performance gap between the senior and junior products. That gap currently is about 40% (a PC with 128K and a single disk costs about $1900, while a PCjr lists for just under $1300).

The Yankee Group expects IBM to create a 25%-30% price differential between the PC and the PCjr. By late first quarter, IBM is due to cut PC prices by 10%-15%. This will mean that the basic one disk drive PC will cost $1500 to $1600, next to the PCjr's $1200. It is important to remember, however, that the bread and butter of the business PC product line is fully configured PCs or XTs. Even if the PCjr cannibalizes some low end sales, the overall PC base will be relatively unaffected.

V. Conclusion

IBM has taken a strong but limited stand in the home computer market -- 16-bit power, MS-DOS 2.1, business PC compatibility, and what will undoubtedly soon be the broadest range of upgrade and peripheral products of any consumer computer. However, IBM's focus on the high-end of the home market means that it is essentially providing a price umbrella under which the rest of the industry can fight for market share. Given IBM's limited volume shipments during the first year (500,000 - 600,000 units), there will be a highly attractive opportunity for high volume, low cost suppliers who can ramp up quickly to provide PCjr compatibles.

Despite the attractiveness of the compatible market, the Yankee Group does not expect a rush of PCjr clones or a significant shift to standardization around the IBM unit in 1984. TI, which has an MS/DOS office machine, the TI Professional, now has bowed out of the mass market. Although

the Professional is priced below the IBM PC, and offers a possible re-entry point for TI into a larger, if not mass, market, the company is clearly licking its wounds and seems unlikely to pursue the mid- and low-end market aggressively anytime soon. Even if it did, TI would face considerable problems re-establishing distribution and consumer confidence, although the very fact of IBM compatibility, provided it was full compatibility (which the Professional is not), would soften consumer and retailer resistance.

Atari was the company best positioned to move to IBM compatibility in terms of product development, consumer software expertise, and "cutting edge" image. However, in the wake of its devastating year in 1983, the company appears to have indefinitely, and possibly permanently, shelved plans for the Atari 1600, a dual processor machine that would run both IBM and existing Atari software. The 1600, to have been built by Toshiba, would have allowed Atari a graceful migration path from the 8-bit to 16-bit environment, and all the advantages that come with IBM compatibility and more powerful processors for integrated software. The Yankee Group believes that Atari, by combining IBM compatibility with Atari's existing lead in graphics chips, could have positioned itself uniquely in the field, as offering not only the first consumer-oriented IBM compatible, but the first IBM compatible with consumer level video and graphics capabilities.

However, apprehensions about going head-to-head with IBM, concerns about how to position the relatively high-priced unit, the ongoing turmoil in the marketplace and within Atari's management structure, all worked to persuade the company not to attempt to break ground with yet another machine.

Commodore has had a series of machines, both 8- and 16-bit, to bring to market for most of 1983, but has not had to do so due to the continuing strength of both the VIC 20 and Commodore

64. The new series of 8-bit machines that it is likely to introduce at January 1984 CES will not be compatible with either Commodore's existing machines, or IBM. The first machines to use the 16-bit Zilog 8000 will probably be introduced in Hanover in April 1984. As the dominant (and most profitable) vendor in the consumer marketplace, Commodore is in much the same position as NEC in Japan, and sees little advantages in standardizing around a competitive machine that was never designed or intended for the mass market. Therefore, although Commodore will plan defensively for IBM compatibility, the Yankee Group does not expect the company to move to any standard not of its own making. If strong market demand dictates it, Commodore may, however, revive the notion announced several years ago of "universal adaptability" by way of enhancement slots and dual processor boards. Consumers who choose to, may then move to Intel 8088/MS-DOS, or Z80/CPM compatibility by purchasing the appropriate board.

Coleco's new introduction, the Adam, is a Z-80-based system, and the oompany has its work cut out making a successful launch of its initial computer product without attempting to execute an intricate dual processor strategy. The company is more likely to move to MSX standardization in the near term than to IBM compatibility.

Apple is clearly the company that is most pressured by the introduction of the PCjr; but its likely responses (which include early 1984 introductions of a stripped down IIe, probably with cartridge slots for the home, as well as lower prices and a mouse option for the IIe, and a 16-bit Super II with a new proprietary chip that runs existing IIe software) do not include standalone IBM-compatible products (although MS-DOS and CP/M compatibility through boards already exists).

Finally, the major Japanese computer and consumer electronic companies appear focused on their domestic market,

and on establishing a de jure standard (at this point, probably the Z-80 based MSX system), rather than rushing into the PCjr-compatible market. There have been recent reports of problems within the 11 or so companies comprising the MSX community, at least partially caused by Digital Research's entry into the consumer computer arena. Even if the Japanese vendors choose to develop PCjr clones with improved, non-infrared keyboards, they are unlikely to have product ready for the U.S. market before June CES, 1984 at the earliest.

The Yankee Group believes that the introduction of the PCjr will stimulate the entire home market, push the market towards portability, and in general set new standards of excellence in marketing and "user friendliness" including documentation, built-in diagnostics, use of templates, etc. The jr will not have a major impact on existing vendors, most of which are, or will shortly be, offering total systems for something less than the price of the PCjr in its basic version.

Over the longer term, the attractions of the compatible market will bring in other vendors who do not have IBM's overhead structure, and can therefore compete with even IBM's VLSI program. Mass merchant retailers such as K-Mart, Toys-R-Us, Service Merchandise and others, are shut out of the IBM distribution chain, but desperately want to carry the product or, even better, a low-cost compatible. The overwhelming attraction of a PCjr clone for these retailers is the knowledge that the IBM unit will be around for at least the next few years, and that the best software and peripherals will be made available for the machine. (In the consumer market, the only kind of compatibility that counts is full disk and ROM cartridge compatibility.) These retailers will make space on their shelves to carry anyone's PCjr-compatible machine, a fact that will not be lost on manufacturers; by the end of 1984/early 1985, the retailers will probably have their dream machine.

VI. Apple Compatibility

IBM compatibility has captured the imagination of the press and strategic planners, but Apple compatibility is another clear market trend, and one much further advanced than IBM cloning. Low cost Apple II/e copies are appearing in the U.S. in increasing numbers from Taiwan and elsewhere. Apple still has a much higher mass market recognition factor than IBM, and in a recent survey by the Yankee Group of 800 U.S. households, Apple was the overwhelming first choice of consumers who had not yet bought a computer.

Apple's recent victory in its ROM-copying case with Franklin Computer gives it some leverage against the pirates, and because, unlike IBM, it uses a proprietary operating system, it should be more successful than IBM in legally limiting clones. However, the Franklin case may still be appealed, and it appears difficult but not impossible for would-be-copiers to develop non-infringing machines. Given Apple's enormous software base, especially in games and education, mass merchant retailers would find a legally acceptable Apple clone a very attractive product, in some way even more so than a PCjr copy.

VII. Compatibility, Partial Compatibility, and Graphics Superiority

There is one major caveat in the IBM standardization scenario. The PC was designed primarily with text and numeric applications in mind. Its graphics capabilities are extremely limited, especially beside the "sprite" graphics and much broader color palettes of existing mass market machines like the Commodore 64 and Atari 600XL/800XL. The PCjr improves on the PC's graphics, but in the interests of compatibility, does so only marginally.

As computer vendors targeting the mass market design their next generation of machines, they have to weigh the attractions of full IBM compatibility on the one side, against its limited graphics capability on the other. Because of the strong entertainment bias of computer usage in the home, superior graphics capability is a critical design and marketing issue.

The next generation of graphics chips from companies such as General Instrument, some of the Japanese semiconductor vendors such as NEC, and possibly Atari, will offer near broadcast quality imaging capability. These chips, however, require extremely powerful microprocessors, such as the new generation of chips from Intel (80188, 80186, 80286), Zilog (Z800 and Z8000 -- which will be offered in Commodore's new models) and Motorola's venerable 68000 (it was introduced in 1979) which powers Apple's Lisa and MacIntosh computers.

Although the 32-bit internal architecture and 16-bit databus of the Motorola 68000 (vs. the 16-bit architecture and 8-bit data bus of Intel 8088) has made it the chip of choice in contexts where high graphics capabilities are required, the Yankee Group believes that Intel's chips will put severe pressure on the Motorola chips as the processing engine in the next generation of consumer oriented computers.

At present, therefore, manufacturers face a difficult choice. They can choose to develop a fully IBM compatible machine using the Intel 8088/8086 processor, and accept the graphics limitations, or develop units with partial compatibility that have superior graphics capability.

Tandy has gone this partial compatibility/improved graphics route with its new Tandy 2000, which offers 640 X 400 screen resolution with eight colors, compared to 320 X 200 with four colors for the PC. Other computers that sacrifice complete IBM compatibility in favor of better keyboards and superior

graphics include the NEC APC, the Wang Professional, the Victor 9000, and the TI Professional. At least two other companies, including Mindset Inc., a venture startup headed by an ex-Atari president, are developing 8088/80186-based machines for the consumer market with superior graphics capabilities.

While the advanced graphics capabilities of the machines listed above are adequate for business users, they are not adequate for the home market. Even the enhanced screen resolution and broader range of colors of the Tandy 2000 do not really address the graphics requirements of consumer-oriented applications. These include features such as multiple sprites and easy execution of complex screen routines involving animation, as well as the ability to handle the vastly improved imaging capability that only next-generation video chips can provide. (See Chapter Four.)

If, on the other hand, vendors choose to abandon IBM compatibility (at least under MS-DOS) and go with the new generation of video coprocessors, then the Intel 8088/8086 chips alone are not really up to the processing task.

A. Compatibility is a Moving Target

IBM compatibility is a moving target, as mainframe vendors have learned through experience. The PCjr is itself not fully compatible with the PC, and enhancements to these machines and others in the IBM line will not necessarily bring them closer. The PC and XT (and apparently to a lesser extent, the PCjr) have not reached the limits of their graphics potential, thanks to a relatively "flexible" hardware architecture that could accommodate additional coprocessors.

The optional Intel 8087, for example, is a powerful math processor that sits next to the 8088 on the IBM PC board. It can upgrade the speed of mathematical functions dramatically

(graphics applications require complex trigonometric computations), but only a few programming languages can address this processor at present. Similarly, upgrading the PC's Intel 8088 to the Intel 80186, a faster chip that incorporates many of the previously external support chips, would allow significant graphics improvements with or without additional graphics coprocessors. While applications will have to be written to take advantage of these coprocessors, their addition will not make the older machines' software obsolete. Rather, it will still run without problems, but the older software will not be able to take advantage of the new hardware capabilities. An alternative route is for third-party vendors to provide the coprocessors in board form to fit the expansion slots on the PC and PCjr and "turbocharge" their graphics capabilities that way. One cost problem with all these increased graphics chips, however, is that for optimum performance they require increasing amounts of dedicated screen RAM.

Coleco's Adam, with 16K of dedicated screen RAM, is a harbinger of even larger dedicated memory requirements. Several of the low-end Japanese machines, such as the Panasonic JR 100/200, have 16K of screen RAM, in keeping with the general commitment by Japanese vendors to graphics excellence, even when other features are lacking.

The Yankee Group expects several consumer oriented machines based on the Motorola 68000 chip to be introduced in 1984. In addition to Apple's MacIntosh computer, Amiga Corporation has developed a 128K, 68000 based machine with superior video (and sound) capability (price around $1200) that will be introduced in the fall of 1984; and Sinclair Research (U.K.) is expected to announce a 68000-machine in the first quarter of 1984, priced at under $600. The Amiga machine will offer MS-DOS and possibly PC-DOS capability, and Apple has stated that the MacIntosh will offer a "window into the IBM PC world."

All of these factors suggest that the move to market standardization around the IBM PC/PCjr, if it occurs, will be a more complex and staggered phenomenon than a simple reading of situation might imply.

VIII. Major Product Trends In 1984

The Yankee Group sees several major product trends in 1984, apart from the continuing improvement of price/performance ratios. These are:

- "user friendliness." This term has been so overexposed that it is hard to use seriously anymore. However, the reality that it addresses is critical to the future success of the microcomputer industry, both business and consumer. It has two facets, hardware and software. On the hardware side is the increased microprocessor power and memory size needed to run the new generation of software, and improved or alternative input devices ("mouse" controllers, touch screens, digitizer and touch pads, lightpens, voice recognition/speech synthesis, etc.). The demand for memory and mass storage continues to be insatiable, and because the cost per bit is declining so rapidly, it continues to be easier to throw hardware at a problem rather than figure out ingenious ways to condense software requirements. Most of the new software products make use of the new graphics and "pointing" technologies, almost all of which currently depend on disk drives.

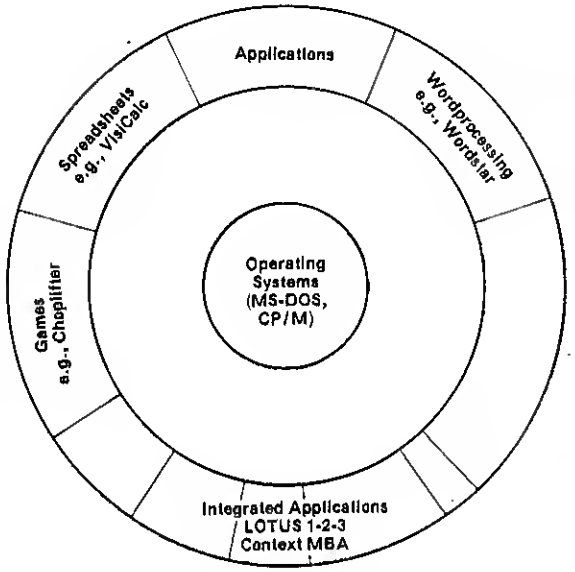
  On the software side are the operating systems and the new operating "environments" such as that found on Apple's Lisa and VisiCorp's "VisiOn" and Microsoft's "Windows" (see Figure 1-1). These product allow "integrated" (another much overused term) software applications that include features such as "windowing," "menu management," use of icons, etc. (See Chapter Three.)

- standardization. As discussed above, the most important standardizing influence in the market at present is IBM's entry. However, Apple's II/III line, and "MacIntosh/Lisa" computers, possible consumer products from AT&T using the UNIX/Xenix operating system, and the Japanese MSX standard all mean that computer standardization of hardware and operating systems, will not happen in a major way in 1984. There is a long-term market bias towards standardization as a means of overcoming fragmentation and less than optimal production runs for third-party peripherals and software. During 1983, this trend moved strongly in the direction of the IBM PC, a market focus reinforced by the introduction of PCjr. However, as noted, the limitations of the PCjr, in the realm of graphics, significantly undermine the attractions of the unit as a straightforward standard in the home.

  There are a number of other areas, including the PLP/NAPLPS graphics standards, the likely adoption of the Microcom modem standards, etc., that will have a more limited but still important impact on the issue of standardization. The Microcom Networking Protocol (MNP), available as communications software, or as a modem with built-in error detection and correction, has been adopted by most of the major vendors including (tacitly) IBM for the PCjr, and VisiCorp for VisiOn. MNP is important because it allows different brands of computers to communicate directly with each other without going through a value-added telecommuni- cations service such as Telenet.

- telecommunicating vs. standalone terminals. So far, the computer industry has attempted to create one vanilla computer terminal for all applications in the home. The Yankee Group believes that during 1984/85, the distinction between standalone and telecommunicating functions in the home (see Table 1-5) will become increasingly important, and that companies like Atari (through its Ataritel division), AT&T, ITT, GTE, and others,

FIGURE 1-1
SOFTWARE OPERATING SYSTEMS,
ENVIRONMENTS AND APPLICATIONS



Source: the Yankee Group

TABLE 1-5
STANDALONE VS. TELECOMMUNICATING
TERMINAL FUNCTIONS IN THE HOME

Standalone	Telecommunicating
Programming	Database Accessing
Entertainment	Electronic Messaging
Education/Self Improvement	Host Computer Accessing
Productivity	Home Banking
Wordprocessing	Classified Ads, etc.
Home Budgeting	Teleshopping
Energy Monitoring	Billing
Security	Energy Monitoring (remote)
	Security (remote)
	Entertainment Education Teleshopping

Source: the Yankee Group

will offer a range of enhanced telephone/computerphone/teleterminal products that can handle most computer-based telecommunication consumer applications in the home. (See HOF VIII: "Personal Computers in the Home," and the forthcoming 1984 HOF Report on "The Home Terminal.")

Each of these product trends raises important software issues, which are dealt with in the following chapters.

CHAPTER TWO
THE SOFTWARE MARKET: COMPUTERS AND VIDEOGAMES

The term "software" was originally coined to describe the operating and application programs that make computers run. The colloquial use of the term has since been extended to cover a variety of products including computer programs; videogame programs for home and arcade; video programming, both broadcast and on disc and tape; and even audio records. This chapter provides an overview of the markets for computer software in the home, and for videogame software for home and coin-operated consoles.

I. Personal Computer Software Market

Computer software for mainframe and minicomputers traditionally was developed either by the vendor, or in-house by the end user in conjunction with the vendor. Although a number of firms provided software on a subcontract basis to end users, independent software houses publishing their own products emerged only with the microcomputer industry in the late 70s.

As the microcomputer market fragmented into various submarkets (corporate, small business, educational, scientific, home, etc.), small companies, frequently simply one-person operations with a mailbox, began offering programs targeted at specific applications for specific machines. As the installed base of personal computers grew, a few of these companies had spectacular successes with single products. These included:

- Digital Research Inc. (Pacific Grove CA) with its CP/M operating system originally developed for 8-bit Z-80-based machines, and later with CP/M 86 and Concurrent CP/M for 16-bit machines, including the IBM PC;

- Microsoft Inc. (Bellvue WA) with Microsoft BASIC, and later, the MS-DOS operating system developed for use on the IBM Personal Computer. Although Microsoft also produces some hardware products (such as the CP/M "Softcard" for the Apple II/e), over 50% of its revenue is still derived from licensing its version of BASIC;

- Micropro International (San Rafael CA) with Wordstar, the first word processing program to offer many of the features found on more expensive dedicated word processing machines. Wordstar has the largest installed base of any software program (about 600,000 licensed Micropro claims, excluding bundling agreements with companies such as Osborne and Kaypro), and the program accounts for 75% of Micropro's 1983 revenues.

- VisiCorp Inc. (San Jose CA), which markets VisiCalc (around 550,000 units licensed), the spreadsheet program developed by Software Arts (Cambridge MA) that probably did more to expand the personal computer market than any other single program. VisiCalc reportedly grossed $36 million in 1982 and $53 million in 1983, with total royalties for Software Arts of $7 million to date. VisiOn, VisiCorp's powerful new integrated software package, promises to be a big revenue earner for the company thanks to a distribution deal with IBM. However, a year after announcement at the fall 1982 Comdex, VisiOn had still not been shipped.

The common thread is that these companies were all single product firms that established an early lead in the personal computer software business, and have been scrambling ever since to maintain their advantage. To do this, they have all attempted to develop varying product lines, bringing them into increasingly sharp competition with each other as well as with a flood of new competitors. These include companies such as Lotus Development Corp. (1-2-3), Ashton Tate (dBase II), Software Publishing International (PFS series), and others.

An important feature of the software market is the degree to which the original products of these companies still dominate their respective markets (and their originators' bottom lines), despite the appearance of competitive products that frequently offer superior features at lower prices. Lists of bestselling products by distributors like Softsel and MicroD illustrate dramatically the staying power of the originals, and the enormous difference in units shipped between, say, "Wordstar" and its closest rivals. This sales edge, in the face of superior product competition, points to the leverage available for a product that establishes an early lead, is demonstrated and supported by the retailers, and then comes to dominate the shelfspace.

The leading independent software vendors also are still relatively small companies despite their rapid growth and the fact that they dominate the industry. All of the companies mentioned had revenues in the $10-$40 million range in 1982, and will be in the $30-$70 million range in 1983. By comparison, Activision had revenues of $125 million in calendar 1982, before declining to around $90 million in 1983. (See Table 2-1.) Activision's best selling game cartridge was "Pitfall," which sold around 3 million units in 1982/3, for retail revenues of $90 million.

For all the successes of the independent software vendors, the companies generating the largest revenues from software remain the computer hardware companies. Of these, IBM is the clear leader, with an estimated 1983 revenue from microcomputer software of over $200 million. Moving beyond its own rapidly expanding software line, IBM recently announced that 68 titles not carrying the IBM logo can now be sold by its direct sales force. The titles include Ashton Tate's dBase II, Micropro's Wordstar, Lotus's 1-2-3, Digital Research's Concurrent CP/M-86, and Microsoft's Flight Simulator.

TABLE 2-1
REVENUES OF SELECTED SOFTWARE PRODUCERS

Vendor	1982 -$M-	1983 -$M-	Chief Products
Activision	125	90	Pitfall, Decathelon, etc.
Atarisoft	n/a	75	-----
Broderbund	3-5	7	Choplifter, Bank St. Writer
Commodore	18	63	Infocom Series
Digital Research	22	46	CP/M, CP/M-86, Concurrent CP/M
Hesware	0	10	Omnicalc, Heswriter
IBM	80	250	Third Party Software
Information Unlimited	4	7	Easywriter
Lotus Development	0	40	1-2-3
Micropro	25	36	Wordstar
Microsoft	32	70	MS-DOS, Xenix, Basic
Parker Brothers	75	110	Star WArs, Q-Bert
Peachtree	9.5	18	Accounting
Software Arts	2	6	TK Solver!, VisiCalc
Tandy/Radio Shack	53	77	Superscript
VisiCorp	36	53	VisiCalc, VisiOn

December 1983

Source: the Yankee Group

Tandy's fiscal 1983 software revenues of around $77 million (up from about $53 million in 1982) are about 8% of computer hardware sales, which in turn account for 34.6% of Tandy's fiscal 1983 revenues of $2.47 billion. (Database management and word processing accounted for about 70% of total software revenues.) Commodore has announced that in 1983 software also accounted for about 9% of its $681.2 million in revenues, and has indicated that it is planning an extraordinarily ambitious increase to $500 million in software revenues in 1984. Apple's revenues from software are stable at just over 12% of total revenues.

The advantages for the hardware companies are clearly established distribution, a lead time in developing system and (key) application software, brand recognition, and leverage in advertising, marketing, etc.

II. Computer Software in the Home

The home software market has developed along somewhat different lines. The major hardware companies (Apple, Atari, Commodore, Tandy, Timex, Coleco, Texas Instruments, Mattel) all developed proprietary operating systems, despite the fact that they all used either the 6502 or Z-80 microprocessor. (Microsoft's BASIC in one version or another is the programming language available on almost all consumer-oriented computers.) Because no one company dominates the home market, no standardized operating system has emerged, and applications software cannot be rewritten easily for various machines. This has placed the primary burden, and opportunity, on the hardware vendors to provide software for their machines.

It is not possible to provide a neat definition of the home software market, for two reasons:

- overlap between business and consumer applications. Because the home hardware market covers both "personal" computers (including portables) and "home" computers, software demand ranges over applications for both types of machines. As these markets converge (see Chapter One), customary categories become ever more suspect;

- creative turmoil in the software market. The computer software market is undergoing rapid and wider product evolution. The extension of operating systems into operating "environments" on the one hand, and the development of "integrated" applications software on the other, mean that the distinctions between system and applications software are breaking down, and that the distinction between different kinds of applications is blurring as they are integrated on various levels into a single giant program.

Most of these developments are occuring first in the business arena, where larger hardware capabilities (16-bit processors, larger memory, hard disk storage, etc.) make it easier to implement the new programs. However, the same set of crestive challenges faces the consumer software developers -- how to make applications-more powerful and at the same time easier to use. These developments are therefore finding their way into the consumer world in a variety of ways. These include scaled-down versions of business programs (i.e., Commodore's "Magic Desk"), introduction of consumer-oriented programs that are almost pseudo-operating environments (Digital Reeearch's "Dr Logo"), and the official entry of both Microsoft and Digital Research into the consumer market.

Microsoft hae approached the consumer market in several ways. The first is by way of an investment in HES (Human Engineered Software), a Torrance CA-based software company, with a presence in the game and educational field. The agreement allows HES to market Microsoft's "Multiplan" program

to the consumer market, presumably in a scaled-down version. (Commodore's earlier announcement at June CES that it would be marketing Multiplan for "under $100" for the Commodore 64 seems to have fallen away with the HES agreement.) The second and more important approach is a new operating system, MSX-DOS, which Microsoft developed for Spectravideo, and then managed to get most of the major Japanese consumer electronic companies to adopt formally as a standard for home computers in Japan. The MSX standard, which consists of a hardware configuration as well as the MSX-DOS operating system, is intended primarily for the Japanese domestic market, and possibly Europe. (See HOF Report No. IX, "Japan and the Next Generation of Consumer Electronics.")

Despite a formal announcement of the system (largely at the initiative of Matsushita), most of the announcing companies have done little to forward the system. In particular NEC (which has about 50% of the Japanese microcomputer market) and Sharp (10%) see little to be gained by adopting a system which weakens their own market position, though it would clearly assist in growing the total market.

Pertinent reservations have also been expressed by a number of signatories, such as Sony, about the wisdom of standardizing on an 8-bit rather than 16-bit or 32-bit system, and the problems that MSX would face if a serious attempt was made to export MSX systems to the U.S. So far Activision and Atari (and possibly Coleco, which almost meets the hardware configuration requirements) have announced software support for the MSX system <u>in Japan</u>. None of the majors is making any commitments for the U.S. market.

Further clouding the issue is the fact that Digital Research (DRI) is scrambling to establish its own consumer division, headed by a former president of Atari's coin-operated game division. The division's first offering will be Dr. Logo

(which will be available on introduction for most consumer computers), and the market focus in general will be education and productivity software for schools and home. DRI also has had extensive conversations with the adoptors of the MSX system, attempting to persuade them of the advantages of DRI's own forthcoming consumer operating system as a putative standard.

To increase the attractions of CP/M in the consumer environment, the Yankee Group expects DRI to announce a ROM-based version called "Personal CP/M" by yearend 1983. The new operating system, which will be manufactured, marketed and distributed by Zilog and American Microsystems, Inc. (AMI), will be embedded in a single chip, operating processor based on the Z-80 microprocessor.

By building the operating system in ROM, OEMs can cut cost, and consumers are saved both the cost and inconvenience of having to use a disk drive to load the operating systems. "Personal CP/M" will feature "help" screens and other visual aids to simplify use for first-time users.

III. Definition of Major Market Segments

As noted above, the categories for computer software in the home are evolving continually. The following is the Yankee Group's classification of the products currently on the market. Revenue and unit estimates for each category are provided in Table 2-2.

- System/Utility. This category is small, but essential, because without system software (i.e., operating systems, programming languages, diagnostic programs, etc.), the computer cannot function. At the consumer level there is a trend to bundle the necessary system software, or to build it directly into the ROM memory in the machine, as in BASIC.

TABLE 2-2
ESTIMATED REVENUES BY SOFTWARE CATEGORY
FOR THE HOME MARKET

	- $ Millions -				
	1980	1981	1982	1983	1984
Entertainment	3	18	157	405	710
Education	neg.	4	25	73	240
Business/ Productivity	5	16	53	135	195
System	2	6	26	50	73
Home Budget/ Improvement/ Misc.	neg.	2	11	22	65

* Home educational market only

December 1983

Source: the Yankee Group

- Entertainment. Games have been associated with computers since the earliest days of mainframes. They constitute the single largest market for home computer software. Although many of the titles are simply games brought over from the arcade and home consoles, there is also a significant market unique to computers for text and strategy games. Entertainment programs are used by more members of computer-owning households than any other software category, and constitute the largest aftermarket, in unit terms, across all brands and price classifications (see Table 2-3).

- Education. This is the fastest growing home market, and even more than entertainment, is tied to the presence of children in the home. It frequently is confused with computer "literacy" which is the skill (of programming, not an applications market). It is a complex market (see Chapter Five) and overlaps with several others, including the school educational market; entertainment (especially, for example, when using Logo-like formulations); and the "how to" or self-help market (see below). It is the first market after entertainment and business software that has been able to establish a separate marketing identity for retailers.

- Business/Productivity. This is the most developed market, in terms of range and quality of software, and covers a number of distinct product areas aimed at professional users including spreadsheets, database managers, word processing, graphics, and telecommunications software. The vast array of vertically-oriented software applications packages aimed primarily at various professional groups such as lawyers, doctors, real estate brokers, etc., falls into this category (depending on the sophistication of the package.) This is the only category of software used in the home that is still distributed primarily by computer specialty retail outlets.

TABLE 2-3
COMPUTER PROGRAMS PURCHASED
OR RECEIVED WITH CONSOLE BY SOFTWARE CATEGORY
AND COMPUTER PRICE CLASSIFICATION, 1983

		[---- Price Classification*----]		
Category	Average	High	Medium	Low
Entertainment	1.2	1.4	1.8	1.1
Education	0.5	0.7	0.7	0.5
Home Budgeting	0.3	0.5	0.2	0.3
Business	0.3	1.5	0.3	0.1
All Programs	2.3	4.1	2.9	1.9

Note: Averages are weighted for all owners using zero for those not buying the specific class of software.

* For machines included in each price classification, see Table 1-2.

December 1983

Source: the Yankee Group

Although falling, prices and margins are still typically five to 10 times higher than those of other home software categories, where $50 is the top end of the range. Because of the size of the hardware and software investment involved, product continuity and compatibility is a major consideration in this market.

- Home Business/Personal Budgeting. Originally limited to makework applications such as checkbook balancing and recipe filing, this category has improved to the point where it is beginning to offer real utility. It includes both simplified versions of professional level programs (word processing, mail lists, spreadsheets), and such areas as tax preparation, personal time scheduling, and household budgeting.

- Self Help/Miscellaneous. Essentially a residual category, this covers "how to" programs on everything ranging from repairing computers to learning a foreign language. Because it is relatively undefined, it has had difficulty getting retailer support, but clearly offers significant growth potential over the longer term.

IV. Major Market Trends

In most "software" businesses, after a number of years the amount of money invested by the consumer in software (records, tapes) comes to exceed the original hardware investment by a considerable amount. As the size of the installed base rises, therefore, the software industry comes to dwarf the hardware industry in revenue terms. The home videogame industry has followed this pattern, with software revenues surpassing hardware in 1981, and the differential has increased, even in the current market downturn. (See Table 1-1.)

The home computer software industry should prove no exception, and the Yankee Group estimates that by 1988 software

revenues will exceed those of hardware. The major trends that the Yankee Group expects to characterize the software market during 1984 include the following:

A. Pricing

In the personal computer industry, microcomputer software historically has been priced extremely high in relation to actual production costs, in order to reflect the cost of development which had to be amortized quickly over a relatively small installed base. This has led to a pricing structure for business/productivity software that is a reflection of perceived value, not manufacturing and distribution costs.

This same pattern, albeit at much lower pricing levels, prevailed in the home software arenas -- computers and videogames -- until early 1983.

The Yankee Group believes the home software market is moving to one more closely resembling other software industries, (i.e., cost-based pricing). End-user prices will be based on the cost of manufacturing, distributing and marketing the product, plus a profit margin in the 15%-25% range. The shakeout in the videogame industry already has changed its overall pricing structure dramatically. Commodore has also made a commitment to driving down software prices and margins the way it has done for hardware, and will significantly affect other vendors.

As in any industry, vendors always face the choice of reducing prices and/or offering improved performance/features. So far business/productivity software has proven resilient in holding its price structure in the face of intense competition. In particular the industry standards ("Wordstar," "VisiCalc," etc.) have held up surprisingly well. However, they have been marketed through computer specialty stores which

require substantial margins of 30%-40% to survive. The situation is quite different in the mass market, where computers and software simply are additions to existing business lines, and the margins can be based on variable rather than fixed costs.

The following factors are forcing software prices down:

- the proliferation of vendors and titles, and the glut of product in the videogame market;
- the fact that mass market retailers are not as committed to maintaining high margins as the computer specialty stores;
- the falling price of the hardware consoles, which makes consumers unwilling to pay $35-$50-plus for a software program when they are paying only $50 to $200 for the console;
- simplified and low-cost versions of high-cost programs;
- economies of scale from mass production -- for example, Commodore has gone from four-inch to five-inch wafers with significant cost savings; and
- ability to amortize development costs over an increasingly large installed base.

B. Distribution

The volatility of the software market, coupled with the enormous market inventory of mediocre game cartridge titles, has made retailers very reluctant to make a substantial commitment to new inventory. The bail out of Mattel and Texas Instruments has made everyone skittish about the remaining vendors, especially Atari and Timex. Over the longer term, the only way to deal with the inventory problem, including backlists and software for discontinued hardware lines, is electronic distribution, whether to retail store or home.

There are many issues that have to be addressed before electronic distribution becomes a real market force. However, major announcements such as those between Coleco and AT&T, and between Atari and Activision, signal the beginning of a trend that will have an enormous impact on current distribution outlets, and on software pricing. (See Chapter Seven.)

C. Entry of New Players

The software market traditionally has been a market of amateurs, in which small third-party firms subcontracted to the major hardware manufacturers, or introduced their own products on a mail order basis through advertising in the major computer magazines. The Yankee Group estimates that there are about 3,000 software "publishers" offering around 25,000 titles in various formats. However, in terms of real mass market potential, there are only a few dozen companies that have the creative, financial and distribution clout to become or remain a serious factor in the business over the next few years.

Prior to the ubiquitous establishment of electronic publishing or software downloading, the major retail outlets face the continuing problem of proliferating titles, formats, and vendors. They will respond either by moving to rackjobbing, and/or dealing directly with a limited number (typically around a dozen) of publishers and distributors. The Yankee Group believes that the home software business, even with electronic distribution, will essentially become a three tier business consisting of:

- major publishers. These are large companies from a variety of fields including hardware (Atari, Coleco, Commodore, Apple, IBM), software (Activision, Digital Research, Microsoft, Parker Bros.), and publishers from other fields (CBS, McGraw-Hill, Random House, Houghton Mifflin, Time Inc.). These two dozen or so companies will dominate the

industry, frequently controlling their own distribution. They are large enough to support their products at retail with everything from point-of-sale displays, advertising and superior documentation, to field trainers and credible customer hotlines. Although some of these companies, especially the computer companies, will retain large in-house programming staffs for strategically critical products, for the most part the titles they publish and distribute will be from outside authors and program developers.

- minor publishers. As in the movie, book and record industries, there will always be a place for a number of smaller independent "labels" which target specific niche markets. Obvious candidates in the home software industry include vertical software packages, specialized entertainment and educational software.

  Epyx Inc., for example, has developed a small but comfortable market niche by positioning itself as the "thinking person's game company." Most of the home educational companies fall into this category. All of these companies are candidates for takeover or merger, and many will take this route in order to get the resources needed to compete effectively.

  The specialized labels within the record industry (Arista, Geffen), and of market-specific divisions and imprints within the large book publishers, are obvious models for computer software houses which need larger resources but want to retain their functional autonomy. However, analogies and models to other "software" industries should be used with caution, because just as records, books, and movies have their own market dynamics, so too does computer software. These secondary publishers, probably numbering about 100, will distribute their products either through the major distributors or by agreement with one of the larger publishing houses.

- authors/micro publishers. At the base of the publishing pyramid will be the thousands of author/programmers and entrepreneurs that constitute one of the industry's greatest resources. Working on a contract or independent basis, as individual programmers or in small ad hoc groups or companies, they will be responsible for much of the specialized software that the majors publish.

Obviously, an enormous amount of strategic effort currently is being devoted by the smaller software houses to follow the steps of an Activision, Microsoft or Lotus and break into the big leagues. However, the cost of doing so is rising every month, and it now takes at least $1 million to launch a major new product nationally (see below). Very few of the aspiring candidates will be able to break away from the pack and make it into the big leagues. Moreover, the "big leagues" of the computer software publishers are still miniscule by comparison with the annual revenues of other software publishers moving into the business, such as McGraw-Hill or CBS.

Electronic publishing clearly lowers some of the entry level barriers to smaller publishers, because the inventory cost is minimized for both publisher and retailer. However, manufacturing is only part of successful publication. Creating awareness of the product through advertising, and supporting it after sale, are and will remain critical to market success. Even though the market is moving towards products that are increasingly self-explanatory, the range of applications is sufficiently large, and the tasks of much software sufficiently specialized to maintain demand at retail stores to demonstrate and customize particular programs.

D. Advertising and the Cost of Entry

Advertising costs continue to rise for all computer software markets. The current success story is Lotus Inc., which has managed to make its innovative "1-2-3" program an

industry standard in a few short months since its full launch. However, Lotus spent $1 million in three months, and $3 million in its first year to establish its dominant position. The national launch of a first rate title in the crowded videogame market costs about $1 million in advertising. With the current downturn in the market, even licensed arcade "hits" (such as they are) cannot ensure publishers the massive sales of 1981 and 1982. In 1982, for example, Coleco earned about $11 million on a single title, "Donkey Kong." The top arcade titles in 1983 that Coleco has licensed, such as "Time Pilot" and "Mr Do", will not earn anything near the revenues of the earlier hit, despite massive advertising and a larger installed hardware base.

There is a general trend away from celebrity endorsement advertising towards a focus on utility. Commodore has abandoned Captain Kirk of Startrek fame; Apple no longer uses talk show host Dick Cavett; and even before it left the business, TI was phasing out comedian Bill Cosby in favor of more targeted advertising. Atari is the only one going against the trend, and has reportedly signed a five-year, $20 million deal with actor Alan Alda.

V. Major Product Trends

The computer software industry is in a state of creative turmoil. Product development breakthroughs are happening in half a dozen areas, although not as easily or quickly as the flood of press releases would have one believe. As noted in Chapter One, the most important issue facing vendors at all levels of the market is improving "user friendliness," or making the functionality of the computer easier to access for inexperienced users, even as the programs become more powerful. Much of what is happening in microcomputer R&D can be seen essentially as footnotes to Apple's March 1983

introduction of "Lisa," which itself can be seen as a footnote to the development of the Xerox "Star" and the pioneering research done at Xerox's PARC laboratory. Although the focus of the best development efforts (and publicity) is for "personal" computer products, these same developments will rapidly migrate to the mass consumer level. The following are the software product trends that the Yankee Group believes will be the most significant over the next few years.

A. Integrated Software

The current enthusiasm for integrated software disguises the fact that there is no standard definition of what the term entails. There are at least five different senses in which software can be said to be integrated:

- concurrency. Concurrency permits different programs to reside and operate from the computer's memory at the same time. Different programs, such as word processing and spreadsheet can be loaded into memory and the user can switch instantaneously from one program to the other without having to first save the results of one program before loading up another program, a fairly inconvenient and time consuming process. Alternatively, one program can be printing or telecommunicating, while the user works with another program. Concurrency permits two or more programs to be run simultaneously; this is the key difference between it and other forms of integration. Other approaches allow the user to view different programs simultaneously, and to transfer data between them, but typically only one program is actually running at any given moment. VisiCorp's "VisiOn" and Digital Research's "Concurrent CP/M" both offer concurrency, among other advantages.

- simple coordination. The simplest form of integration is a series of programs, usually from a single vendor, that are designed to share similar commands for similar functions. Because the programs

usually store files in the same format, passing information between them is fairly simple. However, to get this compatibility, only members of that particular series of programs can be used, regardless of whether each individual program is the best for an intended purpose. Perfect Software's "Perfect" series (Perfect Writer, Perfect Calc, etc.), bundled with the Kaypro portable computer, is an example of simple integration or coordination.

- shared technology or multi-function programs. Shared technology products combine various application technologies such as spreadsheet, database, graphics, word processing and communications within a single program. Lotus Development Corporation's "1-2-3" combines the first three applications mentioned into a single program; Context Management Systems' "MBA" program integrates all five. Information can be moved easily between the different programs, and both "1-2-3" and "MBA" allow the user to split the screen into several different windows and work with a different application in each window.

  One qualification on these programs is that they are typically built around one core program (in Lotus's case, a spreadsheet) which can limit the flexibility and performance of the other applications. Like coordinated programs, one can only use the applications built into the program, whatever their particular merits.

  A recent variation on the multi-function approach has been the introduction of programs that use database management systems as the core program upon which a variety of applications programs are run. The various applications therefore all have a common database. Vendors using this approach include Condor Computer Corporation, Microrim Inc., and Alpha Software Corporation.

- integrated operating environment. This approach offers the greatest potential for real integration of a number of different programs, and all the major software

houses are locked in fierce competition, including Digital Research, Microsoft, VisiCorp, and Micropro, as well as newcomers such as Quarterdeck Office Systems (Santa Monica CA). Some environments, such as that built into Apple's "Lisa" computer, or VisiCorp's "VisiOn" program, require use of specific applications programs developed by the vendor (in VisiOn's case, "VisiCalc" and "VisiWord").

Others, like Microsoft's "Windows" (which is essentially an enhancement of the MS-DOS operating system), and Quarterdeck's "DesQ," are designed to use any vendor's application program that runs under MS-DOS. Although Microsoft's "Windows" is not as powerful as either "VisiOn" or "DesQ", it has the advantages of being cheaper, and of working with 192K of memory and dual floppy disk drives, vs. the 256K plus hard disk drive required for the other two programs. If Microsoft can deliver the product close to the scheduled delivery date of April/May, 1984, it could affect the demand for other integrated software packages significantly, since end-users can use their existing (MS-DOS) applications programs under "Windows." However, "Windows" will not work with all MS-DOS applications, or rather not all applications will be able to take advantage of its windowing capability, at least not without further rewriting. Programs that fall into this category include 1-2-3, Supercalc, and Wordstar.

B. Metaphors, Icons, Mice and Windows

In addition to allowing the user to move quickly and easily between different applications programs, and to shift information between them (move figures from a spreedsheet to a word processing or graphics program), the above-named integrated environments offer several other important features. To make the packages easier to learn, software developers have adopted a number of hardware and software interfaces that make the programs more intuitively obvious for unskilled users.

The first of these is the use of "metaphors," or contexts that are familiar to the user. The most popular metaphor for business-related programs is the desk. Because users know what it is to have different objects and files on their actual desks, they also know intuitively what the relationship and ordering sequence between them is. By using "icons" or visual representations of a desk and typical objects (files, filing cabinet, trash can, typewriter, etc.) software developers can create an immediately familiar environment that first time users can manipulate (select file, open file, select document, respond to document by answering (typewriter), or deleting (trashcan), etc.).

To facilitate movement around the desk and selection of particular icons (programs), vendors also offer a variety of alternative hardware interfaces. The most common of these is the "mouse" cursor controller, used as a simplified pointing device, that has been popularized by Apple's Lisa computer. Commodore and Coleco make use of joystick controllers to achieve the same result, and Hewlett-Packard's recently announced HP-150 computer uses a touch screen. Finally, in keeping with the desk metaphor, where several files may be in view at any one time, software developers offer the capability of splitting the screen into overlapping or adjacent "windows" so that several files/programs can be viewed simultaneously.

Not all integrated software packages offer all these features. VisiOn, for example, offers concurrency, overlapping windows, and (for an additional $200) an optional optical mouse controller, but does not use icons. Apple's Lisa offers overlapping windows, partial concurrency, a mechanical mouse and extensive use of icons. Microsoft's Windows offers a maximum of four adjacent or tiled (not overlapping) windows, a mechanical mouse capability, portability to 8- or 16-bit systems running MS-DOS, but not concurrency. Twenty-three vendors, including Wang, Digital Equipment Corp.,

ewlett-Packard, Data General, Tandy, Zenith, Honeywell, urroughs, and TI, have already announced support for icrosoft's Windows.

1. Metaphors and "Learnability"

Despite the limitations of the current generation of "user friendly" interfaces, they represent a critical step forward in the mass diffusion of computers. The metaphor approach focuses attention on the issue of "learnability," which may be defined as the ability of the user to quickly gain a conceptual mastery over the product that allows progress from simple initial exploration to more complex subsequent uses. As computer use and ownership move further and further away from the existing computer community towards naive and first-time users, learnability or "intuitive obviousness" become increasingly important. Building on a user's prior experience and understanding is the easiest and fastest way to productive use of the computer.

Though use of functional "metaphors" has greatly advanced the "user friendliness" of computers, they still represent only the first link in a long chain of software evolution. Even in as seemingly well defined and "rational" a context as the office, how people actually organize their work patterns, use their files and the surfaces of their desks, turns out to be an extremely complex and idiosyncratic process. Studies in organizational ecology and ergonomics (the science of human factors engineering) are beginning to provide some insight into the process, but, just as composing on a word processor is different from using either pen and paper or a typewriter, so too, having a work style organized around the structure of a computer "metaphor" is very different from the usage of files and objects on a real desk. It will take many thousands of man-years of software development before computer usage is sufficiently flexible to become customized so that every

"personal" computer is in fact "personal" to its primary user. Major advances in artificial intelligence and natural language interfaces will be necessary for present goals to be realized.

As noted earlier, most of the new integrated software packages require 16-bit processors, and much expanded memory and mass storage capability, including, typically, at least a five Megabyte hard disk drive. This capability will not be available at mass consumer price points until 1985. Moreover, most of the software currently being developed for the consumer market is cartridge- and cassette-based, rather than disk. However, scaled down versions of the above programs that still offer many of their most useful features will make their appearance on 64K, disk consumer models during 1984.

More important than the translation of existing programs for the consumer market is the issue of how to make use of these new hardware and software approaches for non-business applications in the home. One of the important breakthroughs of VisiCalc (like that of word processing for dedicated word processing units) is that it created a use so persuasive that the microcomputsr market took off largely on the strength of that initial application. (It can be argued that PAC MAN had a similar brsakthrough impact in extending the appeal of videogames, whatever the industry's current problems. See below.) So far, no equivalent breakthrough program has fueled the consumer computer market.

C. Diversity and Databases

It is, of course, quite possible, even likely, that no single program will emerge to drive the consumer market, but rather that a whole range of programs, each contributing a small but significant utility, in aggregate will drive it. Indeed, the clear trend of the home computer market is to greater diversity and the beginnings of vertical markets, most

notably in education (programs for particular age groups, learning disabled, foreign language, etc.) and entertainment (video versions of bridge and chess, crossword puzzles, strategy games for business, etc.).

The design flexibility and programming power made possible by the combination of integrated software environments and alternative hardware interfaces will lead quickly to significant improvements in existing programs, and interesting new programming. The flood of entrants, including large companies with specialized expertise, mandates a niche market approach for all but the most powerful software companies.

Apart from games and educational programs, word processing in particular seems likely to become a powerful force in the student market, especially once the cost of correspondence quality printers drops below $200. Word processing will be a major beneficiary of the integrated software approach, with an increasing trend to built-in spelling checkers, dictionaries, thesauri, and glossaries. Other programs routinely will make use of built-in databases of varying sophistication and specialization.

D. Animation, Soft Software, and Layered User Friendliness

Another major trend of consumer programming, even that aimed at productivity applications, will be increassd use of color, animation, speech synthesis, voice recognition, music, etc. The graphics capabilities of consumer-oriented computers, most of which offer "sprite" graphics and an extensive range of colors in several modes, frequently are greater than that of even sophisticated business systems. Coupled with low cost digitizer and touch tablets, these features will allow software developers to create programs that are easier and more attractive to use because they involve many senses.

"User friendliness" is a requirement that varies between naive and sophisticated users, and even for the same user over time. The icons, menus, templates and prompts that are helpful when first learning a program become unfriendly once the user has mastered the program and becomes more concerned with speed and power. Developers are therefore writing programs that have different "layers," so that the user can adjust the help and feature levels of the program as experience increases, and the need for elaborate guidance decreases. The advantage of the layered approach is that a single program can offer both introductory and advanced features, and the first-time user does not later have to relearn, say, new word processing commands, in switching to another vendor's more powerful program.

Similarly, developers are working on programs that incorporate features that allow users to modify easily everything from the basic parameters and functions of the program to the differing skill levels required for mastery. Games and educational programs already offer these capabilities. Pioneering examples are Bill Budge's Pinball Construction Set (Electronic Arts, Sunnyvale CA) and Rocky's Boots (The Learning Company, Portola WA). The Yankee Group believes that this "soft" software approach increasingly will become the norm over time, allowing users to customize their most used programs to their particular needs and work styles.

However, successful execution of consumer programs that incorporate these features will take time, and, in general, more powerful computers than currently constitute the home installed base. Beyond these approaches is the whole world of artificial intelligence (AI) and so-called expert systems. These are hardware and software configurations that typically attempt to make use of natural language command structures and interactive prompting programs that allow a degree of dialogue between the user and the machine about a particular task. The

present state and potential of AI for home computer usage, particularly in the context of financial and information software applications, is examined in detail in HOF #5, "Work at Home: Asset Management Systems and Electronic Cottages."

VI. The Home Software Market: Videogames

As noted in Chapter One, the home videogame market has gone through a period of intense turmoil in 1983 that has shaken out many of the small players and even some of the larger ones, such as Fox Videogames and Imagic, that had good distribution and relatively strong financial resources. Most of the companies that entered the home videogame field, such as Data Age and Telesys, to name two that achieved brief flurries of visibility, were merely opportunistic endeavors feeding off the apparently insatiable Atari VCS market.

These companies were undercapitalized, with minimal game design talent and even less commitment to the market they were ostensibly serving. Most of their budgets were dedicated to advertising hype and marketing (Data Age's "Journey" cartridge exemplifies the genre -- third rate execution following second rate inspiration), rather than original product development. As the market matured and game players became more discriminating, the flood of mediocre product could not find shelfspace and, where it could, did not achieve sell through, at least at prevailing prices.

The problems facing the videogame industry are manifold. In the home market they include:

- approaching saturation. Although videogaming reaches all strata of society, the core group is the youth market (13-17 years), followed by children below that, and the male 18-34 market above that. The

last category is largely arcade-oriented. With an installed base of about 19 million game consoles by the end of 1983 [against demographic pool of 24 million households with children under the age of 17 (12.9 million with incomes in excess of $20,000)] the future market for videogames clearly is restricted. It includes purchasers demanding "state-of-the-art" in game playing devices -- a group likely to migrate to the first home laserdisc or computer/disc game models as these become available; a small pool of new families that fall into the demographics circle each year; and an even smaller pool of owners moving towards replacement or second game playing terminals.

- changed demographics and purchase patterns. Declining prices have broadened the market, but the current wave of purchasers has much lower average income per household, and is buying fewer cartridges per console than first round buyers did. Even earlier buyers are spending less on software in the second and third year of ownership than previously.

- product scarcity and product glut. As in other software arenas such as film and record, the number of genuinely creative and entertaining games produced in any given year is relatively small. In the period 1979 - 1982, the U.S. videogame market was largely cannabalizing the videogame "library" of Japan, and most of the megahits of the period came from Japan. In fact, of the 20 highest revenue generating games in the U.S. market, around 80% were licensed from Japan. This pool of creativity, although still strong, no longer has a backlog that can be tapped (much like the situation in the video software market, where 40 years of Hollywood product have been consumed in four years -- See HOF #6: "Video Software: Changing Dynamics of the Home Market").

  Although several U.S. companies have demonstrated proven game design strength (Activision, Parker Bros, and, of course, Atari), there is a scarcity of first-rate

product in 1983. At the other end of the spectrum, a flood of second- and third-rate product has been dumped on the market by companies exiting the business. The Yankee Group estimates that there is a market overhang of about 20 million cartridges that will clog the distribution pipelines well into 1984. In the Christmas quarter of 1983, closeout titles selling below $10 accounted for between 40%-50% of units sold for many distributors.

The glut includes everything from "a buck for a box" cartridges by companies that never should have been in the business, to excess inventory of former hits (Atari in particular has this problem), to product by companies like Mattel, Imagic, TI and CBS that would have been salable in a more stable market, but now fall into the discount category.

- format proliferation and competition from computers. The home game market has suffered from a proliferation of incompatible game formats (Atari 2600 and 5200, Intellivision, Colecovision, Odyssey) as well as competition from (incompatible) computers. The problem of format proliferation means intensified struggle for shelfspace as well as complex inventory problems for vendor and retailer. For companies committed to original programming rather than arcade licensing, there is the additional problem of waiting until a title proves itself a hit on one format, before incurring the cost of reprogramming it for other formats. This can involve time delays that make it difficult for companies like Activision to maximize a hit game's "window," and to cross leverage advertising for both computers and game consoles.

  Computers are also clearly displacing dedicated game consoles. Extensive Yankee Group research revealed that by mid-1983, in households owning both computers and videogames, over 51% used the videogame less since purchase of the computer. The issue is whether computers are displacing game consoles or game playing. Despite

evidence of the importance of "entertainment" on home computers, there are strong indications that programming (especially involving soft software and user designed games), and programs like Logo are tapping into the time and energy previously dedicated just to gameplaying.

- crumbling installed bases and failure of game consoles to grow. By the end of 1982, Intellivision had a 16% market share and installed base approaching two million units. Timex had the largest installed base of home computers (650,000 units) and Odyssey, the original market pioneer, had placed around 600,000 units. By yearend 1983, TI will have an installed base of 1.5 million units, that will grow to a final figure of just over 2 million. With Mattel, Odyssey and TI now out of the business, and with the Timex TS1000 essentially in closeout, the value of these large installed bases is crumbling rapidly. Many software vendors produced games for the Intellivision unit in 1983, only to find that the unit was no longer selling in volume at retail, and more importantly, that distributors and retailers would no longer carry the software if they did not carry the hardware. (A significant part of Imagic's and Activision's difficulties can be traced to this factor.) So even though demand may exist by owners of these systems, it is very difficult for vendors to establish distribution, and mail order is likely to become the major channel for them during 1984.

An interesting dimension of the game console market has been the failure of the units to grow into computers as their manufacturers had strategized. The computer upgrade modules offered by Mattel for Intellivision, and by Entex (The Piggyback), Spectravideo, Emerson Radio, and Atari (The Graduate) for the Atari 2600, all failed to materialize. (see Table 2-4.) Entex cancelled the Piggyback for financing reasons; Spectravideo has also had problems financing its production (although it successfully raised over $6 million in a public offering early in the year) and Atari cancelled The Graduate, despite orders for over 400,000 units.

TABLE 2-4
PRODUCT OBSOLESCENCE IN THE COMPUTER AND VIDEOGAME MARKETS

Company	Product	Introduced	Delayed/Cancelled	Reason
Atari	The Graduate	February 1983	July 1983	Not price competitive by date of introduction
Coleco	Supergame Module	February 1983	July 1983	Subcontracted wafer-tape drive not ready
Commodore	Ultramax	June 1982	December 1982	Not price competitive by date of introduction
Entex	Piggyback	January 1983	May 1983	Financing difficulties
Mattel	Acquarius I	January 1983	June 1983	Not price competitive; Replaced by upgraded unit (Acquarius II)
	Acquarius II	June 1983	July 1983	Still not price competitive enough to justify introduction
NAP/Odyssey	Command Center	January 1983	July 1983	Computer upgrade for game console abandoned
Panasonic	JR100	June 1982	May 1983	Not price competitive; Replaced by upgraded unit (JR200)
	JR 200	June 1983	October 1983	Still not price competitive enough to justify introduction
Spectravideo	SV318	January 1983	June 1983	Not price competitive; Financing difficulties
Texas Instruments	TI 99/2	January 1983	April 1983	Not price competitive by date of introduction
	TI 99/8	[June 1983]	[October 1983]	Never officially introduced
Timex	TS 2000	January 1983	May 1983	Not price competitive; Replaced by upgraded unit (TS 2068)

Source: the Yankee Group

These product failures are directly related to the plummeting cost of home computers, which destroyed the competitive viability of the add-ons, for all their marketing appeal. This has left Coleco as the only company with a viable computer upgrade product. This is not surprising since Colecovision and the Adam computer were originally designed as an integrated system, unlike competitive upgrades, which were afterthoughts and showed it. However, Coleco's continuing problems in bringing Adam to market in volume and with reliability has somewhat undermined its competitive edge. The company remains uniquely positioned, however, as the only company offering an attractive product migration path from high-end game unit to a computer with real utility.

VII. The Coin-operated Game Software Market

The Amusement and Music Operators Association (AMOA) convention in New Orleans, October 28-30, 1983, has come and gone, and with it hopes of an imminent videogame industry rebirth based on laserdisc technology. The videogame industry has been in serious difficulties for most of 1983, although the timing and degree of the decline has been felt differently by each of the major segments -- arcade, programmable, tabletop, etc. Despite advances in the home market, the videogame industry is still largely driven by the coin-operated sector. Among the slew of difficulties facing the coin-op industry, the two most critical issues are flagging creative spirit and lagging technological innovation (see HOP Report No. XI, "Japan and the Next Generation of Consumer Electronics").

This latter factor in particular is now widely acknowledged, and since the last AMOA show in April, every major coin-op vendor has been scrambling to bring new product -- especially laserdisc product -- to market. The first disc-based unit in volume production for the arcades is an

elementary game called "Dragon's Lair" that uses cartoon-quality graphics by ex-Disney animator Don Bluth. It has achieved remarkable success in the few months since its introduction, with rentals ranging from $600-$1,200 per week. This compares to a 1983 industry average of $65-$75 per week and total revenues of around $4 billion, down from the heady days in 1981, when Pac-Man and other games pushed the industry average take to $120 per week, and total revenues to over $7 billion.

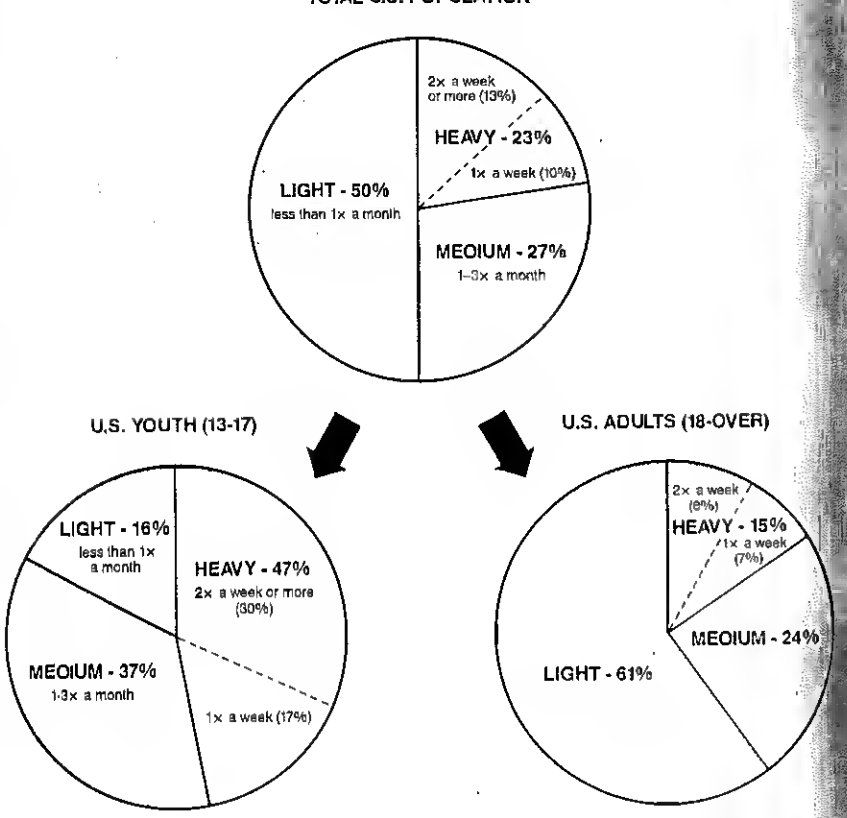
Distributors and operators at AMOA therefore had high, even desperate, hopes that somewhere at the show would be the solution to their current difficulties. Unfortunately, although there was much to stir their imagination, there was almost nothing for them actually to order. No single game stood out as a potential megahit, and most of the games available in any format were mediocre at best.

If there was a star of the show, it was videodisc technology itself, but it is a technology still very much in search of an acceptable product execution, hardware, and software. In all, 14 vendors showed videodisc-based games (including several so-called "gray area" gambling games), but few were ready for immediate shipment. None really tapped the imaging power of the new technology, or used it in a manner that added in any important way to the current vocabulary of game design and play.

Vendors that announced or demonstrated new arcade systems at AMOA are listed in Table 2-5.

Table 2-5 should be used with caution, since in almost every case, the actual date of availability is likely to be later than that announced by the vendor. Despite the enormous promise of interactive videodisc-based entertainment, the problems associated with the new medium are proving far more difficult and time-consuming than the vendors had anticipated.

FIGURE 2-1
FREQUENCY OF COIN-OP PLAY IN U.S.



* 1983 Gallup Poll of video game players

TABLE 2-5
NEW ARCADE SYSTEMS ANNOUNCED AT AMOA

Company	Game	Technology	Retail Price	Availability
Atari	Firefox	Disc	n/a (s)	Jan., 1984
	TX/1	3-screen	n/a (s)	March, 1984
Bally	Astron Belt	Disc	$5,995 (s)	Dec., 1983
Centuri	Badlands	Disc	n/a (u)	n/a
Cinematronics	Dragon's Lair	Disc	$4,695 (u)	July, 1983
	Spece Ace	Disc	n/a (u)	Feb., 1984
Data East	Begas Battle	Disc	$5,595 (u)	Oct., 1983
Digital Control	Countercade	Disc	$2,495 (c)*	Feb., 1984
Electro-Sport	Quarterhorse	Disc	$4,295 (u)*	Jan., 1984
Entertainment Sciences	Bouncer	High Resolution	$5,595 (u)	Jan., 1984
Exidy	Skeet Shoot	Large Screen	$4,195 (u)	Jan., 1984
Funai	Interstellar	Disc	$4,750 (s)	Jan., 1984
Mylstar (Gottlieb)	Mech III	Disc	$5,995 (s)	Nov., 1983
Simutrek	Cube Quest	Disc	$5,595 (u)	Dec., 1983
Stern Electronics	Cliffhanger	Disc	$5,195 (u)	Oct., 1983
	Goal to Go	Disc	n/a (u)	n/a
Status Games	Laser Shuffle	Disc	$3,795 (u)*	Dec., 1983
Taito	Laser Grand Prix	Disc	$5,495 (s)	Jan., 1984
Williams Electronics	Star Rider	Disc	n/a (s)	Jan., 1984

(c) = countertop
(s) = sitdown
(u) = upright

* "Gray area" gambling game

Source: the Yankee Group

Atari, for example, was on the cover of "Replay" magazine for "Firefox," its new videodisc-based game that uses footage from the Warner film of the same name. However, Atari was unable to demonstrate the game at AMOA on any of its sitdown cockpits (including an elaborate prototype styled directly from the movie), and delivery is now slated for early 1984. Sente Technology, Nolan Bushnell's new videogame company, contrary to industry speculation and Bushnell's own earlier comments, did not celebrate the ending of Bushnell's non-compete contract with Atari by showing a new game system. Instead Sente personnel wore "No comment" buttons, and pointed to a large anonymous box, with the coy notice "Do not Open till December 9" on the side. Since Sente is known to be working on both enhanced graphics capabilities as well as disc-based systems (the latter largely through another Bushnell company, ByVideo), it is not clear when Sente will in fact enter the market with a disc-based system as its first product. The December announcement was to be largely concerned with Bushnell's plan to launch a videogame franchising scheme, in which various kinds of consoles (conventional and disc) are sold or leased to operators on a regionally exclusive basis. The operators will then be able to rent up to four games a year from Bushnell's company at a flat fee (around $25 -$35 per week), depending on the game.

Similarly, "Star Rider" from Williams Electronics was demonstrated as a game-in-development rather than a finished product. Although Star Rider was the only disc unit at AMOA to use a pseudo-frame buffering technique that allows greater game design flexibility than its competitors, Williams has since layed off over 70 people, including most of its R & D division. (Williams game income in 1983 is largely from licensing rather than manufacturing.)

Bally's "Astron Belt" (brought over from Sega with Bally's purchase of Sega's U.S. manufacturing operation), like Data East's "Begas Battle" and Stern's "Cliffhanger," hardly

qualifies as much more than scrolling wall paper with occasional moments of interactivity. (According to Stern Electronics, which has licensed the first game from Laser Disc Computer Systems, it chose not to show the LDCS game on the grounds that it would undercut demand for Stern's other disc-based games, although a more likely reason is that the game had to be reprogrammed for Stern's single disc system.) Cinematronics/Starcom showed its new Bluth animated game "Space Ace" only in a private suite at the Marriot, with availability scheduled for February/March 1984. The new game will be available as a console and as a kit conversion for existing Dragon's Lair units.

Mylstar's "Mach III" is a conventional computer graphics target game that uses film footage as a backdrop for the aerial dogfights. New venture startup Simutrek (which is 25% owned by Robert Abel and Associates, the west coast computer graphics special effects house that contributed to the Disney movie "Tron") had the fanciest graphics of the show. Unfortunately, actual gameplay is limited to a small circle in center screen, and consists of a space target game using conventional arcade graphics. (As the company proudly explained, the game can be played even if the videodisc background is lost due to equipment failure.) Centuri's "Badlands" took the prize as worst disc-based game at the show, and has since been pulled, ostensibly for technical reasons.

In the absence of any potential major hit games using conventional arcade technology, some distributors and operators took what they could get of the laserdisc units, hoping that the novelty effect would be strong enough to allow them to recoup their investment and tide them over until better games emerge. Most were disappointed by the new games, however, especially given the much higher console prices, and adopted a cautious "test now, buy later" approach. Many in fact turned away from videogames, and looked for more traditional products

to round out their product lines -- manufacturers report renewed interest in pinballs, jukeboxes (especially the new videojukeboxes, see below), pool tables, etc. All the disc games at AMOA highlighted the embryonic stage of the new medium's development. In particular the following issues need to be addressed before laserdisc can make a significant contribution to the videogame industry.

A. Technology

Because of cost considerations, most game vendors are moving towards single rather than dual disc systems. Disc player manufacturers are trying to develop "instant access" single disc players that allow jumps of 100-plus frames at a time. At 30 frames a second, the 100-200 frame prototypes available from Pioneer, Philips and Hitachi provide limited jumps in any given sequence. (In testing, the prototypes are having difficulty in meeting their manufacturers' proposed specifications. The Philips player, for example, currently allows only 40-frame jumps in either direction before loss of color burst and sync make the image unacceptable.)

The new laserdisc players are not yet in volume production, and special agreements (Atari/Philips, Bally/Hitachi) mean that the units will be in restricted supply well into 1984. So far none of the major game vendors appears to be developing product based on RCA's recently announced interactive capacitance unit. It is also noteworthy but not surprising that much of the technical and creative innovation is coming from startup ventures such as Simutrek, Entertainment Sciences and LDCS, rather than from the established manufacturers.

Apart from access times on the disc, the use of computer graphic overlays is another critical technical issue with few areas of agreement. The most ambitious designers are developing systems that combine full disc interaction with

real-time graphics generation of varying levels of sophistication. Since game play is dependent directly on the level and speed of interactivity of the system, the manner and degree in which computer graphics (typically using the TI 9918 "sprite" chip) are integrated with video images on the disc significantly defines the overall attractiveness of the product. A major drawback of all the disc systems showed at AMOA was the slow and almost random level of interactivity with the screen, especially by comparison with the best of the conventional new games such as "Blaster" (Williams), "Star Wars" (Atari), "Track and Field" (Centuri/Konami), and the new high-end games like "Bouncer" (Entertainment Sciences) and "TX-1" (Alpha Densi/Tazmi, licensed to Atari).

"Bouncer," which represents the current state of the art in computer graphics games, offers an interesting counterpoint to the enthusiasm for disc-based games. The game offers superior resolution to conventional arcade games (512 X 384 vs. 256 X 256), and the graphics imaging is close to cartoon quality. To support this level of graphics capability, the game uses four microprocessors, including a 16-bit AMD 29116, and three 8-bit processors (compared to the one or two 8-bit processors typical of most arcade games). It also has one megabyte of (EPROM) memory (compared to 64K in most games) and is a real-time image processing system. The net effect of all this graphics technology is superior imaging capability and improved interactivity, albeit at significantly higher cost than standard arcade games. By comparison with a disc game like "Dragon's Lair," "Bouncer" offers almost the same level of imaging, and incomparably better gameplay, with the player able to control a variety of interacting factors (choice of target, speed, force, etc.) for a number of different characters on the screen.

Because of this multitude of choices and possible outcomes, games like "Bouncer" will remain challenging for far longer than a game like "Dragon's Lair" with its elementary branching

techniques. (Most of the disc games shown so far use a straightforward branching system; once the pattern is learned, there is no further surprise or challenge factor -- in Boston, for example, players who mastered the sequence simply pinned the "instructions" up on the side of the console for others to follow.) "Bouncer" resides in a single memory board, which the operator can easily replace with a new board for a different game, like the conversion kits for conventional arcade games or the kit approach to new disc games, where a board and disc change are required for a new game.

Although the Entertainment Sciences product is clearly a new level or generation of computer graphics for the arcades, it is also a transitional product at best, from a startup company scrambling for a place in the market. Larger companies (General Instruments, Atari, etc.) are also working on graphics chips that offer near-broadcast rather than cartoon quality graphics; the GI chip will be available in early 1984. Cartoon level images, even with complete interactivity, lack the psychic impact of film quality imagery, and the best game systems in the next three to five years are likely to incorporate both discs and superior graphics.

Game players, especially in the arcades, have become used to extremely fast response times, and very close connections between their own responses and what occurs on the screen. Indeed, it is precisely these correlations that allow a player to improve his/her game over time. Because of the limitations of the first generation of disc games, especially the tenuous connections between events on the screen and player responses, the new disc games represent a step backward rather than forward in game playing terms. Obviously, one of the attractions of disc-based games is that they offer features not found in conventional games, and therefore new and different kinds of games not dependent on simple reflex actions become possible. So far, however, the disc games are simply old games

in new clothes -- racing ("Star Rider") or target ("Mach III") games with improved special effects, rather than new game concepts.

The long-term viability of single-disc vs. dual-disc systems in the arcades is also still to be established in the field. Despite the greater capacity of optical compared to magnetic storage, video imagery is very space-consuming, and a typical laserdisc only provides 30 minutes of continuous play per side. Although this is enormous compared with existing arcade storage media (and, with imaginative layout of the disc, can be effectively increased by the non-obvious repetition of key sequences), a relatively elementary branching game like "Dragon's Lair" can easily consume an entire side.

Until very recently, 128K of memory was considered more than adequate for most personal computer applications. The popularity of the new integrated software programs like Lotus Development Corporation's "1-2-3" (which requires at least 192k of memory), and VisiCorp's VisiOn (which requires a hard disk drive) is making 256K the minimum acceptable level. Similarly, in the videodisc field, state-of-the-art games in the next 18 months may require an hour or more of video, and that means either longer recording times or multiple players. One scenario suggests that single-disc systems will prevail in the home, and dual- or multi-disc systems will dominate in the arcades, as the coin-op industry struggles to maintain a technological and experiential edge over the home/consumer environment.

B. Pricing

Single disc systems cost appreciably more than conventional arcade consoles ($5,000 vs $2,000). It is not clear that consumer, rather than industrial, machines are rugged enough to do the job, and it will take time for even stripped down industrial units in volume production to meet current price

levels. Even as hardware prices fall, the cost of programming the new disc-based games, many of them using licensed special effects footage from films, is soaring. The Yankee Group estimates that current disc games cost in the $200,000-$500,000 range, and that new games are likely to well exceed the $1 million level by the end of 1984 -- assuming the technical problems can be overcome, and that at least one major hit with staying power emerges.

The higher cost of the new hardware is a serious market handicap, given the high debt burden persisting at the distributor and operator level, especially in the current market downturn. Many distributors and operators therefore wait for even popular games to go into closeout, which is happening earlier and earlier in a game's lifecycle, as manufacturers struggle to meet their fixed costs. Higher prices are not an insurmountable obstacle, since distributors and major operators buy on an ROI (return on investment) rather than price basis. The new games typically come in sitdown versions, and, at 50 cents per play rather than the more typical 25 cents, generate higher revenues. The higher cost of the units does mean, however, that most street locations (which account for around 75% of the total existing installed base of game consolee) are not potential locations for the disc-based games at their current price levels, because the locations cannot generate the ROI to justify a $5,000 game.

Once there is an installed base of disc-based games (hopefully but unlikely, a standardized installed base), the economics change for the operator. New games cost only the price of the new disc/pc board. At present, second games for existing disc consoles are being priced similarly to kit conversion for conventional games, i.e., in the $700-$1,000 range. These prices could decline dramatically over time as the installed base rises.

C. Availability

After mammoth and thus far losing investments in videodisc players, the major manufacturers, especially Pioneer and Philips, are approaching the instant access market with caution. Tooling up production lines for one season is not to their advantage, and although most of them are now convinced that the arcade (and home) market are real enough, they want to be sure of just what is required technically before making even minor ramp-up commitments. In the end-user market, Cinematronics is the leader with a maximum of 7,500 "Dragon's Lair" units installed by yearend. The rest of the market combined will probably contribute a like amount, yielding an installed base of at most 15,000-17,000 unite in 1983. Assuming that at least several vendors produce ROI viable hit games, the Yankee Group estimates the installed base for laser disc-based units in the U.S. at about 50,000-60,000 units by yearend 1984.

D. Reliability

Most of the disc-based units in the field use consumer model Pioneer players. These were not designed for, nor are they holding up to, the rigors of the arcade market. The new "instant access" models are either industrial grade players or, like the new Pioneer LDV1000, new units positioned between consumer and industrial performance capabilities. A major drawback of disc-based games is service. Manufacturers' warranties are typically only 30-90 days, and are frequently breached by the game manufacturers in developing their proprietary game systems. Distributors are therefore having to take on the job of providing regional and national service and support for the disc players, a role for which they are ill-fitted.

E. Standardization

It is far too early for standardization to emerge in the technologically immature disc-based game market, but the corollary is a variety of competing and conflicting formats with incompatible software. To the extent that the R & D commitment of software developers is dependent on the potential size of the installed base, these incompatible formats clearly hinder overall market development.

F. Game Software

The biggest difficulty of the new disc-based games is not technological, however; it is creative. As pointed out above, most of the disc games introduced so far are simply variations on old themes with improved special effects. Even the use of cartoon quality graphics, undoubtedly superior though they are to current arcade graphics, suggests a serious misperception of what laserdisc technology brings to the interactive entertainment/education industries.

Most game manufacturers have opted for cartoon graphics because it makes the complex task of programming the branching sequences on the laserdisc much easier than trying to shoot live footage for every alternative in a game. Taking the path of least resistance, however, means sacrificing precisely what makes disc-based games potentially interesting -- the ability to provide (filmed) images with a level of resolution capable of emotionally involving the player beyond the stimulus/response categories of current games. Movies are popular because they are accepted as a surrogate reality with enormous psychic impact. Videogames are popular because they provide interactive entertainment. Once the imaging power of films (either on disc or by way of the new supervideo chips) is successfully combined with the interactivity of games, the interactive electronic entertainment market immediately is broadened and deepened. Interactive entertainment, education,

and training all take on a new lease once the medium is capable of emotionally, intellectually and physically involving adults as well as children.

As the arcade-oriented game companies are finding out, however, it takes much longer to program interactive disc games than computer graphics ones, and requires a wider variety of skills. Whether the existing game manufacturers are capable of developing or successfully subcontracting the requisite range of "software" skills necessary for the new generation of products remains to be seen. (Atari's link to Warner Films and Mylstar's link to Columbia Pictures become important and possibly critical advantages in this context.)

Game manufacturers such as Bally, Sega and to a lesser extent, Atari, grew primarily by licensing their arcade hit games from third-party vendors, especially such Japanese companies as Namco, Nintendo and Taito. The startup companies have yet to prove their game design capabilities, and so far co- or joint-ventures (rather than simply cross licensing) between companies with proven track records in the home like Activision and Broderbund, and the coin-op companies do not exist. Not that such co-ventures would be automatically guaranteed of success, anyway, because of the different skills required, but the best of the game companies do have game designers who have demonstrated that they understand something about the psychology of gaming and game players. But for the moment, the home videogame companies have their work cut out shifting their strategic and design focus from game consoles to home computers.

VIII. The Game Industry: Finding its True Market Level

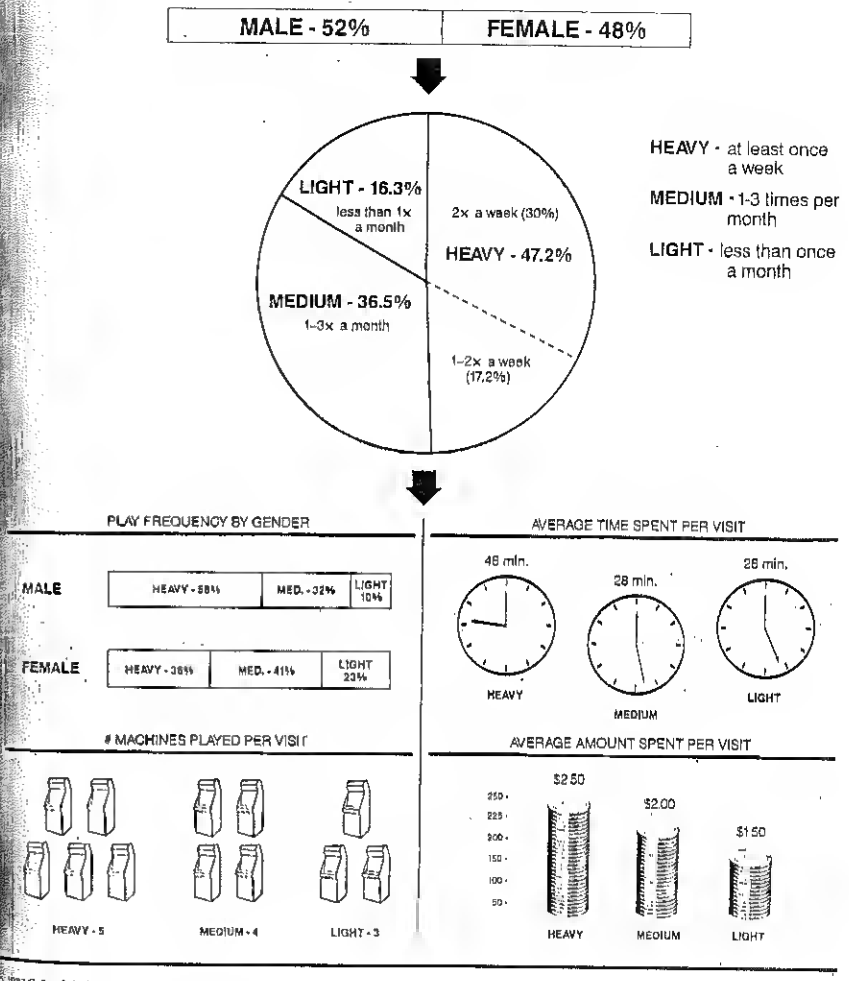
The videogame industry, coin-operated and home, has in many ways been the entertainment phenomenon of the last decade, with revenues soaring from less than $100 million to more than $10

billion in 1982. 1983 has seen a fallback, particularly in the arcades, with a decline of around 60% at coin-drop and around 85% at the arcade manufacturing level. Despite this downturn, the videogame industry is still an enormous one. At around $4.3 billion in 1983, the coin-operated sector is still bigger than the movie or record business. The home sector will be a $2.5 billion business at retail in 1983, most of it ($2 billion) being in software.

The Yankee Group believes strongly that interactive electronic entertainment (read videogaming) is here to stay and grow. Whether industry revenues ever reach or surpass the heady peaks of 1981 and 1982 is less important than that the industry matures from its unstable fad status to a perennial entertainment form. The fad element of videogames over the last few years inflated its revenues and made projections about its actual market level almost impossible. According to a Gallup poll taken in early 1983, 54% of the U.S. population play coin-operated games, and exactly 50% can be characterized as either medium (one to three times per month) or heavy (one time per week or more) players. Among U.S. youth (13-17 years), 84% are medium or heavy players of coin-operated games. (See Figures 2-2 and 2-3.)

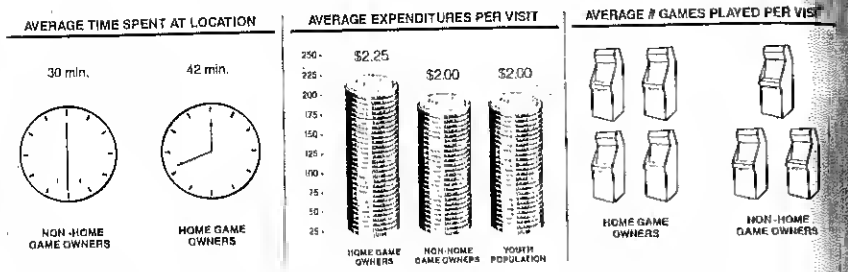
The current decline in videogame interest and revenues is part of a redefinition of the industry in terms of its core participants, the serious gameplayers. This group is obviously much smaller than the fad market, but it is still likely to be substantial. Moreover, as the industry moves through its technological rite of passage (the equivalent of the shift to sound in movies, or from mono to stereo in records), its ability to reattract larger numbers of (occasional) players should increase dramatically. However, even once the videogame industry cuts its technological teeth, and matures in artistic terms, it will continue to experience the revenue volatility of other entertainment industries, such as film and records, which

FIGURE 2-2
PATTERNS OF COIN-OP GAMEPLAYING AMONG U.S. YOUTH (13 - 17 YEARS)



1983 Gallup Poll of video game players

FIGURE 2-3
OWNERSHIP OF A HOME VIDEOGAME CONSOLE AND PATTERNS OF COIN-OP GAMEPLAYING



* 1983 Gallup Poll of video game players

rise and fall with seasonal regularity. Despite the lamentations of marketing executives during every decline about the changing demographics of their marketplace, or the impact of new technologies, the most important single factor in the fortunes of entertainment industries remains creative talent, and the ability to produce "hits."

At the moment the videogame spotlight is on the engineers and the technologies. Every time consumers have been given an option of higher prices (per game console in the home, or per play in the arcades) for higher levels of graphics imagery, they have chosen to spend more dollars. Full interactivity with broadcast quality graphics is clearly the goal of videogame engineers, although significant problems remain with instant access disc players, supervideo chip design, and the massive memory and processor requirements for real time manipulation of near-broadcast imagery. However, once these technologies are in place (as they should be for at least the next wave of product) by late 1984, the spotlight will shift again to creative talent. Beyond the novelty effect of the new technologies is the demand for improved game play and new kinds of games. The current transition between game technologies may be painful for vendors and operators, but if the industry can attract the creative talent it needs, its prospects seem assured.

CHAPTER THREE
MAJOR ISSUES IN SOFTWARE DEVELOPMENT

I. Distribution and Storage Media

A major issue in home and personal computing in the next several years is the differentiation of storage and publication/distribution media. Because semiconductor memory is volatile -- information disappears when power is turned off -- small computers require storage devices and media to preserve information from one session to another.

In the 1978-82 period, the 5.25-inch floppy disk emerged as the standard mass storage device for personal computers. "Floppies" have a unique cluster of attributes that gives them an edge over competing mass storage media. Both floppy disk drives and media are relatively low-cost when compared to Winchester and other "hard" disk devices; floppies are removable, allowing them to be archived and collected into libraries; and they provide quick random access, unlike tapes. Until recently, the price of floppy disk drives (typically around $400-$500) has prohibited their use for mass market computers, most of which use tape cassette storage, and some of which do not use anything. The slow speed and unreliability of standard tape cassettes make them less than desirable as a mass storage medium, despite their low cost. (See HOF Report No. VIII: "Personal Computers in the Home.")

As electromechanical devices, floppy disk drives, along with printer mechanisms, do not enjoy the same price curves as semiconductor devices, and have a higher final plateau. However, prices have been coming down rapidly for both. Commodore, the price leader for low cost peripherals as well as consoles, has brought the price of its 170K floppy disk drive for the Commodore 64 down to $250 at retail, and has achieved penetration of about 80% of consoles sold, a previously unheard-of level for the mass market.

Wafertape drives, which seem to offer very substantial cost advantages, appear to be on hold currently due to production problems in meeting the required performance specifications (see below), and their market window as an alternative medium in the mass market is narrowing rapidly. Coleco has introduced a non-standard "digital data pack" (which is simply a high performance tape drive) as the initial mass storage device for its Adam computer, although it will also be offering a disk drive in early 1984.

In the mass market, both minifloppy and wafertape drives are under pressure from microfloppies in the near term, and from semiconductor devices like non-volatile RAM memory, battery backed CMOS RAM, and bubble memory over the longer term.

A. Mass Storage vs. Publication/Distribution

While floppies are entrenched as storage media for personal computer systems, and increasingly for home systems, this in no way qualifies them as the ideal distribution medium for software. Indeed, there is a contradiction between the role of floppies for mass storage, and for distribution, a contradiction that permits software piracy and which has, and will continue to, reduced the role of floppy disk distribution beneath its market demand levels and will continue to do so. A storage medium can, by definition, be written on by the average oomputer user. Since microprocessors must at some point have their instructions in a "pure" native-code form, software will always be relatively easy to copy on disk-based systems. While disk-protection schemes discourage amateur copiers, hardware devices such as the "Quik Shot," which takes an undetectable snapshot of the computer's entire memory space, are impossible to defeat.

Cartridge-copying, while technically feasible, has not been as profitable (or more accurately, cost-saving) as copying

high-priced business disks. However, the emergence of low cost "promblasters" which make consumer copying of cartridges onto blank EPROM cartridges possible, may significantly diminish the apparent advantages of cartridges for distribution in terms of piracy. Even mail-order catalogs are now offering promblasters (ostensibly for cartridge backup) at around $100, and the price could fall well below that. Despite the fact that careless use of a cartridge (inserting or withdrawing it from the console while the power is on, for example), can damage it, cartridges are far more durable than diskettes, and much less liable to accidental erasure. Cartridge publication enjoys one other advantage at present, which hinges on consumer perceptions of legality. Copying of cartridges is generally considered illegal by consumers, while floppy-disk copying, supposedly for back-up, is not, since it is encouraged by the vendors themselves. This subtle point is an important one, best compared to consumer attitudes toward copying prerecorded video tapes -- perceived as being morally and legally wrong -- as opposed to home taping off the air, which is seen as a right.

Floppy disks can be published on demand -- one at a time if necessary -- and have been ideal for undercapitalized software houses. Cartridges using ROM memory require large "print" runs with attendant set-up and inventory carrying charges, as well as the risk of overproduction. With mid-sized software houses like Spinnaker, Adventure International and Broderbund entering the volatile cartridge market, a miscalculation such as that made by Atari with "E.T." or Data Age with "Journey Escape" could knock a firm out of business.

At retail, preferences for distribution media have been determined by the needs of the differing customer bases. Computer and software specialty stores, which account for the overwhelming bulk of diskette-based software, need the large capacities of the medium to store business programs that frequently run 100K to 250K. At the mass merchandising level,

the anti-piracy attributes of cartridges have made them the preferred medium, plus the fact that they produce fewer customer returns than cassettes and disks. The problem with cartridges thus far is the fact that they have a relatively high cost for a relatively limited capacity, a situation that is now starting to change.

II. Technology Trends in Distribution Media

A. Cartridges

The ROM cartridge will remain for some time the dominant means by which game and educational software is distributed. Cartridges are relatively indestructable and are easily used by children. Programs in cartridges are instantly available to the computer's microprocessor, and do not require a period of time -- often one to two minutes on computers with slow disk systems, such as the Apple II -- to load into RAM, as do programs distributed on disks or tapes. Cartridges are so widely used that the absence or presence of a cartridge slot on a computer is a very good indicator of its intended market. IBM's PCjr has two cartridge slots, clearly underlining its intended marketing focus as the "home" market.

To date, the terms "cartridge" and "ROM pack" have been freely interchangable, since few cartridges contain anything other than read only memories, printed circuit boards, and simple support circuitry. In the future, however, cartridges will contain chips other than ROMs. Cartridges involve publishing on silicon generally, as opposed to publishing information-coated magnetic media, such as tape or disk. Cartridge costs closely track those of semiconductor chips. Cartridge technology has enjoyed and will continue to enjoy the two fundamental trends in the semiconductor industry:

1. the movement toward higher levels of integration and performance at essentially stable prices;

2. the trend toward custom chip design brought about by advances in CAD/CAM engineering.

1. Near-Term Cartridge Trends

a. Larger ROMs

Higher levels of integration have allowed the size of Read Only Memories to grow from the current size of 32K bits (4K bytes) to 64K bits (8K bytes), to the 128- and 256K- bit sizes being introduced late in 1983. While larger chips are in the earlier stage of their life cycle and still relatively expensive, prices will fall within a year to a point where cost per bit of memory is lower than that of the smaller sizes.

b. EPROMs

Erasable Programmable Read Only Memories (EPROMs) are currently some $2 more expensive than masked ROMs, but have the advantage of being reusable. Romox, a Campbell, CA-based start-up, has since early 1983 published software on EPROM and, as a result, been able to offer software distributors a keenly competitive "full returns" policy similar to that found in the record and book industries. Despite the higher price, many software publishers in the games field have used EPROM cartridges for their first production runs when they are field testing new cartridges, or when a title takes off and they need a rapid ramp up of production to maximize sell through while demand is strong. Any major use of EPROMs in software publishing will drive their cost down to a point where, with inventory, carrying and returns cost considered, they may be more attractive than ROMs.

2. Custom ROMs

While ROMs to date largely have been commodity parts, much like 64K RAM chips, the increasing sophistication of semiconductor companies has reduced the cost and, equally important, lead time required to produce custom chips. Most well-known semiconductor manufacturers such as Motorola and TI have custom chip design, as do several dozen start-up companies, including VLSI Technologies, LSI Logic Corp., and International Microelectronic Products, Inc. Using a "standard cell" design technique, such companies have reduced the cost of designing a custom chip from some $250,000 to $75,000 and the time from 20 months to less than six months.

The Atari VCS market leads the way with custom chip designs, because of the size of the VCS installed base, and because of the performance limitations of the machine. All of the major VCS software houses have custom chip designs in progress. Custom chips in production for the Atari VCS include:

- Atari's 8K bank-switching chip. Atari released a number of games, including its "Adventure," "E.T," and "Raiders of the Lost Ark," on chips twice the size of the current 4K VCS standard. These chips incorporate patented circuitry that flips the two 4K pages in and out of the VCS's limited memory space.

- Activision's Custom Chip. More secretive than other game houses, Activision has under development a large ROM that includes some circuitry for enhancing VCS graphics, as well as a subroutine library available for use by Activition programmers.

- Parker Brothers' 8K "Page Mode ROM." For games shipped in the last part of 1983, Parker Brothers has had Motorola and a Taiwanese semiconductor house design a 8K "page mode ROM" that switches 1K pages in and out of VCS memory in varying combinations.

- Imagic's "Dabbler II." Before its difficulties, Imagic, the Los Gatos, CA-based game house, took a 2-chip solution to the cartridge problem, and had NEC design a chip that can interface the VCS to commodity 8- and 16K ROMs and to RAM. Parker Brothers also has a 2-chip cartridge that adds RAM to the VCS.

- CBS ROM/RAM chip. For its games "Tunnel Runner" and "Wings," CBS Games designed a 12K ROM and 128-byte CMOS RAM chip.

At least one VCS chip, designed by Pacific TriComp Polytechnical and fabricated by AMI, will be sold to third party software houses.

3. Mass Storage in Cartridges

Semiconductor chip prices follow the same economics as paperback books. Any chip contains material -- sand -- that costs about 50 cents. There are some assembly costs involved in making chips, especially in bonding leads, but in general the materials cost of a chip on the margin is little more than a dollar. Z-80 microprocessors today sell for $2, and some memory chips for as little as $1.20.

As the prices of these older chips show, the major cost of making chips is the cost of set-up and design. If these costs can be amortized over enough units, the marginal cost of even the most complex chip will approach its materials cost. Naturally, it is in the interests of the company that originally designed the chip to maintain its price above cost in an effort to recover R&D expenses and sustain its profits. But, given multiple sourcing and price competition, prices to end users eventually follow the unit cost curve. Because of their large requirements, companies using cartridges for software distribution are in a unique position to push chip technologies down the learning curve. (Atari alone used almost one half of the world's production of ROM memories in 1982.) A number of new semiconductor products stand to benefit from use in cartridges:

- non-volatile RAMs. Non-volatile RAMs, or "non-RAMs," currently are limited in capacity to some 256 to 2000 bits, but offer major advantages for disk-less low end home game and computer systems. Non-RAMs used in cartridges could store small amounts of information that could be used for a variety of applications, such as a user's current checkbook balance, sign-on codes, weight, key medical history, or location in an adventure game. Because it is non-volatile, the information can be used repeatedly without being lost at the end of a session. Seeq, a San Jose company, and Xicor are the leading makers of non-RAMs.

- CMOS RAM. One of the original semiconductor technologies, CMOS has come back into favor by virtue of its low power requirements, especially for use in portable computers. CMOS memory is volatile, but can be backed up easily by a battery to preserve small amounts of information while a computer is off. Control Video Corporation's Gameline's adaptor uses a 2K CMOS RAM to etore various personalized codes, while the extremely successful Tandy TRS-100 uses CMOS RAM to preserve user-written notes and programs in memory.

- bubble memories. Having passed in and out of fashion, bubble memory, which is non-volatile, remaine a potential threat to electromechanical storage devices such as tapee and disks. Bubble memory has gained a reputation for reliability in the paet few years, prices are falling, and the product is in active use in portable computers such as the Grid Systems' "Compase" computer, the Gavalan, and several Japanese computers. The new Tandy TRS 200 portable computer being designed by Microsoft is rumored to use 256K of bubble memory to complement the 256K of RAM. Intel has introduced a bubble holding one megabit of information, that is, about half the information on a 5.25-inch floppy disk.

B. Wafertape

Wafertape is a new version of an old storage technology, mag tape. The technology offers a number of advantages, especially price. Wafertape is a digital tape of extreme simplicity. The drive mechanism has one moving part, the capstan, which pulls the tape through the drive in a continuous loop (as on an eight-track audio cassette). A computer "searches" the tape by simply playing, if necessary, a full loop of the tape, which varies from five to 50 feet in length, and may take as much as one minute to come full cycle. Wafertape drives have a manufacturing cost of approximately $15. Individual tapes hold between 48K and 128K of information, depending on length. (See HOF Report No. VIII: "Personal Computers in the Home.")

Timex recently has demonstrated an extremely compact wafertape drive with 85K capacity and an average accese time of 3.5 seconds. The drives can be strung in eerial fashion up to six at a time, and are expected to retail below $100 when they are officially introduced in 1984 at CES. Entrepo, the Cupertino CA based company that pioneered wafertape, has been unable to deliver product up to the required performance levels, partially as a result of undercapitalized funding of its tooling facilities. Wafers are still not completely interchangeable, meaning that a wafer written on one system may not read well on another; further, the tapes wear out after several thousand passes, a level considered unacceptable for the consumer market by quality conscious companies. To overcome these problems, Entrepo has sought and found a partner in BSR Ltd., the Hong Kong-based electronic components and consumer electronics company, which has acquired a third of the equity in Entrepo. BSR is finalizing the R & D on the waferdrive which it will also manufacture. (TI, which had licensed the wafertape technology from Entrepo, was manufacturing its own drives to overcome the production problems.)

The extremely low manufacturing cost and small size of the wafertape drive continues to make it attractive as a mass storage device where cost is critical, or possibly in portables, where size is important. However, as noted in the discussion of both microfloppy and semiconductor alternatives, wafertape's window of opportunity is rapidly closing. As a distribution medium, wafertape competes with floppies in price, with blank wafers in any quantity costing under 50 cents each. The tape used currently is mass manufactured as video tape, purchased on reels, and sliced to the wafer's .068 inch thickness. Various lubricants applied to the tape are critical for successful functioning of the drive.

C. Audio & Digital Cassette Tape

Caseette drives differ from wafertape drives in having two hubs rather than one. Cassette drives must be able to move tape both forward and backwarde between the two hubs, adding complexity and cost to the motor and control mechanism. In general, a cassette drive has a manufacturing cost some two to three times that of a wafertape drive of comparable quality.

In other respecte, cassette drives used on low-cost home computer systems eseentially are identical to home audio cassettes, although "digital" drivee have fixed volume and tone levels optimized for recording data, ueing the same FM and MFM recording tschniques ueed on floppy disks. Nearly all low-cost home computers can use cassette tapes in their minimal configurations, and many personal computers of the 1976-81 design generation, including the Apple II and IBM PC, have vestigial cassette ports now largely unused. In general, cassettes have a reputation among consumers for being inconvenient and unreliable. Because of their low cost, familiarity, and availability for other uses, data cassettes still constitute the primary mass storage device at the mass market level. Since 1979, the number of programs distributed

on cassette tape has steadily dropped in favor of cartridge and diskette. However, for particular brands, including the Timex TS1000 and Commodore VIC 20, cassette remains an important distribution format.

D. Micro-Floppies

The "micro," or 3- to 3.5-inch floppy disk, was first introduced in 1980, and is a result of engineering progress on floppy disks and disk media that allows between 500K and 1 megabyte on a single disk. With this capacity, which matches or exceeds that found on 5.25-inch drives used on personal computer systems today, the micro format slowly is gaining acceptance as a low-cost replacement for the 5.25-inch drive. Amdek now sells a $299 microfloppy replacement for Apple's 5.25-inch drive, which typically sells for $550. Desktop office machines from Sony (SMC-70), and Hewlett-Packard (H-P 150) already use the drives, and several manufacturers, including Apple for the Macintosh and Commodore for the Commodore 64 and subsequent models, are expected to announce units with microfloppy drives in 1984.

Microfloppiee have several important advantagee over 5.25-inch floppies as software distribution media. The disks, which come in a hard plastic case, are small -- thsy fit sasily into a shirt pocket -- and lend themselves to book-sized packaging that is easy to rack. The plastic shell has a shutter to protect the recording surface when the disk is outeide the drive, allowing the cassettes to be handled by children, dropped, and otherwise abused without damage to the disk inside.

The microfloppy disk is not one format, but several, including a 3.5-inch sized disk introduced by Sony in 1980 and a three-inch format developed by Hitachi in 1981. Sony won a major battle for its format with a large order from

Hewlett-Packard in 1982, but major announcements in favor of the Hitachi format are expected in 1984. Sony has the support of two major U.S. drive manufacturers, Shugart Associates and Tandon, while Hitachi has support of a host of smaller companies. Table 3-2 gives the complete roster of each team.

Two other microfloppy formats, a 3.25-inch disk sponsored by Dysan, the disk media company, and another four-inch format of IBM, also exist. IBM does not seem to have plans to push its format, which is technically inferior to the others, although any choice by IBM would become a de facto standard. Hitachi expects sales of drives will double from one-half million units in 1983 to one million in 1984, and disk media sales to jump from four to five million units in 1983 to 20 million in 1984.

E. Minifloppy Disks

The 5.25-inch floppy disk is at present the major medium used for distribution of personal, as opposed to home, computer software. Unlike cartridges, which currently can store at best 32K bytes of program information, floppies can store between 140K (Apple II/e) and 360K (IBM PCjr, Wang) at a retail cost per blank floppy of some $1.60. Floppies can be duplicated in runs as small as 50 or 100, avoiding the overproduction problems common in ROM-based cartridges. As computer software becomes a mass market business, however, the Yankee Group believes that minifloppies will lose ground among publishers to sealed microfloppy and cartridge formats. Unprotected minifloppies are somewhat unreliable for mass market distribution, being especially sensitive to dust, heat and general abuse. The 5.25-inch floppy also presents packaging problems because of its size.

III. Piracy, Copyright and Media Issues

Far and away the biggest single problem with diskettes, however, is piracy. MicroPro International, to cite an extreme case, claims that there are five bootleg copies of its "Word star" word processing program for every legitimate one. Whatever the correct figure, copying of disk-based games and productivity is a serious problem for software publishers. Not every recipient of a bootleg disk would have bought a program -- many pirates are collectors, who like to have things without necessarily using them -- but clearly some percentage of software sales are lost to pirate copies. Most copying is informal, among friends, computer club members, or in schools, and thus extremely difficult, sometimes for public relations reasons, to stop. An extensive survey of the problem by the Yankee Group revealed that consumers admitted to informally swapping or exchanging software programs an average of once to twice a month. Among high-end owners, 40% of owners swap or exchange programs "before buying them." Program exchange and copying was particularly prevalent among Apple II/e owners, in part because they are an especially well connected community through active user groups. Since consumers are likely to under-report activities such as exchange and swapping, the actual average per month is probably higher.

Among young software pirates, cracking software protection schemes is a form of recreation, often considered more satisfying than adventure, strategy, or other types of games. In the Apple II game market, piracy has created an escalation of electronic measures and countermeasures likely to be duplicated in any large disk market. At first, software publishers protected programs only against the relatively simple disk copy utilities distributed by Apple on its system disk. These programs were relatively easy to defeat by faking "bad" disk sectors, a technique currently used to protect software on the IBM PC. Within a relatively short period of

time, however, the first generation of so-called "nibble" copy programs appeared. These programs, all written in machine language, read a disk track as many times as necessary to get consistent data (speed variations among disk drives cause them problems), then rewrite the data to another disk.

In response to nibble-copy programs, such as "Locksmith" and "Nibbles Away," software publishers developed "nibble resistant" formats, which required that they completely rewrite sections of Apple's operating system, and usually meant that any disk other than the particular game disk could not be used without restarting the computer. Even nibble-resistant programs, however, fell prey to a new type of device introduced in late 1982, the "Wildcard." The Wildcard is an Apple II card which, when installed, can "freeze" the memory of the computer, and write a snapshot of the memory to disk.

To copy a nibble-resistant program with the Wildcard simply required that a legitimate disk be read into memory, the program started, and a button on the Wildcard pushed. Some programs, such as large adventure games, could defeat the Wildcard by constantly checking the disk drive for an authentic disk. For other programs, however, such as "VisiCalc," which require that the disk be used for data, there is no technical remedy at present that does not require all users to have two disk drives.

VisiCorp, among others, has argued for putting serial numbers on software or hardware, or using plug-in "black boxes." Combination registration -- serial number schemes in which a machine has a serial number imbedded in its ROM which the user calls in after purchase -- is the current leading technological solution to piracy. VisiCorp is considering a serial number protection scheme for VisiOn.

Obviously, in the mass market it is unlikely that consumers would go to elaborate lengths to copy programs. The purpose of

he above discussion is simply to chronicle one aspect of the truggle against piracy and demonstrate the difficulties that technological solutions to the problem face. Once a program or protection device has been cracked, hobbyists rapidly distribute the solution to user groups around the country (including through publication on private bulletin boards) from whence they find their way into less hobbyist-oriented environments as schools and businesses, where the fact that a given program is pirated is frequently not even known to its user. The groups most guilty of illegal copying are generally considered to be students, small businesses, user groups, and commercial duplicators. Because professional users frequently do not themselves pay for the software they use, or can write it off for tax purposes, they typically do not have as much incentive to copy as consumers do.

The Yankee Group believes the most viable long-term solution to the problem of piracy is the emergence of cost-based pricing, which will become feasible once the installed base of users is sufficiently large to amortize the development costs of a program over many users at a small premium, rather than attempt to recover it through premium pricing on introduction. This does not answer the problem, however, of complex programs with high development costs that have only a limited market appeal and, therefore, a smaller potential user base over which to amortize costs. However, precisely because such programs are not intended for a large market, they undermine the hobbyist incentive and informal networks necessary for successful, widespread piracy.

A. Copyright and Computer Software

Three general legal means exist for protecting computer software from duplication: copyright protection, patent protection, and trade secrecy. In the past few years, secrecy and copyright have emerged as the primary means by which

programs are protected. Copyrights and trade secrecy are in some respects at odds with each other, and neither is completely satisfactory in itself. The issues of the definition of intellectual property in the age of its electronic creation, publication and distribution are enormously complex, and are the subject of major investigative and analytic efforts by academics, jurists, and government policy makers.

1. Patent Protection

The U.S. Supreme Court generally has held that software is not patentable. Many programmers belive that some software techniques are "useful," "novel," and "non-obvious," the key requirements for patentability of a mechanical invention. The Court, however, has held that software is akin to mathematics and pure science, whose principles are discovered, not invented.

In some recent decisions, U.S. courts have allowed patents on software, especially non-numeric software. In 1980, Whitlow Computer Systems of Englewood Cliffs NJ, was issued a patent on a sorting program, "SyncSort," used on IBM mainframes. "SyncSort," which contains no mathematical expressions, and whose goal is not solution of an equation, passed the so-called "Two-Step Freeman Test" that is designed to weed out unpatentable software.

2. Copyright Protection

In 1980, the U.S. Copyright Act was amended specifically to include computer programs as articles subject to copyright law. While programs had been accepted for registration by the Copyright office since 1964, only a few hundred were registered each year. In 1982, over 6,000 were registered.

While copyright has emerged as the "official" means of protection for programs, serious problems with this approach

remain. Some historical perspective is in order. Under the 1909 Copyright Act, "machine parts," such as the perforated rolls used in player pianos, were not subject to copyright law. Thus, while sheet music, which can be read by humans, was copyrightable, piano rolls were not.

Similar reasoning has been used to deny computer programs, especially operating system ROMs, copyright protection, most recently Apple's operating system judiciously "reworked" by Franklin for its "Ace" computer. In denying Apple (supported by Microsoft and VisiCorp) a temporary injunction against Franklin, Judge Clarence Newcomer asserted that the operating system code was an "essential element of the machine" that was "not designed to be read by a human." A federal appeals court in Philadelphia overturned this decision in the fall of 1983, and ruled that software is copyrightable, whether it is on a disk or built into the computer in ROM. Although the case, or others like it could still be appealed to the Supreme Court, for the moment the decision has given a boost to software developers, and to the trend to ROM-based software and "firmware."

3. Trade Secrecy Protection

Copyright in theory requires public deposit of the work that is being protected: the work is public, that is to say, published, but the right to copy it is limited.

Software publishers naturally are reluctant to publish the code, particularly the source code, of their programs. (Object code, which is the binary machine code that is assembled or compiled from source code, is far more difficult to follow, and requires a painstaking process of "disassembly" to crack).

In general, software companies prefer to maintain programs as secrets under their control, rather than exchange secrecy for copyright. Some try to have it both ways: Texas

Instruments, for example, files for copyright on both the source and object code of its software products, but deletes proprietary information from its filings. Since secret copyrights are not permissible, such strategy is unlikely to stand up in a test.

B. Continuing Anti-Piracy Research

The Microcomputer Software Section of the Association of Data Processing Service Organizations (ADAPSO), has set up a software protection clearing house to collect data on possible technical solutions to software piracy. Its guidelines recommend:

- low additional cost of either hardware or software;
- that it not involve end-user installation;
- that it not affect program performance;
- that it not require memorization of a code, keys or use of a template for different products;
- and that it allow the user to make back-up disks.

Hardware-oriented solutions should be compatible with all floppy disk sizes and formats, require minimal RAM, allow use of a hard disk, be compatible with a wide range of microcomputers, be transferable from one computer to another, and transferable with a computer to a new owner of the same machine, and be compatible with a variety of operating systems.

The U.S. Copyright Office also is seeking comments on submission requirements for computer software, as a result of complaints by software producers that the current submission

scheme (which requires the first and last 25 pages of source code) leaves them relatively unprotected to would-be-copiers. The office is therefore considering, among other options, submissions in machine language rather than the more accessible languages like Fortran and Pascal.

CHAPTER FOUR
SOFTWARE TECHNOLOGY AND ADVANCED COMPUTER GRAPHICS

Advances in home and personal computer software technology are rarely advances in software engineering at all. With a few important exceptions in the areas of interactivity and multi-processor machines, very few new software techniques are pioneered on small machines. Rather, the rapid progress of micro software generally is a result of the increasing power of micro hardware, which has allowed an increasing number of existing minicomputer and mainframe functions to be implemented on personal and home machines.

Personal computer software, then, progresses by a "trickle down" effect from the mainframe world. Spreadsheets and "what if" financial modeling programs were in existence long before VisiCalc -- indeed, VisiCalc was developed on a minicomputer, before being ported to the Apple. Mainframes draw better graphics with higher resolution and can even, with proper peripherals, play better games. Only a few microcomputer research areas -- data flow machines, reduced instruction set computers (RISCs) -- are on what university and major R&D organizations would consider the frontier of software engineering.

That said, the exciting prospect of home and personal computers is precisely that they will take areas out of the lab and put them into mass circulation. Until the advent of microprocessor-based computer game systems, computer graphics primarily were of interest to draftsmen and a few CAD/CAM engineers. In a real sense, color business graphics and such highly interactive systems as Apple's Lisa have been legitimized by games, not the other way around; few companies would have made such an investment in a pre-Atari era.

As Chapter Two implied, predicting changes in microcomputer software technology is an indirect process, requiring a prediction of trends in microcomputer hardware, and an analysis of what "big computer" features this progress will allow at mass market levels. For the rest, software development, especially entertainment software, revolves around creativity, which is notoriously difficult to predict. Fortunately, creativity in software, as in architecture and other practical arts, operates in the real world. Chips and systems are the building materials of software artists: some types of creativity are possible with adobe, other types with glass and steel.

I. The Development of Broadcast Quality Graphics

Very few areas have been voted on by consumers with greater clarity than the question of graphics. Mattel's Intellivision -- whether one believed George Plimpton or not -- used the specific issue of graphics capability in its successful early rounds with Atari, only to be knocked out in 1982 by Coleco, which did the same thing to it. The resolution of a graphics system is generally measured by how many vertical raster lines are used by the system and by the number of independent dots or "pixels" (picture elements) it can display horizontally.

Vertical resolution, the first number, is not arbitrary on conventional television sets, since the TV's raster beam paints a fixed number of lines down the screen. In the NTSC television system used in the U.S. and Japan, there are a total of 525 horizontal lines from top to bottom on the screen. Of these, at best no more than 484 are visible, the others being evenly distributed into the black "bars" at top and bottom of the screen, that is, in the vertical blanking interval. On the average home set no more than 250-400 lines can be assumed to be visible, since consumer sets typically overscan to eliminate the black bars, and may also be old or poorly adjusted.

To reduce flicker, television displays are interlaced, that is, half the lines are drawn on one pass, and half the lines on another. Graphic display chips can generate non-interlaced video easily, but interlaced video requires considerably more circuitry, effort, and expense. The vertical resolution of computer systems thus "clusters" around two points, essentially 200 vertical lines per screen, and, less common, 400 lines per screen.

Horizontal resolution is more variable, but also clusters around certain points as a result of the properties of the NTSC color signal. In general, horizontal resolution that is some multiple of 160 prevents a smearing of the color of a picture ("artifacts"). Thus, the resolution of the older Atari VCS is exactly 160 color points, while that of the newer Atari 5200 is exactly 320. The horizontal resolution of the IBM personal computer color system is 640 dots across. The vertical and horizontal resolution of some popular systems generate color NTSC composite video. (See Table 4-1.)

A. Game Level Resolution - the TI 9918A

For the balance of 1983 and into 1984, most video games and home computers will operate at a "game machine" level of resolution of approximately 256 points horizontal and 192 lines vertical. In large part, this standard of resolution will be the result of design standardization around the Texas Instrument 9918A "sprite" chip, used in the Coleco, TI 99/4A, and Japan MSX standard.

A number of companies have designed video display processor (VDP) chips, which take care of the "busywork" involved in updating raster screen displays. The first important VDP was Atari's early "ANTIC" chip used in the VCS game system. This chip, also known as "Stella" or simply as the VCS Television

TABLE 4-1
SCREEN RESOLUTION LEVELS OF SELECTED COMPUTERS AND VIDEOGAME CONSOLES

Model	x No. of Colors No. of Hues	Screen Resolution: Horizontal x Vertical
Apple IIe	8 x 1	280 x 192
Atari VCS	16 x 8	160 x 192
Atari 5200	16 x 16	320 x 192
Atari 400/800	16 x 16	320 x 192
Colecovision/ Adam	16 x 1	256 x 192
Commodore 64	16 x 1	320 x 200
Commodore VIC 20	16 x 1	176 x 176
IBM PC	8 x 2	320 x 200
IBM PCjr	8 x 2	160 x 200, 320 x 200
	4 x 1 2 x 2	640 x 200
NEC APC	8 x 1*	640 x 470
Telidon**	16 x 1	256 x 200
TI 99/4A	16 x 1	256 x 192
Timex 2068	8 x 1	256 x 192
Monochrome Resolution:		
Apple Lisa		720 x 364
IBM PC		720 x 350
Wang Professional		800 x 300

* Many shades available to end-user through color-mixing. User can create own colors by mixing different colored pixels with any standard color.

** NAPLPS standard provides for a resolution of 256 x 192, although a terminal with higher resolution is supported. Each individual frame can support 16 colors, though with color-mixing over 2,000 shades can be created.

December 1983 Source: the Yankee Group

Interface Adaptor (TIA), was designed by Steve Mayer and Ron Milner in 1976, not long after their first look at the 6502 processor that would become the "brain" of the VCS.

"Stella" implemented a system now known as "player-missile" graphics. The VCS is a clever piece of hardware design intended to reduce RAM memory costs by generating its video display "on the fly," making the most out of its processor's speed, rather than use a memory-intensive bitmap. Thus the VCS has only 128 bytes of RAM memory, in addition to some 16 or so 8-bit registers within "Stella." These serve to give the VCS a basic background (not unlike Apple II's low resolution mode) of 40 blocks across the screen.

On top of this background, the VCS can "paint" two high-resolution players, each eight bits wide. By clever programming, 48 bits of high-resolution detail can be drawn across each horizontal line of the screen at a rate of 60 times per second. Interlacing the screen display produces more detail at a frame rate of 30 times per second. Updating the screen display slower than this creates more detail, but with flicker, which consumers found highly objectionable in the first Atari version of "Pac Man."

While the video chip used in the Atari 2600 can support two players, the chip used in the Atari 400 and 800 computers, and 5200 game machine can support four, along with a complicated array of other video effects. Atari's chips, however, have, in keeping with that company's arcade game heritage, generally been designed to move objects (spaceships, aliens) on a flat, two-dimensional playfield.

TI's video display chip, designed about the same time as Atari's second ANTIC chip, allowed not only for moving objects (up to five can be displayed on the same horizontal scan line), but for these objects to exist on multiple planes, up to 31,

each with ascending order of priority. The result is a visual field that can easily be used to create an illusion of depth, since "nearby" objects mask out "distant" objects.

The TI chip, like other video display chips, is essentially a type of coprocessor, which communicates with a main processor or CPU. The architecture of the Coleco game system is a typical example of the use of a coprocessor to reduce the workload of a microprocessor or CPU, in Coleco's case a Z-80. The microprocessor need not concern itself with updating the video display, and can concentrate on executing the game. Perhaps the classic example of a system that does not do this is the Atari VCS when it attempts to play chess; when playing the Atari "Chess" cartridge, the VCS simply turns off the screen, displaying random colors, while the microprocessor is calculating.

B. Broadcast Quality Graphics

A level of graphics quality beyond "game quality" graphics must be called "broadcast quality" graphics, that is, graphics that can, if properly formed and animated, create the imprssion of being broadcast analog television. Broadcast quality graphios have a screen resolution of 484 lines down and approximately 640 horizontal dots across, although the "temporal" resolution of such a system--the quality of animation that can be achieved--is far and away its critical measure.

Video games and othsr forms of electronic entertainment are essentially interactive, real-time animation. As such, three hardware items are critical to their production: RAM memory size, monitor quality, and processor speed.

1. RAM Memory

To be fair to the Atari VCS, the Coleco system was designed at a time when RAM memory prices were considerable lower than

they were in 1976. In general, the steadily falling price of RAM has allowed the development of "bitmap" graphics. Apple's Lisa, introduced in January 1983, is perhaps the extreme example to date; Lisa comes standard with a full megabyte of memory. Were the monochrome Lisa to use an 8- or 16-color display, the amount of memory needed by Lisa would be multipled by at least a factor of two.

With the advent of 256K RAMs, sampled in 1981 by the Japanese and in 1982 by IBM, AT&T, Intel and others in the U.S., and with 1- and 4-Megabit chips on the drawing boards, memory prices can be expected to continue to decline into the late 1980s. Memory cost, however, is not the only limit on the quality of graphics resolution that can be expected in home and personal computers. Equally important are total processing power, and monitor display resolution.

2. Monitor Resolution

Although Milton-Bradley's Vectrex game systsm is sold with a specialized monitor, most home games and mass computers are likely to use standard television sets for the rest of this decade. The resolution that can be achisved in the NTSC systsm places a fairly firm limit on graphics resolution at 484 lines down the screen (the number visibls out of the 525 lines used in the NTSC system) and approximately 640 horizontal dots across.

The average ill-adjusted homs television, of course, cannot be expected to achieve even this level of performance, and the number of horizontal dots varies with the size of the picture tube. The highest-quality monitors (not commercially available) made by Panasonic, for example, have the following horizontal resolution:

20 inch tube	920 horizontal
18 inch tube	890 horizontal
16 inch tube	790 horizontal
14 inch tube	750 horizontal

Short of current CRT shadow-mask technology being completely abandoned for a technology with higher resolution (not very likely, since competing technologies, like plasma and LCD screen, have lower resolution, if other more convenient features), these limits on monitor resolution will hold for most mass market applications except portable computers.

3. Processor Limitations

As RAM memory becomes less expensive, other limitations of bitmap graphics appear. Perhaps the most serious is the speed at which microprocessors work, or, more generally, the total processing throughput that can be achieved in a multi-processor system. Apple's Lisa, despite its state-of-the-art 32-bit Motorola 68000 microprocessor, cannot, for example, update its bit-mapped screen while in a scrolling mode any faster than a touch typist can type. Since their invention, processors generally have increased in the size of their registers, basic cycle time, and the width of the data path to memory. Table 4-2 shows the basic progression of major microprocessors.

Microprocessors have also increased in speed: new processors, such as the Motorola 68020, operate at a frequency of 10 and 12 megahertz, compared to the four megahertz of the Z-80 CPU, and one megahertz frequency of the 6502 used in the Apple II.

While processor speed will not limit the quality of still pictures displayed on a system, processor speed can limit the quality of moving images seriously, especially on bit-map displays. A simple movement of an alien on a bit-map display can require thousands of calculations, straining the fastest

Table 4-2

Internal Architecture and Data Bus Sizes for Selected Microprocessors

	-- Internal Register Size --		
Data Bus	8 bits	16 bits	32 bits
8 bits	Zilog Z-80 MOS 6502 Intel 8088	MC 6809 Intel 8088 Intel 188	
16 bits		Intel 8086 Zilog Z-8000 Intel 186	MC 68000 NCR 32-010
32 bits			Intel iAPX 432 HP 9000 Motorola 68020

December 1983 Source: the Yankee Group

processor. For high-quality graphic animation, no amount of processing power is enough: Digital Productions, a Hollywood computer graphics company started in 1982 by two computer scientists who, while at Information International, Inc., had worked on Disney's "Tron," uses a Cray-1 supercomputer for its animated effects.

Semiconductor chips, at least those made of silicon and kept outside supercooling baths, will probably never achieve speeds comparable to that of the Cray. The realistic approach to graphics processing in micro-based systems, then, favors distribution of compression techniques for the video image among many chips. Video display processors (VDPs) can be thought of as dedicated co-processors.

Just as microprocessors compete for "design wins," so video display processors compete to be selected in new systems. Several chips in or near production are candidates to create broadcast-quality graphics standard.

a. The Intel 82720

Intel's 82720 is an Americanized version of the NEC GDC, one of the few Japanese-designed chips to find its way into US computers. The Japanese, who use the same 525-line NTSC system as the Americans do, have a strong interest in developing computer graphics, since only very high resolution screen and printer graphics will permit Kanji word processing. Thus NEC's graphic display chip, introduced in 1981, was designed to work with a 480-line screen, and large amounts of memory. The chip is used in an NEC business computer sold in Japan, and in the Fortune Systems 32:16 made here.

The Intel 82720 is a version of the NEC chip designed to interface with the Intel family of microprocessors, including the 8086 or 80186. The 82720 manages up to 256K of display memory, relieving the system microprocessor of the burden of

computing the bit patterns of lines, and of coloring in polygon fills, by virtue of having a number of graphics "primitives" built into its hardware. The chip can also display text.

b. General Instrument's "AGILE"

General Instrument's AGILE ("Animation of Graphic Images by List Execution") chip, is designed to minimize both memory and processing requirements of microprocessor systems while achieving a 640 x 400 resolution display. Rather than use a full bit-map for graphic images, AGILE uses what might be called a very flexible sprite system, in which an indefinite number of sprites are linked together in a list. By capitalizing on the inherent redundancy in graphic images and scenes, AGILE utilizes the concept that all graphic images and scenes may be composed of a superimposition of a finite set of primitive shapes that may be pre-defined and pre-stored in local memory. Scenes are therefore broken up into an appropriate set of primary shapes with variable colors and light intensity. These shapes are then given symbolic names, and by using a unique GI-developed data structure to gather the primitives that compose a scene, AGILE can then dissect the composition in roster or list fashion to create the video signal. Moving or replicating objects on the screen requires changing pointers in the list, but does not require rewriting RAM memory unless the object's shape is changed, or a new object introduced. The data structure greatly reduces the amount of information storage that is required for the "listing" of the image, as well as providing a substantial reduction in the bandwidth necessary to transmit and recreate the picture.

When sampled in early 1984, 3-chip AGILE sets will be able, with adequate memory, to display near-broadcast quality still images, made possible in part by image enhancement hardware built into the chip. Much of AGILE's initial appeal will be

its ability to reproduce high-quality still video images from a limited amount of data in memory, and consequently, from a limited amount of transmitted data, as in a shop-at-home system. Windowing of displays and fairly complex animation also lend themselves to the linked list display structure. However, AGILE will need to be teamed with a fast processor, such as the 68000 or National Semiconductor 16032, to create real-time animation.

c. Floating Point Processors

While graphic display processors remove much of the workload from the CPU of a microsystem, there are other ways of sharing the computational work involved in graphics creation.

Most mainframes involved in "number crunching" or computation-intensive computing have specialized co-processors designed to do nothing but particular types of numeric calculations. These generally fall into two types: floating point processors, which specialize in multiplying and dividing large numbers to many digits of accuracy, and array processors, which are designed to perform operations on matrices.

Floating point arithmetic chips have been available for micros for some time, starting with the Advanced Micro Devices (AMD) 9511. This chip, placed on an Apple II board, was used as a ooprocessor in a graphics-oriented implementation of FORTH by Applied Analytics, Inc., in 1981. A far more powerful chip, the Intel 8087, became available in 1982. The 8087 is designed to work with the Intel 8088 or 8086 CPUs; in its PC, IBM left an empty socket for the 8087, which IBM began selling as an add-in modification in April 1983.

Chips like the 8087, which is also used in Grid System's Compass computer, can be used with proper software to make the rapid calculations required for computer graphics, either business graphics or animation. The Grid, which has integrated

software, is particularly dazzling in this regard, being able to display a complex graph, based on a spreadsheet, in a matter of seconds.

d. Silicon Graphics' "Geometry Engine"

A Mountain View CA company, Silicon Graphics, has developed an array-processing chip set specifically designed to perform matrix transformations used in 3-D graphics. At present, Silicon Graphics does not plan to sell the chips alone, but rather to build them into a high-speed graphics workstation for sale to the CAD market. Nevertheless, as arithmetic processor prices fall, a similar array processor for home systems is likely to emerge.

II. Film Quality Graphics

Disney's film "Tron" released in July 1982 created new interest in very high quality graphics and computer animation. Graphics for "Tron" -- much of which involved hand-inked animation done in Taiwan -- were produced by several companies, most notably III ("Triple-I"), Digital Productions, and the Mathematical Applications Group, Inc. (MAGI). Computer graphics suitable for use on 35mm film require a resolution of at least 1,500 lines, and at times upwards of 8,000 lines. This resolution is beyond the reach of conventional shadow-mask raster displays, and is generally not produced in real time -- indeed, a single film frame can take hours to be produced. For "Tron," a single frame of computer animation typically required drawing between five and 75 million "polygons" per frame, with 1,240 frames required for one second of animation. The New York Institute of Technology of Old Saybrook NY has had an animated film project underway for several years, "The Works" (licensed to Atari as special effects for a game), and is now considering entering the game design business by way of a joint

venture with one of the arcade vendors using videodisc technology.

With high computation requirements and slow rates of production, better-than-broadcast quality graphics are likely to remain in the domain of special effects houses for the forseeable future. Computer-animated effects primarily are produced for Hollywood films, such as "Tron" or other science fiction films, and television logos and commercials. Effects produced by mainframe computers compete with other, lower-cost production systems, including analog video effects generators, such as those used at Image West, and in filmmaking with traditional optical printing processes.

III. Graphics Standards

While the desirability of a graphics standard has been subject to constant discussion, a standard, if it emerges, seems more likely to come about in a de facto rather than de jure fashion. Graphics have been subject to rapid evolution in past years, not so much in technology, although this of course has changed, but in emphasis and applications. A graphics standard developed too early in the evolution of the industry runs the risk of inadequacy in the face of new applications. Of various graphics standards, the SIGGRAPH "core" standard, first developed in 1977, has the longest history and widest acceptance among the scientific community. The core standard is also one of the vaguest, and leaves considerable latitude in implementation. In mid-1981, a number of major corporations agreeded on the North American Presentation Level Protocol, or PLP, as a graphics standard for videotext and teletext systems.

In general, most graphics standards aim at creating a language of commands for drawing pictures that is independent of any particular piece of display hardware. Graphics commands

usually involve a set of "primitive" or low-level commands that do tasks like draw lines and circles, which can be grouped into long lists to provide complete instructions for drawing more complex scenes. Thus a house might be drawn by sending a command to draw a rectangle, followed by a command to draw a triangle for the roof and smaller rectangles for the windows.

Systems that can draw such shapes as rectangles and triangles are sometimes called alphageometric, as opposed to so-called alphamosaic. Mosaic systems work with little squares on the screen, typically 40 squares across by 24 squares down. Each square, in turn, contains a certain number of dots, perhaps 7 across by 9 down. Intellivision is an alphamosaic system.

In general, while both alphamosaic and alphageometric systems are adequate for drawing still pictures, both are poor when it comes to animation. Thus while Intellivision had static graphics superior to Atari's VCS, for example, even Intellivision's custom designed 16-bit processor, was unable to redraw its little squares at a rate that would produce smooth gameplay.

PLP alphageometric graphics suffer a similar problem in producing animation. To move a space ship in PLP, the ship must first be erased or "undrawn," then redrawn in its new position, with each line and arc of the ship's outline requiring further calculations. This requires considerably more processing overhead than hardware sprite systems, which can move the ship simply by changing the x-y coordinates of the space ship sprite. The Atari VCS TIA chip, Texas Instruments 9918A and GI "AGILE" chip are capable of sprite-type motion with varying degrees of graphic resolution. The general development of interactive microcomputer systems has shown it desirable to be "close to the hardware." Memory-mapped video displays, once out of favor compared to, say, ASCII terminals,

have proven superior in speed and responsiveness. Joysticks and input devices such as mice should be tied to the CPU, rather than interfaced through indirect links. A protocol, like PLP, is a "language," and, as such, is designed for transmission through a communications link. PLP was designed to minimize the number of bytes needed to describe a picture. While PLP is time-efficient from a communications point of view, it must be interpreted prior to display, making it difficult, if not impossible, to use in real time -- a critical requirement for game animation.

Given the importance of speed and interactivity in entertainment software, most programmers write games in assembly language, even when higher level tools abound. Assembly language allows programmers to manipulate graphic screens directly at speeds limited only by a computer's fundamental hardware. While assembly language is not portable, translations of games from one computer to another require optimization by hand in any event. Conversions are sometimes more difficult to program than originals.

For the foreseeable future, graphics standards among home and personal computers are likely to derive from the choices by menufacturers in hardware, not from standards committees. At the present level of game-machine graphics, the TI 9918 has emerged as something of a de facto standard, and is now a de jure standard in Japan, with the MSX. The Yankee Group believes that of the commercially available new generation of video chips, GI's AGILE chip (if launched on schedule) is a strong contender to achieve market domination for broadcast quality, 640 X 480 level graphics.

IV. Natural Languaga Software

As memory prices fall and microprocessors speed up, several forms of processing not involving graphics are also

facilitated. Among the most interesting are various techniques developed in research in artificial intelligence (AI), and to date restricted to large mainframes. A computer with a fast processor and large memory -- and probably programmed in Lisp -- could parse English language words typed in by users, and carry on relatively intelligent conversations with them. Adventure games, all of which use front-end parsers of varying quality, are in fact on the forefront of this technology, with Infocom's "Interlogic" products the most technically advanced.

For further information on the role of artificial intelligence research in home computer software development, see HOF Report 83-5, "Financial Planning Services & Software."

CHAPTER FIVE
EDUCATIONAL SOFTWARE

I. Overview

Until late 1982, educational software development grew relatively slowly, compared to entertainment, business/ productivity, and self-improvement software. The educational software that existed was directed primarily toward school use, with occasional modifications for the home. During 1982, several textbook publishers such as McGraw-Hill and Scott, Foresman tentatively tested the waters, and decided that the electronic education market was well worth pursuing. Not only is educational software a logical extension of textbook publishing, but it also represents an opportunity -- albeit a risky one -- for the traditionally staid publishing industry to give itself a much needed financial shot in the arm.

By first quarter 1983, most of the major textbook publishing houses, as well as several trade publishers (e.g., Simon & Schuster, and Doubleday), had entered the field, and computer vendors avidly were gathering them into their respective folds. The home education market has, from the first, been differentiated from the school market, and as it represented an unknown quantity to most textbook publishers, remained -- until mid-1983 -- the domain of major computer makers and independent software houses.

The Yankee Group estimates that total educational software sales accounted for about $80 million in 1982, or 10% of the total home/personal software dollar volume at retail, of which approximately $55 million was school software. In 1983, the Yankee Group projects that educational software will account for about $150 million in sales, divided almost equally between the home and school markets, or 8% of total software revenues. (Both educational and business software have smaller shares of

the total industry in 1983, with entertainment, system and home business making up the difference.)

By 1985, the Yankee Group believes home educational software will have outpaced school programs by almost 100%. (See Table 5-1) During 1984, the home market for educational software will surpass the school market in unit terms. 1983 was a transitional year for the market, as many new players joined the ever-expanding roster of authors and publishers. Yearend 1983 and early 1984 should see a flurry of acquisitions and joint ventures as the market nears a saturation point (widespread duplication of program subjects and a glut of titles), especially in terms of new entrants.

Leading the expected wave of educational acquisitions was Management Science America (MSA), manufacturer of Peachtree Software, which acquired Edu-Ware in August (in exchange for a combination of its stock, about $1.5 million in cash, and some deferred payments based on future revenues and profits of Edu-Ware).

A. Defining Educational Software

The approaches to developing educational software are as varied as teaching methods. Does one develop software for the slow learners in the hope that hands-on experience with a computer will succeed where textbooks have failed? What about the advanced students who require stimulation greater than can be provided in a traditional curriculum? Do parents want software in the home to reinforce what is being taught at school, or should it be supplemental or groundbreaking in nature? Will children be motivated to use educational software at home, or will they merely use the computer for videogames?

These are just a few of the critical questions that have yet to be resolved by the marketplace. The Yankee Group

TABLE 5-1
EDUCATIONAL SOFTWARE MARKET: 1982-85
(in $millions)

	School	Home	Total
1982	55	25	80
1983	77	73	150
1984	125	240	365
1985	170	330	500

December 1983

Source: The Yankee Group

believes that no simple answer, or type of software, will prevail. There is a need for as many types of educational software as there are types of students. But most school-oriented software falls into one of three categories:

- learning from -- computer-assisted instruction (CAI);
- learning with -- problem-solving (LOGO);
- learning about -- computer literacy.

1. "Learning From"

In this category, the computer is used as a teaching tool, mainly for what educators call "drill and practice," otherwise called CAI. This is the backbone of classroom instruction, and has changed relatively little in centuries of teaching. For this reason (and also because there is little innovation or creativity involved in drill and practice), CAI software is easy to develop. At least 90% of ths software used for instructional purposes in schools is of the CAI variety, but much of it is no better than an automatic page-turner -- merely duplicating textbook or workbook material.

Because CAI is designed to supplement textbooks and classroom instruction, it is not a real factor in the home educational market, except in the case of the "home schools" that are becoming increasingly popular around the country, especially in California. (Such home schools often are created by parents dissatisfied with the education their children receive in schools, and who obtain state authorization to fulfill curriculum requirements in a non-traditional way, by conducting classes at home.) However, there are a number of home programs designed for remedial purposes or for further enrichment for children who have mastered classroom material, and these can be considered as "quasi-CAI." The Yankee Group estimates that quasi-CAI accounts for about 15% of home

educational software. Most large educational software vendors offer these programs, including CBS, with its "Success With Math Series" and Edu-Ware's "Science of Learning Series."

There are both practical and philosophical reasons for the abundance of CAI software that is available:

- The inclusion of classroom computers in otherwise tight school budgets often depends on whether there is sufficient software to support the hardware purchase. CAI demonstrably fits into a standard curriculum, and does not necessarily require extensive teacher training.
- Despite inducing tedium in students and teachers alike, CAI works. It is appropriate and effective for remedial attention, and students can proceed through programs at their own pace.
- Teachers are comfortable with the method. By venturing into more complex uses of the computer, many untrained teachers fear they will lose their authority over students. They do not want to start at a student's level in learning to use the computer because the pupils frequently surpass the teacher.

CAI programs are easy to develop because thsy rsquire little interactivity from users. A correct input allows the student to advance to the next question; an incorrect answer may give the student a second chance before revealing the correct answer, but usually ths program does not take the student through a step-by-step analysis of his mistakes. A second approach to computer learning not only remedies this shortcoming, but also better utilizes the computer's capabilities.

2. "Learning With"

Under this heading fall computer programs that are oriented towards problem-solving and discovery. Here, the computer

becomes less a stern disciplinarian, and more an informed guide. The software that best characterizes this category also served to define it initially -- "Logo."

Logo is a computer language for children, developed over a period of 12 years by a team at the Massachusetts Institute of Technology (MIT) headed by Seymour Papert. The language is considered a "dialect" of LISP (LISt Programming), a logical language used extensively in artificial intelligence research. Logo is associated primarily with its turtle graphics, named for the triangular cursor on the screen identified to children as a turtle.

There are now many versions of Logo, with varying capabilities determined by memory requirements. (See Table 5-2) Many have graphics animation functions, using "sprites", -- cursor-like objects defined by appearance (shape, color, size), and velocity, that can be used to move objects around the screen or superimpose one on another.

Logo teaches users how to think about problems in procedural terms. They learn how to create and debug programs, and how to communicate with the computer using simple, common language. Used as a tool to improve a child's reasoning abilities, Logo also can assist in the way a student learns certain principles, such as in mathematics.

At the same time Logo was being developed, a team at Xerox's Palo Alto (CA) Research Center was working on a similar language called Smalltalk. Instead of supplying instructions themselves, students work within an established set of procedures in what is called a "high level programming environment." The software monitors the student's activities and provides diagnostic feedback where appropriate.

TABLE 5-2
COMPARISON CHART OF LOGO PROGRAMS FOR SELECTED COMPUTERS

Version	Hardware	Memory Needed	Availability of a Sprite	Software Capabilities and Intended Audience	Developed By	Price
Apple Logo	Apple II, II+, Franklin Ace	64K	Sprite version in planning, due in late '83 (will use peripheral)	Turtle graphics, list processing capabilities, advanced filing, math package, editor	Logo Computer Systems	$175.00
Atari Logo	Atari 800	32K	4 sprites	Turtle graphics, list and filing capabilities, math package, editor	Logo Computer Systems	$99.95
Color Logo (Tandy)	Tandy TRS Color Computer	Disk: 32 K Cartridge:16 K	None available	Turtle graphics only	Radio Shack Education Div.	$99.00
Commodore Logo	Commodore 64	64K	8 sprites	Turtle graphics, list and filing capabilities, math package, editor	Terrapin, Inc.	$99.95
DR. Logo	IBM PC	192K plus disk drive	None available	Turtle graphics, list and filing capabilities, game programming, split-screen debugging	Digital Research	$99.95 ($149.95 after 4/1/84)
IBM Logo	IBM PC, IBM PC XT	128K plus disk drive	None available	Turtle graphics, list and filing capabilities, math package, editor, can call up assembly language sub-routines	Logo Computer Systems	$175.00
Krell Logo	Apple II, II+ Franklin Ace	64K	Sprite board available	Turtle graphics, list and filing capabilities, math package, editor	MIT Logo Group and Krell	$89.95 (Sprite version is $400)
Terrapin Logo	Apple II, II+ Franklin Ace	64K	None available	Turtle graphics, list and filing capabilities, math package, editor	MIT Logo Group and Terrapin	$149.95
TI Logo	TI 99/4A	48K	Sprite capability built into hardware	Turtle graphics, limited list-processing capabilities, limited math package	MIT Logo Group and Texas Instruments	$129.95

December 1983

Source: the Yankee Group

These and other programs such as "Sophie," an intelligent tutoring program designed for adult education by Xerox' PARC facility, are at the forefront of electronic education, although in 1982 their unit share was only 5% of the educational software available. This percentage should grow to 7% in 1983, and close to 10% in 1984, due largely to the growing awareness of the new languages by parents and teachers. And while there will always be a need for CAI for the reasons listed above, a more open-ended and creative approach is better suited to the new generation of computer literate students.

3. "Learning About"

Falling somewhere between the other two types of educational software, this category consists of programs that offer instruction in computer literacy. This software, more than the other categories, translates into home use more smoothly.

Computer literacy software coneists largely of programming tutoriale and programs for learning to use individual computer modele. BASIC is etill the most widely taught computer language in echoole, but Pascal ie becoming increasingly popular with etudente, largely becauee of BASIC's inherent programming limitatione.

Since one of the major obetacles to maee acceptance of computere in schoole is the high level of computer illiteracy among teachere, "learning about" programs are also used to train teachers. Ae summer computer camps proliferate for children and young adulte, similar summer training programs for teachers are cropping up around the country. Tandy, for example, has announced "America's Educational Challenge," offering free computer literacy classes (to every teacher in the United States) at Radio Shack outlets.

II. The School Market

A. Hardware

The number of personal microcomputers used for instructional purposes in public schools tripled between 1980 and 1982, according to the U.S. Department of Education. There were close to 100,000 microcomputers (and 31,000 terminals) in the 24,000 U.S. public schools in 1982, more than double 1981's figure, and three times as many as in 1980. The Yankee Group projects that the installed base will swell to over 320,000 by yearend 1983, and will approach one million by 1986. The average number of machines per type of school in 1983 is: four for elementary schools; 6.8 for high schools; and 10.5 for senior highs.

It is difficult to know exactly how many computers there are in schools, and even more difficult to determine the purposes for which they are being used. What compounds the problem is the fact that while some school systems budget for and purchase numerous computers for many schools at once, others may simply send a teacher or administrator out to a retail store to buy one. Several computer manufacturers -- most notably Apple, Commodore, and Tandy -- have been donating computers to schools for several years. The so-callsd "Apple Bill" now before Congress, would allow the vendore to deduct more than the production costs of any computer they donate to elementary and secondary schools.

The Apple Bill (actually called the "Computer Equipment Contribution Act of 1982," proposed by Apple Computer Inc.) passed the House, but was brought before the Senate only a few days before the end of the session and was tabled until Congress reconvenes fall 1983. In the meantime, a law went into effect in California on January 1, 1983 giving state tax credits of 25% of the fair market value of the equipment involved to companies that donate computers to schools .

1. An Apple for the Teecher

Apple and Tandy have been neck-and-neck for the top market share spot in schools for several years, but the Yankee Group expects Tandy's share to slip in 1983. (See Table 5-3) The vendors themselves claim not to have reliable estimates of how many of their computers are in schools because the schools use different distribution channels to purchase the hardware.

Apple has achieved dominance because of the large number and range of programs written for it. Conversely, software publishers develop Apple software because it is so prevalent in schools. It continues to pursue the market vigorously, and recently announced substantial discounts for schools, including a "buy five get one free" promotion. While Tandy has cost advantages over Apple and offers a range of computer hardware models (including the only low-cost local network for schools for the TRS 80 II and up to 16 color computers), its disadvantages are working in concert to topple it from its position of strength. Among those disadvantages mentioned most often by educators and software developers are:

- confusion and incompatibility among different machines (TRS 80 II, I/III/4, Color);
- cassette format less appealing to publishers;
- distribution limited to company stores;
- relatively poor graphics;
- emphasis by company on business software rather than education;
- less technical support offered than for Apple.

2. IBM

With IBM's entry into personal and now home computers, the other players in the market have been looking over their

TABLE 5-3

MARKET SHARE BY UNITS OF COMPUTER VENDORS TO SCHOOLS

	1982	1983	1985
Apple	38%	39%	32%
Tandy	35%	30%	24%
Commodore 20%	24%	24%	24%
Atari	5%	3%	6%
TI	2%	2%	---
IBM	---	---	10%
Other	---	2%	4%

December 1983

Source: The Yankee Group

respective shoulders, assessing the potential impact. In the educational arena, this impact is only barely beginning to be felt, but should not be underestimated, especially with the introduction of the PCjr. For the educational market, with its needs for hardware continuity, product support and continuing software development, the PCjr is a high cost but secure investment.

So far, IBM has been involved in computer education primarily in three states: California, Florida, and New York. These states were chosen for their proximity to IBM facilities that can provide technical support. IBM has donated 1500 computers to teachers in selected schools, and is engaged in a program called "Writing to Read," in the three states above and seven others, in which pre-school children are taught to use the computer's keyboard to construct words and sentences as a tool to teach them to read.

IBM is aleo involved with Carnegie-Mellon University (Pittsburgh PA) to develop a prototype computer network that gives CMU's 5500 students direct access to the university's database. By 1991, CMU plans to have 7500 custom-designed IBM personal workstations, interconnected through a high-speed local area network (LAN). This project will enable IBM to learn first-hand about college-level computer needs and applications, and may help IBM become an authority on future institutional network projects.

B. Electronic Education

So far, the approach to electronic education has been to complement and supplement (to a limited extent) the traditional curriculum. Most school software cross-references one or more textbooks, with documentation suggesting to the teacher ways to incorporate text on the screen with that in the book.

McGraw-Hill New York City, which had 10 educational programs on the market by first quarter 1983, has concluded that software alone is not enough; it must be integrated with print-based, computer-oriented materials. The publisher will be placing strong emphasis on developing print and electronic learning products at the junior high level initially, and subsequently for elementary school students.

There is no definitive method for using the computer in the classroom. Some of the approaches include the following:

- using the computer as a learning tool, controlled by the teacher;
- breaking the class into groups, with the teacher as a supervisor;
- students themselves using PCs for remedial or enrichment activity;
- "computer-wise," older students teaching younger students (and teacher).

Four or five years ago, when computers in the classroom was a revolutionary idea, there was much concern (or optimism, in some quarters) that computers would replace teachers entirely in certain contexts, and that radical changes in curricula and methods would be required. Today, with the perspective of a few years of experience, such suggestions have proven largely groundless. In fact, only 10% of the nation's 48 million school children had access to computers in schools in 1982, and the average time logged on the computer per student during the year was only nine hours, according to the National Center for Education Statistics.

The Yankee Group believes that, to date, school courseware has reflected the demands of teachers and their ability to incorporate it into the curriculum. Many educators and courseware publishers have assumed that school software will

determine the direction in which the home educational market will develop. The Yankee Group differs, and rather believes, that it is educational software developed for the home market that will alter the nature of school courseware. In the future, it may well be the students' demands, rather than teacher preferences, that determine the courseware used in school.

This shift will not take place, however, until several other developments have occurred first:

- there is widespread training of teachers in the use of computers;
- curricula are changed to allow modification to, or replacement for, drill and practice;
- the home education market matures and consumers have a wide choice of high-quality entertainment-oriented education from which to choose.

C. The Publishers

So far, computer manufacturers have relied almost entirely on out-of-house authors for their educational software. Lacking the background to devise programs, vendors have restricted themselves to technical modifications of hardware, advertising and distribution support. Since late 1982, much effort was expended in signing publishers as licensees, but most of these arrangements are not exclusive. Few, if any, publishers want to take the risk of allying themselves with a single manufacturer when market positions are still in flux.

There are four broad categories of publishers for the school market:

1. Mom and Pop operations, i.e., former educators who market their own products, often through mail order. Most programs are considered of poor quality and do not sell well;
2. Cottage industry software developers -- small (under $3 million) companies such as Edu-Ware (Agoura CA) and PDI (Greenwich CT) that have acted quickly to meet specific needs, such as curriculum enrichment or remedial programs;
3. Small- to medium-sized publishers such as Milliken (see below) and Sterling Swift (Austin TX), that built early positions, but are now facing increasing competition;
4. Big publishers -- McGraw-Hill, Random House, Scholastic Inc., etc., which have large stables of authors and more capital to invest in new products.

The publishers profiled in the following sections were chosen for their different approaches to educational software. Milliken is the veteran player, but its edge has been eroded by latecomers. Among these are Scott, Foresman and McGraw-Hill, both prominent textbook publishers. IBM's school software plans are also mentioned, but it is still too soon to assess its direction for the future.

1. Milliken Publishing Co.

One of the earliest entrants in the field was Milliken Publishing Co. (St. Louis MO), which has been in the school market for over five years and in the home market for one year. About 95% of the company's electronic products are developed by an in-house staff, and most of those that come from free-lancers are submitted to several more months of testing by the staff before being released.

Milliken was probably the leading publisher of educational software in unit terms at yearend 1982, with 102 diskettes for Apple. But word in the industry is that the company's electronic ventures have yet to show a profit as a result of large start-up costs.

Although Milliken remained a strong player in 1983, its lead is being eroded by the large publishing houses which are more successful in selling software coordinated with long-established textbooks. The company will face even tougher competition in the home market, where it must acclimatize itself to different marketing and distribution strategies. The advantages Milliken has enjoyed in the school market have been due largely to lead time and affiliation with Apple (as well as high quality products), but neither will give the publisher a strong edge in the home market. In addition, Milliken, like other publishing houses, will have to determine soon whether the entry of videogame manufacturers in the "edutainment" end of the business presents a threat or an opportunity.

2. Scott, Foresman and Co.

This respected textbook publisher (1982 annual revenues of around $2 million), based in Glenview IL, has come on strongly in the school market with its three-year-old electronic publishing division. Its 30 core "modules" or programs for the TI 99/4A and 12 for Apple have been on the market for about a year, and the company had 80 to 100 titles by yearend 1983.

The remaining core modules are being converted to the Apple II+ (some also for Apple IIe) and Atari computers, and some of these, as well as other titles, will be available for the Commodore 64 and PET, TRS-80 Model III, and the IBM PC.

Scott, Foresman uses both in-house staff and free-lancers to develop its software. Its relationship with the free-lancers is on an author/editor/royalty basis. The publisher maintains a separation between its programmers and courseware developers, particularly since it is difficult to find people who both understand the learning process and can translate it into computer code.

Scott, Foresman initially concentrated on producing software for TI. The subsequent bail out of TI from the home computer market, underlines the risk inherent in developing markets, and of the risk of commiting to a hardware system that does not have a continuing growth path, both in units shipped, and upgradabilty.

The publisher plans to continue producing software for TI to market, although it is now looking more to Commodore to establish leading market share in the home.

3. McGraw-Hill

McGraw-Hill is a $1.2 billion corporation that owns seven companies, including Standard & Poor's and Data Resources Inc. (DRI), as well as Business Week and over 500 other bases of information. Its book division is involved in developing educational software (its DRI subsidiary is responsible for publishing business software). The company does not use in-house authors, but works on a contractual basis with outside development companies, or modifies programs received "over the transom."

As mentioned previously, McGraw-Hill's approach to educational software differs somewhat from others in that the company concentrates almost as much effort on publishing print-based materials as electronic ones. At this time, McGraw-Hill has developed software only for the school market, but anticipates getting into the home market probably in the second quarter 1984, or when the school base is well established.

The company's initial offering was a five program package for Apple and Tandy called the Search Series, developed by Tom Snyder, who created the highly successful "Snooper Troops" series for Spinnaker. (See below and Chapter Four.)

McGraw-Hill released another five drill and practice programs for the same two computers, as well as for the Commodore PET. The publisher sees Commodore as a significant market, but has no plans to produce software for TI, partly because of the vendor's insistence on the right of first refusal on licensing arrangements for the Atari 800 and 1200XL.

Despite the cassette software developed for the PET computer, McGraw-Hill has no plans to continue producing programs in that format.

McGraw-Hill's plans for its home-oriented software are still nebulous at this time, but certain indications give the Yankee Group reason to question the publishing conglomerate's approach and potential success in the market:

- the introduction of the first home programs will come at a time when a shakeout -- or at least a shakeup -- in the home software industry is likely to be taking place;
- M-H is not working with companies whose record in the home already has been proven, but instead, largely with software authors who have not worked for anyone else and are willing to sign exclusive agreements;
- M-H wants to publish software that will "endure" (for 10 years!) and that will be "spectacular productions," but which are non-entertainment in nature;
- programs will geared for high-end consoles, in predominantly disk format, with memory requirements starting at 64K, and some probably requiring 128K.

With the introduction of the first titles yet a year away, McGraw-Hill's best advantage is the opportunity to watch the market and guage its own strategy accordingly. In addition, it has the reputation, sales force, and advertising dollars to back its products and tide it through the rough waters it is bound to encounter.

4. IBM

Although IBM has developed some of its own educational software, it does not (at this time) plan to forge ahead into this market. Instead, it plans to continue its present strategy of sifting through the available software, and selecting those it considers to be of highest quality.

Recently, IBM announced contracts with three publishers: McGraw-Hill, MECC, and Sterling Swift. The company plans to continue using third-party publishers, and will target both school and home markets for its programs.

D. Market Segmentation

Most of those publishers who do not distinguish between the school and home markets for educational software believe that by simply repackaging their programs, they are positioned to move freely between markets. With very few exceptions, they are mistaken. Just how distinct the two markets are has still to be established, since there has been relatively little demand from the home to date. But without an entertainment orientation, educational software in the home usually receives a failing grade from consumers.

"Edutainment" is the newly coined, too-cute term for this blend of education and entertainment, and while it doesn't quite come trippingly off the tongue, it suffices to describe educational software in the home as opposed to the school. While educational software may be purchased by parents, it is kids who must use it. In fact, educational software may be driving many first purchases of home computers, as parents grow concerned that their child will be left behind.

In addition to an element of fun, there are other distinctions between edutainment and courseware. (Table 5-4)

TABLE 5-4
EDUTAINMENT VS. SCHOOL SOFTWARE

Home	School
Less formal content per program	More content per program
More "entertaining"	More "instructional"
More "drawback" (repeatability)	Detailed documentation cross-referenced to texts
Specific content areas (e.g., logic, patterns)	General content areas (i.e., multiplication)
Single user oriented	Multiple user oriented

December 1983

Source: the Yankee Group

III. Education at Home

There is a case to be made for the fact that parents are placing more emphasis than ever on education in the home. Not only are parents older and better educated on average before having children, but educational costs are climbing steadily upward, and private schools are becoming increasingly selective. Because of this, parents feel the need to make their child academically competitive, practically from the moment of birth. As Newsweek and other popular media have recorded, they are enrolling their three-month-old infants in courses ranging from classical music to mathematical concepts. Even before giving birth, mothers put their child-to-be on waiting lists for exclusive private nursery schools. And often, parents who both work feel that they must enrich the time the child spends away from them, particularly by filling the child's head with as much knowledge as it can hold.

And what better tool is there that contains the key to all that knowledge than a computer? But until recently, once parents bought a computer and got it home, there was a scant supply of educational software to justify the purchase. Learning aids such as Texas Instruments' "Speak and Spell" were better positioned to take advantage of this burgeoning market than was educational software.

But all that is changing. Not only are the major book publishers mentioned previously directing product development to the home, but there are several small software houses that are aggressively marketing a new range of creative, graphically appealing edutainment products. The greatest impact on this market will be felt by early 1984, however, as the major videogame software manufacturers enter the field.

A. Size of the Market

In 1982, educational software sales into the home were around $25 million. The Yankee Group expects 1983 sales to

almost triple to close to $73 million. By mid-year 1984, home education software will have outdistanced school software and will continue on that course until the market is divided approximately 70% to 30% between home and school software by 1985.

Texas Instruments has been the volume leader in publishing its own edutainment software. It had about 40% of the market in 1982 in dollar terms, and is expected to remain the market leader in 1983 in unit terms, largely on the strength of the closeout. Tandy was the only other major vendor to garner any market share, but Apple, Commodore and Atari are attempting assiduously to claim their respective pieces of the pie in 1983.

The remaining shares of the home market were divided among a group of independent software houses, primarily Spinnaker (Cambridge MA), Edu-Ware Services (Agoura CA), and The Learning Company (Portola Valley CA).

B. Leading Publishers

It is difficult to establish market share by publisher not only because there are so many small, independent houses, but also because it is unclear what percentage of software for a given computer is vendor-published and what is from third-party publishers. Table 5-5 shows the breakout of home educational software by computer make, without regard for publisher.

1. Spinnaker

Spinnaker officially opened its doors in summer 1982; its first products became best-sellers. This fact indicates the eagerness with which consumers embrace solid, well-designed educational software. The added attraction was that the products were also fun. The "Snooper Troops" series, for example, consists of interactive mysteries, the solutions to which require note-taking, mapping skills, and logical thinking.

TABLE 5-5
HOME COMPUTER EDUCATIONAL SOFTWARE
(Unit Share by Computer)

	1983	1984
Texas Instruments	40%	37%
Tandy	20%	18%
Apple	10%	9%
Atari	16%	14%
Commodore	12%	17%
IBM	2%	6%
Coleco		1%

December 1983

Source: The Yankee Group

Spinnaker has its own lexicon of phrases to describe its philosophy, including offering "sugar-coated learning" by concentrating not on particular facets of knowledge, but on "general life skills." The company produced nine disk-based titles in its first year, six of them for children aged three to 10 years old. Spinnaker, in fact, claims to be the leader in the home education market in the under-10 age group.

In 1983, Spinnaker produced at least six new disk titles and up to 13 ROM cartridges, at least half of which were new titles. The disk software was introduced for Apple, but was subsequently made compatible with the IBM PC and Atari home computers, as well as the Commodore 64. The ROM software will be produced for the Commodore 64 and Atari computers, as well as private labeled for Tandy.

Spinnaker has gone through two rounds of venture capital financing for a total of $2.3 million ($800,000 in its start-up round from TA Associates and $1.5 million in the second round from various sources including L.F. Rothschild, Unterberg, Towbin in New York), and currently is planning to undergo a third round. The Yankee Group believes that Spinnaker's conversion of its programs to ROM cartridge may be a mixed blessing:

- While such a conversion is advantageous because of a broad installed base of cartridge-compatible hardware, the fact remains that the hitherto exceptionally high quality of the company's programs may suffer from the current memory constraints of the cartridge format.
- The relatively large memory capacity of the Commodore 64, however, is more than enough for some of the simulation/strategy games the company will be releasing this year. In addition, the rapidly growing installed base of VIC 20 and Commodore 64 owners is clamoring for good cartridge-based products.

At the June CES, Spinnaker showed only its cartridge-based programs, few of which appeared to be up to the level of its previous offerings in terms of innovation and creativity. This may be due in part to the fact that Tom Snyder, who not only created "Snooper Troops" but also helped direct the creation of Spinnaker itself, has not yet completed any ROM programs for the company. Spinnaker's reputation has been tied strongly to Snyder, but it needs to attract other equally creative designers in order to maintain that reputation.

Spinnaker has been selling through four national distributors and about 40 regional distributors, but anticipates selling direct to KMart and Toys R Us, when and if they decide to go to direct distribution. Of the national distributors, Softsel (Inglewood CA) handles 40% of Spinnaker's business, followed by SKU (Berkeley CA).

The company has set precedents in the home market by investing heavily in advertising and promotion. Within six months, the company had achieved product and name recognition, but this was at least partly due to the paucity of competition.

2. The Learning Company

The Learning Company (Portola Valley CA) was established under the name Advanced Learning Technology in 1979, having received one of the first Apple Foundation grants. Its founder, Ann Piestrup, was an educational psychologist who had studied the way children learn and who wanted to explore further the use of computers in that process.

The company received $300,000 in venture capital funding in January 1982 and started shipping its first products in June of that year. The first year of sales produced over $1 million in revenues, and has earned the company a reputation for high-quality software, closely akin to Spinnaker, but with fewer products and a lower profile.

The Learning Company's nine products were all developed by an in-house staff, including then-employee Warren Robinett, author of the company's best-known product, "Rocky's Boots," a logic skills-building program in which players build animated logic machines which teach them the basics of computer circuits. (Robinett is now a free-lancer, but still owns an interest in the company.) The company has a policy of not pre-announcing titles, but advises that it will maintain its current plan of building exceptionally high quality into the relatively few products it publishes.

The Learning Company, like other software publishers, gears the same products to the home and the school, differentiating between them only by documentation. But unlike the others, The Learning Company is achieving a measure of success. Traditional CAI products cannot easily make the transition from school to home, but fun-oriented education is better positioned to do just that. The company's first year million-dollar revenuss were divided almost equally between school and home, but it expects to follow the industry curve that will result in a 30/70 balance between school and home software by 1985.

The Learning Company's products are currently in disk format only, for Apple, Radio Shack's Color Computer, and Atari. It currently is investigating conversion to cartridge, but has not yet announced any products for that medium. The company relies on educational and consumer distributors for its software, but has not ruled out the possibility of selling direct.

The Yankee Group believes The Learning Company is one of a select few independent houses that is a prime acquisition candidate for the large game companies that are slowly plotting their entrance into the educational market. The company has, in fact, been approached repeatedly about joint ventures or buyouts, but is wisely prolonging what may be an inevitable decision. While the quality of its products may be superior to

that of many of its competitors, the company's budget constraints do not provide for much advertising, and a high volume business on any individual product may be beyond its grasp.

The Learning Company has taken advantage of the small, but growing, demand by teachers for alternatives to CAI, but as the home market expands, the company's dual market approach may limit it in appealing to the greater demand from the home.

IV. Enter the Dragons

In conversations with educational software publishers, the Yankee Group asked who they viewed as the major threat to their business. In most cases, the publishers named the large videogame companies, especially Parker Brothers, CBS, and Activision. While there is little doubt that the game companies have their collective eye on the educational market, most have been lying low, allowing the market to stabilize somewhat before moving in. There is increasing likelihood that the game companies may buy out some of the smaller, more innovative educational software companies, but no such acquisitions have taken place yet.

At this past summer's CES, several game companies showed a few games whose purpose was couched in terms such as "discovery" or "fun learning," but they represented, on the whole, a very small percentage of new introductions. Activision, Imagic, CBS Electronics, and Broderbund, among others, did not introduce educational products. (See Table 5.6-)

A. Parker Brothers

Educational software is one of four areas that Parker Brothers (Beverly MA) has identified as a priority for product

TABLE 5-6
EDUCATIONAL GAMES INTRODUCED BY SELECTED VENDORS AT CES, JUNE 1983

Company	Number of Educational Games
Activision	0
Atari	3
Avalon Hill	0
Broderbund	0
CBS Electronics	0
CBS Software	3
Coleco	5
Creative Software	5
Datamost	0
Datasoft	0
Epyx	2
HES	5
Imagic	0
MicroLab	3
Milton Bradley	6
Roklan	6
Sega	0
Sirius	0
Starpath	0
Synapse	0
Telesys	0
Thorn EMI	8

December 1983

Source: the Yankee Group

development. There are several projects in various stages of completion, but the company is not planning to release any of them before January 1984 CES. Calling the products "discovery-line games," Parker Brothers claims its approach is superior to that of other companies that approach designing this type of software from the educational angle first, and fun second.

Parker Brothers believes that parents will buy drill and practice software if their child is having problems in particular school subjects, but otherwise, will soon realize that money spent on "straight educational" products is wasted. The company plans to introduce games it hopes will bridge the gap between what parents want and what children want.

Parker Brothers' strengths lie in several areas:

- large advertising budgets;
- established distribution channels;
- a stable of popular, licensed characters.

Thus far, Parker Brothers has only considered publishing cartridge-based software. It has tried repeatedly to hire authors to write third-party educational software, but Tom Snyder, for one, had been unwilling to do so because of the memory restrictions inherent in the medium. (He is reconsidering, however, now that his company has begun to write cartridge programs for other publishers, particularly as cartridge capabilities improve with RAM/ROM carts, 32K ROM carts, etc.)

B. CBS Software

CBS has been indirectly involved in educational software publishing for many years through its Holt, Rinehart & Winston

publishing subsidiary. But the company's own software division is now moving aggressively into the market, initially through a joint venture with Children's Computer Workshop (CCW). CCW is the for-profit subsidiary of Children's Television Workshop (CTW), creator of television's "Sesame Street," among others.

CBS Software (Greenwich CT) is targeting both the home and school markets for its products, and does not plan to differentiate between the two through documentation or a management program for teachers. The division views the home market as its primary target, where its chief competitors will be Spinnaker, The Learning Company, and, it claims, Broderbund.

As a new entrant into the burgeoning edutainment market, CBS expects to find certain challenges in its path to consumer acceptance, but maintains that it can surmount them based on its size, experience, and reputation. The challenges are not so much in the form of program content as:

- marketing and distribution;
- ability to develop brand name and brand image;
- consumer (and retailer) awareness level.

CBS has contracted with CCW for 50 titles over a three year period. CBS is an active member of the partnership, overseeing product development (including ultimate veto power over concepts), and handling all marketing, promotion, and advertising. CCW, using muppet and non-muppet characters, will be producing 24 games in 1983 for Tandy and Atari, while its CBS software was shown at January CES and will be marketed in the first quarter of 1984.

CCW's software for CBS will be developed by its in-house staff of 70 for children over eight years old, and no Sesame Street characters will be used. Although CTW is best known for

"Sesame Street," its other shows, "The Electric Company," and "3-2-1 Contact," are tailored to older children (the latter specifically aimed at disadvantaged children and girls with problems in math).

CCW will convert some of its pre-existing titles for use in the CBS venture, but it is unclear whether the titles it develops for CBS will belong exclusively to the publisher, although this is likely to be the case. The CBS/CCW software-to-be is categorized under three headings: Strategy World, Design World, and Knowledge World (the most curriculum-oriented of the three). As of early 1984, only Strategy World was available, but the others are under development.

The software will be produced first for the Commodore 64 and made Atari-compatible soon thereafter.

CBS now uses all of the major national distributors for its software, and expects to continue to do so in the short term, at least. It predicts that bookstores and software specialists will emerge as dominant retail channels for educational software, and would be prepared to deal directly with these outlets as they assume leading positions.

CBS is also contracting for educational software with other developers. Among the future products is a cartridge-based program that teaches children to compose music, and more curricular-oriented software in the language arts and speed-reading areas. Additionally, CBS will be offering:

- curriculum-oriented programs for tutorial enrichment at home;
- continuing education software for adults, including career guidance and management skills;

- SAT test preparation software, prepared in conjunction with the National Association of Secondary School Principals.

The Yankee Group believes CBS has the potential to be a formidable contender in the home educational market, but that the company may be underestimating the importance of program content. CBS is throwing its not inconsiderable weight on the side of CTW/CCW, whose record for pre-school children's programming is noteworthy, but whose reputation at the school-aged level is less well established.

C. Activision

Activision (Mountain View CA) has not announced plans to develop or contract for educational software, although it is actively evaluating the field. It maintains that its short-term emphasis is solely on games where it can make a distinctive creative contribution, and that while it is closely watching the development of the education market, it does not intend to enter the market at this time.

Yankee Group expects that if and when Activision enters the field, it is likely to do so, at least initially, by way of subcontracting using outside authors (in distinction to its in-house entertainment policy) or by way of acquisition.

V. Summary

The educational software market presents a series of challenges to the players involved:

- to depart from traditional CAI by offering creative, innovative, curriculum-oriented courseware for schools;
- to appeal to the home market with high-quality edutainment, featuring strong graphics, incentive for repeatability, and a solid learning focus;

FIGURE 5-1
ENTERTAINMENT/EDUCATION SOFTWARE SPECTRUM

1. Arcade ("shoot-'em-up") games
2. Adventure games
3. Fantasy/Role-playing games
4. Discovery games
5. Edutainment
6. Drill and practice

Source: the Yankee Group

- to pursue all major retailing channels as well as emerging outlets (i.e., bookstores), reaching beyond an established direct sales force to national distributors;
- to maintain control over packaging and documentation to create a uniformly strong product;
- to actively explore joint ventures and/or acquisitions where appropriate.

While reports of the educational software market's explosion thus far have encouraged myriad companies to develop and market products, almost no one has shown a profit. Although electronic education revenues range as high as Houghton Mifflin's $8 million in 1983, product development and marketing costs usually have exceeded sales.

Even for a leading home market player like Spinnaker, the profit picture is tempered by the fact that its programs are marketed entirely on consignment, and returns may not affect the bottom line until the following fiscal year.

Still, the Yankee Group believes that educational software is a potential profitable mass market category, depending on:

- significant product innovation;
- attractive pricepoints;
- brand and author recognition;
- broader advertising exposure;
- retailer understanding of and commitment to the category.

The slate of titles introduced at the January CES 1984 marked a radical improvement from the selection a year earlier -- the results of strategic joint ventures, careful consideration of critical market issues, and superior product development by vendors with a real understanding of the needs of the home educational market.

CHAPTER SIX
SOFTWARE RETAILING

The past several years have seen the rapid movement of videogame retailing down the distribution curve from specialty retailers to mass merchandisers, to the point where consumers can now buy games in record, drug, and even grocery stores. With the proliferation of computer software, dealers in these same outlets are generally receptive to the idea of selling software, but due to the differentiation among programs (i.e., application, manufacturer identification), some are better positioned than others to do so.

This chapter will explore the qualifications of various distribution outlets as software retailers, and will consider several of the issues involved in software publishing. To publishers and distributors, the question of which retailer can market and sell products best is the burning issue. To retailers, a primary concern is how to evaluate and choose inventory from among tens of thousands of titles and a seemingly endless roster of publishers.

This chapter will also consider distribution of software from several perspectives. Distributors are playing an increasingly important role, both in representing a wide selection of publishers and products and also in providing rack services to retailers. Several manufacturers prefer to sell directly to dealers, and the effect of this practice on market share by channel will be discussed.

I. Overview of the Industry

Computer software sales, as a percentage of hardware sales, will take a quantum leap from 1983 to 1984, growing from 29% of hardware purchases to over 65%. The Yankee Group believes that by 1988, they will have surpassed hardware revenues. This trend is a result of several factors:

- the falling cost of computer consoles, resulting in a lower annual sales revenue;
- the availability of software across multiple distribution channels;
- the gradual saturation of the home computer market;
- the proliferation of software titles;
- the increasing penetration of higher-priced, disc-based software in the home.

At the same time, however, software prices are also falling in an inverse relationship to the hike in unit sales.

It is difficult to categorize home computer software, since there are thousands of different titles, but for the purposes of discussion and analysis, this chapter will place home computer programs in the five categories developed in Chapter Two. (See Table 2-2)

As indicated, the Yankee Group believes that entertainment, while continuing to account for around half of both unit and dollar sales, will begin to decline in importance to home computer users in 1984. Factors contributing to this trend include increased consumer awareness of alternate uses of the console other than for game-playing, a wider variety of high quality software, greater use of home computers for business purposes, and continued emphasis on computer literacy and educational software in schools, creating growing numbers of school-age children who will demand non-entertainment software at home.

II. A Choice of Outlets

An examination of software retailing in early 1982 would have meant a separate discussion of computer and videogame software because of their largely exclusive distribution

channels. While that is still necessary to some extent today, the channels are merging so quickly that customers can now expect to find word processing packages across the aisle from "Zaxxon" in their local Toys R Us store or Sears.

Several elements distinguish computer software sales from videogame sales:

- pricing;
- sales support;
- marketing;
- end users;
- PC use vs. game console;
- level of documentation.

Distribution of computer and videogame software is skewed differently by these factors, according to the strengths of different outlets. For example, the high volume achieved by mass merchants allows them to be very price competitive, but the specialized nature of computer and software stores gives them the edge on sales support. The computer hardware/software selling issue has its parallel in sales of stereo equipment vs. records. Just as audio dealers who tried to sell records usually foundered in the morass of dealing with different distributors and the problems of stock balancing, many retailers of computer hardware have been unable to meet the challenge of selling software successfully.

The initial question is: which distribution channels are most appropriate for computer software? The Yankee Group believes that no single kind of outlet will emerge as pre-eminent across the field, but rather that several competing channels will co-exist, each marketing according to its individual strengths. Mass merchants and record stores, for example, may specialize in Top 40 or "hit" computer and game

software, with computer hardware and software specialty stores handling the more complex applications packages, backlists, simple but slow-moving lines, etc.

Tables 6-1 and 6-2 show the Yankee Group's estimates of market share by distribution outlet for each category of software. In 1983, the first full year of operation for many software specialty stores, they were able to garner a respectable percentage of software sales in each category. The Yankee Group expects their share to grow in 1984, providing competition mainly to computer stores, specifically in entertainment software. 1984 will also see the erosion of mass merchants' market share in entertainment programs as software downloading for permanent home storage emerges as a new form of distribution.

A. The Emergence of Software Specialty Stores

Software specialty stores can be divided into two groups: those that sell software (and accessories) only; and those that also sell the full range of hardware, including computer consoles, printers, disk drives, joysticks, etc. A Yankee Group survey of software franchisors in mid-1983 revealed a common approach to selling software among specialty retailers. Most have had experience with either computer hardware retailing, or with other franchise operations such as hair salons, in the case of Programs Unlimited. They perceive their entry into the software market as a long-term business venture, and not a quick in-and-out opportunity.

In spring 1983, there were fewer than 10 software chain operations and perhaps three times that many independent software stores. By yearend 1983, the Yankee Group expects the existing chains to have tripled their number of stores on an average, and projects almost twice as many franchise operations in December as there were in mid 1983. (See Table 6-3)

TABLE 6-1
SOFTWARE FOR HOME COMPUTERS:
1983 MARKET SHARE OF DISTRIBUTION OUTLETS

	Ent'mt.	Home Mgmt./ Produc-	Self-Imp./ Educ.	Misc.*
Mass Merchandisers/ Discounters	45%	20%	35%	15%
Department Stores	15%	12%	8%	11%
Computer Stores	16%	35%	25%	40%
Software Stores	9%	10%	10%	15%
Mail Order	5%	18%	10%	10%
Catalog Showrooms	4%	2%	4%	3%
Misc. Stores**	6%	3%	8%	6%

* Includes programming, "how-to," and personal programs (e.g, recipes).
** Includes book and record stores, drugstores, audio/video stores, grocery stores.

December 1983

Source: The Yankee Group

TABLE 6-2
SOFTWARE FOR HOME COMPUTERS:
1984 PROJECTED MARKET SHARE OF DISTRIBUTION OUTLETS
(December 1963)

	Entertainment	Home Menagement/ Productivity	Education	Self-Improvement/ Miscellaneous*
Mass Merchandisers/ Discounters	40%	21%	36%	12%
Department Stores	13	10	7	11
Computer Stores	14	32	25	38
Softwere Stores	15	16	13	18
Mail Order	64	15	7	10
Catelog Showrooms	2	2	2	2
Miscellaneous Stores**	7	4	10	9
Electronic Delivery	3	-----	-----	-----

* Includes programming, "how-to," and personal programs (e.g., recipes).

** Includes book and record stores, drugstores, Audio/video stores, grocery stores.

Source: the Yankee Group

TABLE 6-3
SOFTWARE SPECIALTY STORE FRANCHISES*

Existing Store/Chain	No of Stores in Mid 1983	Yearend 1983***
ComputerLand**	5	50
Information Please!	1	9
Microcon	6	21
The Program Store	7	24
Programs Unlimited	18	50
Software City	12	100
Software Emporium	2	26
Softwaire Centres International	20	50
New Store/Chain		
Computer Center	--	7
CompuShack	--	20
Micro Concepts	--	5
Software Galeria	--	30
Softwareland	--	8

* Includes company-owned stores and franchises
** ComputerLand Satellite stores only
*** Dealer projections

December 1983

Source: The Yankee Group

The explosion of software specialty stores has come about for several reasons:

- relatively low start-up costs;
- proliferation of software titles has expanded beyond means of existing outlets;
- high margins (30-40%);
- entry point into computer retailing industry for those who had previously missed the opportunity.

1. Survey Results

The Yankee Group survey consisted of interviews with software specialty store franchisors and franchisees across the country. They were asked a series of questions concerning inventory, trends, factors in taking on new titles, formats, whether they used distributors or dealt directly with vendors, etc.

The responsee showed that most software franchisees share a "library-style" (open shelving by categories) presentation of products, as well as an emphasis on third-party software. Apart from ComputerLand's satellite stores which deal only with vendors, all deal with distributors as well as directly with vendors.

Content typically is divided among four major categories: entertainment, education, business (including system software), and home management applications. Those whose stock is made up predominantly of entertainment software believe that entertainment will continue to be the volume leader through 1984. The average number of stock keeping units (SKUs) is currently around 1,500 (with a high of 3,000 and a low of 700), with emphasis on diskette and cassette formats, and considerably less on cartridge -- a significant distinction from mass merchants.

When asked which factors were most important in deciding to stock a new title, most respondents mentioned margin, followed by advertising support and vendor credibility.

Typical software margins are 35-40 points, and headed downward. Atari and TI, two vendors that deal directly with many retailers, are already offering margins closer to 30 points. Atari makes up for what it keeps from retailers by offering higher margins to its stable of distributors as inducement to handle only one vendor's line.

2. Software-only vs. Hardware Integration

A major drawback for software-only specialty stores is that they are positioned only for the aftermarket (even though they may also attempt to target first purchase customers). While some customers may shop software stores to explore variety and compatibility of software before purchasing a computer, most buy their first programs at the store where they buy the console and peripherals. Several software-only retailers are realizing this, and have begun to offer hardware as well. They may encounter unforeseen problems based on the different level of sales support required for hardware, as well as lower margins than in software.

The Yankee Group believes the market can support software-only stores for certain categories of software better than those that integrate hardware and software. (A software store that integrates backward into hardware differs from a standard computer store that also sells software, primarily in the higher number of software SKUs and variety of formats, including titles for consoles other than those sold on the floor.) For example, a software specialty store that chooses to emphasize productivity and home management software has several advantages over other retailers:

- it provides the sales support that salespeople in mass market stores are not trained to do and cannot justify the time for in computer stores;
- it offers a vastly wider selection of titles and formats than other outlets for whom this category is only one of many;
- its higher prices and margins make smaller volume business acceptable.

Those that feature only entertainment software and videogames are going head-to-head with mass marketers, and are bound to lose unless their unique location and sales volume allows them to be price-competitive. And because business software often accompanies the initial console purchase, stores that specialize in this category will be better positioned if they sell the hardware as well.

3. Franchising

In sslecting a software specialty store case study, the Yankse Group felt that it was more illustrative to explore a franchised opsration than an independent retailer. Franchising in the United States is a trisd and proven business, accounting for 32% of total sales, according to the U.S. Chamber of Commerce. Its statistics for small businesses also show that over a five-ysar period, 96% of franchised businesses are still open whils 93% of the independents are closed. In an infant industry such as software retailing, it makes sense for certain dealers -- especially those with no prior expsrience in software retailing -- to protect thsmselves from sudden shifts in demand by sharing part of the responsibility with a larger entity.

a. The Program Store

The Program Store is a veteran among software specialists after almost four years of software retailing and one year of franchising. There are four company-owned stores, and three

franchises, and the company grew to 12 of each by yearend 1983. Based outside Washington, D.C. (Vienna VA), the stores are positioned to the home market; with entertainment programs representing at least 60% of the inventory and about 80% of sales. The breakout by format for the average Program Store is: 50% cassette, 40% diskette, and 10% cartridge (although several have up to 30% cartridge-based software). The company expects the percentages to shift slightly by 1985, to 40% cassette, 40% diskette, and 20% cartridge.

The Program Store's franchise requirements are less stringent than those of some of its competitors. There is an initial fee of $15,000, suggested opening inventory of $40,000, and total investment projected at $86,000. The average store is about 1200 square feet, located in malls or free-standing. In 1982, the then-three operating stores accounted for a total of $1.5 million in sales.

The major advantage The Program Store and other software specialty stores claim over mass merchants is a high level of customer support, particularly by demonstrating programs on the sales floor. The stores keep over 1500 titles in stock, and are willing to unwrap any package for a customer (they have a shrink-wrapping machine in a storeroom to repackage the program if the customer does not buy it) or to run a program with which a customer has been having problems.

The downside risk is that customers can see a program demonstrated at the software store, then decide to buy it at a discount store or through mail-order. Several stors managers acknowledged that this is a potential problem, but so far have not made attempts to estimate the percentage of lost business that such practices represent.

The Program Store has formed a software evaluation group for the company called DOS (Decisions On Software) which makes recommendations to the franchised stores about which programs

to buy. The stores can order through the company's warehouse, through distributors such as Softsel, or directly from publishers. The initial inventory is selected by the main office, but after that, the stores are mostly autonomous.

Almost all of the software sold in the stores is from third-party publishers. The computers for which the programs are sold are the Atari 400/800, Apple, IBM PC, Commodore VIC and 64, TRS-80 Models I and III, and TRS-80 Color Computer.

Due to the centralized focus of the distribution process, there is as yet no demand for rack-jobbing services. The Program Store's franchises have one year to return any products ordered from the company's warehouse. When dealing with Softsel, they may return after 30 days and before 90 days on a one-for-one exchange basis.

For the franchise stores, the margin on sales is usually about 36%. Softsel's discount is 46% to The Program Stores, and 8%-10% of the sales dollar goes to corporate, including two percent for local and national advertising placed by the main office.

Table 6-4 compares The Program Store's franchise requirements with those of other software specialty stores.

b. Analysis

The Yankee Group believes the advantages to the Program Store's approach include:

- clearly targeted audience (PCs in the home);
- programs organized and displayed by application within computer classification, i.e., "Apple Education," "Commodore Entertainment";

Table 6-4

Franchising Requirements for Software Specialty Stores

	Franchise Fee ($)	Monthly Royalty	Advertising Fee (annual)	Initial Investment	Avg. store size (sq. ft.)
The Program Store	15,000	6%-8%*	2%	86,000	1,200
Programs Unlimited	20,000	4%-5%**	1%	175,000	2,000
Software Galeria	15,000	6%	1.5%	155,000	2,000
Software City	7,500	5%***	1%	32,000-40,000	1,000
Softwaire Centres/ International	25,000	5%	2%	160,000	2,000

*Semimonthly charge
**4% first year, 5% second year
***$100 per week, until franchisee reaches sales of $200,000.
December 1983

Source: The Yankee Group, Computer + Software News

- use of those same computers on sales floor for demonstration purposes;
- combination of "hit" games and other less time-sensitive software;
- franchise stores permitted relative freedom in buying and merchandising.

Weaknesses are:

- greatly varying degrees of experience and organizational skills on part of franchise owners and managers;
- inability to compete on price with mass merchants;
- loss of applications sales to stores that also sell hardware;
- slower response to local demand because of corporate emphasis on national trends.

The Yankee Group believes that software specialty stores such as The Program Store are facing increasing competition from other, larger outlets that will soon match and outweigh the strengths of the smaller stores. The function of providing customer support and hands-on experience is shifting to electronic merchandising devices such as Atari's ERIC and new Game Viewer. New methods of distribution, including downloading of games, such as Control Video Corporation's GameLine, and EPROM reprogrammable cartridges, will represent additional threats to traditional retailing.

Software stores cannot compete in "hit" games with mass merchants, either on price or on availability. But the home-oriented Program Stores are losing out on business sales to computer stores, and will soon begin to suffer the loss of some word processing sales to companies that are bundling those programs with computer hardware.

However, future prospects, if not especially rosy, are by no means grim. In fact, the sheer number of new software stores will help to establish identification for this distribution outlet as an alternative to computer stores, mass merchants, and department stores as a source for software. In addition, the Yankee Group gives the best odds for success to those software stores that are able to:

- emphasize one or two categories of software which they can back with targeted advertising campaigns;
- build up sales volume to establish "clout" with distributors and vendors, enabling them to anticipate and meet consumer demand and institute a favorable returns policy;
- locate themselves near a computer store (if they sell software only), in a high traffic area;
- develop their own method of evaluating new titles, whether on an individual store or corporate basis.

B. Mass Merchants

1. Toy Supermarkets

The top three U.S. toy store chains are Toys "R" Us (Rochelle Park NJ), Child World (Avon MA), and Lionel Leisure (Philadelphia PA). Toys "R" Us had revenues of $1.5 billion in 1982, of which $1.2 billion was in non-electronic sales. The chain's volume is about three times that of Child World (sales of $283 million in 1982), with almost double the number of stores, but Child World is closing the gap in electronics.

a. Child World

Child World was selected for case study consideration because of its number two, "we try harder" appeal. This is taking the form of a new approach to electronics merchandising,

emphasizing hands-on experience and the option for customers of self-service or sales assistance.

Starting in September, Child World opened newly expanded and rebuilt electronics departments in 500 square feet of U-shaped space. One side of the department contains the high-ticket items, including computers set up for demonstration. On this side, software is accessible only through a salesperson. The bottom of the "U" and other side will contain ceiling-high plexiglass cases which customers can open to remove products. On their way out of the department, customers must pass a salesperson at a cash register.

Child World's software inventory is made up of 80% games, 15% educational software, and 5% self-improvement and home management packages. The company views the educational segment as the fastest growing one, and plans a mix of "fun-to-learn" games and courseware, the latter to meet a growing demand by schools, which are now starting to go directly to retailers.

Child World's software is predominantly cartridge-based (80%), with 19% on cassette and the remaining 1% on disk. The merchandising philosophy is that the installed base of disk drives in the home is still too small to cater to, and that in fact, the stores are aiming for a 100% cartridge line.

The computers sold in Child World stores are the TI 99/4A, Atari 400/800 (and new XL consoles), VIC 20, and Commodore 64. Mattel's Aquarius computer was tested in four stores with "so-so results."

Decisions to stock a new title are based on four main factors:

- whether the game is a licensed or syndicated arcade hit;

- whether the vendor is large enough to provide media support, mainly through TV advertising;
- price point;
- format compatible with computers in stock.

Child World considers games as falling into one of two categories: hits or classics. A hit has an average 90-day cycle, then may either fade into obscurity or become a classic. A classic game (e.g., Pac-Man, Donkey Kong) has an approximate 18-month cycle. On an imaginary bell curve, the game peaks after about three months, drops a little, drops a little lower, then stays there "forever."

Child World buys directly from vendors except for third-party software, for which it uses a local and a national distributor, SKU (Software Knowledge Unlimited). Of total units in stock, 20%-25%, or about 50 titles, are from third-party publishers. These represent 8%-10% of total sales. There are about 70 TI titles, 35-40 Atari titles, and 20-25 Commodore titles.

With regard to the uss of rack-jobbers, Child World claims, and the Yankee Group concurs, that rack-jobbing is less effective in retail chains with centralized distribution than in stores that handle distribution on an individual basis. The strength of a rack service is in analyzing market movement and product mix in an individual store. Child World plans to use SKU's market movement analysis of its stores, and will occasionally employ rack-jobbers to analyze the third-party mix in certain locations.

b. Analysis

Mass merchandisers enjoy several advantages over other retailers:

- high traffic exposure;
- ability to set low prices due to high volume;
- high sales per square foot;
- relatively little customer service required;
- rapid order fulfillment.

On the other hand, they also suffer from higher shrink (theft), more employee turnover, and a higher level of returns. General mass merchants do not consider themselves industry leaders, preferring to leave trend-setting to department stores and price-setting to discounters. They are able to follow suit quickly, however, by virtue of the "heavy pens" they wield, enabling them to receive best-selling merchandise even when other retailers have had orders backlisted for weeks.

Margins are generally low in computer hardware and "hit" software, so mass merchants aim to make money on sales volume.

C. Bookstores

B. Dalton (Minneapolis MN) and Waldenbooks (Stamford CT), the two largest bookselling chains in the United States, sold a combined $16 million worth of computer books in 1982. The bookselling giants expect this category to account for 10% of trade sales in 1983 -- exceeding fiction's share. The astonishing success of the computer-related books provided compelling justification to take the next step into selling computer software. Both chains had been testing videogame sales in several stores during the past year, with positive results, and were anxious to determine the viability of their role as a computer software source.

There are several parallels between books and software merchandising:

- both are published products, as opposed to manufactured;
- entertainment software, like mass market paperbacks, enjoys a six-to-nine week life cycle;
- established sections in bookstores can easily incorporate software categories;
- same distributors can be used, since many book distributors have added software to their lines.

Current bookstore activity includes the following: B. Dalton has been testing software in 13 stores for a year, and stocked 400 SKUs of computer software in 15 of its 620 stores starting in late summer; Waldenbooks rolled out to all 820 of its stores in early fall; and Barnes & Noble (Totowa, NJ), is using a 1500 square foot software center (larger than most software stores) in its flagship New York City store, which recorded sales of $15 million in 1982, the largest retail bookstore in the country.

The bookstores are selective in the software they stock, not only by quality, but also by publisher. Waldenbooks is stocking software only from book publishers of software, as opposed to independent publishing houses or game manufacturers like Activision. The reason is that the book publishsrs have a 100% returns policy, unlike other manufacturers and distributors, who require dealers to buy two products for every one they return. The book publishers may not be able to maintain their generous policy for long, however. In 1982, returns on computer books were 50% and higher.

1. Computer Books, Magazines, and Catalogs

There are approximately 3,000 paperback computer-related titles now in print, and bookstores expect every home computer

buyer to purchase three to five of them this year. A Yankee Group survey of the major computer book publishers showed a 100%-plus increase in new titles from 1982 to 1983. (Table 6-6) The emphasis is clearly on programming or computer-specific titles, targeted mainly to the computer hobbyist reader who is avid for information.

This unslakable thirst for computer information has fueled the magazine industry as well. No one is certain of the exact number of computer magazines available (any number cited here will be obsolete at the time of publication), but reliable estimates put the total at between 160 and 175. (See Table 6-5.)

An interesting footnote is the battle that is shaping up in the magazine industry -- not for largest circulation, but for fattest issue. The June 1983 issue of PC: The Independent Guide to IBM Personal Computers weighed in at 640 pages (2.8 pounds), breaking the record previously set by September 1981's Vogue issue, with 610 pages. (The all-time, all-magazine record was set by the February-March 1983 issue of Bride's with 678 pages [504 of advertising], but the fact that it is a bimonthly publication gave it an unfair advantage.) This record is noteworthy, not only because PC went to only 130,000 readers, but also because the publication was only 15 months old at the time.

PC's triumph was short-lived, however, as the September issue of Byte numbered 688 pages, including 412 pages of advertising.

2. The Problem of Product Visibility

One of the most difficult and important problems for the computer software industry is that of bringing the product before the potential user. Other retail software products all have a market mechanism for exposing consumers to the product -- videocassettes and discs have movie theatres, records have

Table 6-5
Profiles Of Selected Microcomputer Magazines
(ranked by total circulation)

Publication	Year Started	Frequency	Circulation	Target Audience
Personal Computing	1976	monthly	525,000	Computer users, beginner to advanced
Byte	1975	monthly	419,000	Hobbyists; computer users, beginner to advanced
COMPUTE!	1979	monthly	350,000	Computer users (primarily home market)
Creative Computing	1974	monthly	350,000	Hobbyists; home users
Popular Computing	1979	monthly	306,000	Home computer users; newcomers to computing
PC World	1983	monthly	170,000	IBM PC and IBM PC-compatibles users
Commodore: The Micro-computer Magazine	1979	bi-monthly	150,000	Owners of Commodore computers; especially for business & educational applications
Computer Decisions	1969	monthly	150,000	Data-processing managers
Power/Play	1982	quarterly	150,000	Owners of Commodore computers, especiallychildren and those interested in playing games
Softalk (for Apple)	1980	monthly	150,000	Apple users
80 Micro	1980	monthly	150,000	TRS-80 (monochrome) computer users
99'er Home Computer Magazine	1981	monthly	150,000	TI 99/4A users
Interface Age	1976	monthly	149,000	Desktop computer users; engineering & business managers
Datamation	1957	monthly	130,000	Data-processing managers
PC Magazine	1982	monthly	130,000	IBM PC and IBM PC compatibles users
Computer World	1967	weekly	120,000	All managers of computer-related fields
Information Systems News	1979	semi-monthly	110,000	MIS managers
Microcomputing	1977	monthly	105,000	Intermediate to advanced users
Antic: The Atari Resource	1982	monthly	100,000	Atari users
InCider	1983	monthly	100,000	All levels of Apple users
Mini-Micro Systems	1974	monthly	100,000	Engineering and business managers
InfoWorld	1980	weekly	90,000	Computer users, home and business
Softalk (for IBM PC)	1982	monthly	70,000	IBM PC Users
Desktop Computing	1981	monthly	60,000	Businessmen, professionals, educators; users and potential buyers
Softside	1978	monthly	60,000	Home computer users
HOT CoCo	1983	monthly	55,000	TRS 80 Color Computer users
PC Tech Journal	1983	bi-monthly	50,000	IBM PC users (advanced)
Sync	1981	bi-monthly	50,000	Sinclair and Timex-Sinclair users
Softline	1981	bi-monthly	45,000	Home computer users interested in playing games

December 1983

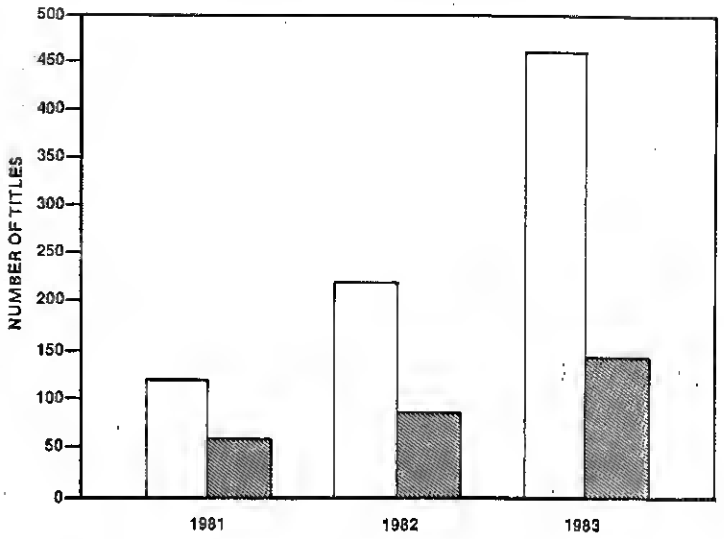
Source: the Yankee Group

Table 6-6
Computer-Related Books: 1981-1983*

	1981		1982		1983	
	Mach.	Lit.	Mach.	Lit.	Mach.	Lit.
Publisher						
Addison-Wesley	0	1	7	7	27	7
Arcsoft Publishing	11	0	18	0	31	0
Ballantine Books	0	0	2	0	0	9
Compute!	2	0	5	2	19	2
DATAMOST, Inc.	1	0	3	2	36	0
Dilithium Press	8	1	10	4	21	8
Hayden Book Co.	12	8	18	14	33	17
Howard W. Sams	12	7	16	11	30	23
John Wiley & Sons	15	14	27	12	31	12
McGraw-Hill	1	3	12	3	28	15
OSBORNE	11	1	9	2	14	0
Prentice-Hall	12	7	17	10	24	17
Que Corp.	0	1	3	3	10	15
Reston	4	1	15	3	23	7
Robert J. Brady & Co.	1	0	4	0	50	0
Sybex, Inc.	5	4	16	0	26	4
TAB Books,Inc.	20	7	27	9	32	10
Weber Sys., Inc.	0	0	3	0	10	0
Wm. C. Brown	4	0	4	0	11	0
TOTAL	119	55	216	82	456	146

* Trade press (no college texts) Source: the Yankee Group
December 1983

FIGURE 6-1
COMPUTER-RELATED BOOKS, 1981-1983*



Machine: computer- and/or language-specific; software programming guides
Literacy: general books on computers, computer applications, buying guides

* Trade press (no college texts)

Source: the Yankee Group

radio, videogames have the arcades. So far no satisfactory mechanism has been found that solves the two aspects of this problem:

- massive product visibility;
- hands-on access to the product for evaluation.

These needs are being met by a variety of responses, including increasing use of interactive video terminals in stores and malls. (See HOF Report No. 3 "Video Interactive Merchandizing"). One of the more interesting ways that is emerging is the software catalog, which is also the next frontier for book publishers.

Doubleday & Co.'s (New York City) recent $1.3 million commission to Stewart Brand, author of "The Whole Earth Catalog," to prepare a "Whole Earth Software Catalog" is only the most visible example to date of publisher interest in software catalogs.

Catalogs of all kinds are enjoying a vogue again, after experiencing a decline in the mid 70s. Indeed the rise of the specialty catalog, many of them dealing with exotic consumer electronic gadgets, is one of the retailing phenomenon of recent years. The advantages of catalogs are convenience, the ability to offer a range of products, price, and targetted markets through the art and science of list demography.

The primary disadvantages, especially in a field where the product is developing as rapidly as computer software, is timeliness, and dealing with the extraordinary proliferation of titles and vendors, many of which are no longer around by the time consumers respond to the catalog. In addition, especially for business software, certain retailers (most notably Apple), have strongly resisted the whole mail order approach for either

hardware or software because it does not provide the support that is often a critical part of being able to use a product successfully.

Most of the software catalog projects announced or in preparation attempt to go beyond the simple presentation or listing of products and provide some kind of "expert" evaluation. Others are specializing within the total field, and focus just on entertainment or educational or productivity software.

According to Yankee Group research, in the fall of 1983, 24% of all computer users in the home had bought software through mail order. This average, however, disguises wide variations between brands and models, from a high of almost 50% of IBM PC owners buying through mail order, to a low of 15% for TRS 80 III owners. (The latter figure is at least in part due to Tandy's extensive distribution network.) While the initial research did not establish the degree to which consumers were using catalogs vs. periodical advertising as the source of their buying information, the numbsrs clearly indicate the high level of acceptance of mail ordsr for computsr software purchases.

Yankee Group expects the use of mail order for software to rise with the entry of major catalog publishers, and direct mail vendors such as Sears and American Express, which expects computer-related mail order to account for $200 million in revenues by 1985. The new entrants will bring improved product presentation and evaluation, sophisticated list management, financial strength, and overall marketing skills.

The long term viability of software catalogs is related intimately to the development of on-line services and software downloading. There are a number of vendors keenly staking out their initial positions in the race to provide electronic

publication and delivery of software. The advantage of electronic catalogs, apart from limitless memory to handle even the biggest inventory, is that they can provide interactive demonstration of the product, and possibly, immediate availability through downloading to a permanent storage medium.

Reference series are also in vogue, attested to by the large advances publishers are doling out to authors:

- Harper & Row Publishers Inc. paid $600,000 to the editors of InfoWorld magazine for a six-volume book series, with an additional $120,000 for production costs;
- Simon & Schuster paid $800,000 to the staff of PC World magazine for a 10-volume paperback series for users of IBM and IBM-compatible computers.

D. Record Stores

While ths book/software parallels are well-defined, comparisons are more often made between software and records. Hopes for revitalization of the financially beleagured record industry reside in two areas: video music and computer software and videogames. (Vidso music will be discussed in depth in an upcoming HOF Report, 83-6: "Video Software: Changing Dynamics of the Home Market").

Because rock music's prime consumers are 15 to 24-year-olds, record stores are natural outlets for videogames, which appeal to the same demographic category. The record industry is actively seeking to increase its sales volume with products outside its traditional prerecorded music base: blank videocassettes and audiocassettes (ironic, since recording from records or off the radio has caused the loss of $1 billion in record sales, according to the Recording Industry Association of America), cleaning and storage equipment, etc. Many record stores have increased the percentage of non-record business to 30%, up from 10%-12% in 1982.

Since videogames actually compete with records for the consumer's leisure time, the move by record retailers into sales of those products is an "if you can't lick 'em, join 'em" philosophy. Margins on videogames are lower than for records, but retailers hope the volume business will make up for the smaller per-unit profits.

Selling computer software is another issue altogether, however. Many record stores find the prospect intimidating, and are reluctant to threaten their already shaky business with an unknown quantity. Enter the record rack jobbers, Pickwick Distribution (Minneapolis MN), Handleman Co. (Clawson MI), and Lieberman Enterprises (Minneapolis), with the financial backing and vendor affiliations allowing them to test the software waters.

Pickwick was the first to offer software to its accounts, through an agreement with software distributor Softssl Computer Products Inc. (Inglewood CA). Pickwick trains stors personnel, suppiies merchandising support, while Softsel handles inventories, marketing, and product development.

Lieberman, on the other hand, is working directly with software manufacturers to develop a program to serve mass merchandisers. The company expects its client stores to concentrate on entertainment software, but other categories also will be tested.

E. Video Stores

In general, video stores are now where record stores wers a year ago in evaluating the viability of videogame and software selling. Although several have been selling videogames, the target consumers for videocassette sales and rentals are usually older than videogame purchasers, and the natural synergy that exists between record stores and videogames may be strained in the case of video stores.

Other factors are working against the imminent move by video retailers into software:

- the video industry is financially sound, and is not as anxious to dilute its established product lines with new ones;
- there are many more independent video stores than chains (80% independent, 20% franchised), making it harder for the outlets to establish public identification as a computer software and videogame source, as well as being less able to back new products with advertising;
- many video stores cannot afford to give up the square footage to stock videogames, whose margins are much lower than videocassettes, and whose volume would not permit the retailers to be price-competitive;
- there is yet no activity on the part of video distributors to form agreements with software vendors and distributors to push those products into video stores.

The Yankee Group believes that video stores will continue to keep an eye on the burgeoning software industry, but will not develop as a software distribution outlet for at least two years, if at all. The home video software industry will be facing increased competition in the next two years, however, particularly from downloading services such as ABC's "Telelst" Network (a syetem using a scrambled signal to transmit movies to VCRs during the early morning houre), started in late 1983. Moreover, if prerecorded video eoftware is impacted adversely by the growing penetration of cable and alternate broadcast services, then video retailers -- like record retailers -- may eagerly embrace software merchandising.

III. The Retail Environment

With the number of software products stocked by retailers on the rise, it becomes more important to provide optimum

visibility for each product to the customer. But greater visibility may also mean greater likelihood of theft. The dilemma facing some retailers, such as bookstores, is whether to offer open shelves and self-service, such as customers are accustomed to for the main product lines, or to keep software locked in plexiglass display racks, requiring customers to ask salespeople for assistance, as is typical in software specialty stores.

The training of salespeople is a major issue in software retailing. For computer and software specialty stores, a well-trained sales staff, often having computer programming knowledge or experience, is a prerequisite. But for discount stores or record stores, how much training is necessary?

As mentioned in the record stores section of this chapter, one rack jobber, Pickwick, offers software sales training as part of its service to record stores. But the fact remains that Pickwick's experience is primarily in records and accessories, and its training assistance is unlikely to make software experts out of record stors salespeople.

The Yankee Group believes that because discounters, alternative retail outlets (video, record, bookstores), and many mass merchants, stock mostly well-known products (or at least software by well-known publishers), the level of sales expertise required is lower than for outlets that distribute a broader range of programs. In the interest of customer relations, it may be a wise idea for any store that sells non-entertainment software to have at least one trained salesperson on the floor at all times, but software purchasers may increasingly adopt the habit of asking their questions at computer and software stores, then making their purchases at mass merchandise outlets.

Another open question is how effective point-of-purchase (p-o-p) displays are for the retailer. Should vendors supply

posters, counter cards, and display racks -- many of which may be used for another vendor's products -- or should the store provide its own displays in harmony with the department's color scheme and layout?

The answer is that there is no single answer. The variables on which decisions depend include:

- floor space;
- quality of design, and compatibility with environment;
- need for additional protection against theft.

A. In-Store Display

When setting up a software department or store, the retailer muet first determine whether the products should be categorized by application or by machine, or in some cases, both. In the store that eells both hardware and software, it is advisable, in the Yankee Group's opinion, to classify the software by machine, perhaps even stocking the programs next to or above the appropriate computer. In a software only store, it may be more logical to display the products by application, or application within machine classification, a practice that also would be effective in creating a more uniform display than by software vendor, where range of selection might be uneven.

Many software retailere began by displaying programs on open ehelves, and many still do. But due to different types of packaging and formats, ae well ae to theft opportunities, many dealers are now shifting to a display case approach, either locked or unlocked. Because it is important that customers be able to read a description of the software as well as to eee the publisher or author'e name and the program title, the best display device devised so far seems to be a round, plexiglass case with angled slots for the programs. (See Exhibit 6.1) A

bookstore approach with some programs facing front and others with spine forward, is effective for popular or immediately recognizable titles, but not for those that require further explanation.

Some retailers have "solved" the shrink problem by displaying empty cases for customers to examine, requiring them to ask a salesperson for the complete package when ready to buy it. Others use a locked case for high-ticket business programs, but permit self-service with entertainment and educational software.

Because of high theft rates, toy supermarkets usually have promoted a full-service presentation, requiring customers either to ask a salesperson for assistance or to pay for the product at a cashier station and pick it up somewhere else. This approach often entails waiting in line to reach the saleeperson behind the counter or the cash register, and is cumbersome and time-consuming for customers who want to make their purchase and leave.

Different merchandising approaches by various retailers are discussed in the sectione below.

1. Lechmere

Lechmere (Woburn MA) is a New England hard-lines discount chain which sells a wide selection of low-end computers and software, and is testing higher-end systems. In several of its branches, the store is creating a separate 800 square foot computer department defined by lighted graphics panels. The department highlights computer hardware by displaying it prominently in the center of the area, while the software is lined up along the 30 feet of back wall. A software information directory assists customers in selecting programs by category.

Lechmere does not use p-o-p materials from vendors since they would conflict with the department's design and graphics. But it does emphasize customer interaction through an in-store cable network with television monitors suspended from the ceiling near the entrance of the store, each screen featuring products from different departments; one is devoted to demonstrating computer software programs. The store is also working on a touch-screen computer program to help customers in making purchases. Store remodeling is expected to be completed in 1984.

2. Bullock's

Another approach is for a department store to lease space to a computer retailer to run as a concession. Bullock's, a 22-store chain in California, Las Vegas, and Phoenix, signed an agreement permitting ComputerLand to open "satellite" departments in selected Bullock's stores in a gradual rollout over the next several years.

The 400-square-foot departments are roughly one-eighth the size of an average ComputerLand store, but will contain low-end computer consoles, software, books, magazines, peripherals, and supplies. They will be staffed and maintained by the local ComputerLand franchisee, with Bullock's supplying customer service and support. Bullock's credit cards can be used to make purchases in the department.

The design of the departments mirrors that of the "mother" stores on a smaller scale, including the same color scheme. The arrangement with Bullock's, a Federated store, opens the door to ComputerLand for future negotiations with other Federated stores (i.e., Bloomingdale's, Filene's, Burdine's).

3. Macy's

Macy's (New York City) has made perhaps the strongest commitment to computer merchandising of the three stores

profiled here. Its computer department is away from main aisles, enclosed by glass doors and display windows so that customers feel relaxed in the quiet ambiance.

There are 14 workstations at which customers can sit down with a salesperson for a demonstration of various computer configurations as well as software. The company uses two distributors, chosen for their stock balancing policy and rack services, and plans to expand the department by adding more software. The department now sells Apple, Epson, and Osborne computers, and the IBM PC, and will be selling the IBM PCjr and Apple "Macintosh" computers when they become available.

B. Packaging

Before major publishers got into the software business, many of the programs available were written and distributed (primarily through mail-order) by unknown authors working out of garages. Programs were packaged in the most expedient and inexpensive manner, usually in zip-lock bags or plastic wraps with a hole at the top for hanging on a pegboard. Documentation, where it existed, was usually typewritten and photocopied.

While some of these packages still make up a sizeable percentage of many small retailers' inventory, they are rapidly going the way of the Apple computer kits. Replacing them are slickly produced, shrink-wrapped packages, with documentation written by professional technical writers. Art for computer software and videogame packaging is becoming as big a field as book and record cover design. For diskettes, three-ring binders with a sleeve for the disk are in wide use. And as a deterrent to theft, many titles are mounted on oversized cardboard backings.

C. Training

One of the major factors determining the distribution curve for software from specialty stores to mass merchants is the level of customer support provided or required in each case. The software curve follows much the same pattern as the hardware curve, except that mass distribution of home-oriented software has not yet replaced the specialty store channels, as it has for most home computers, and the Yankee Group does not expect it to do so in the near future except in the case of entertainment software.

A trained sales staff is most important in business and productivity software retailing. Not only background knowledge, but also programming ability and familiarity with several machines is required of many salespeople. Some business software stores, such as Microcon (Watertown MA), also offer client consultation (at $40 an hour), so salespeople must be up to the task.

As distribution moves down the curve, support is less critical. Software specialty stores geared to home entertainment, such as The Program Store, offer less support than business software specialty stores, but more than department stores. Finally, mass merchants and discounters offer little or no support, but some are beginning to place a higher priority on training. Child World, for example, holds seminars for its personnel working in the electronics department. The company instructs them in assisting customers to choose computers based on application rather than horsepower.

IV. Software Publishers

In an examination of the software retailing industry, it is important to consider the source of the products, namely the publishers. For many retailers, software represents a

dramatically new approach -- the difference between manufactured products and published products. This entails issues such as copyright, piracy, licensing and royalties, as well as product identification with individual authors rather than anonymous manufacturers (see Section C below). These factors would appear to make a strong case for the role of bookstores and record stores as viable distribution channels, but they do not necessarily give these outlets the edge against the greater experience of specialty store retailers, and even mass merchandisers.

A. Book and Magazine Publishers

The book publishing industry, having fallen on hard economic times, has seen computer-related books and software publishing as its salvation, and has embraced them enthusiastically. The welcome mat was on display when the Association of American Publishers voted unanimously in March 1983 to admit publishers of computer software to its membership.

Table 6-7 is a selected listing of the book publishers who have begun to market computer software. Many of them are textbook publishers whose point of entry is in educational courseware (See Chapter Five), but some of these, and others, have branched out into home management, business, and productivity software as well.

Most book publishers based their decision to enter the software market on the astounding success of computer books at a time when sales of other book categories were falling off.

The access to authors gives book and magazine publishers relatively easy entree into at least one end of the software publishing business -- documentation writing -- but does not necessarily assure them of success in software publishing. Many have attempted to put together a team consisting of a programmer, designer, secretary and an administrator, and then

TABLE 6-6

BOOK PUBLISHERS IN THE SOFTWARE MARKETS

Addison-Wesley Publishing
CBS Publishing
Encyclopedia Britannica
Harper & Row Publishers Inc.
Hayden Book Company
Holt, Rinehart & Winston
Houghton Mifflin Company
McGraw-Hill Book Company
Milliken Publishing Company
Prentice-Hall
Random House
Rand McNally
Reader's Digest Services
Scholastic Inc.
Scientific Research Associates Inc.
Scott, Foresman & Company
Simon & Schuster
Sterling Swift Publishing Company
Tab Books
Warner Publishing

December 1983

Source: the Yankee Group

await a finished product. They feel that each member of the team has a specific strength and that, by pooling separate but equal talents, a high quality product will emerge.

While teamwork may be effective in some cases, the product may suffer from conflicting personalities and too much input of equal weight. The Yankee Group believes that better software results from a single source or a project under the leadership of one individual. This may best be achieved using a two-tiered approach in which a publisher contracts with a software production house to produce one or more programs. The software house, in turn, oversees production of those programs using an in-house team process or project leader method. The following section is an example of a small production company that has been using the project leader approach very successfully.

B. Tom Snyder Productions Inc.

Based in Cambridge MA, Tom Snyder Productions is one of a growing number of small production houses that are becoming a significant factor in the software industry. The fact that the company is named after its founder is, itself, interesting, in that software is being identified with authors rather than with corporate entities.

Tom Snyder is probably the best known creator of educational software today. (He dislikes the "education" designation, preferring to consider his programs simply as games.) His first commercial products were published by then newly-established Spinnaker, and the programs -- Snooper Troops I and II -- have sold beyond Spinnaker's and Snyder's greatest expectations.

Snyder started his company three years ago with three employees. There are 12 now, and more will be hired by

yearend. Snyder comes up with all of the potential game ideas, then assigns a programmer to take over the project. That person has full responsibility over the production of the game, overseeing coding, documentation, artwork, and time tables. Programmers can call half-hour brainstorming sessions once a week, inviting anyone else in the company to participate, but otherwise are on their own.

The company's operating costs are about $40,000 per month and each project takes an average of nine months to complete with costs ranging from $60,000-$100,000. Snyder currently is working with four publishers on a royalty basis: Spinnaker, Scholastic Inc., McGraw-Hill, and Scarborough Systems. In general, publishers are paid 40% of the distributor's revenues. Snyder's royalties coms out of the publisher's revenues, averaging 22% for disk products, and 10% for cartridge software. With Snooper Troops, $3 out of evsry $44.95 (suggestsd retail) sale goes to Snyder Productions.

C. Electronic Arts

With the expectation that software publishing will mirror book publishing and the rscord industry to the extent that authors -- not publishsrs or manufacturers -- are commodities to trade upon, a San Mateo (CA) company called Electronic Arts is amassing an impressive "stable." The "electronic artists" who have already signsd on with the company's Talent Development Department to help conceivs game ideas include basketball headliners Larry Bird and Julius W. "Dr. J" Erving, cartoonist Gahan Wilson, and Bill Budge, creator of the electronic pinball game "Raster Blaster" and the highly lauded "Pinball Construction Set."

Electronic Arts was founded with $5 million in venture capital (compared with the average $1 million or less most software startups receive) and projects revenues of $250 million by 1986. The company released its first six games in

May to 800 retail outlets and has seen four of them climb into the ranks of the top 10 best-sellers. An additional 24 titles were introduced in December 1983, packaged in record album format, with liner notes, snazzy graphics, playing hints, and the artist's name prominently displayed.

Again, the Yankee Group issues the caveat that the world's greatest marketing and promotion efforts will be for naught if the product is weak, but Electronic Arts appears to have the bases covered. The company has put together what appears to be a hard-to-beat strategy: get a big name, promise him a higher percentage of sales than other software publishers offer, then promote, promote, and promote some more. The higher volume such promotion should theoretically produce more than covers production and royalty expenses, according to Electronic Arts.

Although the company's initial emphasis has been on entertainment and simulation products, it will be devsloping home management and educational software as well. Several of its non-educational titlss promote learning nonethsless:

- "M.U.L.E." -- an economic simulation game in which players are stranded on a planet for six months and required to compete for and make use of raw materials in order to survive;
- "Music Construction Set" -- developed by a 16-year-old high school studsnt, this program uses musical icons to composs music which the user can playback immediately and/or print out.

Loving detail also has been lavished on the Dr. J and Larry Bird game, "Dr. J and Larry Bird Go One-On-One" (availablс fall 1983). Not only did Erving spend several hours with the programmers assessing the accuracy of the strategy used in the game, but freeze frame photographs were taken of Dr. J on the basketball court to be incorporated into the game's graphics.

All of Electronic Arts' titles are in disk-based format, available for the Apple II, II+ and IIe and the complete Atari computer line, and new titles will be announced for the Commodore 64.

V. The Role of the Distributor

In 1982, around 60% of U.S. software sales went through distributors. Much of this dollar volume was from third-party publishers, and the remaining percentages were divided among the major computer manufacturers who published and distributed their own software. Chief among these were TI and Atari, both of which have initiated policies which have alienated third-party authors and which may result in lowering their respective market shares significantly over the next two years.

The national software distribution for the consumer market is shared by three distributors and several rackjobbers. (See Table 6-8.) In addition to these major companies, there are a growing number of small local distributors and national distributors that focus on a specific segment of the industry, such as Soft Kat (Van Nuys CA), a national distributor of educational software.

A. Texas Instruments

Although TI is no longer in the business, its strategy as a major contendor in a tumultous year is of interest. TI used distributors for only 10% of its software, selling the rest directly to its retail accounts. With its patented GROM (graphic ROM) chip technology, TI threatened legal action for any third-party publishers that develop software for the 99/4A without prior consent from the vendor. Several publishers -- most notably, Atari and Thorne EMI -- called TI's bluff, however, by marketing software for the 99/4A. TI usually

Table 6-8

Returns Policies for Major Independent Software Distributors

Distributor	Returns Policy	Suppliers	Outlets	Titles	Region
Softsel	100 credit for returns within 90 days	200	5,000	3,500	U.S., Europe
Software Distributors	Cash or Credit on titles returned within 30 days of purchase	350	4,000	5,000	U.S., Germany, Japan
Micro Distributors	Return within 90 days for 90% credit	80	3,000	800	Eastern U.S.
SKU	20%-50% credit on return within 90 days but must keep on shelf for 30 days or more;	100	3,000	1,500	U.S.
Micro D/Service Software*	No returns for specialty dealers unless Micro D recommends title; rack-jobbing 20%-50% credit within 90 days	200	1,500	2,000	U.S., Europe, Hong Kong, Australia
Ingrams*	20% returns; recently increased to 100% within 90 days	100	1,200	2,200	U.S., Canada
Handleman*	100% return on rack-jobbing	50	500	500	U.S.
Lieberman*	100% return on rack-jobbing	50	400	500	U.S.

Source: the Yankee Group

* Deal with Mass Merchants

commissioned programs from outside sources, paid the author or publishing house a royalty, then manufactured, marketed, and distributed the product under its name.

Many third party publishers, after extensive and fruitless negotiations, refused to cooperate with TI. They viewed the vendor's rigid policies as shortsighted and unfair from the publisher's financial viewpoint. The larger publishers were reluctant to cede all control over packaging, marketing, and distribution to TI, but some concluded acceptable agreements.

For example, Spinnaker (best known for its educational games), and Broderbund Software (game and computer software manufacturer) agreed to supply the program coding for several of their established "hits" to TI, which then translated it into ROM cartridge format for the 99/4A.

In the first week of August, TI began a new service for its larger national accounts, called "detailing," otherwise known as rack jobbing. The vendor had agreements with KMart and Sears, in which TI agreed to assume responsibility for inventory, upkeep, stock balancing, and training, while the retailer maintained veto power over the detailer's activities.

Detailers check their respective stores every other week, making sure that the demonstration console and software are in working condition, distributing literature, checking product movement, and generally seeing to it that TI's programs have a prominent position on the shelf.

TI entered the rack jobbing ranks so that it can establish more direct control over its retail accounts. For example, whereas KMarts had been distributing products to the individual stores through company warehouses, as of October, each store ordered directly from TI, bypassing the warehouse.

8. Atari

Atari, meanwhile, sells direct to many of its major accounts, but relies on its newly-created exclusive distributor force for most of its sales. This force consists of about 40 of the country's largest distributors who have agreed to drop all other lines in order to handle Atari's products. As inducement to join up, Atari offered the distributors 25% markdowns on its 1982 inventory (and a 40% markdown on the overestimated "E.T." videogame). The advantages to distributors include:

- better gross margins;
- fewer units of inventory;
- ability to put marketing efforts behind a single line.

The disadvantages to the distributors include the loss of a significant percentage of volume from other publishers, an increase in risk by being tied to a single vendor (in this case one with mammoth losses), and an Atari-imposed restriction of sales to specified geographic boundaries. But the primary disadvantages are to national retail chains which will now have to deal with many different distributors instead of one or two, and to other manufacturers, which may be losing distributors to Atari. The Yankee Group believes that the cost to Atari of establishing an exclusive distributor network has not yet been fully realized in either amortised financial losses or industry goodwill.

Claiming antitrust violations, Parker Brothers filed suit against Atari and initially succeeded in obtaining a restraining order on March 28, 1983. But the order was lifted a week later when the federal judge ruled that the freeze on Atari's plans would not foster competition.

C. Electronic Distribution and Publishing

The Yankee Group has tracked the development of electronic publication and distribution in a number of previous reports. For many purposes, electronic publication and distribution is essentially the same activity, but for purposes of conceptual clarity, Yankee Group defines publication as the accessibility of software programs, but only on-line, or in volatile storage eg. Control Video Corporation's Gameline Service or Mattel's Playcable. Electronic distribution is defined as the availability of a non-volatile copy of the program to the retailer or end user, eg. the various product offerings by Xante (Tulsa OK), Romox (Campbell CA), and Cumma Technology Corporation (Sunnyvale CA).

While both of these features could be combined into a single service offering non-volatile distribution to the home/end user, to date the various electronic teledelivery services offer either non-volatile distribution to retail, or volatile publication/distribution to the home.

The Yankee Group believes that the economics and convenience of electronic delivery of software and services are so overwhelming that it is only a matter of when, not if, it will significantly displace more conventional methods of hardcopy distribution. As noted in previous reports however, there are a number of factors apart from economic and technological feasibility that influence the speed and scope of teledelivery services. These include the changed nature of the product, problems associated with billing and payment, and the psychodynamics of the shopping experience itself.

Clearly however, 1984 will see a major thrust by various vendors to make electronic delivery a commercial reality. In the retail environment, the horrendous inventory problems associated with videogame and computer software makes some kind

of electronic distribution extremely attractive, even as it threatens existing ways of doing business, and especially the livelihood of intermediaries like distributors and rackjobbers.

In the home environment, the rising installed base of computers, and the declining price of modems is attracting companies eager to launch products as soon as critical mass is reached. Although a variety of competing delivery channels are still be tested (telephone, cable, DBS, FM sideband, etc.), several companies, including Atari/Activision, Coleco/AT&T, The Games Network (now TGN Inc), NABU/Servenet, and Playnet, will be testing on-line game services in 1984. The various vidoetex offerings by Knight-Ridder, Times Mirror and Keycom will move beyond pilot testing into limited commercial testing in 1984, and CompuServe will be adopting a much more aggressive stance.

The Yankee Group therefore expects the next two years to offer rapid advancement in the area of teledelivery, although none of the current contendors have yet shown producte that are clearly destined for success. Home of the Future will be closely monitoring developments in this fast moving field through a series of special reports on electronic publication and distribution in 1984.

TABLE 6-9
DIRECT SALES BY VENDDR IN 1983
AS A PERCENTAGE DF TOTAL DISTRIBUTION

Apple	45%
Atari	70%
Commodore	50%
Tandy	0%
TI	90%

December 1983

Source: the Yankee Group

TABLE 6-10
AVERAGE SALES PER SQUARE FOOT OF TOTAL SPACE*

Type of Retailer	Sales
Toy supermarket	$150.00
Department store	107.70
Mass merchant/discounter	95.56
Computer store**	390.00
Software specialty store	300.00
Video store**	350.00
Record store	150.00
Bookstore	125.00
Audio store**	300.00
General Merchandisers***	97.33

* Total space refers to total square footage of store, including inventory space.

** Source: National Retail Details of America (NARDA)

*** The "Big 3" -- Sears, J.C. Penney, Montgomery Ward.

Source: the Yenkee Group

TABLE 6-11
AVERAGE RETAIL STOCK TURNOVER

Type of Establishment	Number of Turns
Pizzeria	47
Retail Mean Market	35
Doughnut Shop	21
Delicatessen	15
Toys	7
Arts & Crafts	7
Cameras	5
Offlcee Supplies	5
Books & Stationery	5
Records & Tepes	4
Radio, TV & Electronics	4
Computer Store	10
Software Specielty Store	6

Source: the Yankee Group

CHAPTER SEVEN
SUMMARY AND CONCLUSIONS

I. The Market

The home computer and videogame markets are complex and rapidly evolving. The videogame market is going through a severe shakeout that will get worse before it gets better. Although the installed base of home videogame consoles will rise by 35% (five million units) this year, and software unit sales will rise about 30% to between 75 and 80 million units, software revenues will be flat with 1982, at $1.5 billion retail. There is a shortage of megahits, either licensed from the arcade or originally developed. No title appears likely to generate unit sales much in excess of one million units in 1983, compared to three million plus units for Activision's "Pitfall" or five million plus units for Atari's "Pac-Man" in 1982. The market is glutted with mediocrs product that will depress prices through the first half of 1984, and probably permanently alter the industry pricing structure.

The value of the existing (1982) installed base of 14 million consoles (U.S.) is rapidly crumbling with the exit of Mattel and Odyssey, and retailer resistance to distributing software for hardware they no longer carry. Continuing software development for these units (as well as ths Timex TS1000 and TI 99/4A) is problematic at best. New purchasers are spending less money on hardware and software, old purchasers are using their game consoles less, and retailer and consumer focus has clearly shifted away from dedicated game consoles to computers.

The videogame industry, coin-op and home, is settling into a new and much reduced, but hopefully more stable, level of market activity. The Yankee Group believes that interactive

electronics is an important new mass entertainment form. However, it will take further breakthroughs in imaging technology, most notably in instant-access laserdisc players and broadcast quality graphics chips, to restimulate the market significantly and to broaden its scope.

Depsite the enormous and largely unnecessary losses in the home computer market this year, the industry is well positioned for growth in 1984. The exit of TI, coupled with the official entry of IBM and Apple into the consumer side of the market, will impact the fortunes of the industry positively (though obviously not of every player within it). The Yankee Group believes the hardware market as a whole will move upscale and performance in 1984 will move towards the $500-$1,000 range. A move to the system sale, higher margins, and positioning based on factors other than price will help stabilize the market and move it in the direction of providing real utility rather than relying on hype and consumer fears for their children's education as it has in 1983.

The inetalled base of home computers will be over seven million units by yearend 1983, and should be around 15 million units by the end of 1984. Most of the sales in 1984 will be of 64K-plus computers, which will provide a real and active base for software development.

Perhaps the most important market development in 1984 will concern the emergence of electronic "delivery" of software. There are several important distinctions to be made about the various proposed services. The first is the targeted location of the service -- retail location or home/office. The second is whether the service offers true delivery, i.e., permanent (non-volatile) copies for the consumer, or merely on-line access.

II. The Vendors

The current shakeout among game developers is only the forerunner of a larger shakeout among software developers generally. The proliferation of titles, the increasing competition for shelfspace and the resistance of major retail accounts to dealing with more than a dozen or so software suppliers will force a restructuring of the market. The new market will consist of several dozen major "publishers" drawn from the ranks of hardware manufacturers, software developers, and traditional print publishing. These will leverage their existing product development, marketing, and distribution and financial strength to dominate the intensely competitive multi-billion dollar marketplace.

Below them will be the vertical market and niche publishers numbering around a hundred, and below them, the author/ developent companies. Large scale software development, especially when geared to new hardware configurations, typically requires expensive development systems; this will remain the domain of the majore such as VisiCorp and Apple. However, authorship does not easily lend iteelf to the bureaucratic requirements of even the most flexible in-house control, and the Yankee Group expects the lone author/ entrepreneur and small software houses to continue to make major contributions to the industry. The rising cost of entry, now typically around $1 million for the advertising costs alone for a national new product launch, will limit the role of the startups to authorship. The new few years will be years of acquisitions, mergers and joint ventures as the industry restructures itself.

The relative success of the different software distribtuion channels (video specialty, records, bookstores, software

specialty) in providing the appropriate levels of service and support will clearly shape the fortunes of the companies traditionally tied to those outlets. Because it obviates the inventory risk, electronic distribution is the one factor capable of shifting the balance of opportunity significantly back towards the smaller companies, at least in the short term. Market awareness of the product, documentation, demonstration, support and packaging remain factors pushing the market towards a limited number of major vendors.

III. The Product

The home software industry is still waiting for its "VisiCalc" breakthrough product. Even without it, software for computer usage in the home will improve dramatically in both quality and range in 1984. Vertical markets will become increasingly important. The general trend of the consumer hardware market towards systems sales and more powerful units will give software developers greater flexibility in incorporating the design approaches opening up the business market.

These approaches include various levels of program integration and the use of icons, micro controllers, touch screens and digitizer pads, for easier machine interface. However, hardware limitations will still impose some restraints, especially microprocessor power, memory and disk drive availability. Progress will be made toward standardizing operating systems around IBM and MS-DOS, but a multiplicity of incompatible systems will continue to prevail at the consumer level through 1984.

For some inportant applications, such as word processing, spreadsheets and telecommunications, these will be a trend to either building the program directly into ROM (e.g., Coleco's Adam and Commodore's C264), or at least to bundle the applications with the hardware.