

Multimedia: Technology Push vs. Customer Pull

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I. Introduction

Multimedia has received a great deal of press in the past years as the hottest technology in the computer industry. Multimedia is claimed as one of the top five developing technologies that will drastically influence corporations in the following years, according to a report by Anderson Consulting (Alexander, 1993 Sep.).

While marketers see multimedia computing as the spark for sales of new PCs and up grade-kits, several questions persist about whether multimedia will ever catch on with the buying public. Some feel that the benefits of multimedia systems have been exaggerated (Blackwell, 1991). Zackmann (1990) pointed out the lack of a standard and applications and high cost. Rick Warren, a syndicated audio-visual columnist, disputes industry predictions by declaring the "We have passed the era of revolutionary products." At a cultural level,

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Postman (1992, Nov. 1) argued that Americans are obsessed with what technology can do, rarely even interested in what it may undo. He further claimed that when it comes to technology, "our defenses are weak, our need insatiable, our judgment unreliable, and our perspective short-sighted."

Considering that the rosy projections appear to be driven more by technology/industry push than by consumers' needs, a systematic examination of the stumbling blocks to multimedia diffusion is of importance. Despite the industry push, consumers would not 'snap up' these products solely for the love of technology can offer them and how. Therefore, "what can a technology do?" is not a sufficient question until we add "for whom". In this context, we attempt to provide answers to the following questions: What are possible scenarios for the US multimedia market in the year 2000? Will there be a mass market for multimedia or not?

II. Technology push

2.1 The concept

In a sense, defining multimedia only limits the scope of multimedia. At its simplest, multimedia means the addition of sound and video to personal computers. At its grandest, it means the melding of different media technologies such as PCs, TVs and telephones, as well the melding of the computer, consumer electronics and telephone industries (Johnson, 1991). At a working level, a multimedia system comprises a powerful processor, frame-grabber and full-motion video boards, audio circuitry, data video compression technology, large-capacity storage devices, high-bandwidth networking equipment and customized software. So the concept can be defined at two different levels. First any personal computer equipment with a CD-ROM drive and sound capabilities so that it can run programs or access data that contains sound and moving pictures at the hardware side. Second, a program or data source that includes sound and moving pictures at the software side (Necholson, 1992).

2.2 Technological trends

2.2.1 Digitization

In the past, different forms of information have all been traveling on different tracks. There is no single standard that they all fit, nor are the existing tracks wide enough to accommodate so much traffic. Now, digitization of data means conversion of text, numeric, sound, and visual images to binary signals that can be manipulated, stored, transmitted, and reconverted to its original form for delivery (Coates, 1992). In other words, digitization of data makes inevitable convergence between competing and complementary transmission technologies -- microwave, cellular radio, fiber optic cable, and satellite transmission -- and between telecommunication systems -- telegraphy, telephony, radio communications, and broadcast. This makes possible integrated service digital networks (ISDN) that can carry voice, data, text, and video signals simultaneously.

Accordingly, the continued blending of communications and computer technology will eventually blur the distinctions between the computing and communication, entertainment and news industries. It is therefore uncertain whether the new market will be led by computer companies, telephone companies, entertainment companies (Press, 1990). While the long-range trend toward technological convergence is clear, to users it can seem a long way off. According to Coates (1992), it is delayed by segmented markets, by the failure to achieve interoperability, and by the persistence of obsolete regulatory categories.

2.2.2 Networking

According to Information Strategies Group (Eckerson, 1992), most companies by the turn of the century will be implementing multimedia applications that pull digitized audio, full-motion video, image and text information from distributed servers across an enterprise network. The report predicts that network-based multimedia applications will make the same inroads into corporations that desktop publishing did in the 1980s. It is further described that four applications will accelerate the growth of networked multimedia: education and training, personal communications, business presentations, and information repositories, such as electronic catalogs, libraries and manuals.

The emergence of high-speed networked based on fiber distributed data interface (FDDI) and asynchronous transfer mode (ATM) standards will enable companies to distribute multimedia information demand from network servers instead of physically distributing

CD-ROMs to every desktop.

2.2.3 Compression and Storage

An ordinary telephone line can transmit data at between 1,200 bits per second (bps) and 4,800 bps. An uncompressed color television picture uses 75-90 million bits per second. Simply speaking a television picture takes about 1,000 times as much bandwidth as a voice phone. AT&T's Videophone 2500 which squeezes video signals so much that they can fit over a standard telephone line is an example of the progress of the video compression technology. Bell Atlantic's video dial tone by using Asymmetric Digital Subscriber Line is another example of the progress. The SkyPix Corp., which was formed to provide up to 80 pay-per-view TV channels by direct broadcast by satellite, would have not been founded if the compression technology were not available. The cable television industry has also been backing up the research on the video compression.

Despite the technological progress, picture quality on the multimedia is worse than VHS. Because full-motion video integration in multimedia technology is lacking due to limitations to memory and speed, which requires 30 images or frames per second (fps). A 1,280-X-1,204-pixel image has approximately 1,310,720 pixels, each of which requires one byte for eight-bit color or three bytes for 24-bits color. Compression is a partial solution to the storage problem, but there is no simple answer (Name & Catchings, 1992, May 18).

CD-ROM' players for personal computers have been on the market for years, most at premium prices, and have found a strong niche for storing huge amount of text and other data. The disk's huge storage capacity (560 megabytes of data can fit on a single one, an amount equal to the contents of several large personal computer hard-disk drives) allows computer programmers to write complex applications that combine many kinds of media with which a user can interact. While compression techniques can reduce the bandwidth required for full-motion video to 1.5M bit/sec, more development is required for practical applications.

2.2.4 Speed

More processing power based on microchip design and more storage capacity provided by CD-ROM have become technological trends in the industry. Engineers have moved from simple integrated circuits to large-scale-integration (LSI), then to very large-scale integration (VLSI) which has made it possible to put millions of components on a chip, and we are now poised to move toward ultra-large-scale integration (ULSI) (Gazis, 1991).

More specifically, early microprocessors had about 2,300 transistors. Today's most popular microprocessor chips have about 300,000 transistors on a chip, and a performance of a few millions of instructions per second (MIPS) - the standard measure of computer performance. Intel's new 486 personal computer has 1.2 million. The 586 computer with about 4 million transistors, should be able to perform billions of instructions per second (Coates, 1992). In short, we are able to quadruple the density of memory chips roughly every three years.

Consequently, between 1980 and 1985, the average MIPS declined in cost from \$250,000 to \$25,000. From 1985 through 1990, the average price per MIPS fell from \$25,000 to less than \$2,500 (Rappaport & Halevi, 1991). Put another way for comparison, the \$2,665 that IBM charged for its first generation PC in 1981 today buys a computer with 35 times the processing power, 1,200 times the disc capacity, a high quality monitor, and more (Schlender, 1991). According to Gazis (1991), we can expect billion-bit chips around the year 2000.

Another way of getting performance improvement from a machine is reducing the number of cycles needed to execute an average instruction. This can be done by increasing the concurrency of computational events taking place inside the machine (Gazis, 1991). Not long ago some experts felt that 50 MIPS was an insurmountable barrier to machine performance. Now the 100-MIPS machine is around the corner.

III. Consumer Pull

3.1 Leisuretime use

Leisure time has been increased in the US in the long term. For example, an American worker now puts in 1,800 hours a year as compared to 3,300 hours in the early years of the century (Bennington, 1989). John Robinson (1994) also found that "free time of Americans has increased significantly over the past quarter century, from about 135 hours a week in 1965 to about 40 hours a week in 1985."

While being entertained is an important part of their leisure time (Lieberman, 1991, p. 60), very little of the new leisure is used for intellectual pursuits (Drucker, 1989, p.178). Much of that extra free time has gone into increased TV watching, physical exercise, and sports

activities. Robinson estimated that 40%, or 2.2 hours of the 5.5 hours of daily free time of Americans is devoted to television viewing. Kubey and Csikzentmihalyi (1990) arrived at the same estimate, falling somewhere between 2 and 4 hours per day. Reading has stayed about the same, with the exception of newspaper reading, which has gone down considerably. Recordings may be up a bit, and radio may be down a bit, but they are not large consumers of time. Using these non-TV media is usually done as a secondary activity.

Then, how will leisure-time choices be made as we head into the 21st century? If current trends are any indication, home-based activities will likely characterize American entertainment preferences in the future. While out-of-home entertainment grew only modestly in the 1980s, in-home entertainment spending exploded during the same period. For example, film box office revenues increased by 3%; attendance at professional sporting events grew by 5%; and revenues for Broadway theaters were actually down by nearly 4%. In contrast, half of all Americans find their at-home entertainment options more appealing than the traditional "night out at the movies"(Lieberman, 1995).

A recent survey by the Electronic Industries Association(EIA) also found that the percentage margin between people preferring to stay home to be entertained and those who prefer going out has widened in the past two years (Tuyl, 1994). "Go to nightclub to enjoy music", for example, decreased from 39% in 1989 to 21% in 1991, while "Stay home and listen to music" increased from 48% to 68% during the same period. "Go out to a movie" declined from a 38% to 22% against the increase "Watch a movie at home" from 50% to 67%. As for sports preferences, "Go to sports event: shrunk form 33% to 27%, "Watch sports on TV at home" gained from 49% to 56% during the same period.

Watching TV is not one of people's favorite ways of spending time, even though it has been one the major gainers in free time. While socializing is one of the most enjoyable things that people do during the course of the day, interpersonal get-togethers have declined between 15% and 25% over a 20-year period (How Americans, 1991). At the personal level, people have a strong tendency to spend more time on activities that they like to do.

3.2 Spending on the media

We can describe the economic support of mass media as falling along a continuum ranging from direct to indirect consumer support (Jeffres, 1986, p. 73). At one end we have 100% direct support through consumer purchases. Here we can find both the book and the

film industries which derive most of their revenues from public purchases. At the other end is the broadcasting industry—both radio and television—where most of the support is indirect through either advertising or institutional support such as that given private foundations or the government. Magazines and newspapers can be positioned in between these extremes. We now should add computers, VCRs, cable television, and stereos—whether it is CD-or LP-or tape-player—to an extreme end of the 100% direct support. As we are moving toward the pay-per-society, virtually all media use are turning into utility-like services.

Considering a transition from industrial to information societies, it seems naturally assumed that expenditure on mass media will increase more rapidly than other expenditure. However, the pattern of economic support for mass communication is approximately constant relative to the general economy. McCombs and Eyal(1980) found that spending on mass communication is highly constant during the period of 1927 and 1968, and remained the same between 1968 and 1977. According to McCombs and Eyal(1980), while spending on newspapers and magazines nearly tripled, spending on books and maps did not even double during 1968-1977. Even with the proliferation of audio-visual media devices and services over the same period, the historical patterns of spending on print and other mass media in terms of constant dollars remained stable. Thus, the Principle of Relative Constancy concluded that society's use of mass communication seems remarkably resilient in the face of rapid technological change.

Werner(1986) also supports the Principle with his recent research in Norway during the period of 1958-1982. He has shown that low-consumption households spend only a small proportion of what high-consumption households spend on mass media, even though expenditure on mass media accounts for a considerably higher proportion of total expenditure in low-rather than high-consumption households. Whereas expenditure on the "necessary" media, such as radio, TV and newspaper, accounted for 72% of the low-consumption household's media expenditure, in high-consumption households it only comprised 32%, even though the latter spent twice as much on such "necessary" media. As for the "exclusive" media, such as books and records/tapes/cassettes, in contrast, the former spent only 8% on these as against 40% for the latter.

It is projected that the percentage of expenditure on media will be likely to rise more rapidly in high-consumption households as new media technology are being introduced. A common finding in research on new communication technologies is that only 10% of the users present 50% of all uses, with the other 90% of users making up other 50% of uses

(Rogers, 1987, p. 125)

3.3 Behavioral patterns

3.3.1 Simplicity

At the 1992 Summer Consumer Electronics Show, strategic planners in both the consumer electronics and telephone industries about the new technologies warned that simplicity, not rampant product proliferation, is the key to success (FHTN, 1992, June 1). How simple is simple enough to the critical mass of consumers?

In the past, even the job of a telegraph operator was generally regarded as a highly skilled occupation (Aronson, 1977, p. 17). The telephone users were said to suffer 'stage fright,' an anticipation of microphone and television devices (Briggs, 1977). Matsushita's VCR based on supermarket bar codes. VCR Plus by Gemstar, Insight Telecastm and Sony's double-sided controller are just few examples for easing VCR programming (Johnstone, 1992, July 23).

The print media had to wait longer than 400 years to be accepted by the general public who had to learn the skill to use them - how to read. In contrast, both radio and television which did not require any specific skill except turning them on and off and listening or watching, reached 30% of the general public within 5 to 7 years of introduction. Communication via computers still requires not only the ability to read or write but also the capability to operate the machine, including typing skills. Great efforts have been made to go into the elimination of input devices that tie the user to the technology in ways that impede other movements and activities. As available processing power increase, we expect that today's input devices will give away to more convenient modes of interaction with computers, through natural language input, touch-screen computing eye-tracking interface, and handwriting.

If the computer industry can advance the handwriting-recognition technology, a wide range of companies and government agencies are sure to be interested. The IRS plans to award a \$1 billion contract for technology that will enable it to scan all tax forms by computers by the year 2000. The US Postal Service handles 555 million pieces of mail a day, 20% of it with handwritten addresses (Levyn, 1992, Dec. 7).

In fact, considerable progress has been made in this area since 1970 by Fred Jelinek and his colleagues at IBM Research. Their prototype can recognize a vocabulary of 20,000 words

with an accuracy of at least 97%, and it does this in real time (permitting immediate correction of mistakes). It is thus expected that some version of sophisticated speech input will be using during the 1990s. For \$5,000. Dragon Systems offers software package that it claims enable a computer to record with 90% accuracy what is dictated by a human operator. Verbex Voice Systems for the Wall Street traders and Bell Lab's prototype system for translation are similar examples (Burgess, 1992, Nov. 11).

At the practical level, however, many people shy away from the still quirky machines, finding them too prone to mistake or just too hard to use. Most systems recognize only slow, clearly enunciated speech or have a limited vocabulary. Despite the technological developments achieved in the computer industry, the current simplicity is not likely to be a widely accepted practical reality by the year 2000. Then, maybe, people would rather just watch television.

3.3.2 Portability

As computers become a primary means of communication beyond telephones, cellular phones, faxes, and even live video hookups, portable personal computers are expected to reshape American business in the 1990s. The PC evolution is classified into three groups in terms of size: desktop, laptop, and palmtop. A number of new smaller-than-laptop computers currently encompasses three basic types again: notebook laptops, pen-based computers, and pocket or palmtop computers. Rappaport and Halevi (1991) predicted that opportunities for meaningful hardware differentiation will virtually disappear.

NEC even envisions a future in which people will wear personal computers like clothing, and they have designed a gaggle of prototypes to help PCs leap from desk to neck. According to a NEC premise, electronic miniaturization over the next 10 to 15 years make computers highly portable devices to recognize voice and handwriting, and to incorporate keyboards, telephones, display screens, faxes, CD memories - even cameras and satellite transmitters (Kirkpatrick, 1992). However, computers cannot be truly portable until they can be folded and crash-free dropping as the print media are, which is hardly to be achieved in the following 10 years.

3.3.3 Improvements or Newness

Media history appears to support a modest view of acceptance of new media. The older media merely adapted themselves to new market pressures, finding new ways to appeal to

audiences. Motion pictures, for example, have tried several strategies: specializing (Black films, the youth market) and demassifying the audience (pornography, wilderness films), graphic violence, and special effects (Jeffres, 1986, p. 46). As we know, TV did not kill radio or cinema as radio did not kill newspapers. VCRs did not kill TV or motion pictures. Also, the rapidly adopted media technologies are add-ons to already existing hardwares such as TV (for VCRs), telephone(for answering machines) and stereos (for CD players show).

From a newer medium's perspective, however, each new medium must provide its own special quality to get into the existing media environment to survive. Radio added speed to newspapers; TV gave picture to radio and convenience to motion pictures; cable television provided more channel choice and better picture quality; VCR freed people from the primetime with privacy; and Nintendo games added more fun through frustrated excitement. CDs not only improve the conventional record player in terms of sound quality and size but also provide new levels of programmability via random access capability. In contrast, current multimedia products are merely improvements on old media and lack the excitement and originality that was present on past generations of media(Rosen, 1991 September). Then, what can a multimedia add to the current media environment?

The elements of multimedia technology have been available for several years, but a system of linking them all together has been lacking. This packaging trend is not new. We have long been aware of tendencies to put different devices together, often in one box - ranging from the integrated music center to the TV-VCR combo to the simple combination of a clock and radio in the same housing. The use of microelectronics and digital controls not only makes it more feasible to consider relating together the operation of devices that are in the same box, but also increases the utility of interrelating devices that are not in the same box, by getting them to communicate with each other through the home. The rationale for this integration may be convenience.

3.3.4 Compatibility

Hardware

The incompatibility among personal computers including CD-ROM players reminds us of a historical lesson from both the US recording industry and the VCR industry. During the battle of the speed when Columbia introduced 33 rpm record in 1948 and RCA brought out its 45 rpm in 1949, records sales dropped to \$50 million below the 1947 level as people

waited to see which format would dominate. During the late 1970s consumers, uncertain to which of the two systems would be adopted, bought neither VHS nor Beta. Later, they showed their preference of VHS over Beta more based on machine universality than on technical superiority.

There were as many as 10 different hardware standards were introduced to the 1992 International Conference on Multimedia and CD-ROM (Hilts, 1992, April 27). While the Interactive Multimedia Association (IMA) has started the Compatibility Project which aims at developing multimedia software-compatibility standards, it is unclear whether software developers catering to these hardware standards would rewrite their products once the project is completed (Filipczak, 1991 August). A group of leading computer firms, including DEC, HP and IBM, are working on a project that could standardize application program distribution via CD-ROM. But Apple and Microsoft have decided to proceed with their own separate hardware standards for multimedia (Bits & bytes, 1992, Sep. 14). Currently, multiple standards in file formats, communications protocols, disk-storage formats, and full-motion video schemes, and the necessity of addressing more than one these at the same time, is preventing multimedia technology from progressing at significant speed (Curran, 1992 March; Cisco, 1992 May).

Software: Business versus consumer market

In addition to hardware incompatibility, different applications for different purposes remain the markets separate. For example, when videotex was born in the mid-1970s it was seen as primarily a domestic rather than a business service. The recent revival of videotex interest can be attributed to more business applications. The failure of residential users to embrace the instrumental aspects of Prestel as well as Captain led to the shift in its marketing toward business users. Even Teletel, the largest videotex services in the world, has shifted its emphasis toward business users, who pay higher rates. In fact, interactive text in the form of online data-bases in the US grew rapidly as commercial information vendors joined government and non-profit agencies in the production and marketing of highly specialized electronic information services, most of them directed toward business, science, and the professionals, instead of homes.

It seems historically and cross-culturally common that information as news or data is the first concern of the business sector, whereas entertainment value is strongly preferred by

the general public. For example, the television industry itself suffered in the early days from lack of programming and crude presentation but it lived to become the highest consumption medium ever with the quality of convenient, cheap, and 'novel entertainment'(Bennington, 1989, p. 155). consumers' fun-orientation in their videotex user was already found in Prestel in Britain , Captain in Japan, Gateways trials in the US, and Teletel in France.

Business customers are willing to and most times, have to pay for goods and services that save time and money because they need (rather than want) to be competitive. While personal users also value time and money, they, in addition, seek (whether need or want) entertainment, physical security, and alternative ways spend large blocks of leisure time. It is the lack of compatibility between a speciality and a mass market which keeps them apart.

Telephone use has two dimensions: the instrumental (getting things done as in ordering an airplane ticket) and the intrinsic (talking on the telephone for its own sake) (Keller, 1977). Classie and Rowie(1987) distinguish between relational (intrinsic) and functional (instrumental) calls, but also add mixture of these two categories. An ethnographic study of telephone uses revealed that people tend to differentiate very much between business and pleasure calls.

3.3.5 Functional alternatives

According to an estimate based on 94.6 million US households by the Electronic Industries Association, radio is owned 98%, color TV 97%, audio system 94%, VCR 77%, answering machine 46%, CD player 35%, home computer 33%, color TV with stereo 31%, video game systems 31%, and camcoders 17%(Wood, 1992, January 23). So, the main reason for the failure of videotex in the US has been related to the abundance of alternative information sources (Kramer, 1991).

Commodore's CDTV and Philips' CD-I have not done well in the marketplace mainly due to the popularity of Nintendo and Sega. The share of the Big Three networks has declined from 92% in 1979 to 64% in 1991. Since previewing Newton, a prototype of the first Apple personal digital assistant, introduction of the PDA from Apple has to step back. Many specific technologies can have regretful consequences not because the technology is "in the saddle," but because of the ways in which users quite reasonably employ new devices (Fischer, 1992, p. 271).

In addition, the consumer industry already has digital processing inside the TV set (picture-in-picture). The Froxvision multimedia system creates high definition images for

home use. The system, a video-processing computer, is marketed as a television (Gottschalk, 1992, April 6). Features include user interface, movie-quality images, on-line information and single-button control. Currently, big sellers are rear-projection televisions and laser disc players.

3.3.6 New Use

William Ogburn (1964) postulated the concept of cultural lag in terms of human response to technical capabilities, by saying that cultural systems and human institutions tend to lag in responding to new opportunities offered by technological innovations. Similarly, almost all technological progress begins with a breakthrough in some form of basic hardware, followed by a period before software appropriate to the hardware is invented. At the point progress takes form in the development and perfection of products in which both the software and hardware are applied, while the humanware is still being cultivated (Sakaiya, 1992, p. 231).

Given the cultural lag, it is common for some of the general applications to be quite different from those anticipated at the time the particular hardware was invented. For example, a phonograph recording was assumed to be used as a record of speech. So the first recording made for a practical purpose after the invention of the gramophone was of a speech by Bismarck. It took 15 years for records to become a medium for music. Early films were newsreels or photography of moving objects. So, the early motion picture makers had spent twenty-some years before they produced dramatic films. The telephone as a means for 'trivia gossip' was not envisioned by the telephone industry but was invented by the users (Marvin, 1988; Fisher, 1988). The VCR was introduced for recording from TV or cable TV. Until the mid 1980s, use for recording versus replaying prerecorded videotapes was approximately half and half, with only 3% recording today (Johnstone, 1992, p. 26).

This trend is known as the Kranzberg's First Law:

Technology is neither good nor bad nor neutral. This means that technology's interaction with both the social and cultural milieus some times lead to developments themselves that are far removed from the original goals of the technical elements themselves (Kranzberg, 1989).

Marvin(1988) simply stated that people use communications in new and unpredictable patterns if it is to their advantage and will even change their ways to do so. Rogers (1983 & 1986, p. 121) explains this process as 'reinvention in diffusion theory' which refers to the

degree to which an innovation is changed or modified by a user in the process of its adoption and implementation. In his extensive study on the telephone use, Fischer concludes:

we might consider a technology, such as telephone, not as a force impelling 'modernity,' but as a tool modern people have used to various ends, including perhaps the maintenance, even enhancement, of past practices (1992,p. 272).

In short, we invariably think of a new piece of equipment in terms of expanding the range of functions of equipment already in existence. Soon, however, the technology itself create new spheres utilizing functions unique to it.

In this context, computerized communications are currently conceived of as extensions of postal services, telephones, or television sets. In 10 or 20 years, these systems, with appropriate improvements, will give birth to completely new areas of application. In other words, the various functions that multimedia servers suggest that their consequences will be mixed, unevenly distributed, and diffused, assimilated, and modified at uneven rates, as the tool goes far beyond the task of number-crunching and instantaneous communication of data. Therefore, no one can guess what these new applications will be. One thing clear is that they are tools for storing, processing, and communicaitng (Sakaiya, 1992,pp. 222-3). Again, people utilize the multimedia technology for their different purposes as people do with TVs and VCRs now.

IV. Conclusion

The primetime for the multimedia has not come yet and will not even by the year 2005. Despite the aggressive introduction of the interactive media, the most passive media will remain among the most popular.

In order to make it happen, the multimedia system will need to be something of exceptional value, compared with what the consumer has in 1993. The product needs to be radical enough that consumers see the difference, and yet offer tremendous benefits including easy handling, stellar sound, impressive picture, resistance to shock and great mobility.

Application driving the popular acceptance of computer video appear to be home-based rather than business-based. Despite the diversified applications of multimedia, however, consumers and business, the two ends of the multimedia spectrum (entertainment versus

niche market), will likely remain distinct. Libraries and interactive museums are more likely to be popular users of the multimedia than classrooms.

While consumers are more likely to stay at home to be entertained, home entertainment will maximize the consumer's enjoyment with quality while minimizing the inevitable "downtime" of planning, organizing, and arranging the entertainment event. It may make some difference if future generations grow up with devices at hand that allow them, at an affordable effort, to actively involve themselves in meaningful endeavors rather than simply accepting a mass product.

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<국문초록>

멀티미디어 : 신기술중심 vs. 고객중심

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멀티미디어를 사용하는 인간의 측면에서 기술에 대한 이해부족, 고객들의 혼란, 컴퓨터 산업의 멀티미디어에 대한 잘못된 이해는 멀티미디어 미래를 깊이 생각하게 하고 조사하게 한다. 멀티미디어 기술이 누구를 위한 것인가라는 질문없이 무엇을 할 수 있는가라고 묻는 것은 적절한 질문이 아니다. 본 논문은 미디어기술 채택에 관한 과거의 경향에 초점을 맞춰 인간에게 적합한 기술이 어떻게 개발되고 인간의 선택이 어떻게 이루어지는지 조사한다.