INSIGHT
Anticipating the Future... Assessing the Impact

IPRO 341 Final Report

December 2, 2005

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Statement of Purpose

The purpose of this IPRO is to gather, critically analyze and synthesize data on the public perception and understanding of emerging technologies. The team has decided to begin this task by examining four different technologies: Optical Media, Cellular Phones, the Internet, and Video Games. By studying these technologies we hope to better understand their life-cycle and the players involved in the various stages of their development. While we do not expect to be able to address all of the possible issues and actors with each of the technologies, the study of these four technologies should allow us to begin crafting a generalized model of the different forces at play in the emergence of new technologies. We expect that future IPRO teams will use the data we provide as a common platform to refine the models offered such that it can be applied to current emerging and future emerging technologies.

Introduction

In recent decades the pace and complexity of innovation has grown exponentially. Where it once took decades if not centuries for major technological changes to be developed and become pervasive, now it is common to see these changes within a few years. Due to these technologies, the world has essentially become smaller. Communication is instant and companies now have the ability to deploy new inventions almost instantaneously around the globe. This global marketplace has led to cutthroat competition with entrepreneurs and corporations all competing to release the latest and greatest technology first. This accelerated change has prompted people across the globe to debate the possible consequences of these technologies. No sooner is a technology announced than its benefits and risks become the focus of both academic and public discourse.

The complexity of these technologies and the wider range of their applications have made it increasingly difficult to predict all their possible impacts on society. The innovations in the

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decades since the beginning of the industrial age are far more complex than those seen in the millennia preceding it. We are now manipulating our physical environment in ways that could not be imagined even decades ago. And while the consequences of a new irrigation system will probably not be life threatening, the creation of bioengineered crops, or nanotechnology affecting matter at the subatomic level, may be so.

How then should we proceed as entrepreneurs, inventors, scientists, policy makers, and citizens to ensure that the quest for an improvement of the quality of life does not accomplish the opposite goal? Which issues have we focused on in the past and which should we be focusing on now? Has there been a change in the technological life-cycle, and if so, how should it affect the ethical considerations that must be made when introducing new technologies? Who are the major actors in this discourse and what are their approaches to these questions? In which way(s) must the public be educated to better understand these issues? These are the subjects that this project will attempt to consider and clarify as we attempt to propose a model of the emergence, acceptance, and dispersion of new technologies.

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Objectives

IPRO 341 is to provide a platform to look at how emerging technologies are being utilized into society and how society perceives them. Our objectives have remained the same , although we have slightly refined them.

- The first objective of IPRO 341 is to develop a hypothetical model of the life cycle of emerging technologies through historical analysis. The team has chosen four technologies the study of which we believe will allow us to construct a working model of the life cycle of an emerging technology.
- The second objective of IPRO 341 is to begin an in-depth look into nanotechnology and assess its political, social, and economic impacts. Since nanotechnology is such a wide area of research focus will be put on materials created through the use of nanotechnology. By applying our hypothetical model to the current trends in nanotechnology, we will predict the impacts that the introduction of nanotech products will have on society as a whole.
- The third objective of IPRO 341 is to reassess our model after completing our nanotechnology research. Since the model we develop can only be a theoretical model, we will have to continuously revise our model depending on any new information that comes about during the development of nanotech products.
- The fourth objective of IPRO 341 is to provide an overview as to why research into how emerging technologies affect society is important to both public and private interests

Expected Results are as follows:
- Create life cycle models for four past technologies.
- Analyze the specialized life cycles of past technologies to develop a generalized model.
- Apply the generalized life cycle model to currently emerging technologies.
- Create awareness of the importance of reflecting on how society perceives new and emerging technologies

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Methodology

- Literature Survey
- Research recent technologies and their lifecycle models
- Research societal impacts
- Compare significant trends
- Hypothesis

Team Organization

- Team Leaders Alan and Andrew have prepared all minutes, agendas, led meeting, provided communication, and leadership
- Prepared project plan
- Broke into 4 teams to look at four areas of technology
- Worked together to put together a marketing plan for the IPRO
- Evaluated and assessed each individual and each other on how all members were contributing
- Looked to a time line for deliverables to complete
- Completed the first draft of the report on the technologies chosen.

Resources Used

- Galvin Library- Jeanne Link
- Dr. Marista Poros
- Dr. Peter Lycos
- O'Connor Design Works

Research

Optical Drives

The compact disc industry has developed at a rapid pace over the past 30 years. From the initial development of the original audio compact disc, to the optical disc revolution that has since permeated our society, the initial drivers in the development of the CD were Sony and Philips. Although they initially were competitors, they came together to dominate the early CD market and push CD development further.

It was not until the recording industry adopted CD technology that it really began to permeate everyday life. With the advent of CDs into music, the public began to see the benefits of a technology that had already been introduced to corporations and industry. The use of CDs for leisure in the public began the mass consumerism revolving around CDs, which further encouraged growth and innovative development by many new companies who wanted a 'piece of the pie.' Widespread use and availability emerged when these additional stakeholders jumped in.

Why the public embraced CD technology so readily remains unclear at this time, though it can be speculated that it is due to the sheer fact that the CD was something people wanted to have and it was affordable enough that people could buy it en masse. It seems that the technology did not become truly pervasive until it was inexpensive enough so that its applications were accessible to the public.

The future of optical discs now lies in the competition between two formats of new DVD. The HD-DVD and the Blu-ray each have their own backers, and it will be interesting to see whether this sifts out into one taking off and the other one dying off, or whether they will remain in competition for a long time.

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This chapter will attempt to provide a glimpse of the growth pattern that optical discs and disc drives followed, extract trends that show how they became the standard for portable data storage, and compare these attributes to other sections of the project to see if we can draw generalized attributes of 'emerging technology.' For the future of this project, we hope to be able to use this generalized life cycle model to apply to new emerging technologies and predict society's reactions, the regulatory functions necessary, and the success of a new emerging technology.

The specific areas that we are focusing on in this section are the study of the technological development of optical storage, including but not limited to:

- individuals such as inventors, entrepreneurs, activists, philosophers, intellectuals, and politicians, and;

- institutions such as corporations, government organizations, non-government organizations, media, religious, and education.

The objective is to identify which of these are stakeholders, which are drivers, and which affect policy regarding the introduction of emerging technology into society. This broad brushstroke approach will show how CD technology was introduced into society. This model can then be used in conjunction with the remaining pieces of the other sections of this project to yield a concise view of how technology typically is introduced into society. In future permutations of this project, this model can be adapted and/or applied to a yet-emerging technology, allowing the project managers and stakeholders in the technology to predict what will happen and take necessary steps to optimize the technology development and prevent potential ill effects. A final objective of this report is to determine who holds the responsibility to inform the public of such technological developments.

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Benefits

The benefits of such an analysis are readily apparent, as this information would allow developers to take steps necessary to prevent future technological faux pas. Although all potential oversights are not 100% predictable, at least having a model of some sort is far superior to simply letting technology introduce itself. The model that is proposed to be developed will hopefully cover a broad enough set of stakeholders, drivers, and impacts that it will be able to be utilized to predict the future behavior of emerging technology. All of this analysis is in relation to the current sociological, economic, and political scene. Additional benefits include a better understanding of how information is disseminated to the public, how it is received by the public, and how inventors and drivers can better communicate this information. The mere increase in efficiency of this area is enough to warrant an investigation into this area. The benefits of such a study also include a better understanding of how society accepts and absorbs technology, as well as an understanding of the key elements that make a technology grow and proliferate. With this understanding it will be possible to direct and guide the development of technology, such that it can be better developed to most benefit society as a whole. Although what benefits society is often what benefits the individual, but there is inherent in our sociological organization a need to help the populace as a whole. As well as benefiting individuals, this insight will be of use to corporations developing new technologies as a guide to understanding how the communication about development of emerging technologies should be handled. With as comprehensive of the view as we envision, it would be possible to encompass all of these elements and forge them into one coherent overview that allows for the execution of all of these potential benefits.

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Analysis

The policy issues surrounding optical discs and drives have long been an issue that most have ignored. This policy though has played a large role in the relative success of the compact disc as a form of data storage media. Some of the policy makers include Sony, Philips, Apple, and the Federal government. The roles of Sony and Philips in the policy procedure were mostly vested in the development of a set of standards. In 1993 an ad hoc committee of legislators and business leaders issued a series of circulars to Federal agencies that promoted the dissemination of information via CD-ROM and online services, instead of the traditional hard copies sent to depository libraries[1]. To aid the implementation of this policy the government also required agencies to charge only the costs of distributing the information and not any associated with collecting the data[2]. Most sets of policies aid the development and distribution of this type of media, stimulating growth of the optical disc through a form of subsidization. Among the corporate world the popularity of the CD-ROM has risen as its use has expanded to the role of training new employees. Although this form of training is less expensive, it is looked down upon by most trainees as very few of them can effectively learn from and enjoy this form of training[3].

Most of the policies adopted regarding optical discs were exclusively designed to aid its growth and saturation; and although some have objected to the development and use of this technology, the policies advance it regardless of objections.

The responsibility factor generally has been negligible as the compact disc does not have many liabilities attached to it. The scientists developing optical media are mostly interested exclusively in the technical aspects of the design. The corporations developing and marketing the optical media took responsibility only for the efficiency and reliability of the devices they

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[1] Brintnall, Michael, "Policy on Dissemination of Federal Resources: Updated", The Profession, 1993, American Political Science Association.
[2] Ibid.
[3] Anonymous, "Thumbs down for computerized learning", Education and Training, 1997, Volume 93, Issue 8/9

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manufactured. Corporations also have found it necessary to ensure the accuracy and effectiveness of the media, knowing its limitations and strengths of the devices they are manufacturing. In short, the corporations have the right to make bad products, but it is neither economically nor socially desirable for them to do so. For example, Roy Rosenzweig critiques the multimedia edition of *US History on CD-ROM*, a widely distributed source of historical information in database form. Although he praises its ability to quickly search the information, he says its presentation of "straight text," its poor organization and weak display of information make using it drudgery[4].

Some of the positive effects of CD technology's introduction into society include the ability to move vast quantities of data very expediently, store 150,000 printed pages of data, as well as quick search and random access of the data. Additionally, all of these benefits come at equal or lower cost compared to printed media[5]. This ability allows information to be quickly and easily delivered across a society, thereby increasing the knowledge accessibility.

One negative consequence includes the initial cost of the infrastructure required to implement optical discs for initial investors and adopters. A standard cost of a stand-alone compact disc reader, in 1985, could be upwards of $1000[6]. An additional negative consequence would be the increased ability to pirate through the use of CD-R's, a problem which has grown extremely quickly over the past few years. For example, a study by The Alliance states that in 2000 the city of Hong Kong, with a population of 6.8 million, was responsible for over $110 million (U.S.) of pirated software[7]. Similar statistics likely can be found for the music recording

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[4] Rosenzweig, Roy, "'So what's next for Clio?' CD-ROM and Historians", <u>The Journal of American History</u>, 1995.
[5] Carr, Josephina J., Peterson, James L., "CD-ROM Technology and the Teaching of Sociology". <u>Teaching Sociology</u>, 1991, Vol. 19.
[6] Roth, Judith P., <u>Essential Guide to CD-ROM</u>, Meckler Publishing, West Port, CT, 1986, 52.
[7] Manuel, Gren, "Hong Kong Attacks Piracy Problem", <u>Wall Street Journal</u>, April 23, 2001, A.19C.

industry as well. As the optical disc media becomes cheaper the ability of malevolent citizens to bypass copyright laws and quickly and efficiently distribute data throughout society.

The role of the media in pushing out optical disc technology primarily materialized because of prominent publishers. The primary, initial stakeholder of the audio CD was the recording industry. They were leaders in marketing of this technology because of its cost effectiveness and ease of distribution. The CD-ROM also gained popularity when, in 1994, mainstream publications such at the *Wall Street Journal* and *New York Times Book Review* created a spark of interest in this technology among their readers[8]. Therefore, the primary responsibility of the media was to push out the technology and initiate technology novices within society.

The primary tipping point in the development of the optical disc and drive was the cost reduction(s) allowing the public to access the technology. In 1992, most users paid about $1200 to upgrade their computer for a sufficient multimedia experience, which at that time was also the cost of an entire basic system[9]. The market was slow to develop because of the creation paradox: consumers do not want to pay for expensive reading units without good software and the software companies do not wish to write programs for hardware that is not widely available to the public. However, through the work of developers at Microsoft and Apple the tipping point was reached. According to a 1995 Pew survey, this work came to fruition in the mid-'90s as half of all computer users had access to a CD drive and found themselves using it as much as or more than other competing services such as online sources[10]. This point in time marks the tipping point at which average consumers could easily purchase the reading equipment as well as the optical discs themselves.

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[8] Rosenzweig, Roy, "'So what's next for Clio?' CD-ROM and Historians", <u>The Journal of American History</u>, 1995.
[9] Reid, T. R., Hume, Brit, "Multimedia Still Struggling to be Born on PC's", <u>Chicago Tribune</u>, September 27, 1992, pg 6.
[10] Pew Internet & American Life, "Americans Going Online ... Explosive Growth, Uncertain Destinations", October 16, 1995.

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Standardization also played an influential role in the early growth of compact discs. The development of the Red and Yellow Book standards resulted in the first widely useable format of data writing. The first standardization began in 1980 with the introduction of Red Book standards, and continued with the Yellow Book, in 1982; Green Book, in 1988; and White Book, in 1993[11].

Following the initial patents on reflective storage, the initial stakeholder corporations Philips and MCA (Music Corporation of America) both demonstrated similar devices, which led to the formation of their partnership in 1974. Their initial systems created a de facto standard for the manufacturing process, but further standardization was not implemented. This was the result of a disparity between the target markets. On one hand, the education and institutional markets sought a product of high durability capable of operating at various speeds, including significant use of a still-frame mode. Yet for the consumer markets, the device would simply be needed for serial playback, leading to an increase in storage capacity. These competing requirements led to the situation where a particular company's disc had to be read on their own drives due to proprietary encoding techniques[12]. Failing to deal with these issues at the release of the technology only hindered the development of the Videodisc, sending a promising storage medium down the path to obscurity.

By the end of the decade Philips embarked upon the creation of the next generation of optical media. Following the technology of the Videodisc, Philips partnered with Sony in the creation of the compact disc. The product was to store digitized music in order to compete

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[11] Samsung Electronics, "History of Technology", http://www.samsungodd.com/eng/Information/ODDTech/ODDTech.asp?FunctionValue=view&no=7&type_no=3, 2001.
[12] Hendly, Tony, <u>CD-ROM and Optical Publishing Systems</u>,1987, Meckler Publishing. Westport, CT. pg 12.

directly in the audio playback market. Yet before demonstration, and even before development,

the two companies formalized a standard for mastering the discs. Available to anyone who

wished to master a compact disc, the Sony "Red Book" standard could be purchased for a small

licensing fee for music record labels to ensure compatibility with all Philips and Sony players[13].

This ultimately led to a universal standard, bypassing the troubles of the largely proprietary

Videodiscs, and allowing the compact disc to quickly permeate the music industry by facilitating

the acceptance of entering stakeholders. This ease of entry due to the standards in place

permitted the compact disc to quickly outsell its predecessor (the Videodisc) within 4 years[14].

As the compact disc rapidly grew in popularity around the Red Book standards, other

stakeholders took interest in the potential of the new digital medium. Computer hardware

manufacturers, software suppliers, publishers, and database providers saw the potential of a new

storage and publishing medium[15]. In a similar manner, alongside the demonstration of a Compact

Disc – Read Only Memory unit, an industry standard was published. Developed primarily by

Sony and Philips, the "Yellow Book" standard also invited early hardware and software

developers such as Microsoft and Apple Computer to aid in the standardization process. By

involving stakeholders in the early phases of development for the creation of standards, the CD-

ROM continued to grow in popularity with the release of consumer recordable and rewriteable

media.

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[13] Ibid.
[14] Ibid.
[15] Ibid.

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Social Trends and Drivers

The compact disc originally was developed for the specific purpose of storing digital audio, and therefore can claim the standard drivers of higher quality at a lower cost. The more interesting drivers and impacts are seen in the release of the CD-ROM media, which, being a format for generic data, can cover a broader range of storage needs.

The first, most generic driver for the development of the CD-ROM was the advent of the personal computer. The widespread availability of PCs naturally fosters the demand for easily accessible and searchable electronic information. The compact disc, in both readable and writeable forms, is capable of answering this demand economically[16]. This is epitomized by the desire among personal computer users to purchase published reference work on a low-cost medium for local reference.

This desire for low-cost, reproducible database information in itself forms another driver for the development of the CD-ROM. During its initial deployment, the Yellow Book standards applied only to textual data. As the medium further proved itself in the reproduction of audio and textual information, demand for the implementation graphics of various formats rose[17].

CD-ROM technology found its way into the commercial and public sectors through a variety of channels. Through the professional market several applications in publishing furthered the acceptance of the new medium. The first major trend further facilitated by the advent of CD-ROM technology was in-house publishing. Corporations and government bodies were impacted by the ease of capturing, organizing, and distributing large stores of information via CD-ROM.

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[16] Ibid, pg 75.
[17] Ibid, pg 77.

Conclusion

The ultimate purpose of this report is to improve the development of technology by considering the social, political, economic, and other impacts and drivers of emerging technology. By doing so we hope to find a method of introducing technology into society while providing for better dissemination of information to the public as well as improved awareness of potential pitfalls and how to avoid them. Although this may seem like a daunting task, time is aiding the development and evolution of this project. Hopefully, in the future, this will serve as a guide for future generations as they develop and launch new technologies.

The end point of CD technology has not quite come about yet, though the development of the compact disc has been joined by the DVD, which will soon be replaced by the HD-DVD or Blu-ray. However, because of relative costs, the compact disc is still well established as a standard format for music and data.

The importance of looking at CD technology is evidenced by the fact that millions of homes and businesses have computers that utilize optical media in one or more ways. It is this pervasiveness that is of interest to this report. Hopefully, through a thorough analysis of the development and growth of this technology, a clear understanding of how optical drives became as widespread as they are will emerge.

Convergence began with compact optical disc drives being integrated into every computer system manufactured today. Another aspect of convergence is the appearance of CD-R/RW/DVD drives which enable usage of any of the aforementioned media formats in a single drive.

Society could not have accepted or rejected this technology ahead of its development because the effects of it were then unknown, and the product was unable to reach its full potential until a more sufficient infrastructure was in place. Developers were unwilling to utilize the technology until the hardware became more available, and the corporations were unwilling to build hardware for software that did not then exist. However, by the time the compact disc

reached its full potential, it was nearly impossible to reject this technology as it had already begun being integrated into society.

The Internet

Introduction

Internet connectivity merits a place in this study because it is so highly pervasive in our everyday lives. It is crucial technology playing a leading role in discussions of how our world is rapidly changing. Studying the Internet can help us identify what issues, if any, there are in the way technologies emerge and spread throughout society, because the Internet now has a major role in business, politics, education, healthcare, entertainment, communications and other areas of our world.

Currently in the United States 63% of adults and 81% of teenagers go online.[18] On a daily basis about 70 million adults in America go online[1]. These two statistics lead to the conclusion that the Internet has become completely nearly ubiquitous in American life. As a result, its stakeholders can be defined as universal. It truly is a pervasive technology and its applications can be found in both trivial and vital tasks.

When the Internet was introduced it was to be a tool for knowledge sharing and faster communication for news, business and government functions. It has now become a means to carry out other tasks such as shopping, listening to the radio, watching movies, banking, reading books and magazines, meeting new people, communicating with friends and family, education, healthcare, and many more tasks.[19]

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[18] Zakon, Robert H. "Hobbes' Internet Timeline v8.1."
 1993-2005. <http://www.zakon.org/robert/internet/timeline/>
[19] Susannah Fox, Janna Quitney Anderson, Lee Rainie. "The Future of the Internet."
 2005: PEW Internet & American Life. Washington, D.C.
 < http://www.pewinternet.org/PPF/r/145/report_display.asp>.

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Using this broadly accepted technology we will analyze the creation, emergence, and current applications of it. The greater goal is to identify issues that exist in all three aspects of innovation and see if there are any changes and what creators of future technologies need to be aware of.

Discussion and Analysis

The first incarnation of the Internet came about in 1969. This network, called ARPANET, consisted of only four nodes: UCLA, Stanford Research Institute, UC Santa Barbara, and the University of Utah. The first cross-country link to the network was installed the next year. By 1971, the network had grown to contain 15 nodes. Also that year, Ray Tomlinson created the first e-mail program to send messages between users on the network. E-mail quickly became one of the biggest uses of the network and by 1973 about 75% of all traffic within ARPANET was solely due to e-mail.[20]

The network continued to grow slowly node by node until 1982, the year that TCP/IP was accepted as the standard protocol to be used by nodes on ARPANET. From this point on, growth of the Internet seemed to be exponential: with more and more nodes added to the network, the total reached 1,000 hosts by the end of 1984, 10,000 by 1987 and 100,000 by 1989.[21]

In March of 1985, symbolics.com became the first registered domain, ushering in the era of using domains to access different data on network.[22] In 1990, the first commercial provider of dial-up Internet access was online,[23] and two years later there

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[20] Zakon, Robert H. "Hobbes' Internet Timeline v8.1."
   1993-2005. <http://www.zakon.org/robert/internet/timeline/>
[21] Ibid.
[22] Ibid.
[23] Ibid.

were over 1,000,000 hosts on the Internet. By 1994 Internet traffic passed the threshold of 10 trillion bytes per month. It was around this time that the Internet spilled out into the mainstream of society and the "dot-com" era began. The Internet was introduced commercially in 1995 through Internet Explorer, a web-browsing tool offered with Microsoft Windows 95. This introduction of user-friendly Internet connectivity paved a path for saturation of the technology. Nearly every home computer bought after 1995 had Internet Explorer pre-loaded, giving consumers the opportunity to connect to the World Wide Web.[24] President Clinton and Vice President Al Gore supported companies on their promotion of mass information sharing through the Internet. Although companies introduced this technology with good intentions of increasing global communication for a faster, more profitable way of life, they largely overlooked the societal impacts of the Internet.[25]

As Internet access has become widespread, there have been both positive and negative consequences. The Internet has changed the way that people can find information, especially after books, encyclopedias, and even newspapers went online. One can find the answer to any question imaginable if one knows where to look or how to word the query on an online search engine. With the advent of sites such as www.webmd.com, information on personal health has become readily available to the point where a person can usually diagnose themselves just by answering some questions. While the Internet has increased the availability of information, it has also had negative impacts on people. It has decreased the need to go out and interact in person to

[24] Ibid.
[25] "Americans Going Online ... Explosive Growth, Uncertain Destinations
Technology in the American Household
        1995. The PEW Research Center for the People and the Press
        < http://people-press.org/reports/display.php3?PageID=415 >.

accomplish tasks, children can easily access objectionable content such as pornography, and identity theft has increased. Research has also shown an increase in solitary, online activities and a decrease in group activities.[26]

The biggest industry within the Internet is pornography, with billions of sites containing pornographic material easily accessible to anyone who wishes to access it. The problem is that spam e-mails and pop-up ads have made these pornographic sites easily accessible to those who don't want them, or—as in the case of children—should not view them..

Although communication horizons have broadened, social interactions have become more and more "cyber" since the emergence of the Internet. The Internet has impacted the way we make friends and meet new people. Hundreds of websites are dedicated to online dating and for meeting new people (i.e., www.friendster.com, www.match.com), According to data provided by a report in the Pew Internet & American Life Project, we can see that since its public release in 1995, the Internet has been increasing and has become almost the primary means of communication. This increase reflects the decrease in collective action and leads to downfall in other areas of group interaction. Because of its versatility, the Internet has been able to be used in many different areas, positive and negative

The Internet has boosted the technological world with a slingshot effect, and its growth has been fast. New privacy issues have emerged with the rise of the Internet. Anything you buy online, any website you visit, all your banking, and credit information is monitored by some institution or company that is paid to keep database records of your

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[26] Susannah Fox, Janna Quitney Anderson, Lee Rainie. "The Future of the Internet."
2005: PEW Internet & American Life. Washington, D.C.
< http://www.pewinternet.org/PPF/r/145/report_display.asp>.

transactions. Thus, privacy has become limited with the birth of the Internet Age. Based

on this, future technologies must look into such issues as privacy and inform the public of

the effects their products can have on their lives. A company has a social responsibility

to informing consumers about the drawbacks of using the product. Just as medicines are

required to print side effects and cautionary advice, there should be some sort of social

obligation on companies to consumers to disclose the risks of Internet usage. Policy

makers have addressed issues of privacy by sentencing and penalizing offenders of

privacy laws, but only after the Internet had already so infiltrated our daily lives.

Even though with the Internet there was not an international race for who comes

out with this method of communication first, there was a race for standardizing the

interface of the software that allowed access to the web. Microsoft claimed victory in

this race when they launched Internet Explorer.   Technological advancement is a good

thing, but not at the cost of hurting our society. Companies responsible for the

commercial birth of the Internet had good intentions to boost business and political

functions, giving government and private agencies a faster means of communication. But

they overlooked (or could not foresee) the other impacts of the Internet before releasing it

to the mass public. They did not address issues of privacy and distribution of

inappropriate content. The media called the Internet an "information superhighway"[27]

when it was just beginning to make its way into the public life. This kind of labeling by

the media gave the impression that it was simply a useful communication and

knowledge-sharing tool. There was no discussion of what other uses the Internet could

have and how it could affect our world. Just as the Internet increased the number of

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[27] John Markoff. "Building the Electronic Superhighway."
    1993. New York Times. New York, NY
    <http://select.nytimes.com/gst/abstract.html?res=F0061FFF3C540C778EDDA80894DB494D81>

consumers that businesses could reach, it also made a far larger audience available to promoters of inappropriate content. It also gave protesters and other political and social activists a whole new platform for their perspectives.[28]

A company must discuss public policy and address all foreseeable impacts that their technology might have. They can do so by looking beyond the money factor and the competition for who introduces the technology first. The media also has an obligation to the public, by giving an unbiased review of the technology. Instead of pushing for a positive or negative view of any technology, the media can be helpful and discuss technologies objectively. This idea applies also to protestors and activists: instead of voicing subjective opinions; they should address issues objectively and look at the greater good, rather than simply trying to advance their own agendas. Companies, media, activists and even the consumers themselves play a pivotal role in social responsibility. Each is responsible for education of the technology and its impacts.

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[28] David M. Herszenhorn. "Students Turn to Internet for Nationwide Protest Planning."
1995. New York Times. New York, NY
<http://select.nytimes.com/gst/abstract.html?res=F60614FF3F590C7A8EDDAA0894DD494D81>

Video Games

Video games started simply: A ball bouncing back and forth, a simple space ship shooing asteroids. They have progressed to a level of complexity that no one could have foreseen, with entire universes created and accessible at the touch of a button. Advances in technology and more accessible prices have removed video games from the arena of arcades and put them into living rooms, with 38% of US households now having a console[29]. The market for video games has also exploded, with over 40 million consoles sold in 2002 alone[30]. But their potential is recognized to be far beyond simple entertainment. Video games and their technology have seen applications in the educational, military, and medical fields. This expansion and pervasiveness has attracted many interested social, political, and economic interests, all seeking to influence this ever-growing sector of the technology and entertainment industries. It is the goal of this project to track video games' growth and identify some of the major players in the sector in an effort to better understand the forces involved in its profusion.

The first recorded video game was reportedly created by Willy Higginbotham, a physicist at the Brookhaven National Laboratory in New York. Using an oscilloscope, he created an "interactive table-tennis-like game" in 1958[31]. While he never patented the device, this is supposed to be the origins of "Pong." Ten years later Ralph Baer patented

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[29] Survey conducted by Opinion Research Corporation, October 2003

[30] The report, _The Cycle Turns: Video Game Console Shipments & Revenue to Decline in 2003_

[31] Herman, Leonard, Jer Horwitz, Steve Kent, and Skyler Miller.
    "History of Video Games" Gamespot
    <http://www.gamespot.com/gamespot/features/video/hov/p2_02.html>

an interactive tennis game that could be played on a television[32]. Nolan Bushnell took the idea of Spacewar, a game created by an MIT student for computer terminals, and with the help of Ted Dabney, they create a version of the game that can be hooked up to a television. Bushnell is able to sell this invention to an Arcade Game manufacturer, but the game has limited success.[33] Eventually Bushnell decides that the game is probably too complicated for most people to play, and creates Pong. Bushnell says in later interviews that the goal with Pong was to make a game simple enough for drunken people to play. [34] Bushnell places the game in a bar where it is a tremendous success.

While Nolan had paved the way to make video games popular, they still were not accessible. In order to play one you still have to go to the arcade or bar. Several companies started creating consoles that people could play from their homes. Magnavox Odyssey and Coleco Telstar both offered consumers a way to play games from their homes. These consoles came with preprogrammed games in them, but the Fairchild Channel F was the first console to use cartridges.[35] The console system seems to have allowed for a form of standardization. Shortly thereafter Bushnell's company, Atari, released its own cartridge based systems, which soon became the industry standard.

The development of cartridge-based consoles, the so-called programmable systems, leads to the creation of *Activision*, the first third-party game developer. This event seems to be crucial to the development of the video game market, for it changed the

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[32] Ibid.
[33] Ibid.
[34] Watters, Ethan. "The Player" <u>Wired Magazine</u>
      October 2005
      <http://www.wired.com/wired/archive/13.10/bushnell.html?tw=wn_tophead_5>
[35] Console Museum: Channel F
      Classic Gaming
      < http://www.classicgaming.com/museum/channelf/ >

entire dynamic, thought not immediately. Arcade games are still immensely popular and growing in popularity at this point, with the release of games such as Pac-Man and Asteroids. In 1981 arcades in the US earned $5 billion dollars in revenue[36]. Nintendo released its console system this year as well, after successful runs in the arcade market. These consoles allowed consumers to have more choices as third party software companies developed more and more games. Now you no longer had to go to the arcade, or buy an entire new system to play the newest games. This would force change in the dynamics of the companies themselves.

For a very long time companies were able to keep a stranglehold on the video game market and were able to maintain their success by releasing the same games with minor improvements, apparently figuring that they could continue to break sales records with this dynamic. Expecting that the public will gobble up any games they produce, these companies began to make overreaching estimates, promising investors incredible sales. When they could not meet these goals, their stocks began to plummet. On December 7th, 1982, Atari released a statement that sales did not meet predictions, and its stock drops 32% in a single day. [37] Later on, the market became saturated with too many products. The multitude of consoles available at the time led to oversaturation of the market. The big players, Atari, Magnavox, Nintendo, etc, all became involved in legal battles over the rights of the games that they were essentially all copying from one another.[38] Third party software companies were unable to create lasting games and earn a great enough market share because of market- oversaturation, and most go out of

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[36] Herman, Leonard, Jer Horwitz, Steve Kent, and Skyler Miller.
    "History of Video Games" Gamespot
    <http://www.gamespot.com/gamespot/features/video/hov/p2_02.html>
[37] Ibid.
[38] Ibid.

business. Their titles are heavily discounted in order to make back some of the lost revenue. The major players, then, could not compete with these super cheap games, and in late 1983, most of the industry was losing money.

The industry did not begin to recover until the introduction of the Nintendo Entertainment System (NES) in 1986.[39] While other companies such were continuing to release the same games from the arcade games, Nintendo signed several third-party developers to create new games for its console. New, complex plotlines are introduced, replacing the simple designs that everyone had seen before. Games on the Nintendo system had to be licensed by Nintendo. Tengen was able to crack NES' encryption, allowing them to create and market third party software for the most popular console system. In the end Nintendo and Sega are the only two real competitors in the market, with Nintendo far in the lead. Increases in the abilities of the technology and more relaxed licensing standards allow for a great expansion of the quality of available titles.

Video Games in the Public Eye

Throughout its history the industry had many controversial moments. With the increase in computing power as well as an influx of more-creative people onto the video game creation scene, there were new ideas explored and put into play. One of these aspects was violence. Games began to emerge where violence and murder were not only a possibility but often a goal. As with all new trends, there were many people ready to expose its evils, and violent video games became the target of several groups.

The first video game to cause a real stir was entitled "Death Race." Originally entitled "Pedestrian," the goal of the game was to gain points by running over "gremlins."

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[39] Ibid.

[40]The gremlins, however, were simply stick figures, and people became concerned about a game whose score was tallied by the number of pedestrians being run over. The sales of the game were nothing spectacular, with little over 500 units made (the game was eventually banned) but the public outcry was significant.[41] There are some accounts of the coin operated machines running the game being dragged from arcades and destroyed in parking lots. It was this same public outcry that introduced many people to video game consoles, which eventually led to a major expansion of the market.

The game called Doom was put into the forefront the violence in video games debate when it was discovered that the two high school students responsible for the murders at Columbine High School were avid players of the game. Accusations that the video game led them to commit these atrocious acts overwhelmed any other possible explanations. Video games were used as a scapegoat to supersede the parental and educational responsibilities in this heinous crime.

Recently, the most controversial title has been Grand Theft Auto 3. The game's focus is a life of violent crime, including killing pedestrians and police officers, prostitution and drug trade. The game has been assaulted by many different religious and other social groups who in some cases demanded that its sale be banned completely. Along with violence, sex in video games was (and still is) protested. Mystique, a video game maker in the late '70s, was dedicated to producing pornographic games for the Atari 2600. As this was blemishing the Atari name, the company sued Mystique but lost. One particularly controversial game was "Custer's Revenge" in which a character named Custer walks around nude with a visible erection attempting to have sex with Native

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[40] "Video Game Controversy" **Wikipedia** <http://en.wikipedia.org/wiki/Video_game_controversy>

[41] Ibid.

American women. This game seemed to push all bounds of decency and was protested by several national organizations, most notably the National Organization of Women. GTA3 was again in this controversy when it was found that images of naked women could be viewed using hidden features of the game.

While the industry has attempted to self-regulate in this matter, using the Entertainment Software Rating Board (an independent, non-profit organization) to rate its games and give parents and consumers a better idea of game content, it has not been enough to stifle political pressure. Organizations such as Mothers Against Videogame Addiction and Violence (MAVAV) lobby for tougher restrictions on video games in various states. While some states have created bans on selling violent video games to minors, these have often been struck down in court, with the 8th District Court of Appeals stating that video games were a protected form of speech:

> If the first amendment is versatile enough to "shield [the] painting of Jackson Pollock, music of Arnold Schoenberg, or Jabberwocky verse of Lewis Carroll," *Hurley*, 515 U.S. at 569, we see no reason why the pictures, graphic design, concept art, sounds, music, stories, and narrative present in video games are not entitled to a similar protection.[42]

This decision, however, has not stopped other states from attempting to pass similar laws; with Gov. Schwarzenegger of California recently signing one after legislation was passed earlier in the year by Michigan and Illinois. [43]

The topic of restricting video games has piqued the interest of organizations on both the left and the right. The First Amendment Center, the ACLU, and others have filed court briefs against the censorship and restricted sales of video games. Meanwhile,

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[42] ID Software et al v. St. Louis Count – 8th District Circuit Court of appeals
[43] Pantesco, Joshua, "Paper Chase" <u>Jursit</u>, October 09 2005
        <http://jurist.law.pitt.edu/paperchase/2005/10/schwarzenegger-signs-bill-banning.php>

MAVAV and other, similar organizations claim that video games are addictive and compare the industry to the tobacco industry.[44]

The video game industry is getting larger by the day. It has already surpassed movies in revenue, and is considered the largest entertainment industry in the world. While it has had some bumps along the way, it shows no signs of slowing down in its growth and expansion. A growing number of studies are focusing on video games in an effort to try to understand their effects on our society. Could these issues have been seen at the point of creation of this technology? It seems unlikely that during the creation of Pong, Bushnell would have had the capability to see several decades into the future, towards a world where violent and realistic video games existed and were blamed for society's ills. The job of the creators of video games is to entertain and make profit. Like the motion picture industry before them, it seems unlikely that they can be held responsible for societal ills whose causes have not yet been pinpointed, and likely never will, be. What is clear is that the industry is not slowing anytime soon, and neither are the public debates.

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[44] Mothers Against Videogame Addiction and Violence
        <http://www.mavav.org/>

INSIGHT
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Cell Phones

Introduction to the technology

A cell phone is a type of wireless communication device that uses many base stations to divide a service area into multiple 'cells'. Cellular calls are transferred from base station to base station as a user travels from cell to cell. One of the most interesting things about a cell phone is that it is actually a radio -- an extremely sophisticated radio, but a radio nonetheless. In recent years many companies have offered wireless service to the general public.

Why did you choose to research this topic?

We have chosen to research the cell phone industry because it has a phenomenal growth rate and it is changing the way people do business. The technology is so prevalent in some countries that it has replaced the traditional land-line phones. Given the massive spread of this technology, we want to figure out what societal impacts it carries and what are the side-effects.

Why do companies push certain technologies over other?

Motorola, Sony Ericsson and Nokia have been pushing RFID technology over infrared for quite a few years now. The technology is similar to Infrared and allows wireless users to use their cell phones as bar code readers. It gives cell phones the ability to "talk" to other RFID-enabled devices. For example, while walking down the street, a cell phone user sees a poster for a movie she wants to watch. By pointing her phone at the poster, she will be connected to a website, buy the ticket and be charged through the credit card information stored in her smart phone. Of course, other usages might severely affect the privacy of the user but as the technology is already

being tested, we have a good opportunity to evaluate the risks involved before it

goes mainstream.

Identify the stakeholders in the following categories:
- *Social (education, entertainment, personal, etc.*
- *Political (government use, news media, military, etc.*
- *Economic (business, job training, healthcare, etc.)*

The biggest stakeholders in the cell phone industry are the companies that manufacture

the actual cell phone devices and the companies that provide cellular services. If we look

back in history, we find that the interest in cell phone industry increased exponentially

when the FCC decided to open additional bandwidth for future mobile phone use.

Cellular loomed ahead, although no one knew when FCC approval would permit its

commercial rollout. American Business Radio and Radio-Telephone manufacturers

began planning for the future. Here's a chart outlining the major makers and stakeholders.

Some companies are now out of business or merged with others.

	1973 Revenues in millions	% of Market
Motorola	$350	64.2%
General Electric	80	14.7
RCA (History link)	35	6.4
E.F. Johnson	20	3.7
Harris Corp.	15	2.8
Communications Industries	11	2.0
Scope Inc.	8	1.5
Martin Marietta	6	1.1
Aerotron	3	0.5
Regency Electronics	2	0.4
All Others	15	2.8

At AT&T labs in Newark, New Jersey, and most importantly in a trial around Chicago, Illinois Bell and AT&T jointly rolled out analog-based cellular telephone service. Ten cells covering 21,000 square miles made up the Chicago system. This first equipment test began using 90 Bell System employees.

After six months, on December 20th, 1978, a market trial began with paying customers who leased the car mounted telephones. This was called the service test. The system used the newly allocated 800 MHz band. Although the Bell System bought an additional 1,000 mobile phones from Oki for the lease phase, it did place orders from Motorola and E.F. Johnson for the remainder of the 2,100 radios needed. This early network, using large- scale integrated circuits throughout, a dedicated computer and switching system, and custom-made mobile phones and antennas, proved a large cellular system could work.

What is the social responsibility of the scientists that makes the technology? The company? The public?

We know that freedom of research or freedom of science is written into our constitution, that research and development pursue social purposes, and that responsibility is one of the virtues of a citizen in a democratic society. Nonetheless, it is difficult to state more precisely what responsible 'freedom of research' or 'science' is and what responsible research and development are, where they begin and where they end.

However, as a community, we can certainly define a set of rules that a scientist must adhere to. In a situation where the principles of scientist ethics are at odds with other generally accepted ethical values, the scientist should make a choice on the basis of his own moral reflection. Science should be recognized as an important element of culture and we must defend it against any unjust accusation; however, it is the responsibility of a scientist to maintain a critical attitude in his professional activities. Facts and proofs are to be placed higher than the voices of authorities in the company that makes use of his research. He is obliged to prevent individuals of improper qualifications from entering the scientific community, or using the ideals of science for populist or demagogic purposes.

Scientific research should be performed in a way which does not degrade human dignity or clash with humanitarian principles and human rights. Research employing

human subjects should be carried out in accordance with internationally accepted principles of deontology, respecting voluntary participation of people in such research, anonymity and secrecy. Scientists should use their knowledge, intellect and authority in practical activities for the benefit of society. They are obliged to be correct to their employer, but at the same time, they should present the research data in an objective way, not taking into account the sponsor's expectations of the results and conclusions. Only this way can society truly benefit from scientific research and we can trust the new technologies that are introduced to us.

What is the role of the policy makers?

How has policy affected your respective technologies? Helped it or prevented it from becoming profuse? (Note: we have all chosen technologies that are saturated)

What are the negative and positive applications of the technology?

The issue of cell phone toxicity was recently introduced in Congress. Cell phones are an especially problematic component of the waste stream because they contain a large number of hazardous substances which can pollute the air when burned in incinerators and leach into soil and drinking water when buried in landfills. Many of these toxic substances — including antimony, arsenic, beryllium, cadmium, copper, lead, nickel, and zinc — belong to a class of chemicals known as persistent toxins, which linger in the environment for long periods without breaking down. Some of them — including the metals lead and cadmium — also tend to accumulate in the tissues of plants and animals, building up in the food chain to dangerous levels even when released in very small quantities.

The substance of greatest concern in cell phones is lead, a heavy metal recognized worldwide as a problem material. Lead is a suspected carcinogen, has adverse effects on the central nervous system, immune system, and kidneys, and has been linked to developmental abnormalities. Within the European Union (EU), the *Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Products* mandates that, by July 1, 2006, no new electrical and electronic products containing lead may be put on the market in any of the Europe's 15 member states.

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In the US the policy makers are trying to reduce cell phone waste by introducing recycling programs. Cell phone collection programs of various sizes and types have been springing up around the country over the last several years and continue to do so. Such programs recover used phones from consumers and either refurbish and resell or recycle them, depending on their condition. By refurbishing used phones, such programs extend the lifetime of these products and divert them — along with the many toxic substances they contain — from landfills and incinerators, at least temporarily.

By requiring manufacturers to bear the financial and/or physical responsibility for managing their products after consumers discard them, policy makers can provide a powerful driver for manufacturers to create designs that facilitate cell phone reuse and recycling.

What are the benefits of cell phone technology?

Wireless communication has taken the world by storm. The benefits have far exceeded the costs and overhead involved with cellular technology. In current times, a wireless user can flip open their tiny wireless device and start a conversation with anyone, anywhere in the world. The ability to use cell phones to access the Internet has further enhanced the usability of wireless technology. You can talk to your family, buy stocks, read the newspaper, all while you wait for the next flight out.

There is no greater social convention in our society than talking on a cell phone with those we care about; in a mall, in a theater, in our cars, wherever and whenever. Wireless technology has empowered these private and very social situations. It lets us call a friend even when we forget their phone number; contact our child when they are with a known friend; ensure we don't miss an appointment, and let a relative quickly reach us whether they are far away or visiting.

Our personal safety is implied when we have everything in place to keep us safe. A first aid kit at home, candles for a blackout and a phone nearby to call friends or family. Some

seniors consider their cell phone a personal safety device, letting them reach out to others whenever they need help.

If landline phones are dead during a natural disaster or local emergency, cell phones let us reach others to help, to make a service call, to bring needed supplies, or simply to make us feel safer.

Corporations, small businesses and home-based enterprises depend on cell phones as an important means of communication when their people are traveling, at customer sites or for teleconferencing. Wireless communication has helped build new business relationships, speed contacts and enhance personal productivity. Whether it serves as the user's primary, only, or corporate phone, it helps the individual to stay in touch with and be contacted by valuable customers and new prospects.

Is there an agenda of the activists and media when informing the public? Is it unbiased?

What is the role of the media in promoting your respective technology?

How does the "arms race" or foreign pressure affect the technology? The creation, the emergence and implementation (what it is used for)?

What was the tipping point (in the sense that it began to be used widely by the public) of making this technology so profuse?

How does standardization (the steps that were necessary for the tipping point) play a role in growth and development of the technology?

Does the advancement of our technology help third world countries skip the process of development? Does it give an advantage?

Cell phone companies spend millions of dollars each year to promote their service and newer cell phone models. Motorola recently spent a great deal of money to introduce its new Razr phone. The ads for the cell phones lure people to discard their current device and buy the latest, sleeker models. The innovation in wireless technology is only helping

drive the media campaign. Every other month we hear about something introduced into a cell phone that was never seen before.

There are now about 2 billion mobile-phone users in the world, and market penetration is above 50% in advanced countries. As prices of phones and service drop, another billion customers will sign up by year 2010 in places such as China, India, Brazil, and Russia. The vast majority of the growth in subscribers is coming from emerging markets. Researchers predict that of the 1 billion cell phones expected to be sold in 2010, half will be in developing economies. Most will cost less than $40--still out of reach for the poorest one-third of the world's population, but affordable for the middle third.

Look beyond the high-growth "emerging markets" and you'll find an exploding market for communications technology. Neither for status nor convenience--mobile phones simply make sense in ultra-poor countries. Need to find out what your goods will cost? Rather than spend a day going into town and back to find out, send a Short Message Service (SMS) message. Want to arrange a remittance payment from a relative living abroad? Pay a few cents or a dollar to the local "phone lady" for a quick conversation. The innovations here aren't coming from Nokia and Motorola alone--it's the value-added services like MTN's cell-phone based banking in South Africa that will drive sales and profitability.

Growth of cell phone industry

The worldwide handset business is riding a growth curve this year, as manufacturers seek to fill surging demand for new mobile phones in both emerging markets and mature ones. Shipments will grow nearly 11% in 2006, according to a new report from Time magazine. There is a forecast that 591 million units will be shipped in the next year. Also, mobile phone manufacturers will generate more than $89 billion in revenue this year.

 Drivers for this growth include:
 - Growing demand from emerging markets, such as India

- New camera phones with 1- and 2-megapixel resolutions

- Strong replacement rates in mature markets

- Strong demand for mid-tier models, and flip phones

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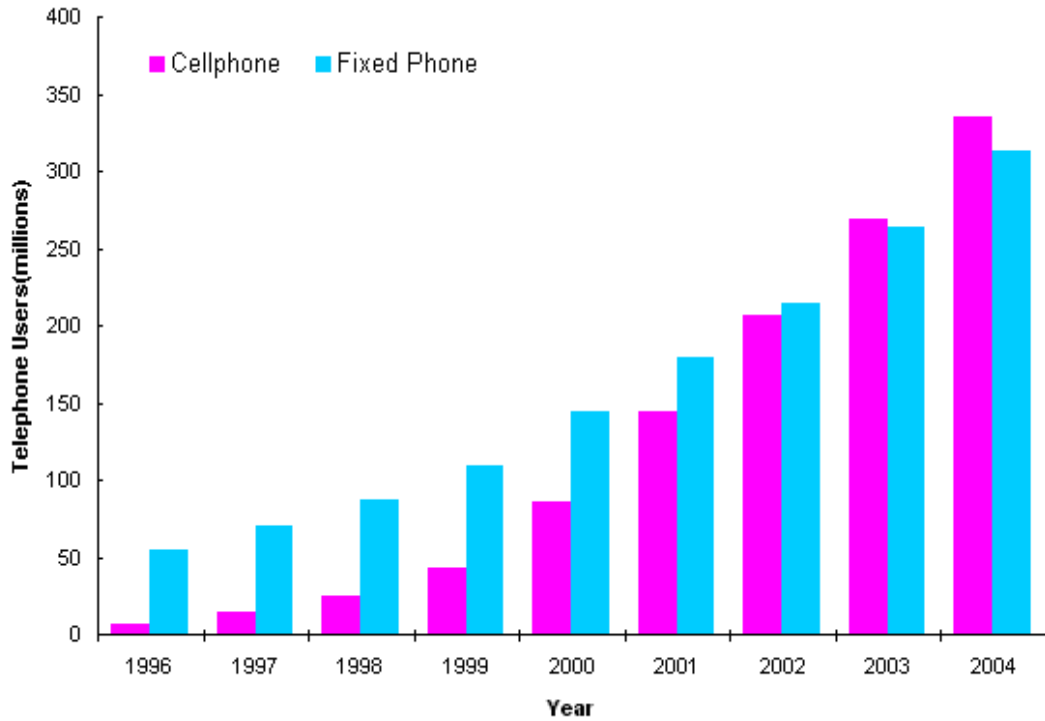
What is the end point of the technology? Does it decline or is it just replaced?

Why is it important to research and evaluate this technology? Should this discussion occur at an academic level earlier than college?

How does convergence, if any, play a role in the pervasiveness of the technology?

Can we accept or reject a technology prior to implementation? Is that decision biased or unbiased?

Does religion play a key role in the emergence of the technology? Is it a more important issue now than it was before?

Will emerging technologies such as nanotechnology, genetics, and robotics redefine the definition of what is human?

Of the all the shaping forces around us, none has more long-term impact than technology, but to what end? In reality it is more about technology than science. Increasingly society is challenging the notion that if it's technology, it must represent progress, so it must be good. We have seen a resurgence of romanticism about pre-industrial societies and their world and a philosophy which pleads for an eco-centric rather than human-centered view of the world. Christians argue that, rather than either of these, a God-centered view is needed to bring back a proper balance of intervention and conservation. It is believed by many that the earth is God's to take care of and everything in the created order has intrinsic value because God created it and invested it with worth. There are a set of underlying assumptions that have often accompanied how society views science and technology. Unless these attitudes are changed considerably, including the formulation of sound public policy, the bitter fruits of technology will continue to be reaped with little to check them and, in the long run, the perceived value of science will be the further undermined.

We are aware of so much that has gone wrong. We are aware of the damage to our environment as never before. A tension has emerged between the good of our planet and the exploitation of science and technology. These two are increasingly viewed as at odds.

The former prestige of science and the great hopes from technology have been replaced by a sense of disquiet and questioning which runs deep, especially in the younger generation, cautious and even suspicious about its use. Yet we also want to keep the unprecedented creature comforts of which technology has been the agent. We are selective in our awareness and in what we single out for censure, but the cries of censure have become loud and long.

In this light, the future of science and technology is not a simple extrapolation of what has gone on for the previous 30 years. We can no longer take for granted anything like the level of the popular support. Many people have felt cheated by the expectations they were led to believe in, by the promoters of the post-war technological revolution. They trusted what they were told and feel they have been let down. A lot of the promised future now looks like so much shoddy merchandise. There is a growing feeling among ordinary people of being remote, and therefore increasingly alienated, from the whole scientific and technological process in which they seem to have no say. In the future, if science wants public support, it will have to work for it to get it. It can no longer just assume it. Too much goodwill has been lost for that. To make the case for some new venture people may well need to be persuaded that, despite past failures, "this time, it really is all right" to go ahead. We have also noted the emergence of a series of public attitudes and perceptions, not all of them commendable, sometimes not even very rational, but they are real and will have to be addressed, whether the scientist likes it or not.

Conclusion

The objective of this research project is to assess the impact of growing wireless technologies on the general public and how it affects the way we live our lives. It seems that the masses adjust themselves to the ever-growing innovations and adapt to the new technology fairly quickly. The question that needs to be addressed is whether we should do more research on the possible side-effects of a technology before we adopt it. It seems that the consumer places his trust in the hands of researchers and developers and leaves the consequences to be determined by the standardizing agencies.

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Since the introduction of cellular telephones in 1983, there have been dramatic changes in the cellular industry. With a growth rate of about 40 percent per year, it is estimated that by the year 2006 there will likely be about 300 million cellular telephone users in the United States.

Changes in the technology, from heavy, cumbersome and expensive cellular telephones, to inexpensive, miniature hand held units, smaller than a pack of cigarettes, have had a significant impact on when, where and how we conduct our affairs, both business and personal. Societal pressures for increased efficiency, more leisure time, and an improved sense of safety, have placed wireless communications at the forefront of potential solutions for an increasingly mobile and technologically sophisticated populace.

While voice communication has been the primary focus of the cellular industry, recent technological and societal trends in mobile communications and computer hardware and software, and the desire to "work on-the-road" have resulted in a move towards integration of technologies. Cellular communications can now be the focal point of a truly "mobile office," including e-mail, fax and Internet services in addition to telephone, voice mail and paging capabilities from any location.

It was inevitable that drivers in vehicles would dramatically increase their use of cellular phones, given the phones' reduced size, reduced cost and increased. Indeed, time spent commuting, caught up in traffic and just plain traveling, can now be productive. In addition, the cellular telephone brought with it a sense of security for those concerned about traveling alone in unfamiliar areas or concerned about vehicle breakdown.

It is safe to say that wireless communication will continue to grow at exhilarating rates. It's the people that drive the trends; not the trends that drive the people. Therefore, we the people will simply have to adapt to the new technologies as we have been doing in the past.

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Appendix 1: Models

Models:

Internet Growth Before TCP/IP Standard Assigned:

Internet Hosts by Year (1969-1982)
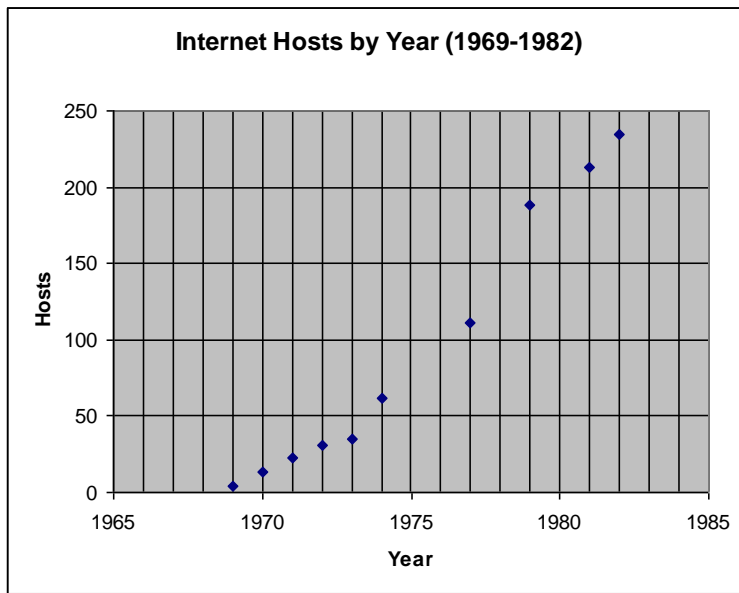
Internet Growth From TCP/IP to Current:

Internet Hosts by Year (1982-2004)