

October 11, 2005
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Com633 Midterm Paper

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See
Comments

The Social Construction of Telecommunication Systems: Mobile Phones The Evolution and a Possible Price for 'Rhetorical Closure'

Necessity is the mother of invention. A need or problem encourages creative efforts to meet the need or solve the problem. This saying appears in the dialogue *Republic*, by the ancient Greek philosopher Plato.¹

We witness daily how things evolve over time whether it is a bicycle, a printer, a coffee maker, or even a new hybrid plum. A product on the store shelf is the working result of consumers' inputs and what a manufacturer can offer based on their available resources. The demand and supply rule is operating in the economy. Where there is no demand, there is no supply. Consumers demand technological artifacts that make their life more pleasant and convenient. *and less expensive usually* Manufacturers provide them accordingly. In this process, technological invention, development, and innovations are created. Consumers make choices at the consumption junction where less popular products are shifted out.

Very long

Good

It is the systems comprising of many components that provide us products we use daily. My mother used to tell us as we had dinner, "think how many people have been involved in bringing the food to our table: farmers, inspectors, packers, middle-men, truck drivers, store clerks, etc. Without these countless numbers of people we wouldn't have today's dinner. So receive this dinner thanking and thinking of all those people who took part in bringing the food to our table." It is obvious that we live in *relatively* seamless societal systems that we keep feeding into and influencing continuously. We daily adapt ourselves to changes brought upon us as the results of these complex interactions. We are all interconnected at various levels and continuously influencing each other whether we are aware of it or not. We are, as a society, a huge breathing organic entity that keeps changing for survival.

yes!

¹ <http://www.bartleby.com/59/3/necessityist.html>

Therefore, it is surprising to find that the sociology of technology is a new field emerging just a couple of decades ago, and that prior to this emergence the technological evolution had been perceived as a linear process: Basic research → Applied research → Technological development → Product development → Production → Usage (A six-stage model of the innovation process).² It is obvious that technological artifacts inventions, innovations, developments and products are the endless social construct processes of negotiations among all social groups involved, all influencing each other at all levels.

good!

- Evolution of Cellular Telephone

The cell phone is a rather new technology which has quickly become ubiquitous in the world and obtained the status of a 'must-have' item in our daily life. There are estimated to be 2 billion cell phones in the world today. In other words, every third person on the earth uses the mobile phone. Nokia estimates that by 2010 the total number will be three billion. The present world population is 6.5 billion.³ The penetration rates of some Asian and European countries are exceeding 100%, which indicates that some people own more than one cell phone. By 2004, there were over 790 million mobile users in Asia, the fastest growing wireless market globally, generating the revenue of US\$180 billion.⁴ The penetration rate of cell phone in the US is less than 100%; however millions of Americans are giving up the landlines because they don't see any benefit owning when they carry cell phones.⁵ Owning a cell phone, not a landline, makes economical and social sense to users. Cell phones give mobility and often include free long distance calls and text messaging. Cell phone has definitely become an integrated part of our daily life. For some it has become part of our body, like glasses to wear. Users have become heavily dependent on this technology.

² p. 23 Bijker, Hughes, & Pinch. 1989.

³ <http://www.xbitlabs.com/news/mobile/display/20050918205724.html>

⁴ <http://www.ecnasiomag.com/print.asp?id=4354>

⁵ http://www.kinetowireless.com/news/industry_articles/millions.html

good

The cell phone did not happen over night. It was built upon more than 150 years of wireless and radio technologies. Privateline.com site delineates mobile telephone history. It cites Samuel Morse's experiment on wireless by conduction carried out in 1842. Early independent inventors such as Faraday, Maxwell, Edison, Hertz, Hughes, and Bell were aware of wireless technology and worked on radio and electromagnetic technologies during the early years.

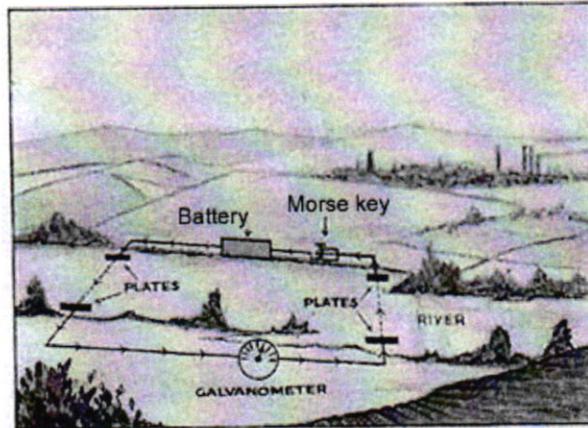


Fig. 1. Radio by conduction. How Morse's experiment in transmitting a message across a river was carried out.

Figure 1 Morse's experiment in the year 1842
<http://www.privateline.com/PCS/history2.htm>

Lars Ericsson, the founder of Ericsson in Sweden, developed the first car telephone in 1910. It was today's 'telepoint' application using two long sticks to tap into free telephone wires on the pole and get connected to an operator in the nearest exchange. (Figure 2) (cited in privateline.com from Meurling and Jeans)



Figure 2 First car-telephone in aka.1910
<http://www.privateline.com/PCS/history4.htm>

In the US, mobile radio began operating at 2MHz among law enforcement officers in 1921. Radio messages were broadcasted through receivers in police cars. It was similar to today's paging systems, and a one-way transmission. The policeman had to call back from a wire-line telephone station. Soon after this experiment in law enforcement, in 1924 Bell Laboratories invented the first mobile, two-way, voice-based radio telephone. (Figure 3)

Good history



Figure 3 First two-way car radio telephone by Bell Laboratories aka. 1924

In 1934, the Federal Communications Commission was created by the Congress to regulate landline telephone business and started to manage the radio spectrum. The FCC's mandate was the public interest and to grant licenses if it was in "public interest, convenience, and necessity". It is believed that due to FCC's plodding pace, the development of cellular telephone in the US fell behind other countries such as Japan and Finland. It wasn't until 1975 that the FCC approved AT&T to operate a cellular system in the US.

Thus, the concept of a mobile telephone system has existed for a long time. The first *public* mobile telephone became available in St. Louis, Missouri with three channels at 150 MHz in 1945, and the cellular telephone idea became available to major telecommunications companies in the world in the 1960s. However, it wasn't until 1970s when Intel introduced microprocessors, that the cell phone as we know it today emerged in the market. Microprocessor chips made it possible to drastically reduce the size of the

telephone. In 1973 Martin Cooper and his team at Motorola filed a patent entitled 'Radio telephone system', the personal, handheld cell phone. AT&T and Metroliner were working on cellular phones as well and got their patents during the same time. However, Cooper and team members are credited to be the inventor of the first personal, *handheld* cell phone, a 'brick' like telephone much improved from a 'briefcase' telephone. They were successful reducing the size first. What the Cooper team did was not an invention of the cell phone, but was an improvement on the existing technology. In addition, it can not be overlooked the fact that the improved battery technology contributed to reducing the size of the cell phone. (Figure 4)

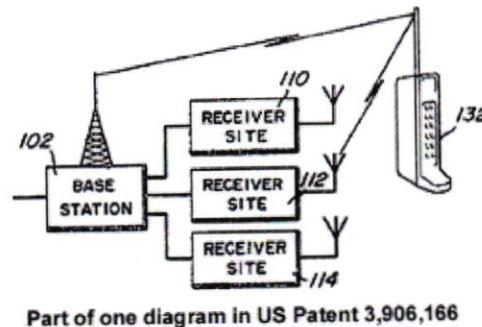


Figure 4: The First Handheld Cell Phone patented in 1973 & Dr. Martin Cooper

While the FCC and AT&T were having their own struggles over the control of telecommunications, on the other side of the world, Japanese companies were developing cellular technology with the financial assistance of the government. This government assistance in R&D enabled Japanese companies to advance their technologies, and because of this governmental involvement in development, Japanese firms could bid at much lower price than other competitors for cellular telephone production at later dates.

NTT (Nippon Telegraph and Telephone), the Japanese government postwar telecom reconstruction entity, developed the car telephone service in 1979 using AMPS and allowed convenient calls from inside buses or taxis first in Tokyo and then throughout the country in 1984. (Figure 5) NTT was successful reducing the size and weight of cell telephone from 500 cc, 750 grams (30.5 cubic inch, 26.344 oz) to 100 cc, 150 grams (6.1

good use of graphics

cubic inch, 5.269 oz) within less than ten years of time. (Figure 6) NTT was converted into a private corporation in 1985. Also, Nokia in Finland took the lead in developing an easy-to-use graphical menu eliminating the antenna to make the devices smaller. The stage for cell phone proliferation was set at this time.

First generation mobile phones in the 1980s used analog transmission. In the 1990s, the cellular phones were switched to digital circuit switched transmission. Digitization brought the function of cell phone capability to another level.



Figure 5 NTT's Car Telephone Service in 1979

Year	1987	1989	1991	1993	1995
System	Large city system (April 1989) High-capacity system			Digital system (800MHz)	
Configuration of mobile station and antenna					
	802B: 500cc 750g	803B: 400cc 640g	Mova: 150cc 230g	Digital 150cc Mova: 240g	Ultra-compact 100cc mobile station: 150g
Antenna technology	• Bottom end feeding $1/2\lambda$ whip	• Side-mounted built-in reverse-F antenna • Small diversity antenna	• Bottom end feeding $3/8\lambda$ whip • Retractable whip antenna on the side • Reverse-F antenna • Integrated with filter • Built-in reverse-F antenna installed at the back	• Wide-band whip antenna	• Wide-band small plate antenna

Figure 6 Timeline of handheld NTT cellular telephone
<http://www.privateline.com/PCS/history10.htm>

- All-in-one, Convergence of PDA, Phone, Computer, TV and More.

For the last decade, the features of PDA, phone and computer are converging or mix-and-matched into a single unit. New generation of 3G systems is opening new possibilities of cell phone. Currently basic cell phones are equipped with calculator, calendar, text message and some voice command features. Cell phones with camera, video recording, data transmission, music features, GPS and Internet capability are gaining popularity. Redefinition of the cell phone as a small computer seems to be making inroads. 'Today's most sophisticated phones have the processing power of a mid-1990s PC while consuming 100 times less electricity.'⁶ It is remarkable how much cell phone technology has advanced over three decades. The first cell phone in 1975 had only 35 minutes of talk time. Now Nokia 6170, for example, has up to four hours of talk time. It has synchronizing feature with a PC, video recording and games and calendar features. (Figure 7)

A New Model is about to come out!

PalmOne's Treo 600 offers the full-featured computer-like phone with a tiny keyboard. These smart phones constitute about five percent of mobile phone sales in the US and their market share is growing. Many people think that it is better than the laptop computer because 'it is always with you, always up and always ready'.⁷

In Japan, by subscribing to a service called 'iMode', a cell phone can be used as electronic money, credit card, electronic ticket, membership card, and for reserving airline tickets, concert tickets, etc. As the name of the service, "Osai-fu-Keitai (=wallet cellphone)", indicates, a cell phone is about to replace Japanese people's wallet.⁸ If you have a cell phone with you, you don't need to bring your wallet. Not only are these 'wallet' services offered, NTT, in conjunction with Nissan Motors, has made possible for drivers to receive i-mode digital maps and restaurant information corresponding to the area in which their car is located or destined, along with GPS cell phone services. NTT is

Yes!

⁶ <http://www.msnbc.msn.com/id/5092826/site/newsweek/>

⁷ <http://www.msnbc.msn.com/id/5092826/site/newsweek/>

⁸ http://www.nttdocomo.co.jp/english/p_s/imode/service/felica/index.html

also offering TV telephone services with which people can talk while seeing their faces, as well as a distant home monitor telephone that synchronizes with a camera placed at home. (Figures 8 & 9)

First Cell Phone 1973	Now as of October 2005
	
<p>The First Cellphone</p> <p>Name: Motorola Dyna-Tac Size: 9 x 5 x 1.75 inches Weight: 2.5 pounds Display: None Number of Circuit Boards: 30 Talk time: 35 minutes Recharge Time: 10 hours Features: Talk, listen, dial http://www.cellular.co.za/cellphone_inventory.htm</p>	<p>Nokia 6170 Phone Features</p> <p>Some of features available</p> <ul style="list-style-type: none"> • Weight: 4.3 ounces • 3.46" long x 1.81" wide x 0.87" thick • Multimedia messaging for receiving, editing and sending messages with text, audio files, voice clips, and images • Video recording up to 4 minutes and streaming • Internal modem functionality HSCSD up to 28.8 Kbps • GPRS/EDGE Class 10 up to 153 Kbps • XHTML browser (WAP 2.0)^{1,2,12} • SyncML for daily synchronization of daytime and nighttime phones • Synchronize your phone book, calendar and to-do list with PC • Downloadable games and applications via JAVA technology(MIDP 2.0) • Battery Life Extended Li-Ion Battery 760 mAh -- Digital Talk Time up to 4 hours* -- Digital Standby Time up to 11 days* <p>http://www.nokiausa.com/phones/6170</p>

Figure 7 Comparison of the first and today's cell phones

handheld



Figure 8 TV Telephone
 (<http://www.nttdocomo.co.jp/service/videophone/index.html>)



Figure 9 Distant Home Monitor Telephone
 (<http://www.nttdocomo.co.jp/service/videophone/monitoring/index.html>)

Next spring, Japanese cell phone users along with Korean users will be able to watch digital TV on their cell phone when the phone receives terrestrial digital broadcasting signals.⁹

In Europe, a software called Symbian Dater on Symbian Series 60 mobile phones (Nokia 3650, 660, etc.) searches other mobile phones with Symbian Dater using Bluetooth. The users create their profiles and input the preferences in advance. The phone will vibrate when the subscriber's compatible date is in proximity. This is a new type of dating services that the cell phone matches people wirelessly.^{10 11}

Dangerous

⁹ [http://www.nttdocomo.com/presscenter/pressreleases/press/pressrelease.html?param\[no\]=581](http://www.nttdocomo.com/presscenter/pressreleases/press/pressrelease.html?param[no]=581)

¹⁰ <http://www.msnbc.msn.com/id/5092826/site/newsweek/>

¹¹ <http://www.geekzone.co.nz/content.asp?contentid=1958>

It is an exciting time for wireless technology. So many possibilities are opening up. Wearable computers will be realized in the near future. The fourth generation mobile phone is in the work. In several years, we will be finding the kinds of phones we have never imagined. One big technological challenge of the current mobile phone is battery life. Battery life hasn't caught up yet with sophisticated technologies available on the phone, such as video. Another challenge is that the phone has no open and single set of protocols for programmers to build around. The software written for one kind of phone won't work on all the others.¹² This will be eventually solved through standardization among industries.

We will have various forms of personal handheld communication technologies during our life time. Only our imagination seems to be the limit of the possibilities.

- Rhetorical Closure

“Closure in technology involves the stabilization of an artifact and the “disappearance” of problems. To close a technological “controversy,” one need not *solve* the problems in the common sense of that word. The key point is whether the relevant social groups *see* the problem as being solved”. (p.44 Bijker et al. 1989)

Today, there are several issues involved with cell phone use: driving and health controversies. Automobile accidents involved in cell phone use are a real concern and many state legislatures are banning the use of phones while driving, or mandating the use of an earpiece or speakerphone. Japan, U.K., Ireland and France made the use of cell phone while driving illegal. This is a regulatory closure to the problem that all social groups come to a reasonable agreement. The second controversy, health concerns over the long-term use of cellular phone, is much more problematic. The FCC, FDA, and

¹² <http://www.cnn.com/2005/TECH/ptech/09/22/phone.study/>

WHO assert that cell phone's health effects are inconclusive and thus perhaps the health aversion is very small but they refrain from claiming cell phone use is safe:

"The available scientific evidence does not show that any health problems are associated with using wireless phones. There is no proof, however, that wireless phones are absolutely safe."¹³

The cell phone manufacturer, Nokia, claims:

"In summary, low-level emissions of EMF from mobile communications equipment are non-ionizing, and cannot break chemical bonds between molecules in biological tissue. Therefore, they do not cause biological effects or physiological changes which, in turn, could lead to adverse health effects."¹⁴

It is reported that a number of studies are pointing the possible adverse effects of cell phone use on the human body, such as cancer, brain tumor, leukemia, DNA mutation and mood swings.¹⁵ A 750-people study (2004) by Sweden's Karolinska Institute found the risk of acoustic neuroma rose by 3.9 times on the side of the head the phone is used. Most of studies are done with analogue telephones and have usually been short-term studies. There aren't many studies available on digital cell phone effects on animals or humans. In particular, there are few longitudinal studies of more than five years. Despite the fact that the cell phone is used widely, it hasn't been part of our life that long. We simply do not know what kind of effects the congregation of various levels of electromagnetic frequencies brings to us. Humans and the planet Earth, for that matter, have never been exposed to microwaves to this extent ever. EMF is piercing through our bodies invisibly without asking the permission.

¹³ <http://www.fda.gov/cellphones/qa.html>

¹⁴ http://www.nokia.com/NOKIA_COM_1/Operators/Mobile_Operators_&_Service_Providers/Mobile_Net_works/zz_Downloadable_Documents/pdf_files/nov03living_web_pdf_eng_2411_net.pdf

¹⁵ "A Clear Call" by B. Blake Levitt. <http://www.wave-guide.org/library/clearcall.html>

The U.K. has banned the use of cell phone among school children. SAR (Special Absorption rate) – a way of measuring the quantity of radio frequency energy that is absorbed by the body—is set to regulate cell phone manufacturers. The FCC specifies SAR as 1.6 watts/kilogram averaged over one gram of body tissue. However, in Europe the SAR limit for cell phones is 2.0 watts/kilogram averaged over ten grams of body tissue. In a recent web search, no information was available about how this SAR level is set, or whether this level guarantees safety at all. The late Neil Cherry of Lincoln University asserted that the guidelines of ICNIRP (International Commission on Non-Ionizing Radiation protection) are too lenient to protect individuals. And the guidelines are based on the preconceived and long held view of western government authorities that the only possible and only established biological effect of RF/MW exposure is tissue heating when compelling laboratory and epidemiological evidence of adverse effects exist.¹⁶

A federal judge in the U.S. dismissed an \$800 million lawsuit that alleging cell phone use caused a Maryland physician's brain cancer in 2002. This legal judgment seems to have brought a rhetorical closure to the cell phone safety controversy. Although we don't know if cell phone use is safe, at least for now, let's decide it is safe and not worry about it. Various industries, governments and the public, all the parties involved seem to be happy to hear this judgment. Billion-dollar industries do not need to worry about a loss of revenue from this cash-cow business, and governments do not face the immediate loss of tax revenues. The public doesn't have to give up the convenience of the cell phone that seems to have become part of the human body. Therefore, it is a happy ending leading to closure and stabilization of this technological artifact. We are aware in our back of head that by subscribing to this judgment, we might be exchanging our health and the environment for the instant gratification of information science. But how can we stop in the middle of the information super highway once we have gotten on?

Very well done — well written & edited — followed well Bijker

We can not

¹⁶ "Cellular Phone: Criticism of the ICNIRP Guidelines", Neil Cherry, Lincoln U 2000