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**Integrating the Old with the New;
Understanding the Social Construction of Cell Phone Technology**

Mario Peia

2009–2010 Penn Humanities Forum
Undergraduate Mellon Research Fellowship

Introduction

Over the past several decades, the impact of the information age has infiltrated almost all facets of life. In fact, it is difficult to think of a common daily activity that does not - to some degree - rely on products of the information age. Sports fans rely on the Internet to update their fantasy rosters, businessmen depend on communication technologies to hold instant, trans-national meetings, and even lovers find assistance from the smooth tones of Barry White's voice, as played through an elegant entertainment system. Our lives as we know it increasingly focus on the technologies that expand our capacities to connect with one another and society. It is through these technologies that we can quench our thirst for ease of connection and communication with our peers. Information technologies, as they are called, have taken a center-stage in society and currently occupy a focus that is unprecedented by any other type of technology.

More specifically, information technologies¹ are technologies that enhance or modify the manner in which we perceive information. Contrary to common conceptions, information technologies are not limited to the modern era; one of the oldest examples of an information technology is the papyrus used in Ancient Egypt. By definition, the information that we handle on a daily basis and throughout life derives in some way from human input. In this manner, information is an element that is at the core of our identity as human beings because it helps foster communication and co-operation amongst people. At a primitive level, information is one of the most important distinctions between humans and other creatures. Today, the core features of "information" sharing

¹ For purposes of this paper, the use of the word "technology" only pertains to information technologies unless otherwise specified.

couple with an improved understanding of the world that has brought the possibility for new technologies, especially in the field of electronics. Information technologies are left to alter the manner in which we communicate with our fellow man. Due to the tremendous importance of information in our lives, it is not surprising those technologies which enhance the dissemination of such information strikes to the core of our persona and have changed the manner in which we perceive the world.

The gravity of our dependence on information technologies has fostered extreme opinions towards the development of new technology. These drastic views dominate peoples' beliefs about information technology, and they continue to polarize our understanding of technology and the role that technology plays in society. The first view believes information technologies threaten society and our way of life. This pessimistic outlook on technology argues that developments that so drastically change the way we interact will certainly bring about the doomsday to our world. On the other hand, the second view bolsters an understanding of technology that is equally extreme from the pessimistic view, but lies on the opposite end of the spectrum. These people understand information technology to be liberating, and see the development of such technologies to represent the panacea to all the world's ills. In other words, this overly optimistic opinion holds the belief that information technology represents the solution to any problem we may face. Both schools of thought - the pessimistic and the optimistic - hold extreme opinions that are the polar opposite of each other. As such, both views are equally problematic because individual beliefs about technology have been show to have a "profound impact" on subsequent behaviors.² If left un-contested, such interpretations

² Lewis, W., R. Agarwal, and V. Sambamurthy. (2003). Sources of Influence on Beliefs about Information Technology Use: An Empirical Study of Knowledge Workers. *MIS Quarterly*, 27(4), 657-678.

expose the threat of the self-fulfilling prophecy in which beliefs come true due to unordinary behaviors.

The battleground that gives information technologies their importance, and forms a base for the opinions of both schools of thought, would be the role that information technologies play in society, or in other words, how the technology is integrated into society. In striking at the core of human values and interaction, information technologies possess a unique sociology about them. Information technologies depend on the social context in which they are used and produced. The need to integrate information technology into society involves social aspects that are unlike many non-informational technologies. People must now consider the social influences on a technology in addition to the technical influences on society. Consequently, the integration of information technologies into society, in being powerful, central aspects of our social life, can easily fall victim to such dichotomous, extreme views. The popularity of these views calls to question how technology is integrated into society and what factors influence that integration. Integration “is a process of struggle as well as a technical problem-solving process.”³ Understanding answers to these questions can help assess the accuracy of the drastically pessimistic or optimistic opinions that surround technological development.

The purpose of this paper is to argue that neither the pessimistic view nor the optimistic view is a correct outlook on the influences that information technologies have and will have on society. Rather, the social shaping of such technologies prevents technological developments from taking on the roles that are envisioned by such extreme, but common, schools of thought. As information technologies integrate into society, they will not represent the doomsday or panacea to modern society. To assist in this argument,

³ Williams, R. and D. Edge. (1996). The Social Shaping of Technology. *Research Policy*, 25, 875.
Penn Humanities Forum Mellon Undergraduate Research Fellowship, Final Paper April 2010
Mario Peia, College '10

I will also show that information technology is not integrated into society by wholly social or technical influences, but it is instead integrated by a reciprocal combination of the two.

In order to accomplish this task, I will begin by assessing the deterministic characteristics of both the pessimistic and the optimistic school of thought. This will be conducted in part one of the paper. Next, I will argue that the manner in which technological integrates into society depends on influences from both social and technical grounds, along with the interaction between social and technical factors. Like the deterministic understandings promoted by the pessimistic and optimistic views, characterizations of technology's integration into society that focus solely on social or technical influences are incomplete, and therefore incorrect. Rather, technology's role in society is determined by a reciprocal balance between social and technical influences. Lastly, the principles developed in Part one and Part two will be illustrated in Part three of this paper, which will provide a case study of cell phone technology to highlight the reciprocal influences from social and technical sources. It will be concluded that an understanding of both social and technical factors, as well as their interaction between each other, can help formulate a more appropriate perception of information technologies as flexible and adaptive. Further, such factors prevent information technologies from integrating into society in a manner that is currently held by the many people who hold extremist views of technology development.

Part 1: The Origins of Fear and Elated Expectations

As is apparent to most people over the age of twenty, information technologies such as the computer, the Internet, and the cell phone have completely revamped the way

we interact, work, and even think. Naturally, such drastic changes will also have an affect on the way people perceive revolutionary technologies. However, in being at the focus of society's attention, information technologies have been met by an increasingly large number of people who hold extreme views either for or against such technologies. Their attitudes toward innovation stand to affect the how the technology is integrated, as well as the future for additional developments. This section will further describe the nature of these opinions, will demonstrate why information technologies in particular rouse such strong opinions, and will argue that both schools of thought have more in common than first meets the eye.

Characteristics of Information Technology

Before understanding the nature of the pessimistic and optimistic view towards technology, it is important to understand what characteristics of information technology lead to such drastic views. On the whole, there are four core principles behind information technologies that lead to such extreme and powerful opinions.

The first aspect of information technologies that seems to contribute to our focus would be the fast-paced nature by which such technologies are developed. As opposed to other technologies, information technologies rapidly build on each other to create constant updates. As a result, the influences that are born from innovation are frequently updating as well. This aspect is possible because of the programmable nature of modern information technologies. Information technologies, like all technology, are composed of hardware that forms the fixed basis of the technology. Hardware describes the

technology's structural make-up that is at its core.⁴ However, in addition to hardware, programmable technologies also use software. Software describes the applications, or the rules and structure of its components, which could be applied to fixed hardware.⁵ These applications modify the use of the technology, making it available for multiple uses. For instance, computers and smart-phones all use software to build and modify uses that do not require the development of a whole new system. Through the use of software, programmers and users can change the uses and influences of information technologies in a relatively short period of time. The potential for rapid change also affects the anticipations and apprehensions that are had by users because of rapidly changing expectations.

Secondly, information technologies also bear powerful opinions simply because they are extremely influential on our lives. In being a species that lives and works in groups, we have placed tremendous importance on the manner through which we interact.⁶ Information technologies, by influencing the way we perceive and gather information, directly affect our patterns of communication. Information technology can even affect how pursue further knowledge in all fields. Our understandings of science have been built upon the capacities of the human-made computer, prompting the characterization of new information technology as the “sciences of the artificial.”⁷ Such developments are central to the way we behave and how we live our lives. Consequently,

⁴ Ferrari, Alberto (1999) System Design: Traditional Concepts and New Paradigms. *In International Conference on Computer Design*.

⁵ Gacek, C., A. Abd-Allah, B. Clark, and B. Boehm. (1995). On the Definition of Software System Architecture. *Center for Software Engineering, International Conference on Software Engineering*.

⁶ Cosmides, L. and J. Tooby. (1997). Evolutionary Psychology: A Primer. *Center for Evolutionary Psychology, University of California – Santa Barbara*.

⁷ Jamison, A. and M. Hard. (2003). The Story-lines of Technological Change: Innovation, Construction and Appropriation. *Technology Analysis and Strategic Management, nr 1, 4*.

information technologies could be seen as striking at the core of what it means to be human.

The third characteristic of information technology that contributes to extreme, powerful opinions would be the seemingly uncontrollable nature of information technologies. With the relatively quick rise of innovation with electronics, many people have become users without actually knowing how to use or care for the product. Although the number of people who are comfortable with electronics is growing, there still remains a strong majority who are left to wonder in bitter anger why their computer crashed. In fact, it is generally not difficult to think of a time when you, or a person you know, had an electronic device fail without any obvious reason. It is almost as if your computer, iPod, or Blackberry has a mind of its own! In contributing to the stigma that information technology is beyond control, you cannot predict when such a crash will occur, nor can most people fix the issue when it arises. As a result, information technologies gain an elusive characteristic that makes many people skeptical of such products.

Lastly, information technologies foster extreme, powerful opinions because they can offer many more uses and opportunities than other types of technologies. For instance, the development of a faster commercial jet can help to reduce your commute times. This is of course beneficial, but such a technology can only influence your travel time. On the contrary, the development of the Internet brought vast amounts of information to the user's fingertips while simultaneously reducing the amount of time required to access such information. With the Internet, users can have more choice as to the information they access and use, which can greatly expand the opportunities available

to any one person. These technologies are “generic in scope, which means that they have, at least in principle, a wide range of potential applications in a number of different fields.”⁸ Consequently, information technology innovations can drastically change the way we perceive the world. Such a power can easily influence extreme opinions by the rate at which change occurs.

Due to these four characteristics, information technologies hold values that contribute to extreme and powerful notions of pessimism and optimism. The four characteristics mentioned are not an exhaustive list, but rather a list of the major influences that may have a role in building such opinions. Now that we have a better understanding of the important characteristics of information technologies themselves, we can now move towards understanding the nature and characteristics of these extreme outlooks.

Current attitudes towards Technological Innovation

As expressed in the introduction, the development of information technologies has split much of society in two. The two groups hold equally extreme views that are polar opposites of each other. In what is increasingly problematic, the number of people who subscribe to either school of thought is growing, and currently occupies the minds of people through all walks of society, whether it be users, producers or scholars.⁹ On the one hand is the pessimistic view and on the other is the optimistic view.

The pessimistic view towards information technology development is one that has crossed all of our minds before. In fact, George Orwell wrote of a world that is dominated by pessimistic fears in his book *1984*. For this camp, information technologies will create

⁸ Jamison, A. and M. Hard. (2003). The Story-lines of Technological Change: Innovation, Construction and Appropriation. *Technology Analysis and Strategic Management*, nr 1, 5.

⁹ Need reference to show that extreme opinions are growing

the doomsday for life as we know it. Primarily, the use of information technologies alters what it means to be human because it changes how we interact with one another. To understand the base for this opinion, simply look to how an e-mail is different than a conversation. Imagine the use of sarcasm in an e-mail as opposed to a conversation. By removing essential elements to our discourse, technology threatens to strip us of our fundamental interactions and enjoyments. In addition, the use of information technologies has sent children from the playgrounds to the television. With such profound influences on our children, the full impact of the technology boom has yet to be discovered. This factor opens the opportunity for immense apprehension for the future, which relates back to our reliance on technology today. Simply, the expanding reliance on seemingly unreliable instruments makes us vulnerable. For a relevant example, one need only remember the fear that surrounded Y2K at the turn of the millennium. At that time, many believed that the turn of the clocks would shut down the electronic framework that powered the country, resulting in a drastic set-back in our way of life.¹⁰ Altogether, the pessimistic school of thought holds fear for the potential disaster that could strike due to our overuse and reliance on information technologies.

It should not be surprising, therefore, that the pessimistic outlook condemns the continued development and innovation of information technologies. The expansion of such dangerous influences will only fuel the threat that is looming in the future. Furthermore, continued innovation will contribute to the already artificial means through which people communicate and interact. Consequently, information technology development must be halted, so as to restore the elements that make us human. In order to

¹⁰ Greenman, C. (December 30, 1999). Who, What, When, Where and Y2K; Watching for Bugs. *New York Times*.

avoid doomsday, we must reduce our dependence on such dangerous items. As such, the pessimistic outlook approaches technological innovation with apprehension and trepidation. However, this is not in touch with reality; technology may change the way we communicate and interact, but it does not contribute to a loss of fundamental human values.

On the contrary, the optimistic view holds an equally extreme view, but unfortunately, this extreme view is equally problematic as well. The optimistic school of thought has traditionally embraced the use of information technologies over the past two decades. Their consistent use of technology indicates a commitment that stimulates positive, elated attitudes.¹¹ Instead of longing for the world with natural human interaction (like that of the pessimistic view), these people recognize the impact of technological influences as being productive remedies to problems that had previously existed. It is commonly noted that innovation has cured many of the world's ills and has provided solutions when it seemed as though no solution existed. The reason for this, as noted by optimists, would be that technology has the flexibility to be what we want it to be. In being constructed by social needs and desires, technology has the potential to be put to any use that we would need. Consequently, the development of information technologies takes on a heroic appeal with the potential to act as a panacea in modern society.

In what naturally flows from such beliefs, those from the optimistic outlook encourage the rapid, mass-scale development of information technologies. They welcome innovation with open arms and are generally eager to test new products. However, in

¹¹ Goodman, P.S., and T.L. Griffith. (1991). A Process Approach to the Implementation of New Technology. *Journal of Engineering and Technology Management*, 8, 268.

what is as problematic as the pessimistic view, this outlook holds related expectations that are not in touch with reality. Although technology does offer solutions to certain problems, it certainly cannot cure all of the world's problems.

While both the pessimistic and optimistic outlooks are dichotomous renditions, both schools of thought house equally extreme views that veer far from the middle-of-the-road attitude. In order to evaluate the correctness of such beliefs, it is important to understand the similarities as well. These similarities begin to show why both views are inaccurate accounts of the present and the future.

Deterministic Assumptions of Extremist Views

At first glance, it is easy to believe that the pessimistic and optimistic outlooks are quite different from each other. In fact, they are. By definition, both schools of thought hold very different opinions for the present and future of information technology development. But yet, these groups hold a very important similarity that (ironically) contributes to their differences. Both the pessimistic and optimistic school of thought relies on deterministic aspects of technological integration.

For ages, scholars have debated the influences that determine precisely how a technology finds its role in society. Many have come to believe that a technology integrates into society through a process known as technological determinism.¹² Proponents of technological determinism, argue that a technology's role in society is solely established based on the principles and limitations of the technology itself. Thomas Friedman, author of *The World is Flat* and well-known subscriber to technological determinism, argues that technologies will bring about social leveling at the global scale.

¹² Friedman, T L., *The World is Flat: A Brief History of the 21st Century*, New York, Farrar, Straus and Giroux, 2005.

Accordingly, social influences cannot affect the integration process, but rather, it is the technology that influences the social values of its use. In this model, the influence of integration is in one direction, transferring from technology to social implications. On the other hand, scholars have also argued that the influence of integration is in the opposite direction; integration is determined by the social and cultural values surrounding the need for the technology and thereby influences the development of that technology.¹³

Advocates of this perspective argue that society creates a need for the technology which therefore encourages development. The influence of integration is once again in one direction, but from this perspective, the causal chain of influence is reverse, from social influences to technological implications. Although each perspective utilizes opposite modes of influence, they both acknowledge that technology's integration is solely manipulated by one cause. Hence, technology's influence is determined.

Like the scholars who hold these perspectives, those who subscribe to the pessimistic or optimistic outlooks on technology hold similarly determined views in opposite directions. The pessimistic view, in believing that technology threatens our way of life, considers technological integration to begin with the technical aspects which then have influence on the social values surrounding the technology's use. Accordingly, the pessimistic view confronts integration with technological determinism. The social and cultural setting does not contribute to the integration process. In fact, social influences are disregarded on the whole, and it is therefore possible to believe that technology will bring Armageddon. While we may develop the technology, its ultimate role in society is

¹³Arnold, M. (2003). On the phenomenology of technology: the "Janus-faces" of mobile phones. *Information and Organization*, 13, 238-239.

uncontrollable, thereby exposing the possibility that the role is threatening and problematic.

On the other hand, the optimistic outlook on technology's integration falls victim to the same deterministic mindset, but in reverse. Rather, than understanding technology's influence on the social setting, these people only recognize and consider the social and cultural values that lead to the development of information technologies. According to this perspective, society presents a need which is filled by technology. They disregard any influence that technology may have on the social values. Therefore, it is not surprising that such a perspective can believe that technology represents a panacea; we use it as we need it!

In holding such extreme views, pessimists and optimists succumb to the same deterministic logic. Both perspectives only account for one pathway of influence. However, a more realistic approach would recognize that influences simultaneously occur from both social and technical components, and that the integration of a technology into society is produced by the interaction between both forces. Through this process, the trajectory of integration can follow numerous paths that act like a "garden of forking paths."¹⁴ This argument is taken up in the next section.

Part II: How Technology Integrates into Society

Whether speaking about the belief that technology development will lead to Armageddon or that such innovation will lead to a panacea for the world's problems, both outlooks require that one observe technology's role in society. Both extreme views start with technology's role and then diverge to believe in two different consequences.

¹⁴ Williams, R. and D. Edge. (1996). The Social Shaping of Technology. *Research Policy*, 25, 867.
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Nevertheless, this base can also serve as a platform through which we can observe and formulate a more realistic view of technological integration. We must start by examining how technology integrates into society. In order to accomplish this goal, I will outline the manner on which social influences can interact with the technology, followed by the interaction between technical influences and society. Neither of these characterizations is purely deterministic in nature, so they should not be confused with the deterministic nature of the pessimistic and optimistic attitudes that was discussed in the previous section. Afterwards, I will use the two interactions to demonstrate that technological development and integration will retain enough flexibility to account for social influences, but will be rigid, technically, such that integration remains unpredictable. Through two, simultaneously occurring influences that promote adaptability and rigidity, technology's role will remain in the middle-of-the-road, and will not represent the doomsday or panacea for our society.

The Social Component of Technological development

As is mentioned in the previous section, the development of technology is commonly influenced by social components. The social pressures can apply at multiple times during the developmental period. At the beginning, social or cultural values could bring the necessity for a technology to address a problem or a desire. This influence primarily occurs before the development of the technology and would thereby lead to the developmental process. In addition to pre-developmental influences, social and cultural values can also influence the manner in which a technology is used and developed after it has been produced. The use of software makes the post-production adaptation much simpler because a new technology does not need to be developed for each change in

expectation. To understand the social influences upon technology, scholars have developed the Social Construction of Technology (SCOT) as a model to understand how social and cultural principles can affect a technology.

SCOT models describe the integration process as one of variation and selection, dependent upon the social principles that attach to a technology.¹⁵ Although the Social Construction of Technology does not address all aspects of social influence necessary to determine precisely what an affect might have, it does provide a useful framework for understanding the various forces that may take part in the integration process. The three aspects of the SCOT framework which will be covered in this paper are known as interpretive flexibility, relevant social groups, and closure. In brief, interpretive flexibility signifies that a technology could have different meanings, interpretations and purposes depending on the social groups who use them. In what is distinct from interpretive flexibility, relevant social groups is a term used to capture how particular groups influence the integration of technology through these distinct interpretations. For example, users and producers will have different influences due to their group's distinct relation to the technology. Lastly, closure is a term used to characterize the framing of problems and solutions that are presented by technology. Commonly, social groups will use closure to reframe a problem such that its new context is not as problematic as the prior context. Through closure, problems produced by technology can typically find solutions or less harmful problems by altering social use. Together, these three components can work to provide a social component to technology's integration into society.

¹⁵ Pinch, T.J. and W. E. Bijker. (1984). The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other. *Social Studies of Science*, 14(3), 411.

Due to the vast number of capabilities that modern information technologies possess, interpretive flexibility becomes increasingly important. Interpretive flexibility suggests that “technology design is an open process that can produce different outcomes depending on the social circumstances of development.”¹⁶ Technologies can have many different purposes, and through interpretive flexibility, we can begin to understand how those uses are determined by social means. The integration of technology requires that “individuals acquire knowledge and skills, affective, and/or evaluative orientations about the new technology.”¹⁷ The cognitive characteristics can both affect the use and be influenced by the use. Consequently, socially assigned principles towards a technology will alter how it is used.

A relevant example would come from the use of social networking tools in the military. Here, social characteristics influence how a technology is used. According to Dana Boyd, the military banned its soldiers and officers from using Myspace, a popular networking database that is available to anyone who wants to make an account.¹⁸ However, they did not ban the use of Facebook, another popular networking database that was at the time only open to college students, by such personnel. The military feared that the use of Myspace by current personnel would threaten their ability to enlist future soldiers. This fear, however, did not pertain to Facebook, because the users of Facebook were past the age of common recruitment. The military’s diverging use of two seemingly similar technologies was the result of differing patterns of the technology’s social use.

¹⁶ Klein, H.K., and D.L. Kleinman. (2002). The Social Construction of Technology: Structural Considerations. *Science, Technology, & Human Values*, 27(1), 29.

¹⁷ Goodman, P.S., and T.L. Griffith. (1991). A Process Approach to the Implementation of New Technology. *Journal of Engineering and Technology Management*, 8, 267

¹⁸ Boyd, D. "Viewing American Class Divisions Through Facebook and MySpace." *Apophenia Blog Essay*. June 24, 2007.

Another relevant example would be the sociology of the telephone in the beginning to middle part of the 20th century. The telephone was originally intended to be of use for urban businessmen to communicate during the course of business.¹⁹ Over its evolution, however, the telephone became to be used primarily by rural and suburban women. Through the telephone, women could communicate instantly during the course of the day even across long distances. Clearly, the intentions and purposes of the telephone were altered by social influences interacting with technological characteristics; the instantaneous feature of telephone use made it useful in non-urban settings. Interpretive flexibility, as used in SCOT, provides a social element to technology that emphasizes that the ultimate purpose and use of a technology does have a social component.

In addition to interpretive flexibility, the SCOT framework also focuses on the relevant social groups that have an influence on technological development. Relevant social groups is used to understand how groups share and differ in interpretive meaning.²⁰ Within social networks, it has been found that more group cohesion can foster stronger uses and attitudes towards technology.²¹ Through social groups, people commit to the use of a technology in a particular manner, and this commitment helps to stimulate the development.²² The term “relevant social groups” is used “to denote institutions and

¹⁹ John, Richard. “Recasting the Information Infrastructure for the Industrial Age.” In *A Nation Transformed by Information: How Information Has Shaped the United States from Colonial Times to the Present*, edited by Alfred Chandler and James Cortada. New York: Oxford University Press, 2000.

²⁰ Pinch, T.J. and W. E. Bijker. (1984). The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other. *Social Studies of Science*, 14(3), 414.

²¹ Fulk, J. (1993). Social Construction of Communication Technology. *The Academy of Management Journal*, 36(5), 921-950.

²² Goodman, P.S., and T.L. Griffith. (1991). A Process Approach to the Implementation of New Technology. *Journal of Engineering and Technology Management*, 8, 268

organizations, as well as organized and unorganized groups of individuals.”²³ Ordinarily, the largest, most broad social groups that could have an impact on technology would be users and producers. Users vary according to numerous factors, but at the most broad level, users can help establish how a particular technology will be used by interacting with the forces found in the interpretive flexibility portion of SCOT. Research has found that as a particular use for a technology will change and adapt as it diffuses through a network of people.²⁴ For example, the use of a technology in the workplace will change depending on how many people have used it. E-mail is useful, but only if many people utilize e-mail services. Diffusion, therefore, can directly affect how technology is used. Overtime, understandings of use in differing groups will negotiate to formulate an consensus of how a technology is to be used.²⁵

Beyond users, however, producers also have an influence on the integration of technology. The influence of producers has been a large driving force of open source software. Open source software is software whose source code is available for other, non-owners, to make modifications.²⁶ The open source features enables many people across the globe to create a product. Computing technology has made it increasingly cost-effective to pursue open ended technologies.²⁷ Successful examples include the operating system Linux and the web browser Firefox. Usually, source code is closed meaning that

²³ Pinch, T.J. and W. E. Bijker. (1984). The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other. *Social Studies of Science*, 14(3), 414.

²⁴ Burkhardt, M. E., and D. J. Brass. (1990). Changing Patterns or Patterns of Change: The Effects of a Change in Technology on Social Network Structure and Power. *Administrative Science Quarterly*, 35(1), 104-127.

²⁵ Klein, H.K., and D.L. Kleinman. (2002). The Social Construction of Technology: Structural Considerations. *Science, Technology, & Human Values*, 27(1), 30.

²⁶ Weber, S., *The Success of Open Source*, Cambridge, Massachusetts, Harvard University Press, 2004.

²⁷ Orlikowski, W.J. (1992). The Duality of Technology: Rethinking the Concept of Technology in Organizations. *Organization Science*, 3(3), 421.

the software can only be programmed or modified by its owner. However, open source codes enable projects to find many producers, thereby allowing many people the opportunity to influence the development of a technology. Beyond users and producers, SCOT theories recognize those who do not fall particularly into one of the two categories. These people include those who are affected by technology in an indirect manner such as legislators and journalists. Such persons do not directly consume the product of technology, but they are undoubtedly affected by the technology's use by others surrounding them. Altogether, the social group consideration of SCOT theories provides the ability to recognize that social groups can influence technological integration and that interpretive flexibility can occur differently in different social settings.

The last aspect of SCOT that I will focus on is the aspect of closure. The introduction and development of technology in society generally comes with conflicts and challenges to our existing structures. The aspect of closure focuses upon how those challenges find solutions thereby allowing the technology to stabilize.²⁸ Fortunately, these challenges can sometimes be overcome through reframing the purpose of a technology. This aspect builds upon influences from interpretive flexibility and relevant social groups. The process of closure signifies that technologies can be reframed in society so as to lead them towards paths that have less harmful or less frequent challenges. An example would be the manner in which iTunes reframed the file-sharing market. The phenomenon of file-sharing in the digital era began with Napster in the

²⁸ Williams, R. and D. Edge. (1996). The Social Shaping of Technology. *Research Policy*, 25, 867.
Penn Humanities Forum Mellon Undergraduate Research Fellowship, Final Paper April 2010
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1990s.²⁹ Napster enabled people to share files of data, such as music and videos, at an almost instant rate. Furthermore, the process of file-sharing circumvented copyright laws because one owner of a song could easily send an exact duplicate to millions of other people without gaining permission from the owner of the copyrighted work. For about a decade and a half (although debatably to this day), file-sharing seemed to pose a serious threat to the music industry. That indication mildly changed, however, with the introduction of iTunes. iTunes is a program that allows users to buy songs for \$0.99 each. By altering the market for music and finding that people would be willing to pay a dollar per song rather than illegally downloading them, iTunes was able to reframe the file-sharing dilemma so as to reduce the harm presented by file-sharing technology. Hence, closure was found by manipulating the social balances to make a legal option more beneficial than a common, illegal option. As is demonstrated in this example, closure works to modify or strengthen the social expectations and balances surround technological integration. Closure is achieved when “large constituencies generally agree on purpose, meaning, and physical form.”³⁰

Thus far in this paper, I have discussed the influences from three aspects of the SCOT framework. However, it must be recognized that SCOT is simply a convenient structure for analyzing the social factors of technological integration. The three aspects are not an exhaustive list of the aspects of SCOT, but rather, they are aspects that are most useful for our analysis. Beyond these components, the SCOT framework does have several shortcomings. SCOT theories do not provide guidance as to when closure will

²⁹ Spitz, D. and S. D. Hunter. (2005). Contested Codes: The Social Construction of Napster. *The Information Society*, 21, 169-180.

³⁰ Edwards, Paul. *The Closed World: Computers and the Politics of Discourse in Cold War America* (1996), Chp. 2 “Why Build Computers? The Military Role in Computer Research,” p. 43-73.

occur and to what degree interpretive flexibility, social groups, and closure will affect technology's integration. This is especially important in the case of information technologies because the use of software can enable one technology to change rapidly and drastically depending on such social influences. For instance, one of the first uses of the early personal computer was for the accounting program VisiCalc, which made an otherwise useless computer useful for the middle class family.³¹ Although SCOT indicates that social influences are important, it is difficult to know the precise extent to which such social influences can have an affect.³² Particularly with information technologies, it is unclear when closure actually takes place because a technology could be framed many times. Full closure may never occur, but this is not to indicate infinite levels of social adaptability. Fortunately, the shortcomings of the SCOT framework can be addressed by the regulations of such technologies.

With the integration of all technologies comes the need to regulate various aspects of the technology's nature. These regulations inevitably act as social instruments to guide the use of technological innovations. However, the basis for such regulations begins with the barriers in place by the technical aspects of the product. They therefore allow us to analyze the manner in which technical components can influence social use, while simultaneously offering evidence of the reciprocal socio-technic relationship of technology integration.

The Technical Component of Technological Development

³¹ Cringley, R. *Triumph of the Nerds; Impressing Their Friends*. Volume 1, New York: Ambrose Video Publishing, Inc., 1996.

³² Klein, H.K., and D.L. Kleinman. (2002). The Social Construction of Technology: Structural Considerations. *Science, Technology, & Human Values*, 27(1), 32.

As demonstrated in the previous section, the influence through social means can be an important factor in determining how a product is used, by whom, and in what mindset. However, all three of these forces work in combination with the physical limitations or particular characteristics of a technology. Perhaps the best arena to assess the influence from technical forces would be in the regulation of such technologies. The past several decades have seen a litany of social uses surround information technologies with some being legal and desirable for society and other lacking one or both qualities. Attention solely to social aspects in regulation can be overwhelming; if we, as users, can use a technology in any way possible, we would certainly diverge from society's best interest in a heartbeat. For this reason, regulation of a technology is a crucial facet of the integration process, and can be extremely important in helping a particular technology find a role in society. Fortunately, the technical aspects of technology formulate a boundary upon which such social influences can take place.

Lawrence Lessig, in his remarkable book *Code 2.0*, outlines for us the technical (and social) aspects of technological regulation.³³ He points to four manners in which technology can be regulated: laws, markets, norms, and architecture. Each form of regulation houses differing levels of social and technical aspects. The first, and most technically dependant regulation method that I will focus on is the architecture.

Architecture refers to the constraints and restrictions that are built into a technology. A technology's architecture is composed of a set of rules that guide how the product physically functions. Lessig refers to these rules as code. In the physical world, code would be described as a locked door; it provides a barrier from accessing or using what is beyond a barrier. Through this code, all information technologies have technical

³³ Lessig, L., *Code: Version 2.0*, New York, Basic Books, 2006.

components that determine how they are used and how they are not used. Code acts as a built-in restraint system for the product's use, and is independent of the other methods of regulation. An example of an architectural barrier would be the Digital-Rights Management Systems that are now attached to music files and CDs. The DRM system prevents people from making infinite copies of a music file by placing a physical limitation to copy. The system built a mechanism into the code of the file that placed a limit on the number of times the file could be duplicated. Protected files could not be copied or transferred, making it much more difficult to illegally send copyrighted information. Hence, technical barriers were able to limit unwanted social influences.

Despite its focus on the physical code of a technology, architectural regulations should not be construed as a system that has complete authority to apply regulations to any scenario. In fact, architectural constraints are flexible because code can be circumvented by those who have knowledge of the item. The skill that is required to circumvent code is directly in relation to the difficulty of accessing and altering the code. If relevant social groups (namely producers, but there can be many others) decide that strong protections are necessary, then the code will be more difficult to circumvent, meaning that significantly fewer people will be able to do so. However, the decision can also be in the hands of users because if the protected feature is extremely desirable by society, the circumvention of the code will be more beneficial for those who know how. Therefore, they will likely commit to such a risk, with the anticipation of a strong reward. On the other hand, if the communal benefit is not present in extreme numbers, circumvention of the code would not be worth the time and the energy. In this manner, the architecture can create an economic relationship that is based on rewards; high

rewards leads to the development of new skills and knowledge that fosters new uses.³⁴

Through the interaction of technical and social forces, a technology can find its best suited use in society. Architectural regulations are flexible enough to account for social pressures, yet powerful enough in technical characteristics to avoid uses that may be harmful to society.

Beyond architectural regulations, laws, markets, and norms all use technical aspects of a technology in order to determine its social use. These three methods can commonly interact with each other in indirect ways. Regulation through markets refers to constraints that are assigned through price. Through prices, markets can control where resources go, which then affects the social aspects of the technology. Next, norms are constraints that are placed on the community, by the community, for purposes of guiding use. By creating or modifying the cultural surroundings and expectations of a technology, norms can influence how the product is used. This could be accomplished by imposing physical limitations to a product's use. Lastly, formal laws act to prohibit a certain behavior or use of a technology. Laws on their own can be significantly weaker than other methods of regulation. For instance, the Supreme Court's decision to forbid the creation of file-sharing programs such as Napster did not, on its own, lead to a reduction of file-sharing behaviors. This fact is demonstrated by the tremendous increase in file-sharing that took place following the (*Grokster*) decision in the Supreme Court.³⁵ Instead, new programs took the place of old programs that had been shut down. In this situation, legal regulation proved to be weak. Nevertheless, laws can be more powerful when used

³⁴ Goodman, P.S., and T.L. Griffith. (1991). A Process Approach to the Implementation of New Technology. *Journal of Engineering and Technology Management*, 8, 269.

³⁵ Lessig, Lawrence. *Remix: Making Art and Commerce Thrive in the Hybrid Economy*. New York: Penguin Press, 2008: 110-113.

in conjunction with other aspects of markets and norms. More specifically, laws can be used to direct markets and norms so as to achieve the desired behavior through indirect means. For instance, when the United States government was presented with the need to curb illegal online gambling from offshore Internet sites, it simply established a requirement that credit card companies identify charges made to the gambling website. Through the indirect use of intermediaries, the government was able to enact law that could manipulate the markets and norms that surrounded a use of the technology.³⁶ Behavior could thereby be controlled.

Despite the obvious social elements of regulations by law, markets, and norms, all three elements place an important underlying reliance on the technical characteristics that are to be regulated. More precisely, laws, markets, and norms all interact with the nature of the technology's characteristics. An important example would be the Internet's seemingly endless boundary. This is best highlighted through Yahoo's experience in France in 2000. In France, it is illegal to sell Nazi paraphernalia. When Nazi paraphernalia appeared for sale on Yahoo's auction website, they were sued in French court. Yahoo claimed that the use of the Internet could not be controlled and specified for the user because it traveled through international servers that could not determine which users were which. IP addresses, which are the traditional tracking devices that enable access to the Internet, do not correspond with a particular geography. It was therefore impossible for Yahoo to know which users were French and which were not. The French court, in observing French law, ordered that Yahoo either ban Nazi materials on their whole website, or block French users from those sites. At the same time, a technology

³⁶ Goldstein, J., and T. Wu., *Who Controls the Internet? Illusions of a Borderless World*, New York, Oxford University Press, 2006.

known as the geographical identification (Geo-ID) was developed that could determine an IP address's physical location with near-100% accuracy.³⁷ Although Yahoo would eventually surrender in the case and ban Nazi materials from their entire auction site, the ordeal did provide a case of how technological features can interact with other aspects of regulation and social use. Now, Geo-ID technology can enable geographically relevant advertising, which drastically alters the social use of the Internet by producers, users, and advertisers, among others. Through this illustration, it is clear that technological characteristics can affect the social implications and integration of a technology.

Re-assessing Deterministic Attitude: The checks and balances approach

The past two sections, which focus on social and technical aspects surrounding the integration of a technology into society, both emphasize that the process of finding and utilizing technology in a particular role is a complex relationship. This relationship is dependant on factors that derive from a multitude of sources, places, people, and organizations. These factors interact with one another to create the ultimate role for a technology. The ultimate use of a technology is always established with help from the social characteristics that surround the use, but is guided and influenced by the technical properties of that technology. Furthermore, since we are the creators of technology, we have the ultimate power to change technical aspects to affect how the technology is socially used. The resultant relationship creates a balance between control and adaptability that will guide technology to the proper role in society.

Due to the malleable nature of social surroundings across various social groups, information technology has ability to provide flexibility in use and interpretation.

³⁷ Goldstein, J., and T. Wu., *Who Controls the Internet? Illusions of a Borderless World*, New York, Oxford University Press, 2006, Pg.8.

Influences from interpretive flexibility and relevant social groups work to create multiple uses across many cultures. Furthermore, these interpretations can change over time. The changes could be caused by reframing or a change in norms or even a change in the available technology. Regardless, the social aspect that is placed around technology prevents the technology alone from determining its use. If a new device does not have a productive use or is harmful to the community, it will simply not be used. In cases where a device can have both a productive and a harmful use, social norms and cultures can guide the appropriate use through regulations. Consequently, the social aspects of technology provide the flexibility necessary to avoid the fears held by the pessimistic school of thought.

On the other hand, such social influences do not run rampant in an uncontrollable manner. Naturally, control can come through additional social influences. However, control can also be born from the limitations and constraints that are built into a technology's architecture. As Lawrence Lessig points out, the code matters! The barriers that are built into a system's code regulate its use and can help guide the social influences that work to integrate the system into society. This form of technological control interacts with the social aspect through market forces. If the control mechanism leaves a product useless or harmful, it will not be used. The circumvention of such mechanisms can act as a social signal that there is a closely related need in society. Such a need can then be more efficiently filled by a different set of hardware or software. Consequently, the control mechanisms of technical features can influence its social use but can simultaneously be regulated by the social aspect.

Through the relationship between technical and social forces, we can see that deterministic perspectives towards technology are flawed. While they may emphasize one aspect of the integration process, they fall short in consideration of the other aspect. For pessimists, a focus is placed on the technological control of technology. This focus places a shadow on the consideration of other social influences that may avoid the doomsday scenario by providing an element of flexibility. On the other hand, optimists focus on the adaptability that is provided by the social influences on the technology. This outlook fails to appropriately consider that technological features can interact with the social pressures to restrict the use of technology in degrees that are more in line with realistic expectations. Technology, therefore, cannot act as a panacea, as is believed by optimists.

A more realistic approach to the integration process would be a perspective that recognizes the many checks and balances that exist along the progression. The social pressures that influence a technology's use provide a flexible component to the process of integration. However, excessive levels of flexibility are not efficient or even useful in most settings. To avoid such difficulties, technical properties of a technology holds the social influence in check by limiting the product's ability to adapt. The same process holds true for technical pressures, but in reverse. Technological properties can be used to control the use of a product, but this control can be held in check by social forces of circumvention and non-use.

Furthermore, while technology will inevitably bring challenges to many facets of life, those challenges will not bring extreme fears or elated expectations to fruition. Future challenges that will be presented by the evolution of technologies will find

solutions by the placement of additional influences from either social or technical considerations. Information technologies, therefore, filter difficulties and challenges through a constant process that resembles the closure aspect from SCOT. Through reframing problems and readdressing challenges with varying scopes of social and technical influences, information technologies have the power to evolve towards their optimal role. Hence, the combination of social and technological properties creates a feedback loop that enables evolution towards the enhancement of operation.³⁸ The process of evolution will continue until the optimal setting is reached or the technology becomes obsolete.

In combining an understanding of the social and technical factors into one, we can see that the influences on integration form a spectrum with technical influences on one side and social influences on the other. A product that integrates from forces on either extreme of the spectrum will never be put to use (and for that matter, created). A technology that is too socially flexible will not have the control necessary to benefit its creators or to find a consistent pattern of use. A technology that is too rigid in control will not be adaptable enough to find a use. Therefore, the deterministic attitudes of pessimists and optimists are not accurate representations of the present or future state of technological integration. New technologies must integrate by using a variety of forces which balance to find appropriate uses and check each other to maintain that appropriate use. The balance and check system turns the integration process for information technologies into an evolutionary development.

³⁸ Goodman, P.S., and T.L. Griffith. (1991). A Process Approach to the Implementation of New Technology. *Journal of Engineering and Technology Management*, 8, 271.

Part III: A Case Study of the Cell Phone's Integration into Society

Thus far in the paper, I have made the argument that information technologies are integrated through a variety of pressures and influences that range from the social to the technical. Although this argument has been supplemented by brief examples along the way, it is necessary to analyze one technology more in depth to gain a complete picture of the dynamic relationships for which I argue. This will be accomplished through an examination of one of society's most influential current technologies: the cell phone. We currently stand at a pivotal point in time for the integration of the cell phone. Since their introduction, cell phones have made great strides, but much work has yet to be done.

This portion of the paper will mimic the structure of the first two sections. I will begin by describing the background of cell phones, which includes the current attitudes towards these technologies. Then, I will analyze how cell phones have thus far integrated into society. This will be separated into three categories. The first will assess the manner in which social values and customs have influences the technical design of cell phones. The second will evaluate how technical properties have cell phones have influences its social uses and meanings. The last category is the combination of both forces to observe how such influential relations create the system of checks and balances as discussed previously. Following the discussion of the present day integration process, I will work to apply such principles to future developments. The cell phone, unlike other technologies, stands to have a tremendous importance in the near future. After describing the future directions of cell phone technology, I will demonstrate how reciprocal relationships of integration will allow cell phone technology to find its optimal use despite ongoing

developments. Altogether, my intention is to provide a modern case study to showcase how social and technical factors influence a technology's integration.

The Current State of the Cell Phone

Despite its undeniably tremendous role in society, the cell phone is actually not a novel invention or technology. Rather, the cell phone as we know it today was born from the historical development of other communications technologies. The cell phone, therefore, is a product of two centuries worth of technological evolution. Over that period of time, features accumulated in the products of the telecommunications industry to ultimately create the cell phone we have today. For our purposes, it is important to understand the basics of the origins, so as to more appropriately gauge how the cell phone appeared on the scene. This section will trace the history of the cell phone beyond the first formal "cell phone." A focus will then be placed on characteristics and features of the modern cell phone.

The beginning of the cell phone's history could begin at various points in time. Here, I will begin from the invention and use of the telegraph. In the mid 19th century – not all unlike today – America was reliant on information technologies. To the founders of the young country, an informed public was critical to achieve a true democracy. Congress heavily subsidized and encouraged industries such as the postal network and newspapers. Yet, there still lay an inconvenient problem; those forms of print technology allowed for communication and the transfer of information at a slow rate because they both required transportation. If the system were to be improved, we would need to transcend the influence of space. The telegraph was designed to do just that. As invented by Samuel Morse and Alfred Vail, the telegraph could send information across

geographical space (domestically or internationally) in a relatively short period of time. The telegraph heavily influenced the news reporting industry, railroads, and business, but did not affect personal communication. It was simply too expensive.

Riding in the telegraph's wake, the telephone was developed in 1876 to allow for direct word-to-word communication. Although it is a small extension away from the telegraph, the development of the telephone did require crucial advancements in the manipulation of electronic signals. Similarly to the telegraph, the telephone was also thought to be a business technology, with its primary users being urban males. However, the telephone's purpose was modified by its users and eventually became a technology used by rural females for personal purposes. The telephone, like the telegraph, was able to cover long distances in a relatively short period of time. This also brought the telephone to suburban areas. Despite its pivotal role as a technology that could yield nearly instantaneous voice-to-voice communication, the telephone did not fundamentally change social patterns or relations by removing geography from the essence of community.

Nevertheless, challenges were presented by the introduction and use of the telephone in society. The telephone established the ability for people to communicate in a virtual format that lacked the face-to-face contact of ordinary conversation. As a result, a member of the upper class could be contacted directly by a member of the lower class. Prostitution could use the telephone to foster business. But, social patterns did not fundamentally change. In addition, the telephone required training for those people to use it. Like the Internet and computers today, there was a difficult struggle to inform users of how to use the telephone. The process was slow, but it was eventually adopted by enough

people to neutralize the problem. Consequently, social patterns did not fundamentally change. Furthermore, the telephone required that new customs be formulated to regulate its use. These customs could come from legislation, but more times than not, it was the social expectations that would regulate its use. Females and males adopted different uses of the telephone. Since telephone wires allowed for other users to listen to a conversation without the callers knowing, privacy concerns were had by government and civilian alike. Civilians needed to understand that information mentioned on the telephone could not be of the private nature. Beyond the eavesdropping concern, wire-tapping presented challenges to the 4th amendment. Fortunately, such challenges were controlled by either the government or users. Despite these various challenges, they did not fundamentally change the way we communicate and geography was not removed from community. The use of the telephone would continue throughout the 20th century. Although it did influence our lives, it did not cause any incurable ills. In the 1980's, right before the cell phone revolution, few considered the telephone to be a dangerous technology. The telephone had received closure and, over time, had found its optimal use in society.

The development of the cell phone represents the next step in telephone technology. The cell phone adopted the technology characteristics of the telephone; it could foster voice-to-voice communication in an instantaneous amount of time. Yet, it supported other features that cut it apart from the traditional telephone. Most importantly, the cell phone is cordless, so it can be mobile in a revolutionary sense. Next, the cell phone supports a screen, enabling users to view graphical data in a new manner. Similarly, it has memory built into the system, so phone numbers can be stored along with other types of information. Now, people are able to see who was calling and choose

whether or not to answer, ultimately creating a slight change to the way we interact. More modern cell phones offer the user a camera. This camera could provide a variety of functions, from recording in memory our favorite clip to acting witness to a crime. Finally, and perhaps most important to its modern use, the cell phone was programmable. This means that it can now hold the software necessary to rapidly alter its use without changing fundamental aspects of the technology. This is especially crucial for the young smart phones. With smart phones, such software could provide various applications or programs for different uses.

As a direct consequence to the features that it has accumulated over the years, today's cell phone has taken on a vast variety of different uses. Since its time of the telegraph, the cell phone can now offer much more than direct communication. Users can now text others, which can once again provide less formal means of communication. Further, users can access the Internet, thereby allowing access to all that the Internet has to offer. By providing access to phone and Internet technologies, the cell phone has influenced its social use while that social use simultaneously alters the technical features. This inevitably involves the cell phone's integration into society, but before assessing those points, it is crucial to understand the attitudes that currently surround cell phone use and development.

Current Attitudes towards Cell Phones

As expressed in the first and second part of this paper, pessimistic and optimistic commonly surround new technology. In this sense, the cell phone is no different. As a technology that is currently finding its optimal use, it is difficult to pinpoint precisely where these views are and what they encompass. For instance, pessimistic views could

focus on many of the challenges that are presented by the cell phone's revolutionary features. Likewise, the same could be said in reverse for the optimistic outlook. With so many flexible features, what problem can the cell phone not solve? This section will attempt to highlight some of the challenges and aspects that these two outlooks may focus on. However, the precise focus may differ from person to person.

Like any information technology, the cell phone possesses the capability of transforming the way in which we communicate and interact. With the revolutionary aspect, pessimists are likely to focus on the ways in which cell phone technology can change the way we talk. For instance, text messaging has reintroduced a form of indirect communication that can now enable new, undesirable effects. People may ask what time their meeting is, but yet they can also break up with their girlfriend or boyfriend. Pessimists in this sense can fear the inappropriate social use of such a technology. Further, the cell phone and text message can provide access to information and people at times where that access would otherwise be inappropriate. Despite engaging in conversation, people commonly stop the conversation in order to investigate the potential message from an unknown source. In this manner, an unknown person can hold more importance than someone who is in direct conversation. Similarly, the availability of constant Internet access persistently distracts students in class and others from their task. Consequently, the cell phone offers the opportunity to change the world for the worst. Persistent patterns such as this, over a long period of time, threaten our world as we know it.

In contrast to the pessimistic view, the optimistic outlook focuses on the cell phone's ability to act as a panacea in the world. By allowing faster, more popular

communication, the cell phone holds the ability to solve problems in the world in a new light. In response to the Haiti earthquake, text messaging offered a new, easier way for people to donate money. Constant Internet access allows for people to find solutions and information in a much faster way. Consequently, problems can be handled in a new, light speed manner, which offers solutions in both micro and macro settings. In this sense, optimists can focus on the increased perceptions and knowledge that the cell phone affords us.

As illustrated in the first part of this paper, these differing views hold deterministic outlooks on technology. This holds true in the cell phone landscape. For pessimists, cell phone technology is problematic because the technology commands a social use that is limited in adaptability. Further, problematic social patterns that occur as a result of cell phone technology cannot be remolded or altered by changing social expectations. On the other hand, optimists ignore the ability for technology to limit and constrain social influences. They ignore the technological properties that may limit our perception of information. By looking at the integration of the cell phone into society, the next section will challenge these opinions. To do so, I will examine the ways in which cell phone technology has taken on non-deterministic characteristics during its relatively short history.

The Integration of Cell Phones

Like any other information technology, cell phones must integrate into society by finding their optimal role and use. As demonstrated in part two of this paper, this process can originate from social influences or technical influences that combine to create a reciprocal relationship. In this manner, cell phone technology is no different, but its

analysis is more complicated. This is due to the fact that the integration process of cell phones is still ongoing, despite their presence for decades. Through this case study, I will express how social and technical influences mix to create a constant reframing of the technology's problems and solutions.

In order to accomplish this task, I will begin by discuss how social factors have an affect on technical features and properties. Like the previous section, I will use three aspects of the Social Construction of Technology framework to outline how these influences occur. Following, I will reverse the order of the relationship by analyzing how technical features regulate social use. To do so, I will observe the manner in which laws, markets, and norms have changed our use, mostly through technical limitations and alterations. Then, before moving to look at the future of cell phone technology, I will combine the aspects to show how a reciprocal relationship is formed from such influences on cell phone technology. Altogether, this case study is intended to add a real-life element to the process explained in part two.

Social Factors that Influence Integration

To observe how social factors have influenced technical properties and the integration of cell phone technology, I will break this section into three subsets that each focus on a particular aspect of the SCOT framework. To briefly review, the SCOT framework uses interpretive flexibility, relevant social groups, and closure. Interpretive flexibility focuses on how one technology can take on multiple uses. Relevant social groups is used to analyze how a technology takes on a different meaning and use depending on the social group that puts it to use. Lastly, closure, which is the most complicated of the three, looks to study the framing and reframing of problems and

solutions to help the technology find an optimal role in society. This aspect is most complicated because, with information technologies, it is not clear who has closure (or the power to alter such framings) or when that closure occurs. Cell phone technology will help to explain that closure in information technologies never occurs because they are constantly updated until they become obsolete. I will discuss these aspects in order from interpretive flexibility to relevant social groups to closure.

The interpretive flexibility aspect of cell phones is particularly interesting because they have the ability to take on many uses in society. For instance, a modern cell phone can make a phone call, but it can also text, play music, instant message and navigate the Internet. Consequently, users have significant amounts of flexibility in determining how they use their cell phone. Once upon a time, the cell phone had a phone-like use. Prior to the addition of music technology and the Internet, the cell phone would traditionally be used as a mobile phone. They were convenient because they enabled their user to make a phone call without being near a landline. The cell phone, therefore, picked up the cultural customs and norms that were assigned to the landline phone. At the same time, use of landline telephones was still popular due to pricing structures and availability.

This role for the cell phone would eventually change. Users began to understand and become comfortable with the use of text messaging and other forms of communication that are not traditional for the cell phone. Over time, cultural customs were established to answer crucial societal questions such as: who can appropriately text who, what type of information could be appropriately sent through a text message, and when was it appropriate to text someone (as opposed to calling). For an extreme example, it is now understood that the death of an important person is not an appropriate message

to send, but when text messaging was first gaining popularity, such an expectation did not exist. In a related manner, the text message would become an important tool if it was possible that a phone call would be interruptive.

Questions also existed over the receipt of text messages: when is it appropriate to answer a text message and what would proper responses be (naturally, such questions also interacted with pricing schedules of text messaging services). It is now commonplace (albeit still debatable) for people to stop a direct conversation when a message is received in order to see who sent the message and potentially respond. This custom was not known at the beginning of text messaging use, but would develop through continued practice. Questions of appropriate use were resolved through the adaptation of cultural customs surrounding the use. Users were able to establish guidelines through continued text messaging in overlapping networks. Over time, appropriate uses of the text message feature of the cell phone were established. In this manner, cell phone owners determined how the text messaging feature would be used.

Beyond text messaging, the cell phone now has the ability to take on many additional uses. As music has become digital, cell phone producers needed to add technical features such as headphone jacks and software programming in order to pursue the market of mobile, digital music. Furthermore, Internet access is in the beginning stages of revolutionizing the role of the cell phone in society. Users have used this access to facilitate many different uses. People have used the Internet to add applications to their cell phone, which acts as software to modify use. Through this course, cell phones added games and news updates to their already expanding list of uses. As this has occurred, cell phones have begun to drop the traditional “phone” uses. I recently overheard somebody

say “I have so many applications on my blackberry that I forgot how to make and answer a phone call.” Such an experience has become common, as users find new, distinct uses for the cell phone. Furthermore, the popularity of dynamic properties of cell phones has forced producers to add features to keep pace with changing uses. For example, producers have had to add memory and develop operating systems to facilitate easier use. With such developments, people would be able to access more information in less time. Our thirst for interaction and communication has yielded technological progress and development.

The use of text messaging and the Internet have demonstrated that the cell phone has taken on many roles in society since its introduction. People and customs have modified the cell phone’s use to transition it from a typical phone to a mobile personal computer. How the cell phone has been used has depended critically upon several characteristics. In order to interpret how the cell phone was to be used, the interface and programming functions must be easy to use and technology must be available to continue its use. Further, such technological developments must not stray too far from people’s pre-existing comfort levels. Otherwise the product would not be used. To capture such characteristics, technical factors had to be adapted to correspond with the social and cultural expectations surrounded cell phone use.

Beyond the cell phone’s dynamic interpretations of use, such uses have been dependant on social groups. While determining such uses has been in the hands of producers and users, each group has subsets that utilize the cell phone in different manners. The interpretive uses discussed have corresponded with uses in the United States. However, cell phones have taken on different roles in international arenas. In

Japan, the cell phone has become a tool for reading books, which is a use that has not entered American social networks.³⁹ In the Philippines, the cell phone is popular because people use it to do their banking and transfer money.⁴⁰ Such a use would not even be attempted in America due to overwhelming concerns for security. In fact, cell phone users in Japan and other countries store their credit card information on their cell phone to foster easier bill paying. Many Americans would characterize that as insane for fear that they misplace their cell phone. However, social customs in countries with bill paying features on their cell phone have developed norms that a misplaced cell phone is to be returned to the owner without stealing such vital information. Furthermore, users in Africa have found additional uses for the cell phone.⁴¹ There, the cell phone is working to revolutionize life by increasing efficiency through the coordination of daily tasks. The cell phone reveals that similar technologies can have much different affects in depending on the social group which is determining the use.

The argument can be made that examples from international circles do rely on the presence of cell phone technology. This would move to indicate that technical features are the ultimate influences in integration. However, such technology would not be used if it did not have the social need. It is obvious that cell phone technology has a social need; the popular uses of cell phones indicate that it is a productive influence in society. International examples of cell phone use provide evidence that social factors do affect *how* that use is established. The cell phone was not developed to be a banking tool, but it

³⁹ Associated Press. (March 18, 2005). Next Hot Trend for Cell Phones: Reading? Mobile technology meets the novel in Japan. *MSNBC*.

⁴⁰ Jordan, M. (October 3, 2006). New Conductors Speed Global Flows of Money: Cell Phones Make Transfers Faster, Cheaper. *Washington Post*.

⁴¹ LaFraniere, S. (August 26, 2005). Cell Phone Frenzy in Africa, World's Top Growth Market. *New York Times*.

certainly became that in some social networks. As such, producers needed to modify technical features to accommodate social expectations and needs. Consequently, social factors affect technical properties.

In addition to the cell phone's flexible uses to varying social groups, the SCOT element of closure has also had an important influence on technical features. As a programmable device, the cell phone's flexibility influences not only its uses, but also its closer. Through closure framing, the cell phone can find an optimal use or can be reframed to find alternative, more improved uses. Producers can constantly introduce new technological adaptations to find better, more efficient uses. This may seem as though the technical features guide social norms through the closure process. However, it must be recognized that social forces can compel a producer to change features so as to find that improved use. For example, the popularity of text messaging indicated to producers that indirect, informal lines of communication could become commonplace. As a result, companies such as Blackberry included features like Blackberry messaging, which built on the text messaging popularity by allowing Blackberry owners the ability to send messages amongst each other without having to pay for text messages. By manipulating the market and interpreting the social need, Blackberry was able to move towards closure. Closure through technical features was pre-founded in the social market that brought about the demand.

Since technical features can be born from a social need, it is necessary for producers to introduce new features by connecting them with social needs. For example, Apple's iPhone was introduced to society as being more than just a phone. To do so, Apple needed to determine that the cell phone had potential in markets to take on such

furthered uses. They needed to observe that prior cell phones did not have the features to facilitate the most efficient uses. Once that is determined, framing and advertising must be developed to link the iPhone to the market potential. The iPhone, therefore, must be introduced as a device that has what other phones lack. The introduction is crucial for obtaining closure. By framing the problems that their product is intended to solve, producers can guide society to use their products in certain ways. This process is not dependant on technical features. For instance, Blackberries and iPhones have similar framing properties, but have different keyboards and features that slightly alter use. Cell phones can have the same basic technology, but can be adapted for different purposes.

Unfortunately, the SCOT framework does not offer suggestions to determine the who has the ability to create closure. In the iPhone example, producers had closure through the introduction of their product. However, users can also achieve closure by redefining how a product is to be used. The Blackberry can be introduced as device for college students to communicate with one another, but it may become the primary technology used by businessmen who seek to check their e-mail on the run. Most importantly for the closure of cell phones, the SCOT framework does not indicate the extent to which closure is obtained. It should be readily apparent to most users that the cell phone is constantly changing uses and frequently alters roles in society. This observation seems to indicate that closure will never be found or that closure is found only for it to be updated in the near future. In both scenarios, social factors such as interpretive flexibility and relevant social groups constantly improve the cell phone's integration in society by allowing it to find increasingly optimal uses. For these reasons, closure itself (and whether or not it is obtained) is not the appropriate concern towards

cell phone integration. Rather, it is the movement towards closure that conveys the important point; social influences upon technical properties help to move cell phone technology towards closure to find its optimal use in the hypothetical future.

This section works to examine how the cell phone's social properties and uses interact with technical properties. Through interpretive flexibility, relevant social groups, and the movement towards closure, social factors influence the development of technical features. The flexible interpretations of social use can create the demand for differing technological properties and changes. As a result, social influences add a dynamic characteristic to cell phone integration. The manner in which groups use the cell phone adds flexibility to the integration process. In the next section, I will demonstrate how such an interaction can work in reverse, where technical features can encourage and alter social use.

Technological Factors that Influence Integration

In the same fashion as other information technologies, cell phones also possess technological characteristics that limit or guide their use. These technical properties are intended to control behavior in some form or another, or to allow for multiple interpretations of use. Using the framework introduced by Larry Lessig, cell phone technology has worked to guide use in four main fields: architecture, laws, markets, and norms. In each facet, technological characteristics have worked to limit, control, or influence the manner in which the product is used. Through this route, technical factors are able to influence the cell phone's integration into society.

As cell phone's have progressed through their timeline, they have adopted many of the fundamental technical properties of computers. Much like a computer, they house

memory and programmable traits that enable modification through software. Likewise the cell phone's architecture closely reflects the architecture of the Internet. The code of the cell phone is established such that applications can be run over an operating system to facilitate easy access, while limiting uses within the scope of the law. For instance, the modern cell phone's code allows the user to run purchased applications, but makes it very difficult for one to illegally copy an application or music. Naturally, when there is a will, there is a way; when it is advantageous for a hacker to break the code, they will do so. However, the code of the modern cell phone is convenient enough so as to warrant less hacker participation.

Further, most cell phones utilize closed code, meaning that the source code from which programs and applications are made are not available to the public for modification. Nevertheless, most cell phone makers allow room for controlled levels of experimentation, entrepreneurship, and private development. With work and some education in computer programming, it is possible to create your own application. If the development of an application picks up, the code of the cell phone is built such that malicious uses can be shut down. Therefore, any use that becomes popular is a beneficial use. Through this manner, the code matters! It works to control and guide social use.

Beyond architecture, the technical properties of cell phones also work to regulate use through laws, markets, and norms. Granted, these three aspects appear to be socially based. Nevertheless, technical components are added or changed to encourage controls along such lines. For example, in the early 2000's (and continuing through today), cell phone use presented a problem on the roadways. People would talk and text on their cell phone while they were driving. The distracted levels of attention would lead to increased

accidents on the roadway. The government stood to stop the malevolent phenomenon. However, it quickly found that regulation of such a popular use was difficult. People would still use their cell phones in the car, but would simply look to hide it from law enforcement officials. Law enforcement needed help to enforce this law. As a result, producers developed advanced technology in the form of hands free use of the cell phone. Speakerphones improved, but more importantly, companies developed Bluetooth technology that allowed people to speak through their radio system. Such a technology was convenient, law abiding, and efficient. Therefore, its popularity caught on and technological features were able to encourage the appropriate social use.

In addition, legislation surrounding the cell phone has separated it from the traditional phone functions. In America, it has been commonly recognized that people have a right to a landline telephone. Even for those in rural areas, telephone companies had to supply some form of telephone capabilities. However, the same principles do not hold true for the cell phone. It is not recognized that people have legal right for a cell phone. Cell phone providers do not need to ensure that their signal reaches the rural lands, if it is not economical for them to do so. As a result, the cell phone has become more of a status symbol, and features on the modern cell phone have differed depending on price. Through this market manipulation, legislation has led to disparate uses in differing communities. Such a trend is sustained by technical properties. Newer, more expensive cell phones hold many more interpretations for use do to its programming capabilities. Technical features have helped to maintain the discrepancies in class and rights.

Beyond laws and markets, norms also work to regulate social uses. Such norms are commonly determined by the technological properties of the cell phone. For instance, as indicated in the previous section, text messaging and other functions required immense amounts of typing. Therefore, the amount of messaging that is done can be regulated by the ease with which it is to type. Older cell phones utilize typical numeric alphabets, with the numbers 0-9 representing different letters and symbols. Such a method was extremely difficult. However, the development of newer technologies saw modified keyboards. Blackberries and iPhone's use traditional computer keyboards. These keyboards are easier to use. Therefore, messaging norms have increased since the development of the new keyboards. Nevertheless, such keyboards are still difficult to use, and many people have complained about using the keyboards. As keyboards improve and become more comfortable to more people, messaging customs will change and increase in frequency. Technical properties directly affect the social use, and therefore, the integration of the cell phone into society.

As represented in this section, technical properties can have a significant impact on regulating and guiding social uses. The examples provided are not an exhaustive list, but they do work to exemplify how such affects occur. Features built into the code or function of the cell phone work to restrain the flexibility generally used in social interpretations. In combination with social factors, technical properties along architecture, laws, markets, and norms, help to influence social use and integration.

The Reciprocal Nature of Social and Technical Factors

Although the past two sections focused on social factors and technical factors, the realistic interpretation of cell phone integration includes both aspects and how they

interact with each other. In most cases, technical properties work to control or limit interpretative uses, while social factors go to provide adaptive uses for the technologies. Such a relationship works like a system of checks and balances. A balance is achieved between the two factors and checks are used to prevent misbalance.

As indicated in this case study, technical forces and social forces function in unison to integrate the cell phone into society. “The range of contexts in which the mobile phone is implicated is clearly very large. It is embroiled in the commercial world of costs, profits, investments and business plans; which connect through to actors in the technical world of signals, circuits, protocols and data bases; which connect through to the social world of teenagers, mothers, business people and cultural mores; and so on.”⁴² Today’s use of the cell phone, as a mini-personal computer, is a result of an evolutionary process that built on social uses and technical capabilities. Text messaging properties, in conjunction with cultural expectations and popularity, enabled the use of the cell phone as more than just a mobile phone. This began the cycle that utilized the cell phone in a manner more familiar to us today. Naturally, these uses differ between social groups and interpretations, but the overall affect is there. Through the socio-technical balance, cell phones find updated uses, updated capabilities, and work to find the cell phone’s optimal use in society.

Nevertheless, optimists and pessimists still have concerns that either aspect would become rampant and uncontrollable. Pessimists would believe that technical developments are beyond our control. Our use of the cell phone is determined and constrained by technical properties. What this view ignores is the many social customs

⁴² Arnold, M. (2003). On the phenomenology of technology: the “Janus-faces” of mobile phones. *Information and Organization*, 13, 242.

that get placed around cell phone technology. Without such customs, use of the technological advancements would not exist. On the other hand, optimists believe in the complete flexibility of social factors. Cell phone technology can work to cure the world's ills because it can be put to so many uses. However, what this view ignores is that technical limitations can work to restrain many of those social uses. In combining the two viewpoints, we can see how technical factors and social factors work to check each other's influence. Consequently, neither aspect can become overly influential, as is feared by extremist views.

Through this system of checks and balances, cell phone technology can appropriately be integrated into society. Small, controlled advancements in technology and social customs can work to move the technology closer and closer to its optimal use. It is unknown when such an optimal use will be found, or what it is. What is most important is not the answer to those questions, but rather the reliance that the system will continue to function in a reliable manner. With societal trust, cell phone technology cannot pose a serious threat or an uncontrollable panacea to our society. The system of checks and balances between technical and social factors works as the most realistic account of how cell phones are and will be integrated into society.

However, the system of checks and balances in the case study of the cell phone is used simply to understand that the trajectory of technology integration is not heading towards a deterministic setting. It is not to be construed as a mechanism that will avoid all problems. In the future, the development of new cell phone technology and new societal expectations will cause challenges to our ways of life. These challenges will present themselves along our legal structures, security, privacy, social relations, and

many more avenues. While it does not prevent these issues, the system of checks and balanced between social and technical factors of integration will help to settle these problems, and to engage new technology in a manner that is best used for society.

For example, the future of cell phone technology will continue to change our expectations of social relations. In employment, many businesspeople are already expected to carry an advance cell phone and to use it throughout the day. As a result, the business world has found an entrance into the home, where people used to be free from the demanding expectations of work. As employer expectations have changed, so too has behavior. With the advancement of cell phone technology, this trend will likely continue. As cell phones become more capable of performing the tasks traditional of a personal computer, employees will be responsible for more work in less time. For instance, if you can conduct conference meetings with your cell phone, you may be expected to be on a conference call at 2am with business partners from across the globe. Furthermore, as cell phone keyboards develop into more practical devices, employees may be expected to write or research at odd times. All of these scenarios move well beyond business' intrusion into the home.

Such expectations may be viewed as a bane on our way of life. Pessimists would certainly understand these future developments to be confirming their beliefs. Superficially, the situation looks grim. However, if the disapproval of such a scenario is overwhelming, or against societal interest, social customs and expectations will be likely to change. Predicting what those changes will be is extremely difficult. Hence, this is a difficult with social construction theories. What we would know is that practice and use will change. Perhaps jobs with high cell phone demands will be paid more. This would of

course indicate that fewer qualified people are willing to make such a sacrifice. Or, to support employee spirits, companies will institute times at which their employees can have their freedom. Similarly, companies can work with their employees to boost morale, which would make them more productive. From technical influences, perhaps cell phones will be programmed to be inaccessible to certain individuals during certain hours. Overall, once a practice becomes socially undesirable, new strategies, whether social or technical, will be developed so as to rectify the unwelcome effect.

In this manner, the system of checks and balances through social and technical forces will help to resolve future challenges that are produced by cell phone integration. The overall affect functions, and will continue to function, like an economy of integration. As integration is changed by either a social influence or technical influence, any non-optimal consequences will be handled by continuing to modify social expectations or technical properties. Hence, it is important that closure not be found on cell phone technology until the optimal settings can be found or the cell phone is made obsolete. Without closure, the cell phone will be able to be updated constantly by all forces. This process will help to resolve problems in an even-keeled, non-deterministic manner.

Conclusion

In this paper, I have argued that deterministic opinions of technological integration are not founded in accurate conceptions of reality. Rather, they are inaccurate because they ignore crucial elements to the integration process. To demonstrate this, I have highlighted various factors that work to integrate a technology, and have also revealed that such influences work in tandem to create an affect. Social influences work

simultaneously with technological advancements to develop customs around our use of technology. Consequently, we are not at risk for extreme pessimism or extreme optimism in the integration process.

The overall affect of such influences creates a check and balance system that functions like an economy of integration. This interaction casts doubt on the common argument from scholars that technology is integrated either by wholly social forces or by wholly technical forces. Such a viewpoint is equally as deterministic as the extreme pessimist or optimist outlooks. Rather, the interaction creates a reciprocal relationship in which both social and technical forces can influence each other in either direction. This process was demonstrated by a case study of the cell phone. The integration of the cell phone is an ongoing process, and it forms a feedback loop to better integrate technology. Nevertheless, social customs surrounding the application of the cell phone, and technological properties have both altered, modified, and created patterns of use that utilize both the social and technical forces. Through this process, deterministic attitudes that see integration as a process driven by either aspect also ignore the crucial influences from the other aspect. Overall, we are more in control than we think!

In moving forward, we as a society would be in a better position to adapt technology and adapt to technology if we were to conceptualize the process of integration as a two-way street. This acknowledgement will help ease technology into society because it would not be surrounded by skeptical or over-elated attitudes. In the future, scholars should work to identify what psychologically fuels such extreme attitudes and how they can be corrected. With a better understanding, we may work to develop truly

useful technology that has a more beneficial immediate impact upon society and the world.

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