The Media and the Messages of Location-Based Services (LBS): Death of Distance or the Revenge of Geography?

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Abstract

With the dramatic increase of mobile phone users, coupled with steady innovations in wireless/embedded computing and communications, the past five years have witnessed the emergence of various kinds of location-based services (LBS). The backbone of LBS relies on an integration of multiple spatial and communication technologies, including (but not limited to) GPS, GIS, wireless communication, mobile computing, the Internet, etc. The emergence of LBS provides unprecedented business opportunities as well as enormous challenges for society. This paper reconceptualizes LBS as new media. By doing so, a synthetic framework based upon Marshall McLuhan's laws of the media is developed. The media and messages of LBS are discussed through a preliminary tetradic analysis, followed by a discussion on the applicability of Asimov's laws of robotics in guiding the development of LBS. The paper concludes by arguing that the way to cope with the paradoxes of technological innovations is a major challenge in the information age.

Keywords

location-based services (LBS), laws of media, laws of LBS, social impacts

I. INTRODUCTION

As the revolution in mobile communication continues to march on, the past five years have witnessed the rapid convergence of mobile phones, mobile/embedded computing, and spatial information technologies led by GIS and GPS. The new generation of smart phones allows users to access mobile Internet services and run applications at any time and at any place. It is estimated that there exist around 500 million Internet-enabled mobile terminals in the world by the end of 2003 (Karlson, et al., 2003). This number is expected to exceed the number of fixed line Internet users by the end of this year. The rapidly growing mobile terminal users generate a huge market for related services and offer new opportunities for businesses. Among them, location awareness and personal location tracking become important attributes of the mobile communications infrastructure, as human society enters the age of increasing mobility (Koshima, Hoshen, 2000; Wu, Sun, 2001). According to the Ovum report, location-based services of various kinds are estimated to create $20 billion commercial opportunities annually for the wireless communication industry by 2005.

Although universally accepted definitions of location-based services (LBS) still do not exist and some are even called by different names, such as telegeoinformatics (Karimil, 2004), LBS generally refers to geographically-orientated data and information services to users across mobile telecommunication networks (Shiode, et al., 2002). LBS is essentially an information service that exploits the ability of technology to know where things are, and to modify the information it presents accordingly (Goodchild, et al., 2002; Virrantaus, et al. 2001). Different from other services in the economy developed so far, LBS is inherently distributed, mobile, and potentially ubiquitous.

Although still at primitive stages, the existing prototype LBS has demonstrated that it is capable of increasing the information provided directly to observers through the normal human senses. Furthermore, LBS can also allow data to be analyzed as they are collected, followed by a progressive construction of knowledge base of LBS users.

The backbone of LBS is the convergence of new information and communication technologies such as mobile telecommunication systems, location aware technologies [GPS or radio frequency identification (RFID)], mobile Internet, GIS and spatial databases. GPS and cellular technologies based upon RFID are enabling a new generation of mobile electronic devices to acquire positional information on the Earth's surface, and process the information while they are collected.

LBS today represents only the beginning of a series of technological innovations that can potentially impact society in many ways at various scales, ranging from surveillance and the invasion of personal privacy, to technologically induced changes in human spatial behavior. For the businesses community, LBS may engender drastic spatial structuring of retail and other services. Perhaps most importantly of all, further penetration of LBS in people's daily lives will mark the beginning of what Bill Gates (1995) envisioned as a "documented life." With more and more people's daily routines recorded at very fine spatial and temporal resolutions, massive amount of data at the individual level will be accumulated with the growing popularity of LBS. Thus, LBS has the potential to provide novel sources of data to researchers in a variety of disciplines and business, especially in marketing.

LBS has provided researchers with unprecedented opportunities to build and access databases, and conduct sophisticated analysis of data via new data mining techniques. All these analyses can be done while located in the field, immediately following acquisition of data (Goodchild, 2002). Despite the growing interest in LBS by industry, government agencies at various levels, and interdisciplinary scholars, there exist little consensus on the broader implications of LBS, as reflected on the diversity of opinions expressed during the first scholarly conference on LBS held at the Center for Spatially Integrated Social Sciences (CSISS) in Santa Barbara three years ago (see www.csiss.org for details).

This paper has three objectives: 1. to develop a new conceptual framework by reconceptualizing LBS as new media; 2. to conduct a preliminary analysis on the social and spatial impacts of LBS using McLuhan's laws of the media; 3. to discuss some possible frameworks to address emerging issues by situating LBS in a larger context of technological innovations.

This paper is organized in five sections. After a brief introduction, Marshall McLuhan's laws of media and its relevance for LBS are introduced in section two. A detailed tetradic analysis of LBS using McLuhan's laws of media is presented in section three, followed by discussions of Asimov's laws of robotics as a possible framework for coping with the paradoxical impacts of LBS. The paper concludes by situating future growth of LBS in the larger context of technological innovations.

II. LBS AND LAWS OF THE MEDIA

Although still at a rather primitive stage, the impacts of LBS on individuals, businesses, and society at large are profound. The existing literature on LBS has been dominated by the computational and technical concerns (Bahl, et al., 2002; Adams, et al., 2003; Berger, 2003,) although its potential social impacts are slowly gaining attention (Dobson, 2000; Raper, Livingston, 2001; Aoyama, 2003). A key point that is conspicuously missing from the current literature is treating LBS as new media. Extending an early idea of GIS as new media developed by Sui and Goodchild (2001, 2003), I argue in this paper that LBS can (and should) also be understood as new media for two reasons. First, the driving force behind LBS is wireless communication; and second, all the information accumulated in previous medium can be potentially accessible via LBS. By reconceptualizing LBS as new media, we can conduct further analysis of the media and messages of LBS.

In one of his most influential books - "*Understanding Media: The extension of man*" (McLuhan, 1964), Canadian communication theorist Marshall McLuhan made himself an instant international celebrity. McLuhan's work was intensely debated within the academia and among the general public in the 1960s and 1970s. Although McLuhan's influence seems to have diminished rather quickly after his untimely death in 1980, there have been some consistent efforts since the late 1990s to revive McLuhan work and his ideas. In retrospect, McLuhan was celebrated mostly for the wrong medium back 40 years ago. As our current lives are increasingly mediated by massively connected electronic network, McLhan is more relevant than ever. As Robert Logan observed (quite rightly) "Man, he [McLuhan] understood the Internet. He was the Internet in the sixties. The world's just finally caught up to him. He was an Internet in the sense he was in touch with the entire globe. He was wired long before the editors of Wired magazine were born (cited in Horrocks, 2000, p.1)." I believe that it is even more enticing and exciting to have a peek of LBS through McLuhan's looking glass. Indeed, McLuhan was talking about LBS back in the 1960s.

Space does not permit to discuss McLuhan's complex ideas thoroughly here. It would suffice here to sketch a broad contour of McLuhan's thoughts for analyzing the impacts of LBS. Interested readers are referred to Sui and Goodchild (2001, 2003) for further details and references.

McLuhan and many of his followers believe that there have been three dominant modes of communication throughout human history: oral/speech, writing/printing press, and the electronic medium. Each dominant medium has produced dramatically different psychic and physical impacts on individuals and on society as a whole. McLuhan succinctly summarized these impacts as the laws of media, presented in a tetradic framework (Figure 1) in a book co-authored with his son Eric and published posthumously (McLuhan and McLuhan, 1988). McLuhan's laws of media has four major dimensions: any innovations in the dominant mode of communication media will invariably (A) intensify/enhance certain elements of social practices in a given culture, while at the same time (B) making other aspects of social practices/ cultural practices obsolete. Furthermore, all media innovations will also (C) retrieve a phase of certain social or cultural practices
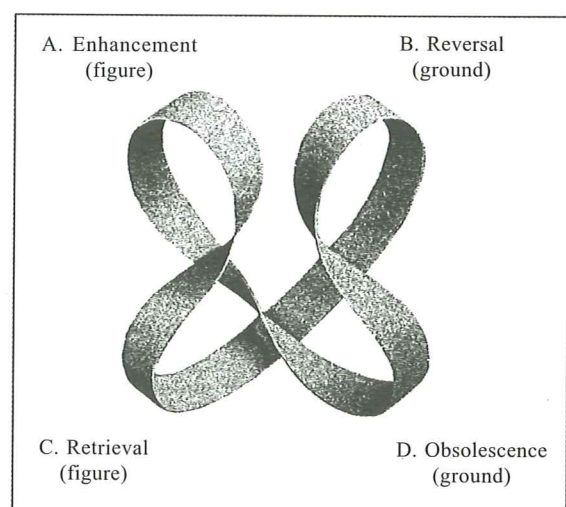

Figure 1. McLuhan's law of media
(Modified after McLuhan and McLuhan, 1988)

long ago pushed aside, and finally (D) undergo a reversal when extended beyond the limits of their potential. The four phases of the tetrad manifest also sets the limits of the cultural impacts of an artifact, by showing how a totally saturated use would produce a reversal of original intent.

McLuhan's laws of media weaves two key elements to understand his tetradic model: 1) the distinction between visual versus acoustic space and 2) the relationship between figure and ground as outlined in *Gestalt* psychology. According to McLuhan (1964), dichotomous intellectual discourses are reflections of bifurcated minds deeply rooted in the visual mode of thinking - the result of the Gutenberg (printing press) revolution. McLuhan and Powers (1989) further argue that the "visual space" mind-set leaves little room to alternatives or for participation when no provision is made for two entirely different points of view. The result is usually the exclusion of alternative perspectives.

To fully comprehend the new reality mediated by the electronic medium, McLuhan and Powers (1989) call for a fundamental shift from the values of linear thinking - visual, proportional space - to those of the multi-sensory life - the experience of acoustic space. Visual thinking places information structurally and sequentially - having separate centers with fixed boundaries. Acoustic thinking regards things as simultaneously interconnected - having centers everywhere with boundaries nowhere. Visual thinking is centered and bounded. Acoustic thinking is built on holistic and organic ontology. Acoustic space has no cardinal center, just many centers floating in a cosmic system which honors only diversity. This shift demands that we engage in simultaneous understanding and integral awareness. As I have argued elsewhere (Sui, 2000), the shift from a predominantly visual to an aural metaphor is one of the major changes in geographical discourses in the late 20th century. Such a change was made possible by an array of philosophical, technological, and social changes in society.

At the very fundamental level, visual and aural thinking entail different sets of epistemological values orchestrated as by the eye versus by the ear. We now know that sound imposes its concreteness on us by immersing and surrounding us and that sound tends always to socialize. Voice is inherently relational and subjective. In contrast, sight entails an object world fixed in space, giving an illusion of permanence. Vision is thus inherently detached and objective.

Also implicitly woven into McLuhan's tetrad is the concept of figure/ground, borrowed from *Gestalt* psychology: enhancement and retrieval as two figures, and obsolescence and reversal as two grounds. Visual thinking usually stresses one figure or one ground, rarely both. Acoustic thinking engages us in double figures and double grounds and enables us simultaneously to evaluate the overall effects of an artifact on society. McLuhan believes that every product of human intellectual effort manifests the same four dimensions. His

tetrad enables us to reposition ourselves into a holistic perceptive mode - the mode of the dynamic multiple centers — and to move away from the monolithic linear visual image. Instead of simplistic utopian and dystopian views, McLuhan's inclusive and irreducible four-part laws of media provides a better conceptual framework within which to understand the complex and multiple implications of LBS.

So far the fragmented literature on LBS has covered the technical, business, and social aspects of this emerging technology. McLuhan's laws of the media could potentially tie all the scattered elements together, thus contributing to a more complete and holistic perspective on LBS.

III. LBS: THE MEDIA AND THE MESSAGES

If LBS is indeed becoming new media for communicating various forms of personal and business information in society, it will be fruitful to scrutinize LBS from a media theoretic perspective and explore to what extent can McLuhan's laws of media be applied to examine its multiple dimensions. In this section, LBS as media is examined first, followed by a tetradic analysis where the four dimensions defined by McLuhan's laws of the media will be addressed.

A. LBS: the media

As Boorstin (1987) pointed out earlier, the supreme law of the republic of technology is convergence - the tendency for everything to become everything else in the technological world. In the case of LBS, it is a convergence of multiple media that were developed for communicating oral/voice, printed text, visual images, and geographic/spatial information.

According to Shiode et al. (2002), mobile telecommunication networks (MTN) have evolved rapidly in Europe since the late 1990s (3G Americas, 2002). From the humble start of the first generation terrestrial systems , the second generation MTN was based on the Global System for Mobile Communication (GSM), followed by the so-called 2½ generation MTN - General Packet Radio Service (GPRS). The third generation MTN, based upon the Universal Mobile Telecommunication System (UMTS), is operational . MTN bandwidth has evolved from 9.6 Kbps to 115 Kbps, and UMTS can now support 2 Mbps (Shiode, et al., 2002). Industry leaders in LBS have been working on a Wireless Application Protocol (WAP) since 1997. The goal of WAP is to develop a common standard that will facilitate the convergence with the existing (fixed) Internet infrastructure so that eventually we can have one mobile Internet solution that operates using the same worldwide protocol (Ericsson, 2001; Webraska, 2004).

These new developments in MTN have also expanded the capacity for services, from focusing primarily on transmission of voice data to various applications transmitting multimedia information (Grajski, Kirk, 2003). In particular, the emergence

of handheld, mobile and small size wireless devices such as Personal Digital Assistants (PDAs) and mobile smart phones have been enhanced and can be connected via infrared, GSM modems or radio signals to wireless networks (Siber, 2001). With the continuing improvements in both satellite-based and terrestrial systems-based positioning systems, LBS will most likely continue to grow in the near future. IDC (2004) predicts that by 2005, almost 50% of European mobile subscribers will use LBS. The U.S. FCC's new mandate on enhanced 911 (E911) will definitely provide new incentives for value-added LBS (FCC, 2001). Interoperability across multiple networks, platforms and devices will become more crucial for the success of LBS, but an open industry specification has yet to be developed (Jose, et al., 2001).

So far, LBS can be offered to consumers at three levels. At the first (also the most primitive) level LBS can provide users with raw coordinates on location and navigation activities. A GPS or a cellular radio system can supply the coordinate information (Mountain, Raper, 2001). From the raw coordinates it is possible to provide individuals with a grid reference that would enable locating themselves with a distance and direction for navigation. At the second level, raw coordinates are combined with information from a local GIS to indicate user locations on a street map and provide a route. At the third level, LBS could use web-based information about locations of interests. It could provide a route to navigate to an interest location. Dynamic information could be converted into services by matching the changing environment and historic preferences of the user.

Different from all the previous media, LBS is in principle capable of integrating all the three major modes of human communication: oral, textual, and electronic. If we following MuLuhan's argument that media are extensions of man, LBS is the extension of man in the fullest sense since it may involve multiple senses (ear, eye, and touch). Indeed, LBS has transformed those who have access to this technology into nomads in a global village. Considering the emergence of affective computing (Picard, 1997), LBS in the future may not just evolve to more instrumental/utilitarian applications, but enable its users to explore more intimate ways at the psychic and emotional levels.

B. Messages of LBS: a tetradic analysis

Inspired by McLuhan's laws of the media, four questions can be posed to decipher the messages of LBS. Preliminary answers to these four questions are provided here to stimulate further discussions. The goal is to make a better sense of this emerging technology in a more holistic way, and suggest areas for future studies. Discussions below are not meant to be definitive answers to these questions.

The message of LBS (I) - what does LBS enhance? It has been long believed throughout human economic history that time is money (Fadden, 1977). The development of LBS is

challenging and complementing this long-held motto . New innovations in LBS technologies will enhance the value of locational information related to human activities. The first important message of LBS is that it will lead to the commoditization of location and the emergence of mobile commerce (m-commerce). Indeed, LBS has converted the entire world into a (digital) market place. LBS certainly is an integral part of the new wave of businesses that run at the speed of thought using a digital nervous system as Gates (1999) predicted. Goodchild (2002) stressed that location is already a fundamental component in the algorithms used to charge users for cellular service. Furthermore, carriers might pass locational information to organizations as part of location-based subscription services purchased by the customer, who would in return receive information related to current location, such as the state of congestion on nearby roads. In return, customers might purchase services when LBS alert them that certain locational conditions exist, such as the locations of pet stores or children recreation.

Both industry and governments have been making efforts to facilitate the further commoditization of location and promote m-commerce (Table 1). A number of LBS providers are working together to develop standards, and promote them through such organizations as the Location Interoperability Forum and the Open GIS Consortium. The Wireless Communication and Public Safety Act of 1999 in the US defines conditions under which network operators can release locations to emergency services, and other legislative frameworks will likely regulate other uses of locational information. In the UK the Regulation of Investigatory Powers Act of 2001 can require recovery of locational information for intelligence purposes. All these new legal mandates could potentially stimulate further growth of LBS and its diffusion into more new services through the awakening in the business community to the value of locational information.

Table 1. The commoditization of location: potential areas of LBS (modified after Shiode, et al., 2002)

▶ Customized personal profiling and advertising
▶ User-requested information (such as local traffic information, weather forecasts and local services)
▶ Instant messaging for communication with people within the same or nearby localities
▶ Real-time tracking of vehicles, people, and goods
▶ Mapping/route guidance, directing people to reach their destination
▶ Emergency services
▶ Location-based tariffs
▶ Monitoring of physical activities and public health applications.

At the individual level, LBS will enhance the social use of location (Raper, 2001; Shiode, et al., 2002). The pricing structure of cellular phones has encouraged very heavy use by younger cohorts (those under 30) and for mostly socializing purposes. Evidently, the short message service (SMS) is being heavily used to exchange information about location, and to facilitate meeting or finding friends. LBS can also further promote communities without propinquity on the one hand, and

encourage *flocking* or *swarming* behavior among social groups on the other. LBS will also further enhance the kind of virtual life style Mitchell (1999, 2003) described so vividly.

The Message of LBS (II): What does LBS make obsolete? The second proposition of McLuhan's laws of the media argues that new media and technologies do more than simply extending or enhancing our social practices in many significant ways. At the same time new media also make obsolete (or "amputate") various social practices and human faculties. By obsolescence, McLuhan did not mean the total disappearance or outdating of certain social practices, but rather that certain media or social practices will no longer be dominant.

LBS will continue to worn-out the role of distance in society, and promote the emergence of what Gates (1995) called the friction-free capitalism. In retrospect, the pronouncement of the death of distance in the late 1990s (Cairncross, 1997) proved to be a little bit premature, even though the importance of distance in influencing the behavior of individuals and social practices has been greatly undermined with the revolutions in telecommunication. Indeed, if distance is a terminally ill patient, LBS may play the role of Dr. Kevorkian to accelerate its pace toward death. The death of distance is the result of a long historical process of time-space compression and distanciation, in which space has continuously been annihilated by time due to sharp declines in the cost of long distance communication and transportation. We are increasingly conducting our lives in a shrinking world-which McLuhan (1964) has so perceptively called "the global village (p. xii)."

As for the business community, the LBS also entails substantial amount of creative destruction. LBS is transforming industries so that the old market leaders lose their dominant positions. The old world with closed and vertically integrated systems is giving way to a layered and open architecture based upon new protocols and standards, as demanded by LBS. Even though the old style market leaders won't vanish over night, it is the datacom industry that will ultimately win the market battle.

The death of distance also poses new challenges to conventional business practices and models. In ways similar to e-commerce's challenge to brick and mortar, LBS and M-commerce will surely make certain practices of e-commerce outdated. M-commerce is characterized by the emergence of location-based services delivered by a variety of hand-held terminals, such smart mobile phones and palmtop devices. LBS is capable of accumulating massive amount of user profiles, creating new challenges to the industry. Instead of basic e-mail spam or web browsing hijacking, businesses in the age of LBS need to develop personalized one-to-one advertising with much improved spatial and temporal precision. Businesses should offer a pallet of diversity to satisfy specific consumer needs at specific moments and locations (Nicholas, 2002). This naturally requires businesses to rethink space allocations in the context of LBS, as is proved by the growing emphasis on micro-marketing and multi-site and multi-service stores. In recent years, the quickest route to retailing disaster was trying to be all things to all people , an approach that was a reflection of the initial impacts of LBS. Indeed, multiplicity might be the order of the day for business in the near future.

In the new digital economy, LBS will blur the traditional boundary between production and consumption. The growth of LBS is a potent testimony of Rifkin's (2000) observation that life is an all-paid experience in the new economy. Many of the conventional business models are become obsolete. However, the death of distance does not mean the end of geography. In contrary, it will mark a new beginning for geography (Kolko, 2000; Malecki, Gorman, 2001; Wang, Lai, Sui, 2003,) as the laws of media tells us that innovations also simultaneous retrieve older practices that have long been pushed aside.

The message of LBS (III): What does LBS retrieve? The backbone of LBS relies on the real-time exchange of spatial and temporal information at the individual level. LBS entails *locational profiling*, which include tracking of the user and of characteristics associated with the track - such as speed of movement, positional accuracy, and the relevance of information to the user. Once a detailed locational profile is collected, it is possible to analyze tracks, to obtain estimates of speed, to make inferences about activities based on the speed and geometric nature of the track, or to transform them into density surfaces, etc. All these goals are precisely what Torsten Hägerstrand (1970) tried to accomplish back in the 1960s and 1970 through his time geography. Obviously, the growth of LBS will inevitably retrieve "time geography" as a research practice in the next few years (Miller, 2004a, 2004b).

Hägerstrand (1970) is widely acknowledged to be the originator of modern interest in the tracks of people through space and time, and the processes and constraints that govern such tracks. LBS can provide abundant *tracking* data on the daily movements of people, and is already widely used in ecology to track the behavior of animals (Goodchild, 2002). In a more generic sense, tracking data normally consists of a sequence of tuples $<x,y,t>$ ordered by t, indicating the location (x,y) of the moving object at intervals of time denoted by t. In mountainous areas, altitudinal information z is also required. Although early attempts were made to implement Hägerstrand's framework using GIS were not successful, recent development of LBS has fully retrieved time-geography. Inquiries along this line have led Miller (2004c) to develop a people-based GIS, as opposed to a location-based GIS.

Another resurgence that was enabled by LBS is of classical locational theories. The growth of LBS has made researcher revisit many premises in the classical location theories as advocated by von Thünen, Weber, Lösch, and Christaller. Such theories deal with the locational choices made by

individuals or groups, and the economic and social bases for such choices in traditional economies related to agriculture, industry, and retail services. To what extent can location theory provide theoretical insights for choosing locations for servers, LBS devices, clients, and other components of computing networks; and the locations chosen for the human intelligence that makes use of such components? (Goodchild, 2001). Are new sets of theories, fundamentally different from the classic theories, needed for LBS? These topics are obviously some of research frontiers to be focused by researchers in the next couple years.

The rediscovery of time geography by LBS and the prospects of developing a people-based GIS (Miller, 2004c) can potentially lead to a much improved analysis and monitoring of people's daily routines, thus helping to ease problems such as those related with traffic congestion and access to services, and improve people's quality of life. But it is precisely the possibility of a fully documented life through locational profiling that is causing grave concerns.

The message of LBS (IV): What does LBS reverse into? The last proposition of McLuhan's laws of media is that when a medium is pushed beyond its limit, it will be reversed into the opposite of what it was originally designed for. In McLuhan's words, "we become what we behold; we first make the tools, then the tools will make us" (McLuhan, 1964). To McLuhan and many of his followers, media are not simply "making-aware" agents but also, perhaps more importantly, "making-happen" agents. With growing concerns about the intrusive nature of LBS, we are already beginning to see earlier signs of LBS' reversal effects.

Concerns over the possible invasion of personal privacy with the use of geographic information are becoming even more acute in the context of LBS. With the personal profiling capabilities increasingly embedded, LBS could easily be reversed into an electronic version of Jeremy Bentham's *panopticon*. Although the societal benefits of using LBS to conduct electronic surveillance are enormous, ordinary citizens should be concerned with its pernicious potential of a Orwellian Big brother watching us wherever we go. Believe or not, various forms of *panopticon* (CCTV in public spaces, cameras at traffic lights, etc.), although imperfect (Hannah, 1997), are already part of our daily lives (Gandy, 1993). LBS, if not well guarded, could make each one of us living in a perfect *panopticon*, which could have profound implications on social relations —citizens vs. state, employer vs. employees, children vs. parents, husbands vs. wives, etc. How ironic it will be, LBS—a technology originally developed to liberate us from the confines of location—can in principle also convert all of us into "prisoners" of geography.

In fact, the growth of LBS, especially through the development of human tracking devices, introduces a new potential for real-time control that extends far beyond privacy and surveillance per se. As a result, Dobson and Fisher (2003) even warned

that society must address a new form of slavery characterized by location control. Geoslavery now looms as a real, immediate, and global threat. According to Dobson and Fisher (2003), geoslavery refers to a practice in which one entity (the master) coercively or surreptitiously monitors and exerts control over the physical location of another individual (the slave). The inherent danger, Dobson and Fisher (2003) further argues, is that "the potential for a master to routinely control time, location, speed, and direction for each and every movement of the slave or, indeed, of many slaves simultaneously (p.48)". This new form of slavery has raised the fundamental issue of whether locational privacy is a fundamental human right that should be universally protected (Monmonier, 2002; Fisher, Dobson, 2003).

Other possible reversal effects of LBS may include negative environmental effects due to the increasing levels of material and energy consumption caused by ubiquity (Fishbein, 2003), personal health problems due to the excessive use of LBS caused by radio frequency (RF) pollution, and the potential for growing crime on identity theft. Perhaps, the most disturbing part for the reversal effects of LBS is that as of today, there exists no national or international laws that explicitly regulate the use of LBS, especially on the rights and responsibilities for the use of human tracking systems. Some general ideas drawn from the laws of robotics could be helpful.

IV. DISCUSSIONS: LAWS OF ROBOTICS VS. LAWS OF LBS

Intellectual discourses on technological innovations often branch off into either utopian euphuism or dystopian despair. As revealed from McLuhan's laws of the media, impacts of new technologies are often complex and paradoxical. The central theme of McLuhan's laws states that the effects of media (or technologies in general) on society are inherently paradoxical. As both Tuan (1989) and Tenner (1996) have elucidated with fascinating examples, such paradoxical effects defy simplistic characterizations as either good or bad. Instead, we must try to grasp the four dimensions simultaneously. McLuhan's implicit message is that the social impacts of technology are ambivalent. Excessive use of technologies always leads to the opposite of what they are designed for.

If LBS are indeed going to evolve along the four dimensions proposed in McLuhan's laws of the media, society in general will certainly interpret the messages of LBS in different ways, depending to whom we ask or whose interests are at stake. In the context of LBS, it is futile to debate whether LBS are good or bad for society. At this point, the only meaningful question will be how can we identify and deal with the ambivalent nature of LBS applications in society? Should there be any general guidelines on the development and use of LBS?

Although legal and social issues regarding the use of

geographic information have concerned the GIS community for quite some time (Onsrud, et al., 1994; Goss, 1995; Cho, 1998), these issues are far urgent in the context of LBS due to its potential ubiquity and close coupling with people's personal lives. Although calls have been made recently for a more comprehensive legal framework, there still exist no official legislation regarding the use of LBS. Inspired by Asimov's "Three Laws of Robotics" (Table 2), Jean Michel Durocher (2002), CEO of Webraska Inc. (one of the world's leading LBS provider) formulated a set of laws of LBS. Drawing a parallel from Asimov's laws, Durocher contended that the LBS industry should adopt the three laws of LBS (Table 3). I believe the extension of Asimov's three laws of robotics can serve as a starting point for a long legal journey regarding the regulation of LBS.

Table 2. Asimov's laws of robotics

First Law	Second Law	Third Law
A robot may not injure a human being, or, through inaction, allow a human being to come to harm.	A robot must obey orders given to it by human beings, except where such orders would conflict with the First Law.	A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

Table 3. Durocher's laws of LBS

First LBS Law	Second LBS Law	Third LBS Law
Location, through its availability or non-availability, must not allow a human being to come to harm.	The availability of one's Location must be in one's complete control, except where such control would conflict with the First Law.	The providers of location-based services must be allowed to create a profitable business from these services as long as such business does not conflict with the First or Second Law.

In anticipating both the positive and negative consequences of Robotics, Isaac Asimov presented his three laws in a short story called "Runaround" - originally published in 1942 (Warrick, 2002). Since its publication, Asimov's three laws of robotics have been continuously debated and fine-tuned. Although still controversial, they have been widely accepted as a reasonable guide to discuss the moral issue of robotics. Even Asimov himself admitted that "there was just enough ambiguity in the three laws to provide the conflicts and uncertainties required for new stories, and to my great relief, it seemed always to be possible to think up a new angle out of the sixty-one words of the three laws [cited in Warrick (2002, p. 175)]."

Although much more further fine-tuning are needed, Durocher's three laws of LBS offer a reasonable guideline for the use of LBS in the near future if an enforcement mechanism can be established. The first LBS law addresses the requirements of LBS in emergency situations. It is consistent of enhanced 911 (E911) services as mandated by the new FCC regulation. It is reasonable to expect improved emergency services if all 911 calls are locationally explicit. The first law of LBS also requires that no services should put mobile users in danger.

The second law would ensure that LBS services are voluntary, and therefore that privacy should always be preserved for individuals subscribing these services. Under normal circumstances, a subscriber should be able to prevent others from locating him or her. But totally complying with this could also put the user at risk, since in emergency situations it might be impossible for him or her to provide the necessary life-saving authorization. And in some cases, the police will want to (and already do) track cellular phone usage to locate dangerous criminals.

Finally, the third law stresses the fact that just location alone, like any technology, is not sufficient. Service providers must find the way to develop the right business models and charge for the right services. Applications must bring real value that consumers and business users will be willing to pay for. However, the third law also ensures that no business should be able to benefit from the availability of location data to the detriment of a LBS user's right to complete privacy and safety.

As fisher and Dobson (2003) illustrated in their 7 different scenarios regarding the use of LBS (Table 4), the legal and ethical implications of LBS are complex and contingent upon many uncertain parameters in the real world. Nonetheless, I believe that the three LBS laws provide reasonable guidelines for most civilian applications during peace time. These three laws run into moral and ethical difficulties in the context of war, especially in cases like the on-going war on terrorism. I do believe that all these three laws must be necessarily violated in order to win the war on terrorism. Or, perhaps more intriguingly, the flip side of the issue: there will be peace on earth once all these three LBS laws are strictly observed by each and every individual citizen of the global village?

Table 4. Surveillance scenarios and laws of LBS*

Scenarios	Examples	Ethical Issues	Laws of LBS
They didn't know where you were	Normal life for ordinary citizens	Personal privacy	Obeyed (violated if the person is suicidal?)
They know and you want them to	On call, emergency, alibi	Consent	Obeyed
They don't know but you thought they did	Faulty signal, signal blocked, physical density	Ignorance	Violated
They know and we wanted them to	Criminal activity, unethical conduct	Public interest	Ambiguous
They know and you didn't want them to	Nuisance calls, stalking, monitoring	Geo-identity Theft	Violated
They know and we thought we wanted them to	Abusers, hostage takers	Coercion	Violated
They know and can physically keep you there	Forced labor or domestic abuse	Geo-slavery	Violated

* The first three columns were modified according Fisher and Dobson (2003).

V. SUMMARY AND CONCLUSIONS: COPING WITH THE PARADOXES OF TECHNOLOGICAL INNOVATIONS

By reconceptualizing LBS as media, this paper aims to develop a more synthetic, robust framework to better understand the multiple, complex implications of LBS. The analysis of LBS as media, conducted using McLuhan's tetradic framework, enabled to link messages of LBS that have been scattered in the literature so far. Instead of the dichotomous characterization in the either/or mode, the development of LBS has been transmitting a complex set of messages of simultaneous enhancement, obsolescence, retrieval, and reversal at the individual, organizational and societal levels. By reconceiving LBS as media, we can transcend currently common instrumental and utilitarian interpretation of LBS by both LBS developers and users, and cultivate a more holistic approach to non-linear relationships between LBS and society. The most clear and present danger is not related to LBS or any rapidly evolving technologies per se, but to our blissful ignorance of the full implications of what new technologies are going to do TO us, because we tend to focus primarily on what LBS can do FOR us. The only sensible way of dealing with this inherent technological ambivalence is always to treat the LBS media as a means to higher social ends.

For quite some time in human history, location has played a crucial role in influencing (in some cases even determining) human economic and cultural activities. The spatial clustering of economic activities has not only achieved economies of scale and capitalized on the effects of agglomeration, but also annihilated time by space: minimizing time by placing things closer to each together spatially. With the gradual improvements in communication and transportation technologies, space has also been annihilated by time: cost and time for communication dropped drastically, making spatial clustering no longer necessary. The emergence of LBS will further strengthen the on-going trends of time-space compression.

The rapid development of various LBS led by coalescing innovations in mobile computing, wireless communications, GIS, and Internet etc. has simultaneously enhanced, obsolesced, retrieved and reversed the roles of location, space, and distance played in human affairs. It is partial, even misleading, to characterize its effects simply as the death of distance or revenge of geography. The take-home message of this paper is that LBS is creating multiple impacts at the individual, organizational/business, and societal levels. While fully cognizant of the unintended consequences of human actions, this paper cautiously calls the academic and business communities to consider the application of Asimov's laws of robotic to LBS, in order to capitalize the enormous benefits it can bring to society and at the same time deter (or even avoid) the emergence of a dystopia of Orwellian or Frankenstein proportions.

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