Locative Technologies and the Affects on Society

Luke Chambers - 308134
University of Plymouth
School of Computing, Communications and Electronics
BSc (Hons) Digital Art & Technology
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Contents

Abstract

This dissertation draws on existing theoretical models, such as technological determinism and the theories of 'hard' and 'soft' determinism as argued by Leo Marx, Merritt Roe Smith and Robert L. Heilbroner, to discuss the affects of developing technology on society. It focuses on the use and application of location technologies to explain how these might change in the foreseeable future. Many writers, such as Donald MacKenzie or Hughie Mackay, have theorised that there is a direct link between advancing technology and the way it has shaped society.

Society has become more and more aware of its geographical location in relation to the rest of the world. As such people's lives revolve around location and as such the ability to use tools to aid navigation is very important to society. Online cartography such as Google maps and real time positioning such as satellite navigation has allowed us to position ourselves with relative ease. Location based technologies have been adopted into society as useful tools that you could argue have affected how we live our lives to enhance modern living.

Locative technologies are now more wide spread than ever with a multitude of different applications, such as *TomTom*: a satellite navigation technology that can be programmed to navigate to a location and GPS receivers: devices that allow you to accurately determine your position on the earth. The advent of new locative technologies such as these, spark the development of new locative technologies thus influencing society.

This dissertation explores the concept of 'locative technologies', 'locative media' and the ways in which they are used in society. Following this it investigates how GPS has developed over the years as well as looking into current applications in order to understand how society has appropriated this technology.

By examining current advances and applications this dissertation attempts to outline how each has affected society, drawing on technological determinism, social construction of technology and social shaping of technology. Finally it takes the ideas and theoretical models to decide how future locative technologies and applications will advance and will consider what potential these have to effect society.

Introduction

Location is an important part of everyday life; we rely on locations to organise ourselves and to structure our lives. Room numbers in buildings, post codes in towns and cities, locations of shops, bars, cafes for meetings, recreational places and work. As such society has created media and technology as a tool to aid us to navigate to locations such as these, usually in the quickest time possible. As such there is a need for locative media and technology within society. One of the areas this dissertation aims to investigate and probe is the way that technology has taken the traditional way we would look at a map and transformed it into something we can interact with and explore, with in-car satellite navigation systems. One such example is *TomTom*, a device that allows you to navigate a specified country's roads by typing in a starting position, such as a postcode and an ending destination, such as a city. With the use of the GPS the technology works out a route and communicates the directions whilst you are driving in real time.

Such technology and media have been around for quite some time now and it is little wonder why society has embraced locative technologies, such as *TomTom*. This raises the first question for discussion; where did it all start and why has such technology and projects, like *Mscape*, developed into the applications and media we know today?

Technology is a broad term but is part of what society is made up of and without it, it can be argued, society may not exist as we know it today. Donald Mackenzie and Judy Wajcman explain in the book *the Social Shaping of Technology*:

> 'Material resources - artifacts and technologies, such as walls, prisons, weapons, writing, agriculture – are part of what makes large-scale society feasible. The technological, instead of being a sphere separate from society, is part of what makes society possible – in other words, it is constitutive of society.' (1999: 23)

A technologies path is never a simple one and its influence on society never stops once it has been sold. Once a technology has grounded itself in society it can be used as a launch pad for other individuals or organisations to progress the technology further and to introduce it into new cultures. This path can allow societies to appropriate the technology, causing it to be taken beyond what the designers

originally envisaged as Hughie Mackay explains in the book entitled *Information Technology and Society*:

> 'People may reject technologies, redefine their functional purpose, customize or even invest idiosyncratic symbolic meanings in them. Indeed they may redefine a technology in a way that defies its original, designed and intended purpose.'(1995: 44)

In turn this can lead to further demand in development of a particular technology to fill the gap that has been created by appropriation. It is this that has guided this dissertation to explore the term technological determinism and the theories behind the effects on society.

The first chapter explores the question of where locative technologies may have started in identifying how the GPS has developed from a military system into something that society uses every day. It also raises the argument as to what extent society is influencing locative technology and whether or not this is something that is beneficial for the technology.

In the second chapter this dissertation seeks to explore social construction of technology along with social shaping of technology and technological determinism and its many explanations into the effects on society, using *TomTom*, locative media projects and real life situations as examples. It also aims to explain what is meant by 'hard' and 'soft' determinism. The chapter goes on to compare these theories and will attempt to highlight how they may relate to the applications of GPS in a social context. This in turn will highlight my argument as well as help to better understand where locative technologies are headed.

The final chapter takes a speculative look into future development of technologies that encompass GPS as a locative technology. It is a given that technology will develop further and as such society is influential in its development. It will draw on the theories that have been outlined previously, such as technological determinism, to predict where locative technologies are heading next and how these might affect society.

1. Locative technology: development of GPS and its applications

This chapter begins by outlining the term locative technology and introduces the concept of locative media. It explores the development of GPS as a locative technology, drawing upon its history and current applications.

1.1. Locative Technology

To begin we must explore the term locative technology and to do so it is necessary to break it down into its 2 parts; location and technology. Location can be used to describe the physical position of a place, object or person. However, in this usage it is in the context of a geographical position on earth. Technology takes on many different meanings. The International Technology Education Association (ITEA) defines technology as:

> 'Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.' (1995)

The Merriam-Webster dictionary (2007) gives the following definition: 'the practical application of knowledge especially in a particular area' and 'a capability given by the practical application of knowledge.' Applying this term to the specific area of location, in a geographical context, taking the definition of technology and location, will in turn give a more specific definition:

Locative technology is any capability given by the practical application of knowledge that solve problems and extend human capabilities to produce information about the physical geographical position on earth of any given place, object, artifact or person.

For locative technologies to have meaning and functionality within society it is necessary for them to produce information useful to the user of the technology. This information is known as locative media. Wikipedia (2007) tells us that locative media can be described as 'media of communication bound to a location. They are digital media applied to real places and thus triggering real social interactions.' It is Locative technologies such as mobile phones, laptops and the Global Positioning System (GPS) that implement such locative media to allow the creation of projects and applications that have a critical or social context. Projects such as *Mscape*

(2007), the *Amsterdam RealTime* project (2002) and the *Amazon conservation* project are just a few examples which are discussed later in this chapter.

GPS is becoming one of the main locative technologies to enable locative media, as Wikipedia (2007) tells us it 'allows for the accurate detection of a specific location' which is crucial for locative media projects to even exist. But what makes up this system, where did it come from and how did it develop? Scott Pace's book *The Global Positioning System* goes into great detail to describe what it is made up of:

> 'The Global Positioning System (GPS) is a U.S. military space system operated by the U.S. Air Force. It consists of three segments: The space segment of GPS is a constellation of 24 satellites that broadcast precise time signals. When the satellites are in view of a suitable GPS receiver, these signals can be used to aid position-location, navigation, and precision timing.' (1995: 1)

The GPS's history lies with navigational techniques of the 1920's where by mariners used radionavigation to figure out their position on earth. This system first used radios to place the direction of transmitters based on shoe when a vessel was in range. Pace explains the system in more detail:

> 'The marine radionavigation aid LORAN (Long Range Aid to Navigation) was important to the development of GPS because it was the first system to employ time difference of arrival of radio signals in a navigation system, a technique later extended to the NAVSTAR satellite navigation system. The control segment consists of a control center and access to overseas command stations, and the user segment includes GPS receivers and associated equipment.' (1995: 237)

Development of artificial satellites allowed for line-of-sight radionavigation signals, making the system more precise. This in turn led to a Navy system called Transit which was the first system to use satellites for position-finding in two-dimensions. This paved the way for GPS. Originally used by the Navy for locating ballistic missile submarines and other ships, in 1967 Transit was made available to civilians and was used by a large number of commercial marine navigators and pleasure ship owners, up until the end of 1996.

Another Navy sponsored program also created the founding roots of GPS. Developed by the Naval Research Laboratory from 1964, Timation was a two-dimensional space-based navigation system of two experimental satellites. This program set the standard to place precise high-stability clocks in space, a technology the GPS relies upon. Whilst the navy was busy concentrating on Timation, the Air Force worked on a design concept that wasn't too dissimilar called System 621B. This system gave continuous three dimensional navigation, providing latitude, longitude and altitude. By the late 1960's each of the services; the Air Force, U.S. Navy and the army were all working on their own navigational systems. What resulted was a collaborative agency called the NAVSEG (Navigation Satellite Executive Group). This co-ordinated the efforts of each satellite navigation group which spent the best part of two years working out the specification of a satellite navigation system.

By 1973, a system that combined the best features of earlier Air Force and Navy programs was beginning to take shape. This system concept is what is known today as the NAVSTAR Global Positioning system. Two refurbished Timation satellites were the first NAVSTAR satellites to be launched in 1974 and 1977. From 1978 to 1985 Block Is, developmental GPS satellites were launched and tested. After many setbacks, by 1989 the first Block II satellite was launched and since then there have been 23 more.

In 1983, U.S. President Ronald Reagan announced that the GPS would be made available for international civilian use once it became operational. By April 1995 NAVSTAR declared the system fully operational and in 1996, U.S President Bill Clinton recognised not only military users but civilian users and issued a policy that declared the dual-use of the GPS, establishing the Interagency GPS Executive Board to manage it. Two new civilian signals were added in 1998, upgrading the GPS to give civilian users greater reliability and accuracy, especially in aviation safety.

Twenty first century developments were brought about in May, 2000 when 'Selective Availability', a signal degradation technique, was deactivated allowing the accuracy for pin pointing locations to become ten times more accurate. The first modernised satellite started transmitting civilian signals to enhance user performance in 2005 and the most recent launch took place on the 15th March 2008 from Cape Canaveral, Florida. *GPS World* (2008) covered the story stating that '[t]he

just-launched SVN48 joins five other IIR-M and 12R satellites in the GPS satellite constellation. The IIR-M satellites are modernized…with an upgraded antenna panel that provides increased signal power to both military and civilian receivers on the ground, two new military signals for improved accuracy, enhanced encryption and anti-jamming capabilities for the military, and a second civil signal.' These most recent advances can only mean that there is more to come in the future.

1.2. Applications

The number of possible applications for the GPS is vast, from military (intelligence, weapon aiming and guidance, target location, and navigation) to recreation on land, sea or in the air and of course applications for locative media. This section gives different examples of applications and attempts to explain the effects on society.

The first example of a locative technology is *TomTom,* but what exactly is it? Their website describes it as the following:

> 'TomTom NV is the world's largest navigation solution provider. TomTom's products are developed with an emphasis on innovation, quality, ease of use, safety and value…TomTom's products include all-in-one navigation devices which enable customers to navigate right out of the box…Additionally, independent research proves that TomTom products have a significant positive effect on driving and road safety.' (2008)

TomTom's products allow for everyday consumers in society to set routes via a touch screen display, using towns/city names, street/road names and even postcodes to plan routes using GPS, which are narrated to the user whilst he/she is driving a car. David M. Williams from iwire.com (2007) explains its simplistic nature: 'turn it on, set routes via touch screen, and away you go (and go you do, quite literally!)' Tom Tom's products as locative technologies play a big role in society giving a simple to use tool to 'solve problems and extend human capabilities.'(ITEA) This could be described as a positive influence on society as consumer's use it in a positive way to their advantage, something of which *TomTom* have proved through independent research.

This research was carried out by Dutch research institute TNO in 2007. It showed that satellite navigation systems have a positive influence on road safety. A report on the

TomTom website outlined the main conclusions the research drew. It showed that 'drivers who do not use a navigation system make 12% more claims for damage and claim 5% more damage costs' as well as 'using a navigation system increases driver alertness and reduces driver stress' and 'using a TomTom navigation system reduces the number of kilometres driven by 16% and the journey time by 18% when driving in an unfamiliar area to an unfamiliar destination.' (2007: 3)

As with society there will always be people who will want to extend the functionality of locative technology, thus advancing the technologies' capabilities that go beyond what the designers originally envisaged giving it multiple purposes which seems to be a growing part of society. This relationship is outlined by Hughie Mackay in the book *Information Technology and Society* in his essay *Theorising the IT/Society Relationship:*

> 'People may reject technologies, redefine their functional purpose, customize or even invest idiosyncratic symbolic meanings in them. Indeed they may redefine a technology in a way that defies its original, designed and intended purpose. Thus the appropriation of technology is an integral part of its social shaping.' (1995: 44)

This is what Williams talks about in his article *Hacking the TomTom ONE through Open Source*. He puts forward the idea that 'hardware hackers' as he puts it, will go to great lengths just to prove that mainstream locative technology can be hacked to create further functionality or 'practical applications - for instance, outputting GPS locations via Bluetooth to a WiFi-enabled laptop, thus pinpointing precisely where open WiFi networks are located. And others imagined how nifty a tiny touch screen media player could be, particularly with its built-in SD slot and loudspeaker.'(2007)

For me this is a good thing for both society and the manufacturers themselves such as *TomTom*. It not only shows manufacturers what people really want out of a product on top of its intended functionality but it also in some respects leads to the shaping of that particular technology by society.

There are many different applications that embrace locative media but the *Mscape* (2007) and the *Amsterdam RealTime* (2002) projects are prime examples. The *Mscape* project allows users to socially interact and share locative media using a GPS enabled mobile device. Using software downloaded from the website, users

can create what is known as a Mediascape. The *Mscape* website describes Mediascapes as '...location-based experiences, games and tours on a handheld device. Here you can download the software, grab the latest mediascapes created by the community and most importantly, learn how simple it is to make your own.'(2008)

The project is still in its early stages but already has an established community of users that can only get bigger. This project has allowed for locative media to be opened up to society which is a positive step for social connectivity in the real world. In article, *Social viscosities: mapping social performance in public space*, from the journal *Digitally Creative*, Lily Shirvanee (2007) articulates this idea:

> 'These dynamic social spaces are forming increasingly, as locative media become more commonplace in urban environments and thus bring about greater connectivity, spontaneous formations of collective activity and trends of movement.' (2007: 151)

This brings about the notion of social spaces as society adopts these methods of sharing locative media. Henri Lefebvre talks about social histories of space, in his book *The production of space*, where his discourse is still very much relevant to contemporary locative media in a social context:

> 'The spatial practice of a society secretes that society's space; it propounds and presupposes it, in a dialectical interaction; it produces it slowly and surely as it masters and appropriates it...' (1974: 38)

Shirvanee outlines another good example incorporating the use of locative technology and media; The *Amsterdam RealTime* project (2002). The project invited Amsterdam's inhabitants to be equipped with a real-time tracking device, for a week at a time, which contained a GPS unit inside. This device would track movements around the city of Amsterdam to construct a map. The website explains further:

> 'Every inhabitant of Amsterdam has an invisible map of the city in his head. The way he moves about the city and the choices made in this process are determined by this mental map. Amsterdam RealTime attempts to visualize

> these mental maps through examining the mobile behaviour of the city's users.' (2002)

This project allowed the participants to see an unconscious map constructed by their GPS device traces as they walked around the city. 'The tangible result is stories that are physically linked and embedded in landscapes, a form of social history uniquely enabled by locative media communication.' (Shirvanee 2007: 154)

GPS and Google Earth Save Amazon in *GPS World* (2007: Vol. 18 Issue 4: 60) is an article that describes the uses of locative technology with GPS support, along with Google Earth, to help Amazon Indians to map out their very own 'points of interest' to '…conserve forests and maintain ties to their history and cultural traditions, which include profound knowledge of the forest ecosystem and medicinal plants.' (Rhett A. Butler 2006) To help them with this is the Amazon Conservation Team (ACT) who aim to 'conserve biodiversity, health, and culture in South American rainforests.' (Butler 2006) In using such technology and the internet the Indians can monitor deforestation and prevent illegal invasion of their land. A positive effect of this application strengthens the society and its culture by bringing together youths with their elders, who share their knowledge of the locations of 'life-saving medicinal plants and other resources.'(GPS World 2007: 60) ACT's Brazilian program director, Vasco van Roosmalen, talked with mongabay.com in an interview:

> 'All the technology in the world is not going to explain to you the spiritual significance of a spot. No, it's the old guy sitting at the back of the hut, the one you've ignored since you were a kid. He's the one with the knowledge. All of a sudden these old guys are being appreciated as tremendous sources of knowledge by the younger generation, conservation organizations like ACT, and government agencies. Now they see the value of these elders when before no one cared.' (2006)

Once suspect areas are found using Google Earth the GPS coordinates are noted and a foot patrol proceeds to investigate the area, updating their knowledge. This really goes to show the effects of western technology combined with indigenous knowledge and how it is improving their society and culture within an inhospitable environment.

To conclude it is apparent that GPS as a locative technology has extended human capabilities from a political, cultural and socially secure point of view. Different applications of locative technologies have had an influential effect on the way societies function and adopt such technology. Locative media plays important role to bridge the gap between the real world, mobile devices and social interaction, bringing people closer to each other and their environments. The ACT project is a good example of how such bridging is influencing and shaping the indigenous society to become more aware of their environment. Projects such as *Mscape* and the *Amsterdam RealTime* project have given societies the chance to create their own narratives landscapes that are filled with strangers' locative media who have inhabited the same space. It is apparent that through these projects the initial purpose of GPS technology has been extended into the realm of the social to provide further functionality to a global service. Similarly with *TomTom's* satellite navigation products as described in David M. Williams's article on iwire.com, consumers are looking to extend the functionality beyond what the manufacturers intended.

Locative technologies are having an influential and positive effect on society that provides beneficial applications to act as tools and social interfaces. Whilst this is taking place this leads me to question whether society appropriates, modifies and extends locative technologies and applications to the point where it drives forward and influences the development of a particular locative technology in a new device or tool or in an existing piece of technology.

2. Locative Technologies: Social and Technological Affects

This chapter introduces the theories of social construction of technology (SCOT) as well as technological determinism, a response to SCOT framing these in a social context. It also explores the question of whether society's appropriation of locative technologies drives forward and influences the development of existing or new devices and tools known as locative technology.

2.1 Social Construction of Technology

Social construction of technology was developed in the 1980s by Wiebe Bijker and Trevor Pinch and is used to argue that users' actions shape technology rather than technology shaping how users' actions are determined. In the chapter *The social construction of technology* from the book *The Social Shaping of Technology* Trevor Pinch and Ronald Kline explain further: 'In SCOT, 'relevant social groups' who play a role in the development of a technological artifact are defined as those groups who share a meaning of the artifact.' (1999: 113) This is known as *Interpretive Flexibility*, a core concept of SCOT.

To frame what Pinch and Kline refer to as artifact in the context of a locative technology, the artifact could take the form of more convenient way of determining your geographical position on earth; a GPS enabled locative technology such as the example explored in the last chapter; a *TomTom* product:

> 'Different social groups associate different things to different meanings with artifacts leading to interpretative flexibility appearing over the artifact.' (Pinch & Kline 1999: 113)

Pinch and Kline's explanation can be used to determine certain developmental paths of technology. The 'relevant social groups' that they talk about are typically made up of users and producers, such as 'engineers, advertisers, consumers and so on.' (1999: 113) Groups such as these can always be identified by distinguishing their shared or diverging thoughts of a particular technology. But there is more to it than this as Pinch and Kline explain:

> 'Although relevant social groups share a meaning of the artifact, they may of course share other properties of family resemblance, which also give them their group characteristic.' (1999: 113)

Framing this statement in the context of the *TomTom* example, male users of a *TomTom* product may have the shared meaning of the locative technology as a useful navigational tool and share the family resemblance that they are men. SCOT stands out from other theories that attempt to explain the technological advancement as Kline and Pinch explain further:

> ''Interpretative flexibility' distinguishes SCOT from other social constructivist approaches in the history of technology. SCOT underscores artifacts and in particular, their working as subject to radically different interpretations that are coextensive with social groups. This goes beyond saying that technology is merely embedded in human affairs. SCOT focuses attention upon what counts as a viable working artifact, and what indeed counts as a satisfactory test of that artifact.' (1999: 114)

Another key concept of SCOT is *design flexibility* which outlines the fact that there are many different ways of constructing technologies. Design of a technology is only one of many technical methods that reflect the understanding of relevant social groups. Whilst SCOT is useful in arguing users' actions shape technology rather than technology shaping how users' actions are determined, it does have its problems as Pinch and Kline state:

> '…as many commentators have remarked, said little about the social structure and power relationships within which within which technological development takes place.' (1999: 114)

In a critique of SCOT, by Langdon Winner (1993), called *Upon Opening the Black Box and Finding it Empty: Social Constructivism and the Philosophy of Technology*, Langdon highlights another important problem. He talks about how SCOT can explain the how technology develops and arises whilst ignoring the effects these technologies have after. Social shaping of technology (SST) is a similar theory to SCOT that fills some of the gaps that SCOT fails to distinguish. SST is based around the concept that there are multiple routes or choices artifacts or systems can follow that will lead to different technological outcomes. The significance of which is directly related to the implications for society and social groups.

An example of such implication might be an improved awareness for a group's environment, ability to conserve forests and maintain ties to history and cultural

traditions, as explained in chapter 1 with the indigenous Indians of the Amazon using GPS devices to their advantage. Another implication could be the growing presence of hackers that extend the functionality and use of existing locative technology such as *TomTom* products, whilst such individuals question whether this type of technology is actually finished as customisation, modification and maintenance extends it. As such technologies never really stabilise as society influences development. This is a concept familiar to Hughie Mackay that he talks about in his essay *Theorising the IT/Society Relationship* in the book entitled *Information Technology*:

> 'To suggest that once a technology is produced, or even sold, it reaches the end of its social shaping, however, is to ignore both its marketing and how the technology comes to be used or implemented…' (1995: 44)

Therefore '[t]he subjective, social appropriation of a technology is thus one key element of a technology' (Mackay 1995: 46) and in a way the social development of a technology doesn't just boil down to a design process but it is a product of, as Mackay puts it three conceptually distinct spheres. The first sphere is conception, invention, development and design, the second; marketing and the third; appropriation by users.

A key sphere often missed from social shaping of technology accounts is marketing as Mackay goes on to say: 'Marketing is part of the social shaping of technology not only in that it informs design, but also in that it plays a part in constructing demand' (Mackay 1995: 48) As such technologies are predefined in their forms of use, whether its intentional or not from the producers.

2.2. Technological Determinism

As an appositional theory of both SCOT and SST, technological determinism puts forward the notion '...that technical change is a prime cause of social change, and that technical innovations are themselves 'uncaused' – in the sense that they arise only from the working out of an intrinsic, disembodied, impersonal 'logic' and not from any 'social' influence.' (Edge 1995: 14) Therefore social factors simply control the timing of inevitable developments of technology. Mackay describes it as '...the notion that technological development is autonomous of society; it shapes society, but is not reciprocally influenced. Rather it exists outside society, but at the same time influences social change.' (1995: 41)

The theory of technological determinism encompasses the notion of hard and soft determinism. Hard determinism views the development of technology as an independent event from social concerns. As Leo Marx and Merritt Roe Smith outline in their introductory essay to the book *Does Technology Drive History?*, such a deterministic view would say '...that advancing technology has a steadily growing, well-nigh irresistible power to determine the course of events' (1994: xi-xii) of social activity. In short as a society we work around technology to meet its needs which is beyond our control which in turn doesn't give us the freedom to make a choice in the outcome of the technology. Soft determinism, on the other hand, is far more passive view of the interaction between technology and social situations. This notion still believes that technology is the main force of society's evolution but suggests there is some control and freedom in decision making determining the outcome of a situation where we take a chance and see what the outcome is.

Robert L. Heilbroner (1994) opts for such a notion of technological determinism, where '...he sees a complex historical scenario in which technology, while acting on society, also reflects the influence of socioeconomic forces on its development.' (1994: 53) In the essay *Do Machines make History?*, from the book *Does Technology Drive History?*, Heilbroner states that '...we can indeed state that the technology of a society imposes a determinate pattern of social relations on that society.' (1994: 59) Therefore the direction of advancing technology is directly linked to social direction as Heilbroner states: 'In this way the direction of technological advance is partially the result of social policy.' (1994: 62) But as with anything '[a]n advance in technology not only must be congruent with the surrounding technology but must

also be compatible with the existing economic and other institutions of society.' (1994: 63) Heilbroner concludes that 'Technological determinism gives us a framework of explication that ties together the background forces of our civilization, in which technology looms as an immense presence, with the foreground problem of the continuously evolving social order in which we live.' (1994: 77)

As with SCOT, technological determinism is also met with criticism as well as challenges on its credibility as a theory of technological change. In Leo Marx's essay *The idea of Technology and Postmodern Pessimism* from the book *Does Technology Drive History?*, Marx highlights with optimistic technological advancement comes 'widespread social pessimism' stemming from the unforeseen consequences of technological breakthroughs, leading to disasters, traumas and a loss of faith in technology as 'the driving force of progress':

> '...if we fully credit the technical achievements of modernity, their seemingly destructive social and ecological consequences (or side effects) have been sufficiently conspicuous to account for much of today's technological pessimism.' (1994: 238)

He frames this argument in a historical context bringing to light disasters such as Chernobyl and Three Mile Island and the Vietnam War:

> '...in recent decades that same entity (technology) also has been implicated in a spectacular series of disasters: Hiroshima, the nuclear arms race, the American was in Vietnam, Chernobyl, Bhopal, the Exxon oil spill, acid rain, global warming, ozone depletion. Each of these was closely tied to the use of the misuse, the unforeseen consequences or the malfunctions, of relatively new and powerful science-based technologies.' (1994: 238)

Donald Mackenzie and Judy Wajcman also dispute technological determinism, where they talk about how change is independent from society is assumed and should be rejected:

> 'As a theory of society, then, technological determinism is asking a good question, albeit often providing an oversimplified answer. Where we part company with it more decisively is in its aspect as a theory of technology, in

> its typical assumption that technological change is an independent fact, impacting on society from outside of society, so to speak'
>
> (1999: 5)

Adopting the theory is in a way allowing society to cruise on through life's technological advancements with the 'view that technology just changes, either following science or of its own accord, promotes a passive attitude to technological change. It focuses our minds on how to *adapt* to technological change, not how to *shape* it.' (Mackenzie & Wajcman 1999: 5)

To conclude these theories go a long way to explain the affects of technology on society as well as the affects of society on technology and how one is driving the other. I feel that there are aspects from SCOT and technological determinism that clearly lead to the advancement of technology. From SCOT I agree with the theory that human actions shape technology and how it is used and embedded in a social context but its lack of framework to deal with the effects of the technology are off putting to really draw conclusions based of that theory alone. With technological determinism I agree to an extent that technology is a key governing force in society but reject the fact that development occurs autonomously of society, existing outside of it instead.

As such why isn't there a theory that combines these agreed arguments of both theories of technological development, social influence, appropriation and change? It seems there is a gap between SCOT and technological determinism that not even SST seems to fill. Granted there are aspects of SST, such as the multiple routes or choices artifacts or systems can follow, leading to different technological outcomes but I feel there is a need for something to sit in the middle.

All you have to do is look at developments and applications of the GPS as a locative technology to realise, as I've already suggested with the growing community of hackers appropriating *TomTom* technology and expanding it as well as locative media projects such as *Mscape* making society more aware of social narratives and sharing media.

3. What's next for locative technologies and locative media?

This chapter takes a speculative look into the future to predict where GPS as a locative technology and the locative media used on such a technology will head next.

There have been many technological predictions in history, one of the most renowned being Moore's Law, stated by the co-founder of Intel, Gordon E. Moore in an article entitled *Cramming more components onto integrated circuits*, in Electronics Magazine. This stated that 'the number of transistors that can be inexpensively placed on an integrated circuit is increasing exponentially, doubling approximately every two years.' (1965)

Originally this was every one year but Moore redefined it to every two years. What this determines is a sense of predictability in the way technology develops in a sequential format. Heilbroner explains:

> 'What is interesting is that the development of technical progress has always seemed *intrinsically* predictable. This does not mean that we can lay down future timetables of technical discovery, nor does it rule out the possibility of surprises. Yet I venture to state that many scientists would be willing make *general* predictions as to the nature of technological capability 25 or even 50 years ahead. This, too, suggests that technology follows a developmental sequence rather than arriving in a more chancy fashion.' (1994: 57)

Factors that determine this change will always be relied upon before any further advancement can take place, no matter what they technology is. Heilbroner suggests that '…a major constraint always operates on the technological capacity of an age, the constraint of its accumulated stock of available knowledge' (1994: 57) and '[a] second controlling factor is the material competence of the age, its level of technical expertise.' (1994: 58) Therefore to make any predictions on where GPS locative technology and its locative media are headed we need to consider what's currently available as a basis for these predictions.

With the growing need for society to place media as well as itself, geographically speaking, we can see locative technology such as GPS converging with other existing technology. In a recent article on pocket-lint.co.uk, by Stuart Miles (2007),

entitled *Kodak to add GPS to camera range*, Miles reports that Kodak '…will include GPS in its camera range by 2009 to allow users to location images easily.' Miles goes on to say that:

> 'According to Kodak, the GPS information will be added to the metadata of the photo allowing you to search for images shot in a specific country or location such as shots taken in Chelsea. GPS is likely to be the next big thing in the camera world as more and more people look to capture location data. There are currently 23 million images with location data available on Flickr.' (2007)

So with GPS locative technology being added to cameras these photos will form a new kind of locative media but is it any wonder that Kodak have got this in the pipeline? After all, as Miles reports, there are already 23 million images with location data available on Flickr. Surely some proof towards the theory put forward in chapter two of SCOT and SST. Kodak, seeing how society is sharing photos combined with where they were taken as an opportunity to provide an all in one tool that aids this process. In some ways parts of technological determinism should shine through in this example as this type of locative technology will become a key governing force in society. As such future society will appropriate this new form of converged technology developing society for the better. Jacques Ellul explains this in his book *The Technological Society*, where he talks about social growth:

> '…new circumstances (the machine) now compel us to recognise a kind of social development that is rational, intelligent, and conscious…' (1964: 6)

Ellul uses the term *technique* to explain the how technology fits into society; 'The term *technique* as I use it, does not mean machines, technology, or this that procedure for attaining an end. In our technological society, technique is the totality of methods rationally arrived at and having absolute efficiency (for a given stage of development) in every field of human activity.' (1964: Notes) Later on Ellul expands on this idea:

'Technique integrates the machine into society. It constructs the kind of world the machine needs and introduces order…' (1964: 5)

Following on from the Kodak article we can really see much more convergence between existing technologies taking place. If users on Flickr already upload photos from their computer why not have the facility on the camera to upload them straight after they've been taken, complete with the location data. This will then cut out the need for another internet enabled piece of technology. Perhaps a similar situation will arise with the *TomTom* products as more people will develop more functionality for what is merely a GPS enabled locative technology. Maybe *TomTom* will branch its products out by adding more functionality such as those that Williams outlines in his article *Hacking the TomTom ONE through Open Source*. There's even a wiki on hacking *TomTom GO* products found at opentom.org, so will *TomTom* catch on and invest in these ideas?

As talked about in the first chapter, the *Mscape* project has only recently established itself with a growing community of users, creating Mscapes that include locative media for people to experience in the real world. Whilst it is still in its early stages it is possible that this type of location based media and interactivity really going to take off. At present to experience an Mscape you need a W*indows Mobile 5* enabled pocket PC device. This somewhat limits the number of people that can become part of this community, and in the future we could see this crossing over to other mobile platforms. Who knows, it may even cross over to the *TomTom* platform which could expand it even further. GPS technology is slowly making its way into mobile phones so why not tailor the software to accommodate for new platforms. This could even open up new locative media that could embellish text messaging and the use of telecommunications to put across narratives.

As outlined in the first chapter Lily Shirvanee (2007) talks about 'dynamic social spaces' that are increasingly forming 'as locative media become more commonplace in [an] urban environment' that bring great connectivity. Perhaps future locative technologies will inform you as you enter such dynamic spaces to allow you to instantly download the locative media and interact. This in turn could give rise to more locative devices converging with GPS technology. This would of course depend on how society shapes and appropriates this early version, the *Mscape* project and how the producers interpret this in order to produce the next generation.

The history of GPS, as explained in the first chapter, talks about the latest GPS satellite to be launched are highly modernised 'with an upgraded antenna panel that provides increased signal power to both military and civilian receivers on the ground, two new military signals for improved accuracy, enhanced encryption and anti-jamming capabilities for the military, and a second civil signal.' (GPS World 2008) This can only mean that these satellites will continue to be upgraded for the foreseeable future, provided that there is a demand from both the military and society for the service. However, will a new system immerge that provides an even more accurate position location? At present it is near impossible to receive a GPS signal from inside a building whilst it's very hard to find one under tree or dense cover. Perhaps the future will see an improved system that finds a way around these problems and as such companies will develop new products to satisfy social shaping and or demand. If this type of locative technology existed one day we can be sure the social implications would change dramatically as privacy issues would arise.

Given present day developments and applications of locative technology and media this chapter has tried to give a speculative look into how such technologies and media might take shape. As suggested, current projects and movements within society are a good framework to base predictions of the future on, especially as according to my own theory that sits in between SCOT and technological determinism. Its most definitely hard to say what the future will bring regarding these technologies but the fact of the matter still remains that if society still continues to take technology one step further from its producer and uses technological development as a driving force of society then locative technology will continue to develop. Therefore such development will provide new innovations to develop systems that solve problems and extend human capabilities.

Conclusion

The beginning of this dissertation introduced the terms locative technology and locative media giving some background to the history of the GPS, turning from a military experiment to a system civilians use every day, going on to outline technological develops and applications as well as projects that have resulted from its use. With the introduction of GPS it is apparent that society has embraced this locative technology very differently, creating new tools that solve problems and extend human capabilities. It has in turn been able to modernise a society that seeks knowledge of its geographical location to use to its advantage. Some applications of GPS benefit communities and some serve to act as an interface between communities, location based media and narrative.

Theories of technology affecting society and the social shaping of technology can only go so far to explain the ever expanding development and use of locative technologies in society. Social construction of technology explains the theory that human actions shape technology as well as how it is used and integrated in a social context but it lacks in the areas of the effects that new technology is having on society. Social shaping of technology makes up for this partly by putting forward multiple routes or choices artifacts or systems can follow in the development stages, leading to different technological outcomes but it still seems to fall short. Technological determinism does well to explain that technology is a key governing force in society and as a result society does revolve around the use of technology but the development of technology doesn't occur autonomously outside of society, as society does more than just consume technology.

So why is there not a theory that combines my agreed arguments of the social shaping of technology, technological determinism and the social construction of technology that explain theories of technological development, social influence, appropriation and change? To me this would go further in explaining the affects of technology on society as well as the affects society has on technology.

All you have to do is look at developments and applications of the GPS as a locative technology to realise this. Society is shaping locative technologies in order to extend and modify function. It is using technological development as a driving force that effects social change whilst this occurs. Once a society adopts a locative technology such as *TomTom*, the next stage of advancement can only come to

light as it is appropriated and its function is probed. Society affects technological development but in turn technological development affects society.

This is important for the future of locative technologies as companies are beginning to realise the need for locative information. Kodak, as my example suggests, are heading in the right direction, integrating GPS into cameras but companies such as *TomTom* need to realise the need for more functionality in its products. If society continues along the path it's taking and society still continues to take technology one step further from its producer and uses technological development as a driving force of society then locative technology will continue to develop into something a lot more substantial, compared to previous developments.

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