

From Fixed, Mobile to Complex: The Social Shaping of ICT for Sustainable Travel

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ABSTRACT

This paper looks at the changing shape of mobile connectivity and how it has influenced the potential for informing on sustainable travel. It examines the role mobile connectivity has had for an ICT based service informing on traffic and transport in order to trace what role social practices of interconnecting through mobile media may have had for such an enterprise. The paper looks at two historical examples of ICT based traffic and travel information services in Stockholm, Sweden in order to discuss what role mobile connectivity may have for promoting sustainable travel through ICT.

Author Keywords

ICT, sustainable travel, social shaping of technology, mobile media, institutional change

1. INTRODUCTION

The potential for ICT based services to become efficient at acting as soft measures to traditional transport solutions is based on providing information that will encourage a voluntary shift towards more sustainable forms of transportation, such as public transportation [6]. The hope is that these services can change travel behavior by providing the option to choose from real-time based information concerning alternative routes, travelling modes and travelling time. One likely pathway for this is by connecting users to an intelligent information infrastructure of mobile users, services and products that collaborate in order to provide users with more choices for sustainable travel related to public transportation, ridesharing services, and bicycle for rent or non-travel alternatives.

Apps in particular, in conjuncture with social networking services are having an immense effect on both public and private enterprises that strive to find less costly means of both involving unpredictable users and finding solutions to providing for a reliable service. The potentials rest on the increasing number of users being equipped with highly connected mobile devices

during their day to day travels that permit them to act both as 'human sensors' and prosumers within an ICT based service.

How social practices surrounding the use of mobile media are connected to institutional, economic and cultural factors that shape the form and use of such a technology needs to be considered when talking about the use of ICT for promoting sustainable travel [23]. Considering this condition it is imperative that any notion of an ICT based service aiming towards sustainable travel should include a look at the social shaping of such a technology since contemporary technologies and practices of media and communication are reconfiguring how people socialize and relate to people, places and objects as well as being shaped by them. How increasingly pervasive media and technology frame our collective sense of time, place, and space and how it orients us and is made use of in our everyday life are some of the questions that need to be addressed.

The purpose of the paper is to highlight how Swedish attempts at promoting sustainable travel through information technology has been connected to socio-technical practices surrounding the use of mobile ICT for informing on traffic. To shed light on these practices from a historical and sociological perspective the paper makes use of two examples involving traffic information services that provide travel related information to mobile ICT users.

The first example concerns a radio based service stretching back to the late 1970s in the form of the Stockholm local radio and their use of different forms of mobile ICT based networks to report on traffic.

The second example concerns a web based service for travel planning named *Trafiken.nu*. Both services are looked at in terms of their relationship to mobile ICT users and if they have made use of any such networks for informing on traffic.

The paper is organized as follows. The following section presents a sociotechnical approach towards the social shaping of sustainable travel seen as promotable through ICT. The second part presents each of the case examples used in the paper through a historical review of each one of them. The third part concludes the paper with a discussion on the changing shape of mobile ICT and what role ICT may have for the promotion of sustainable travel.

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2. THE SOCIAL SHAPING OF ICT FOR SUSTAINABLE TRAVEL

Technology is often ascribed as possessing the power to fundamentally change and transform society where IT is claimed not only to transform society but also have the ability to get us out of the industrial society and transfer us to the new information society. The transformations are not primarily due to the artifacts in themselves but by the widespread use of them sparked by the excitement of using them. In other words technology along these lines, both as a vital force and to maintain society's basic functions is seen as a determinant for societal development.

However, the point of departure for a constructivist perspective is that technology is articulated and given meaning by both actors and actants in social processes and or controversies. The people, organizations and decisions related to sustainable travel together with the tools they employ can in this regard be seen as 'culturally drenched' in being immersed within meanings defined within and throughout social and material connotations. Of importance becomes the institutional framework that governs the intentions of an organization or groups actors and their relation to technology in which institutions are seen as active participants in the emergence and use of mobile ICT for sustainable travel.

How sustainable travel and its relationship to ICT is constructed relates in big part to a mixture of economic, cultural and political intentions. IT and particularly broadband infrastructure is seen by governments in many countries as an important means of increasing the international competitiveness of their country. These countries see IT as a driver of both electronic commerce and of the information economy society. In this context issues such as infrastructure (or service) competition and the role(s) of public government are often central for understanding the role of technology [21]. The issue becomes in what ways governmental agencies work with industry and with other elements of the government.

In the case of apps there are strong industry actors in the form of Google and Apple which are companies that hold a large share of both the production of consumer devices and the distribution of apps. One milieu where this becomes visible is in Europe, where the European Union and various nation state agencies work together with industry to coordinate common development [21].

An example of this can be seen in 2001 when the Vice-president of the European Commission for Transport and Energy Loyola Palacio declared IT as holding the potential of dealing successfully with the growth of pollution and congestion caused by transport in cities. This was declared by a person responsible for launching two successful 10-year policy programs for the competitiveness and sustainability of the European transport system.¹ Still, in 2009 the then acting Vice-President Antonio Tajani would contend that "the scope of these challenges is such that a profound transformation in the transport system will be required in the coming decades" adding that "yet, resources available to meet these challenges are limited by the economic crisis".²

¹ EU, 2001, *European Cities Clean Up Urban Transport* <http://ens-news.com/ens/jul2001/2001L-07-16-03.html>, accessed 2012-03-25

² 2007–2012 global financial crisis, also known as the 2008 financial crisis, is considered by many economists to be the worst financial crisis since the Great Depression of the 1930s.

Some theorists consider that the current political system is insufficiently equipped to deal with the complexity of sustainability and have pointed out that incremental change will not address the fundamental system failures that underpin the issue. As an alternative there are those that propose a multi-level perspective on the interplay between regime, niche and landscape concepts when depicting technological transitions [11]. The argument has been that the inherent complexity of society resulting from the difference of perspectives, norms and values adding to the variations of modern day issues requires a new form of governance [15]. This requires a need of conceptualizing IT and its intended use as a set of material affordances and restrictions that are inseparable from their development and use context [21].

With a more explanatory socio-technical perspective on how the promotion of sustainable travel may be connected to the use of mobile ICT the potential increases to understand the societal impact, institutional effects and changes that IT and mobile connectivity may have for the promotion of sustainable travel. The following case examples are based on previous research by the author as seen in two forthcoming articles.

3. NETWORKING TRAFFIC THROUGH THE LOCAL RADIO – A STORY OF EMPOWERMENT

Sweden being the place where the first mobile telephone system was launched in 1956 has a long history of mobile ICT use for informing on traffic [3]. The MTA as it was called, standing for 'Mobile Telephone system A', would become the first fully automated mobile phone system for vehicles allowing calls to be made and received in a car using a rotary dial [7]. MTA phones consisted of vacuum tubes and relays with a weight of 40 kg. Calling from the car was fully automatic, while calling to it required an operator. Although the late 1970s would be a time when mobile telephony in the car held the potential of informing on traffic conditions the biggest contribution would come from another form of ICT called the 'Citizens Band radio'.

Radio was during the late 1970s the primary technology to inform the public on traffic conditions and traffic related concerns but it became local only with the establishing of the Swedish Local radio in 1977, a formation that could be seen as a decentralization of the media institution [13]. Inspired by the fast, unpretentious and non-hierarchical means of producing content in America the Local Radio was to become an organization in which "everyone at the station pitched in regardless of their position as a technician or a journalist in order to quickly relay the news [10]. Traffic reporting would under these circumstances become one of the Stockholm stations most particular traits with the establishment of a traffic staff under a 'technician turned traffic journalist' named Sven-Roland Engström.

Engström was a keen hobbyist and tinkerer of radio technology and had a fascination for anything related to traffic [Gustavsson, personal communication]. Having experienced the effects of the traffic measures following the 1973 oil crisis he had as many other Swedes come across a very active network of people informing on traffic called the *27 MHz:ers*. These were people who made use of a system of short-distance radio communications called Citizens' Band radio (CB) in order to inform themselves and others on such things as the location of nearby gas stations or traffic disturbances [14].

The Citizens' Bands Radio service had been established as early as in 1945 by the Federal Communications Commission (FCC) but the version accessible for the public was set in 1958 when the FCC established the Class D Citizens Band at 27 MHz. This frequency or band was chosen because it would be cheaper to produce radio equipment on such relatively low-frequency and parts were more common. However, there was a downside to this frequency in that it was shared by industrial, scientific as well as medical devices that could create interference[12].

The FCC had banned CB operations across distances of more than 150 miles in order for large businesses and their employers to not become intercepted or interfered by open radio communication. Constrained in this fashion the FCC granted a license to any adult citizen who requested one without any form of examination [12]. The technology would increasingly be seen filling a real need for a two-way communications service that almost anyone could make use of without advanced technical knowledge or expensive equipment.

The Citizens Band radio would as such gain an explosive breakthrough in American society thanks to the working class that used these relatively inexpensive radios in their daily routine. The CB allowed people to get to know one another in a quasi-anonymous manner similar to current Internet chat rooms. The prominent use of CB radios in 1970s films such as *Smokey and the Bandit* (1977) and *The Dukes of Hazzard* (1979) further increased the appeal of CB radio and helped establish CB radio as a nationwide craze in the U.S in the mid- to late-1970s.

The culture of CB radio was increasingly free and at times related to the circumvention of the law. The alerting to other drivers about police speed traps during the oil crisis of 1973 is one such example. Reports in 1975 indicated that more and more Americans were communicating from their cars and elsewhere by two way Citizens Band radios [16]. Constant relays of information let professional drivers and other CB-equipped motorists avoid traffic delays, update on weather conditions and report accidents or other traffic related incidents to the proper authorities. Although CB radio had already been introduced in the U.S it was not until in May of 1961 that general rules for private radio systems in the 27 MHz band were issued by the Swedish Government.

3.1 Citizen empowerment

CB radio would be seen in Sweden as paving the way for a completely new means of communication for individuals according to users of the technology, where the trend of using CB radios was probably similar to today's online chats and text messaging [Engström, Personal communication].

People making use of CB in this way could be seen in the work of a Swedish CB network called *Vägbas Stockholm* (tr. Road base Stockholm). The network was composed of members that relayed traffic related information from both professional drivers such as truck drivers and fellow motorists to the authorities. The information that the Local Radio needed to gather and later disseminate traffic information was to a high degree co-created through the day to day communications between these people.

The network contributed to a quick and highly dynamic form of reporting on local traffic that would eventually lead the owners of Stockholm Local Radio into "realizing the value of the whole thing, dedicating traffic its own time" according to one of its traffic reporters [Gustavsson, personal communication]. As such,

the CB network would prove important for their public service function.

Thomas Engström who was an active member of *Vägbas Stockholm* during the 1980s recalls a time when volunteers such as *Vägsamariterna* (tr. The Road Samaritans) and *Radiorävarna* (tr. The Radio Foxes) still had important functions for the road safety and relayed important information through the CB. They were all part of an infrastructure of different groups connected through the CB radio who shared in the feeling that they were conducting an important societal function, in a "spirit of good will".

The increasing use of cell phones and the Internet would to a large extent replace the use of CB radio during the late 1980s and the early 1990s. As Thomas Engström would later put it "it was the cell phone that wrecked it for us at *Vägbas Stockholm*" [Engström, Personal communication].

3.2 A paradigm shift

The second half of the 1980s would see an increased computerization of Swedish society. Computers had like in other countries already been introduced during the late 1950s but it was during this period with its rise of personal home computers that the term information technology caught a new meaning alluding to the notion of an information society.

The years 1990 to 1993 would see an explosion of development in terms of software and protocols that permitted the interlinking of documents and increased search capabilities much in due to a new means of communicating through the Internet's World Wide Web system [10]. The push towards a digitalization of the media as it was called had a strong economic incentive where fast and space saving data could be edited, copied, and reused at much lower costs and at multiple locations.

New platforms for interaction such as email, chat and the likes fit well with the need to disseminate information through various channels. This development also fit well with the self-running character at large as exemplified by Sven-Roland Engström. Curiously it was during this technological shift that he passed away in 1994, at the height of a paradigm change. As the traffic reporter Lars-Åke Gustavsson describes the incident "he died here, with his headphones still on nine-thirty on a Monday morning. At ten o'clock, there was going to be 'traffic'. They played the signature jingle, and it was quiet. Then they went in and looked. They found him sunken down under his table" [Gustavsson, personal communication].

The Swedish Radio had in the same year conducted its first experiments with web pages and in 1996 its popular program *Ekot* was broadcasted via the web. It proved to be a success with "over 160 000 visitors in the first half year"[10]. The convergence of communications technologies through the Internet with its interlinking of documents and the increase of search capabilities would make the task of coordinating traffic and travel related information less cumbersome. This brought with it an investment in new internet based technologies and a push towards the digitalization of the media.

In all this development and institutional change the basic institutional framework of the Stockholm Local radios traffic staff persisted, but the "on the road" mobile ICT source of information shifted from being CB informants to cell phone users who could be anyone and anywhere in the Stockholm traffic.

4. 'TRAFIKEN.NU' – A CASE OF MISSING CONNECTIVITY

The earliest attempt at managing increasing traffic in Stockholm through a public Internet portal would be seen in the form of a web page called *Trafiken.nu* (tr. The Traffic.now). The year was 2001 and Stockholm had experienced an impressive political investment in its IT infrastructure together with several infrastructure projects being built for a more efficient transport system. With the promises of the World Wide Web an idea was proposed to gather all data pertaining to traffic onto one place that could be accessed by the public. The aim was to facilitate the creation of a portal for an Intelligent Transportation Systems and Services (ITS) [Pettersson, personal communication].

One particular event that would influence this decision would be connected to one transportation project in particular, the one laid forth in the 'Dennis agreement' of May 1990 (referring to the National Bank Governor Bengt Dennis). The project included a series of new highways to be built around the city core, to facilitate mass motoring. A meeting was made quietly behind closed doors where an agreement was signed by the three biggest political parties of Stockholm [22].

Public pressures had amounted on an efficient implementation since it was under scrutiny of the public eye. The use of ITS had become a big issue, particularly so because of the tunnels that needed to be constructed which demanded traffic coordination to avoid traffic congestion. This gave way for an idea to make use of all the data coming from different transport related systems where the slogan "better to have one site than a thousand different sites" was coined [Pettersson, personal communication].

The project answered to a Government proposition in 2001 that pointed out that an access to information in digital form and its application would make it possible to develop a more flexible system to meet transport needs [19]. The proposition further stated that planning of infrastructure should interact with measures to influence transport demand.

As an example of such a transport demand it proposed measures aiming at "influencing attitudes and behavior towards a more eco-friendly, safe and efficient travel" by reducing individual car use and increased use of transport modes such as public transport, carpooling, walking and bicycling. One way of achieving this would be to have the current traffic situation "communicated rapidly through new information systems" where *Trafiken.nu* would become one such information system [19].

The project was a joint partnership between the City of Stockholm, Stockholm Public Transport, the Traffic Administration and the Swedish Road Administration and was launched the 10th of January in 2001. The intention was to provide information on traffic disruptions, traffic advisories and travel planning for the Southern part of Sweden and Greater Stockholm.

Since there were neither such services, nor webpages that displayed a whole picture of the traffic it would be a service that fulfilled a function that was much needed it was argued. The main target was the commuter and road user and how to cater to their individual information needs. Being a time when the World Wide Web had proved to be an easy to use and flexible format for popularizing information it came as no surprise that the service would take the shape of a web page.

4.1 Providing real-time travel planning

Travel planning on the Internet had become an increasingly common feature in Stockholm following the launch of the Stockholm Public Transport authorities web based trip planner in 2000 [Lindström, personal communication]. A report from 2003 issued by the Swedish Bureau for Statistics reported that 29 percent of respondents had used Internet services "in connection with travel or accommodation" [2]. This opened up for a means of influencing transport demand through real-time travel information it was believed.

New requirements on the service were placed where data provision, GIS data, real-time information related to walking, bicycling and bicycle routes became necessary to obtain. This was a problem area that started to surface of an institutional character concerning data provision, standardizations, APIs, claims for deregulation, ownership issues, business incentives, and brokering issues, just to name a few of them [Pettersson, personal communication].

Popularizing such an ITS became a high priority for the actors involved who believed the application of IT could make use of the transportation system more efficiently [2]. The popularization fulfilled another goal in promoting a Swedish way of implementing ITS for an international audience [Pettersson, personal communication].

Operating *Trafiken.nu* was seen as requiring the interaction between different public actors which was an important aspect of the Swedish working model, something that the Government's ITS Council was eager to show up at upcoming international congresses for ITS [Pettersson, personal communication].

While the owners were preoccupied with having the web page display as much real-time and multimodal transportation as possible there surfaced another important function that needed attention.

4.2 Demands for a mobile friendly service

Following a questionnaire with open answers in 2007 concerning the usability of the service some respondents had questioned the lack of a mobile version of the site. One of them had the following to say, "You must make the web page possible to surf on through the mobile. Mobile-people are the ones using this type of service, not retired people sitting at home" [2].

Mobile ICT use had been on a steady rise and with 2 million new subscribers of mobile broadband alone in 2011 the demand for a mobile friendly service had increased [20]. Since the launch of their own iPhone app there had been four times more travel planning searches made through the mobile version of the web site than the web version, according to an internal communication by *Trafiken.nu*. Launching their own app in 2011 had proved to be too late since privately developed apps by individuals using their data were already available for public use.

This proved that in the app market both customers and companies are at the same footing when it comes to reaching intended customers through providers such as Apple or Google. Making all the data available online had opened up the possibility for individuals to develop their own apps.

Since 2007, more than 500 million iOS and Android smartphones and tablets have been connected to the Internet [17]. Considering that many of these smartphones and tablets come with broadband connectivity out-of-the-box it has led to *Trafiken.nu* finding itself in a similar situation as did the Stockholm Local Radio during the

early 1990s with an increased computerization and proliferation of mobile phones in Swedish society.

5. DISCUSSION

The study has looked at how different forms of mobile media and their corresponding social practices can be related to how traffic and travel information has been gathered and disseminated in Stockholm since the late 1970s.

The main question has concerned itself with what institutional framework has been needed in order to promote such uses of technology and how much of it implies the use of a certain kind of technology and expertise. This includes looking both at the intentions and the technologies employed by all affected stakeholders under a certain kind of political and societal condition that may have influenced “the rules of the game”. Socio-political events such as the oil crisis of 1973 or an international congress for ITS are both able to question common practices and trigger changes that can lead the development of a service into a different direction.

How prevailing political and ideological conditions shaped the Stockholm Local Radios institutional framework demonstrates the importance political intentions have had on its service provision. Informing on local traffic conditions becomes in this sense the interplay between technologies, consumption practices and different media uses working together with one another in order to deliver a service that can provide for such an option.

I connect these attempts to what Yochai Benkler calls an institutional ecology where ‘participation’ is seen as a commons-based approach to managing resources [4]. The role technology and media play for collective action and better decision-making and possibly resource management becomes aspects of importance since it touches upon the possibilities of a technology to both produce and mediate expectations set by a certain institutional ecology (such as an networked information economy) [5].

One such example is the use of a participatory network of CB users which demonstrates the role a form of citizens empowering has had in both shaping and influencing the means of providing real-time and dynamic based information to the public in Stockholm.

The importance of the public becomes yet again apparent when looking at the case of Trafiken.nu. The scrutinizing of the Dennis agreement in 1990 demonstrates how the pressures to succeed with its implementation led to the idea of consolidating data through an ITS. The decision of presenting all these data in the form of a webpage is also telling of the importance another form of ICT had for the service, namely the Internet.

The example demonstrates how much the demand for a level of public participation has changed throughout Trafiken.nu’s history because of user demands and by the media itself. As such, it becomes part of a networking information economy that has become increasingly defined by levels of participation and the value of networking information [5].

A lesson from the case examples is that in order for a service to achieve its functions it needs to adapt to the current demands from its users. With almost a third of the world population being online through the Internet it comes as no surprise that many ICT based services are increasingly making use of the wireless Internet through mobile ICT:s such as the smartphone. The question

becomes what effect increasingly market driven trends of using apps through ‘smart’ devices will have for the promotion of sustainable travel.

We need to keep in mind that there are strong market forces behind much of what is driving the use of app based devices and services that needs to be considered when talking about an ICT for sustainable travel.

What I have stressed throughout this whole exposition is that we need more of a historical and sociological gaze on the role of such uses of ICT. What do these gadgets awaken within people, organizations and stakeholders that may actually lead to a more sustainable travel and what can we learn from previous examples on how a collective view on resource management and problem solving may or may not have been beneficial in order to coordinate and inform travelling towards a more sustainable one.

A close-to-operational-hypothesis that can be drawn from the case examples is that the active encouragement of user participation greatly improves both the reliability and the efficiency of the service by involving a local eye on issues pertaining to an everyday condition such as traffic. What needs to be kept in mind is that the form of involving such a local eye on an operational level needs to take into account the inherent choices that the technologies possess.

Media technology possesses scopic functions that for the better or worse are susceptible to what the owner of the media or the media institution finds economically, politically or otherwise beneficial and hence worth pursuing [9]. This relates to what means are provided for or not in society in the form of rules, services and systems for informing oneself and what role technology has for such information systems. Networking information through a multitude of users in a multitude of localities holds the potential for a more synergetic collective reasoning.

The potential outcome is a service that can better answer to the requirements posed by the complexities of daily travel. This in turn increases the potential for promoting sustainable travel by providing a better ground for decision making while en-route.

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