

# SHARED SPACE SHARED RESPONSIBILITY: DESIGNING FOR NON-OBSTRUCTIVE BROWSING

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**Abstract:** The use of mobile technologies is an everyday feature in public places. It is therefore important to take into account implications that arise of the use in these settings. Particularly when mobile technology usage is physically restricted to locations by technical limitations, such as the use of PDAs and laptops at settings with wireless Local Area Networks (W-LAN). In this paper we focus on the problems caused by co-presence of others, which is a persistent feature in public places. We study this feature by looking at petrol stations, where smooth flow of cars and customers explicitly highlights the problems of sharing a public space. We propose four design approaches towards *non-obstructive browsing*: One where those present agree on appropriate use, one where spatial arrangements guide mobile technology one where the use is restricted technically through design and finally an approach where designers support the ongoing negotiation of the place by providing awareness through the systems of the mobile technologies.

**Keywords:** non-obstructive browsing, petrol station, mobile technologies, co-presence

## 1 INTRODUCTION

The adoption and widespread use of mobile technologies is an issue among many interdisciplinary researchers (e.g. Brown et al. 2001). Particularly the research on mobile phones has provided a notion of the entanglements between mobile technologies and the settings in which they are used. This entanglement will most likely continue as e.g. the possession and use of PDAs, and laptops equipped with W-LAN cards increase in public places (Druckner et al. 2002). These mobile technologies are making it possible for the users to access high bandwidth digital communication wherever there is a “public” W-LAN available i.e. hotspots (Ye et al. 1998). Co-presence is a persistent feature in public places. Our aim is therefore to understand how co-presence has an impact on the use of handheld and ubiquitous technologies and consequently how co-presence is affected by handheld and ubiquitous technology use. Thus it can be a good idea to study and design for the settings where mobile technologies are used.

A hotspot can provide access to universal services but also location dependent services (e.g. Cheverst et al, 2000). Hotspots are emerging in different public locations for example airports and cafés and even McDonalds (Acharya et al, 2002; Starbucks 2003; Nobel, 2003). Due to its significant role in road use petrol retailing industries, such as Statoil, are looking into the possibilities of providing electronic services at petrol stations.

Thus, like airports and cafés, petrol stations are being equipped with hotspots even though the petrol station differ as public places. At airports for instance, the time that travellers might have to wait before boarding a plane can be used to browse and check e-mail, something that was done even prior to the implementation of hotspots (see e.g. Perry et al, 2001). Co-located people at the airport are “static” and bound by the boarding time, just like the mobile technology user. Thus using the time slot to browse is not perceived as obstructing as it can be at a petrol station.

Cafés on the other hand, usually has continuous flow of customers coming to and leaving the café, the space is also limited. But here the duration of time that people spend at the café is much longer than it is at the petrol station. Many cafés offer newspapers and journals for customers to read. There is a tolerance that customers engage in side involvements such as reading while eating or drinking coffee (for literature on being at a café see e.g. Laurier et al. 2001). Thus using handheld and ubiquitous technologies while seated in a café is only one of many involvements that many find appropriate to do in cafés.

The petrol station is in many ways different from airports and cafés, petrol stations are *hot spots* in the sense that it has a high and often smooth flow of cars and customers moving through the place. In this setting it is important to attend to the activities of those that are co-present so that one collaboratively can share the place. The use of mobile technologies will increase the probability of being in the way of others physically. Based on ethnographic fieldwork on petrol stations and accumulated understanding on mobile technology use in public settings (e.g. Brown et al, 2001) we propose four design guidelines that address co-presence in handheld and ubiquitous technology usage. We find it important to take into account the probability of co-presence where users otherwise might find his or her activity obstructing the activities of others that are co-located. Thus we propose guidelines for design that enable users to conduct *non-obstructive browsing*.

## 2 RELATED WORK

Handheld and ubiquitous technologies, particularly the mobile phone, are a successful example of the “disappearing computer” (Brown in Brown et al, 2001:3-15). “Disappearing computer” is term for how computers blend into single function appliances, such as mobile phones, and

become unnoticed (as computers) in our everyday life. But while computers become ubiquitous and entwined into the environment, the design rationale for them changes. One aspect proposed by Weiser and Brown is that system designers have to start designing *calm technologies*. Calm technologies minimise the cognitive risk of information overload by moving back and forth between the centre and the periphery of our attention thus providing information without exposing too much focus (Weiser et al, 1996).

This design approach has for example been used in systems that mimic the “peripheral awareness” in co-located collegial work for distributed workgroups such as the *portholes* system (Dourish et al, 1992). Even though this system can be described as a good example of an awareness server, it does not have the properties to jump between the centre and the periphery of focus, which can be seen as the main challenge for handheld and ubiquitous computing (Buxton, 1995).

This approach, i.e. designing for calm technologies, seems to be preoccupied with single or distributed users. One exception being the system proposed by Intille (2002) address the disruptions that calm technologies can have on those that are co-present. He state that:

“When multiple people are in the same space, each individuals information will clutter the visual space of other occupants. Unfortunately, the human visual system will automatically attend to nearly all resultant motion transients, disrupting the feeling of calm”(Intille, 2002:95)

Thus, the shift between central and peripheral focus as suggested with calm technologies threaten to disturb everyone co-located as the individual is notified of its change. The detection of change, which is perceived as resource in e.g. portholes, is itself a disruption of calm according to Intille. Instead Intille suggests the use of change blindness in system design. Humans are sensitive to detect sudden changes but can through various techniques be tricked to miss changes that otherwise would be perceived as obvious changes, this is called change blindness. By utilizing change blindness to change information a system is proposed by Intille that does not disrupt the calm environment in which it is situated (Intille, 2002). Even though he provides a novel and fascinating solution on disruption of ubiquitous and mobile technologies, the system only handles one part of the problem, namely displaying information. Humans interacting with computers can, as mere presence of usage, disrupt calm environments.

Since mobile phones already are a part of the mundane habits of everyday life, insights on the use of these technologies can be of importance for future handheld and ubiquitous development. Thus to understand how co-presence of humans affect and are affected by mobile technology use we take a look at studies on the *use* of mobile phones in naturalistic settings. Studies on the social aspects of mobile technology use is a fairly recent field (e.g. Brown et al, 2001; Weilenmann, 2003; Katz et al. 2002). These studies primary focus on everyday aspects of mobile technology usage. For example Townsend (in Brown et al. 2001, pp62-77) describes the impact mobile phones have on the use and navigation of urban space. He suggests a major re-examination of the urban space and time, due decentralisation and fragmentation of social communication. Whereas Townsend highlights that there are changes, Murtagh looks at some of the features of these changes in public places.

Following the work of Goffman (1963) and ethnomethodology, Murtagh describes the “rules” evolving around mobile phone use and how these “rules” are contingent upon the process of interpretation in the situations (in Brown et al, 2001, pp.81-91) Murtagh includes co-located others of the settings that do not participate in the usage of mobile phones but that do engage in non-vocal activities and responses to mobile phone use. By looking at the engagements in a train, Murtagh observed how people would display “civil inattention” towards people talking in phones, thus in some ways respecting their use, but only to some extent. Extensive mobile phone usage or

explicitly private conversations would evoke others to question the “legitimacy” of the mobile phone usage. The appropriateness or inappropriateness of mobile phone use is collaboratively accomplished by those that are present in the given situation.

Cooper focus on the private/public distinction in mobile phone use (in Brown et al, 2001, pp.19-31) However as he continues, mobile phones do not only blur the distinctions between private and public, it is part of the reformulation and the critique of the distinctions themselves. He states that it is not clear whether the use of mobile phones “should be taken to represent the intrusion of public into private, or private into public.”(Cooper in Brown et al, 2001, p.24). Thus mobile phones could be described as an “indiscrete technology”. The issue of co-located others, and their ability to overhear half conversations, becomes a central feature of mobile phone use. As Cooper exemplifies, telling where you are in the a mobile phone conversation is a way to attend to the contextual sensitivity of talk; it establishes the restrictions of what is appropriate and inappropriate for both participating in the conversation and those co-present to the conversationalists.

To recapture, we have moved from calm to indiscrete technologies, showing that designing mobile technologies are not only a question of the cognitive constraints of the user, i.e. the risk of causing information overload, but also the setting of co-located others that might inflict on the mobile technology use. Particularly studies on mobile phone use have showed that; when designing for mobile technologies, we should take the issue of the space where the technology is used in careful consideration, especially when the place in question encourage co-located others.

### 3 METHOD

Complementary to the findings on mobile phone use we have conducted a pre-development observational study, (Brown et al, 2003) to understand how co-presence might affect the use of handheld and ubiquitous computing (and vice versa). The *pre-development study* was conducted as an ethnographic observation of a petrol station. The petroleum retailer, where we conducted our study, is in the process of implementing W-LAN at their petrol stations. It was therefore in their, and our, interest to understand how petrol stations “work” and how the activities at the petrol station might be affected by the implementation of W-LAN capabilities.

Ethnography, as a research method originating from anthropology and sociology, has become a known method in system design, particularly within Computer Supported Cooperative Work (CSCW) and Participatory Design (PD), (for reviews of the method see e.g. Harper 2000; Crabtree et al, 2001; Shapio, 1994; Berg, 1998; Wasson 2001; Hughes et al, 1994; Pors et al 2002) Proponents of ethnography often argue that the method is necessary when taking the social context of technology use into design consideration. Thus, the method is in line with the aim of this paper, i.e. highlighting some of the implications due to co-presence in handheld and ubiquitous technology usage.

The fieldwork was carried out at a suburban petrol station on the west coast of Sweden. We visited the petrol station regularly between April & June 2002. The first weeks as a staff member, following a shift, working variously between 06:00 and 22:00. This was important in order to be treated as an “insider” of the setting by the staff but also to learn the “life cycle” of the petrol station setting (Harper, 2000). My “ritual induction” to the setting was when I was left alone by the counter with the comment: “If you know how to run a computer, then you know how to run a cashier machine.” At the last two weeks we observed the store and forecourt as a customer, either standing at a “café table” or sitting on the grass outside. Thus changing “costume” to get a different perspective of the site (Zuiderent in Pors et al, 2002 pp. 59-78). Throughout the entire fieldwork extensive field notes were taken. On four occasions, conversations between staff and customers were recorded at the counter (aprox.13h). The material, field notes and selected

recordings, were then transcribed and made anonymous. Themes were identified; firstly in relation to the location the activities took place.

The design approaches presented in this paper arose through ongoing conversations and numerous meetings with colleagues where the findings of the fieldwork were presented, analysed and questioned (Crabtree et al. 2001; Esbjörnsson et al, 2002; Ljungberg et al, 1998)

## **4 THE PETROL STATION A *HOT* HOTSPOT**

Even though our aim is to describe implications of co-presence when using mobile technologies in general, petrol stations are particularly interesting since they highlight the complexity of sharing a limited space with co-located others. It is also a suiting example where the technology in question, e.g. hotspots, are bound to a place that therefore can be analysed and studied *prior* to the implementation and use of mobile technologies.

Statoil are in the process of implementing W-LAN access, this has also been suggested by researchers (e.g. Bogenberger et al, 2002; Lot et al, 2001; Cohen et al, 2002), however, only a few have elaborated on its possibilities; Ye et al (1998) present the possibility of relaying road-navigation information through the use of hotspots at petrol stations; Minale (2000) provides an example of a petrol retailer that builds in-store banking, and touch-screen information kiosks (both in the store and on the forecourt); and Bisdikian et al (2002), being primarily interested in "middleware" for telematics service, use a petrol station as an example of a local service provider with contextual applications. They describe how drivers arriving at a petrol station can use both universal and location dependent services through a local area network at the petrol station.

Since most petrol stations are small the area is shared among the customers i.e. customers have to adapt and collaboratively coordinate their use with the demands of other visitors. Traditionally, petrol station managers have addressed the problem of the limited space by selling gasoline as fast and smooth as possible, thereby they minimise the time each customers spend at the limited space. However road-users have many other needs besides refuelling the car, they can get hungry too. In many parts of Europe petrol stations have turned more into convenience stores (Minale, 2000). Thus petrol stations, as the one we studied, have provided supplementary services at the place, i.e. hot-dogs, groceries, leisure articles, clothes, letting videos, lotteries, postal and banking services, car-wash, toilets, etc. This might not be surprising in light of the larger profit margins that merchandises generate, averaging at three times more than fuel (Minale, 2000). But it has also added a complexity of sharing the petrol station since they, on one hand, continue to provide gasoline as fast and smooth as possible and, on the other hand, have a wide assortment of different services that acquire time and space.

### **4.1 Mobile technology use on petrol stations**

The stations are heterogeneous, already, and offers a wide variety of commodities and services. Current uses of mobile phones on the petrol stations add to the complexity of handling activities simultaneously going on within the location. During the fieldwork a customer with a bus refuelled and left the station without paying. A member of the staff ran out on the forecourt to stop him, but it was too late the buss had already driven up on the main road. However the bus had large stickers with the contact information to a voluntary organisation. Subsequently, the staff member contacted the organisation and retrieved the mobile phone number to the bus driver to phone the driver. At first the line was busy but eventually the staff got hold of the driver. Half an hour later the bus driver returned to the store and excused his departure commenting that: "I got a phone call while I was refuelling so I just walked into the bus and took off..." This example shows that while the bus driver was refueling, his attention was diverted to the mobile-conversation; therefore he acted as a criminal and drove away without paying for the petrol. This example

shows how mobile technologies increases the complexity of engaging to the activities of a place, the diver managed to refuel and talk but not to conduct the multiple activities of entering the store and paying while using the phone. Thus the use of handheld and ubiquitous technologies has an impact on how things are done within a public place.

Handheld and ubiquitous technology use, not only affects the user but also those that are co-present. As previously described in section 2, co-located customers show “civil inattention” towards those that use their mobiles and the users actively avoid being in the way. A person that had a lengthy conversation in the store walked to a secluded area behind the shelf’s when a topic was initiated in the conversation. He then returned to a more visible area when the topic seemed to be finished. This more visible part of the petrol station also provided an overview of the forecourt and the vehicles on it. When a new conversational topic was initiated, the person once more moved behind the self’s. The movement during the conversation could be interpreted as an effort from the mobile phone user to avoid being in the way and to choose a less visible part of the store to talk in. This limited the impact on those that were co-present as he tried to minimise the impact of the “indiscrete technology” that he was using. This activity confirms and supports the findings on how people handle mobile phone use in public places as described in e.g. Brown et al (2001). Both users and those that are co-present to usage attend to the situation.

#### **4.2 Handling co-presence at petrol stations**

Being at a petrol station, or any other public place, is collaboratively *achieved* and *accomplished* continuously as customers and staff use the place in ways they think are appropriate in relation to those that are co-located (Goffman, 1963). It is our opinion that an understanding of *what* customers and staff do in order to share the station area can be important when designing for these settings. First, we found that customers and staff divide the forecourt into zones where some activities are more or less appropriate, e.g. the area by the pump is only used by customers refuelling and customers move from this place fairly quickly after they have refuelled. The “zoning” of the forecourt relied on the spatial arrangements of the forecourt such as the fixed location of the pumps and arrows painted on the asphalt. Second, customers adjust their displacement at the forecourt depending on how long they intend to stay, e.g. when having lunch people park in the periphery of the forecourt. On the other hand, if customers are quick with their visit, then they can park anywhere even in front of the entrance of the store. Third, customers that otherwise fail to follow the “rules” of parking at specific zones of the forecourt, depending on the time of activity of their stay, can be questioned for their legitimacy for being at the petrol station, similar to what Murtagh describes about mobile phone conversations (in Brown et al, 2001). For example we observed a truck driver, who was sitting in his truck drinking coffee and reading a newspaper (which he bought at the petrol station), that was asked to leave the forecourt since he was in the way of another customer that wanted to rent a trailer, when he had parked in front of the rental trailers.

Finally, a central feature of the coordination at petrol stations, that makes the task of sharing the space even more complex, is that when customers leave their vehicles to use certain services they also have to attend to the space that their vehicle occupies so it does not interfere with other people’s activities. Cars are big and occupy the space and the things you can do wherever they are parked on the forecourt. The ambiguity of minimizing the risk of being in the way, while utilizing the various activities at the petrol station is handled in a variety of ways. Visitors are guided by the design of the petrol station but they also adjust to each other’s probable requests, levelling between either taking time or taking space.

Our findings of the pre-development study showed that stopping to refuel or to buy groceries at the petrol station, were troublesome due to the tension of being “*in the way*” of co-present others. Customers and staff where concerned about where on the forecourt they conducted their activities

so that they would minimise the time they were in the way. The time these activities were expected to take, also played an important role in the way they avoided to block other customers as little as possible. The position of the vehicles was a serious concern when customers had to leave their cars to conduct tasks in the store or in the vicinity of the petrol station.

## **5 FOUR DESIGN APPROACHES FOR NON-OBSTRUCTIVE BROWSING**

So far, mainly architects have tackled the complexity of sharing public places such as petrol stations. While focusing on the practical use of the forecourt they have searched for solutions to improve the visibility to locate free pumps – i.e. ensuring the free flow of traffic. Large windows at the stores have provided overview of the forecourt to minimize security risks. There is also an example of a station where they have divided the forecourt so that tasks are conducted on either side of a wall depending on the time it takes to conduct them (Minale, 2000). It is imaginable that people will surf the Internet, download infotainment and maps, or browse for local restaurants with laptops and PDAs through W-LAN or 3G phones on public places such as petrol stations (Bisdikan et al, 2002; Magdic et al, 2002). However with the implementation W-LAN at these kind of settings the levelling between either taking time or taking place can become even more complex.

In this context, providing electronic services within this area could equally increase the tension of being “in the way”. People will, like the staff and customers on the petrol station, try to handle the increased complexity in the way they currently handle mobile phone use and the ways they avoid being in the way at petrol stations. Still we recommend that system designers take a more progressive role in the use of mobile technologies. Co-presence have a direct impact on mobile technology use and should therefore be accounted for in design. Based on our empirical understanding of the petrol station and the descriptions of how people handle mobile phone usage four different design approaches are outlined: 1) Relying on *users and non-users negotiation of space* 2) designing *spatial arrangements* that guide use 3) providing *positioned services* in use and 4) offer a system for *co-located awareness support* within the system that provides access.

### **5.1 Users and non-users negotiation of place in space**

Regardless of whether designers will take co-presence into consideration or not, people will continuously negotiate the usage of handheld and ubiquitous technologies in relation to co-located others on the place. Contemporary use and non-use of mobile phone is in many ways a good example of how people accomplish understandings of how they should act in public places while using mobile technologies, so that their use is not inappropriate for the situation (see e.g. Murtagh in Brown et al, 2001). “Rules” of how to use mobile phones become part of common sense.

With this passive approach, system designers delegate the complexity of handling co-presence to users and non-users of the handheld and ubiquitous technologies. Whether browsing will be perceived as appropriate or inappropriate are based on what customers and staff agree upon, like the “rules” of mobile phone use is and have taken form. The “rules” that takes shape can then be imposed through formalisation and sanction.

### **5.2 Spatial arrangements of places**

Especially at the petrol station the accomplishments of sharing the place are guided by the design of spatial arrangements. Spatial arrangements are an integral part of the local practices they are 1) visible and constructed for their visibility, 2) commonly known for “members” of the place and paired with a competence for their use (Crabtree, 2000). For example the totem (or petrol station sign) is visible and constructed for its visibility along the road. Its not a deep mystery for drivers

that the totem signalises the location of a petrol station and that the petrol station is paired with, at least, the activity of refuelling. These spatial arrangements, e.g. sign posting prohibitions or designated areas can guide mobile technology use within the location.

The “*spatial arrangement*” approach implies that there are signs in the station area at tables and/or parking lots where browsing is encouraged. Customers will to a higher extent conduct their browsing at these locations even the use is not restricted to these zones. One could say that the complexity of co-presence is delegated to architects. The signs guides the browsing activities to specific locations but the usage is not enforced only to these designated locations. The parallel to the variation of mobile phone signs are apparent.

### **5.3 Designing for positioned services**

Providing “*positioned services*” would imply that browsing is only available where it is not seen as being in the way of others, e.g. at the outer rim and parking lots of the forecourt. Or it could refer to the possibility that browsing only to a couple of minutes where one could be in the way e.g. at the pumps. Thus access is limited which in turn limits the use. This approach is more enforcing than previous approaches since the availability is technically restricted. But it can, as the initial prototype exemplifies, alert the user of a probable risk of being in the way rather than prohibiting access. This approach is similar to what people do at the petrol station, the area seemed to be divided into different zones where one could spend more ore less time. This approach is similar to the proposal for situated information spaces that Fitzmaurice (1993) suggests. Even though the motivation for the two approaches differ. Between the user and the technology this can not be considered a *calm technology*, however reminding the user of his/her location might create a *calm environment*, as proposed by Intille (2002).

### **5.4 Designing for awareness support**

Finally, “*co-located awareness support*” is an approach where a co-located customer’s activity on the access point becomes partially transparent. The application will inform the user of other co-located customers intentions or it can notify those that are co-present that the user is browsing. This information makes it possible to e.g. “honk” at each other when conflicting use of the same physical place occur. The customers themselves will then handle the priorities between conflicting uses of the same physical location. Co-located awareness support can also be designed to assist the ongoing collaboration between people on the petrol station. For instance customers experienced a tension, identified during the fieldwork, where they were concerned whether their vehicles might be in the way of other customers as they were away from their cars. This tension could be relived through co-located awareness support. For example by providing a visual overview of the situation on the forecourt customers can form an opinion of whether they are in the way or not. The approach is inspired by the extensive design on peripheral awareness by e.g. Dourish et al (1992).

Using electronic services at petrol stations will add to the complexity of sharing the place. A complexity that we either can leave to the customers to handle, as part of the mundane use of the petrol station, but the technology can also be designed so that the electronic services are made accountable in the location where they are used. Thus guiding customer’s collaboration of sharing the place.

## **6 CONCLUSION**

The widespread adoption of mobile technologies into urban locations has implications not only for the users but also for those that are co-present. As Intille (2002) exemplified, mobile technology use takes a lot of attention from those that are co-located, thus disrupting any calm. It

is plausible that we should start to design with these implications in mind, not only focusing on the interface between the user/s and the technology. Based on our understanding of the complexity of public places, e.g. the petrol stations, it seems sound to take a close look to see how the use of mobile technologies are incorporated into the practices and understandings of the place. How will they negotiate their use of mobile technologies in relation to other co-located users of the place? How will the local practice of mobile interaction be organised?

The presence of others is also a resource in mobile technology usage (see e.g. Weilenmann et al in Brown et al, 2001, pp92-107). The vast possibilities of co-presence have only started to be explored in system design for mobile technologies (see e.g. Faberjö et al, 2003; Esbjörnsson et al, 2002). But the presence of others can also pose a problem in mobile technology use – or mobile technology use can pose a problem for those that are co-located, especially in settings such as petrol stations.

It is therefore important when designing for digitalized public places to take into consideration how people in a collaborative accomplishment share these locations, guided by spatial arrangements at the place and on what they find appropriate depending on their and other's probable intentions. This is a challenge both for social studies and for design of mobile technologies. Therefore we propose four different design approaches that handle the problem of making the mobile interaction appropriate for the local circumstance and place in relation to those that are co-located but not necessarily participate in the activity of using the mobile technology. Guiding customer's collaboration of sharing the place thus enabling the user to conduct *non-obstructive browsing*. As part of further research, prototypes following the guidelines of the third and fourth approach are developed, one that will use adjustable W-LAN access points to position the user, and one prototype that provides awareness of co-located others through web cameras. These prototypes will be further developed and evaluated.

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