

Coping with Cars and Co-presence at Petrol Stations

Daniel Normark

Mobility, Interactive Institute

Karlavägen 108, P.O. Box 24081, SE-104 50 Stockholm

danieln@tii.se

+46 703 485049

ABSTRACT

Office settings and public places are indeed very different places. Whereas the development of mobile technologies has been informed by insights regarding the office the same cannot be said about the knowledge regarding public places. Still, mobile technologies are frequently used in public places. In this paper we focus on the problem of engaging with technology while others are present, which is a persistent feature in technology use at 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 mobile-ICT-use*: 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.

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INTRODUCTION

A persistent feature of public places is that quite often you share it with strangers, people that are co-present but to whom you only have a minimal relation. In these settings, mobile technologies (such as mobile phones) are very likely to be used, and indeed they frequently are [see e.g. 4]. This might not be so surprising since a promoted benefit with mobile technologies have been the possibility of using them irrespective of timeliness and geographical distance [16]. However, the context of co-present people affect the use of mobile technologies and subsequently the context is affected by mobile technology use.

Over the past few years the notion of “context” has become a central theme in CHI research. Grouped under different labels e.g. ubiquitous computing, context-aware computing, pervasive computing etc. research has predominantly focused on “how computation can be sensitive and responsive to its setting” [9, p19]. This research has resulted in the development of various sensor technologies and applications but also in a serious undertaking to “understand the potential relationship between computation and the context in which it is embedded”[9, p20].

In this paper we focus on co-presence to understand the relationship between mobile-technology-use¹, the setting where it is used and the co-presence of strangers. We choose to concentrate on petrol stations, since they are particularly complex public places but also due to the current implementation of hotspots (i.e. W-LAN access) [21]. 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. Based on ethnographic fieldwork on petrol stations and accumulated understanding on mobile technology use in public settings [e.g.4] we propose four design guidelines that enable users to conduct *non-obstructive mobile-ICT-use*. Since 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.

COPING WITH CO-PRESENCE AND TECHNOLOGY USE

The emergence of “context-aware computing” shifts the focus from desktop computers to computationally enhanced devices (i.e. tools rather than machines). But while computers become ubiquitous and entwined into the environment, the design rationale for them changes [9]. One aspect proposed by Weiser & Brown is that system designers have to start designing *calm technologies*. Calm technologies minimise the cognitive risk of information overload by moving

¹ There is a subtle, but analytically important difference between *use* and *user*, which is out of the scope of this paper. Important to note however is that the analytical unit in focusing on *use* is the situation (or interaction) and not the person or the technology. As Dourish points out: “context and activity are mutually constitutive” (p28). This “embodied interaction” approach shifts the focus to *use* and, what in social sciences would be called, the unit of *the hybrid* consisting both of the mobile technology and its user. Thus it is not only the activity and context that are not (always) separable but the division between the computer and its context and the user and its context are also questioned.

back and forth between the centre and the periphery of our attention thus providing information without exposing too much focus [24].

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 [8]. 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 [5].

This approach, i.e. designing for calm technologies, seems to be preoccupied with a single user in a room, and her/his effort of relating to distributed colleagues. One exception being the system proposed by Intille, which address the disruptions that calm technologies can have on those that are co-present [14]. 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”[14, p95]

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 [14]. 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.

Coping with co-presence and mobile phones

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 are a fairly recent field [e.g. 4,15,23]. For example Townsend [in 4, 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 to decentralisation and fragmentation of social communication.

Murtagh looks at some of the features of these changes in public places, describing the “rules” evolving around mobile phone use and how these “rules” are contingent upon the process of interpretation in the situations [in 4, pp81-91]. 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. Those that are present in the given situation collaboratively accomplish the appropriateness or inappropriateness of mobile phone use.

Cooper focus on the private/public distinction in mobile phone use [in 4, pp19-31]. 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”[4, p24]. 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.

PRE-DEVELOPMENT STUDIES OF COMPLEX SITES

Complementary to the findings on mobile phone use we have conducted a *pre-development observational study*, [3] to understand how co-presence might affect the use of handheld and ubiquitous computing (and vice versa). Even though petrol stations are implementing W-LAN access, our study was conducted at a location where this was not the case. Still, the study could provide a deepened understanding in how people handle co-presence in relation to their and others activities (where mobile-ICT-use is one out of many activities).

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. [1,7,12,19,20, 22]) Proponents of ethnography often argue that the method is necessary when taking the social context of technology use into design consideration, which is in line with this paper.

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 [12]. During 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. Thereby changing “costume” to get a different perspective of the site [Zuiderent in 19, pp59-78]. 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.

The design approaches presented in this paper emerged through ongoing conversations and numerous meetings with colleagues where findings of the fieldwork were presented, analysed and questioned [7,10,17].

THE PETROL STATION A *HOT SPOT*

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. 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 customer spends 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 [18]. 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 [18]. 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. In the following findings from the fieldwork is presented. We will show how people at the petrol station try to minimise the risk of being in the way as they simultaneously use the various services available.

Mobile technology use on petrol stations

Hardly surprising, people arrive at petrol stations with their mobile phones, which they also use on the forecourt and in the store. During the fieldwork we could see the effect of mobile-ICT use at the petrol station. For example 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 bus was already on the main road. However the bus was decorated with large stickers with contact information to a voluntary organisation. Subsequently, the staff member contacted the organisation and retrieved a phone number to the bus driver. 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 refuelling, his attention was diverted to the mobile-conversation; therefore he unintentionally shirked without paying for the petrol. The driver managed to refuel and talk but not to conduct the multiple activities of entering the store and paying while using the phone. Mobile technologies increase the complexity of engaging to the activities of a place. Thus, the use of handheld and ubiquitous technologies has an impact on how things are accomplished within a public place.

Handheld and ubiquitous technology use, not only affects the user but also those that are co-present. As previously described concerning mobile phones, co-located customers show “civil inattention” towards those that use their mobiles and the users actively avoid being in the way. For instance, a person that had a lengthy conversation in the store walked to a secluded area behind the shelves 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 [4]. Both users and those that are co-present to usage attend to the situation.

Handling co-presence at petrol stations

Being at a petrol station, or any other public place, is collaboratively *achieved* and *accomplished* continuously as customer and staff use the place in ways they think are appropriate in relation to those that are co-located. It is our opinion that an understanding of *how* customers and staff do, in order to share the station area can be important when designing for these settings. We found three important aspects. First, staff and customers divided the forecourt into activity “zones.” Second, their activities related to the time they intended to stay. Third, customers attended both to their activities in the store and their vehicle on the forecourt simultaneously. In the following we will study how visitors related to each other based on these aspects.

Limiting different activities to specific locations

Customers arrive at petrol station for various reasons and they conduct several different activities, e.g. to buy groceries, refuel, wash the car, rent a trailer, eat lunch, call on their mobile-phone, read newspapers, structure their office material in the car, tend to their vehicle etc. In order to share the limited forecourt, we found that customers and staff divided the forecourt into zones where some activities were seen as more or less appropriate. For example parking beside a pump is almost entirely perceived as an initiation of refuelling. Similarly parking by the trailer reveals what the driver intention, “booking” the trailer in advance by parking in front of it. During the fieldwork a staff member and a customer walked out to a truck driver that had parked along the trailers. The truck driver was drinking coffee and reading a newspaper and was asked to leave the location so that the other customer could rent a trailer. Through the conversation, the staff and customers collaboratively *accomplished* an understanding of the location as inappropriate to park at in order to drink coffee at this particular situation. The spatial arrangements of the forecourt, such as the lines of the parking lots, the pumps, the trailers and the car-wash building guide the customers to the appropriate location for their activity.

Sometimes the location that customers understand as appropriate to use is occupied. For example if there are cars beside all the pumps. In this situation customers need to agree on using the location in sequence often by forming a file of cars, i.e. a *queue*.² Thus the complexity of sharing a petrol station is collaboratively and continuously solved mainly by either, occupying different spaces or lining up in files, using the service in order of arrival. 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.

Intended duration of stay

One important feature when sharing the petrol station is that people perceive them as places with fast service and smooth flow of cars and customers. This understanding is partly based on the petrol station design, with streamlined and practical forecourts. But the flow of cars at the petrol station is not only a feature of the arrangements of pumps, entrances etc. it is equally an *accomplishment* by the people in place. Customers take different “liberties” on the forecourt depending on how long they intend to stay. For instance, a big white arrow was painted on the asphalt in front of the entrance to the store. Signalling that vehicles were not permitted to park there. Still at several occasions, the arrow was hidden underneath a parked car. It is not surprising to find that people park close to the entrance. The eventualities for why are numerous such as avoiding getting wet, difficulties in moving, keeping an overview of the car or something in it, or just that it is close to the entrance. But a common denominator, for most of the “ignorants” parking on the arrow was that their visit at the petrol station was brief. They took the liberty of parking on the arrow since they were only there for a brief moment. One could say that the arrow on the asphalt confirmed their appearance of being *on the way*.

Similarly, people stopping for long breaks are careful about where they park on the forecourt so that they are not in the way. As in the following observation where a group of customers avoided being in the way of others:

A car parks beside the underground containers “exhaustion pipes” on the far end of the forecourt, from the perspective of the store. Two men and one woman leave the car, walks across the forecourt into the store. Later on they sit on the grass beside their car, gazing at the sun, enjoying some sort of lunch, probably purchased in the store. They stay more than half an hour on the grass.

Observation 1: Parking far from the store, to be out of the way of other customers.

The group parked far from the store but close to a small grass yard prior to entering the store. The location of the car was not the custom place to park. They placed their vehicle so that they, after buying the lunches, could sit on the grass and enjoy the sun, while still being in proximity to their vehicle. Being close to the car (while eating) seemed to be more important than being close to the store (while purchasing). By parking far away from the entry of the store they could have a long break and still maintain a sense of the place as fast and swift. They tried to avoid being *in the way*.

² The appearance of queuing are sometimes misinterpreted and customers spend a lot of time collaboratively agreeing on the order of the queues. However since the article, like the forecourt, is limited, I will briefly note that the customers establish queues in various ways.

The arrangements of objects, inside the store and on the forecourt, hamper relaxation i.e. it does not offer any space to sit and relax at. Instead customers sit in their cars, on the grass out at the outer rim of the station, lean against motorcycles and the wall of the store or sit on the sides of the trailers, while gazing at the sun and zipping coffee. By parking far away from the entry, as in observation 1, resting is identified as an activity in the periphery.

The local practices of the petrol station are guided by an understanding of the smooth flow of cars and customers on the forecourt. Those that make brief stops take the liberty of parking outside the entrance, while those that intend to rest park on the outskirts of the forecourt. Thus, the ways customers find it appropriate to act depend on what they intend to do but also how long they intend to stay.

Being at two places at the same time

Cars are big and occupy the space and the things you can do wherever they are parked on the forecourt. Thus, when visitors leave their car to visit the store, they occupy the space of the car and the space they have themselves (e.g. in the store). This increases the complexity of avoiding being in the way. Regardless whether the visit is brief or long customers have to split the attention between activities in the store and the situation around car 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. One way is to move the vehicle to an appropriate location on the forecourt prior to entering the store. As in the following observation when a woman shifts the location of the car depending on her current task.

Having parked at a parking lot, a woman enters the store. She comes back out with (one or two) plastic bags. She opens the backseat door behind the drivers seat and puts the bags there. She steps into the car and starts to back away from the parking lot. Then she drives to a pump. She steps out of the car, and starts refuelling... After finishing refuelling (and conducting other subsidiary tasks) she locks the car and walks back into the store. Once she returned to the car she moves it to the car-wash queue.

Observation 2: Doing several tasks by walking back and forth between the forecourt and the store.

The customer divided her tasks at the petrol station. She performed the tasks as a series of sequences: grocery-shopping, refuelling and car-washing. But as she conducted her tasks she also moved the car on the forecourt to an appropriate location for her activity in the store. This forced her to repeatedly go back and fourth between the store and the forecourt. By dividing the tasks she was able to be as little as possible in the way of others on the forecourt and still conduct the tasks available at the station.

Moving the car on the forecourt can however be misinterpreted. As following excerpt shows, the location of the vehicle is an "index" of the activity that the customer is conducting. Thus leaving the vehicle in specific locations on the forecourt can be important. In this excerpt the customer moved the car from the pump before she entered the store.

1	C: Good, heh I just thought that, I thought, wonder what they think if I start driving now, so actually you, don't
2	want us to, right now there weren't [any cars but
3	Staff: [for my for my sake, you could gladly stay still
4	C: Okay, so it's [better to do so?
5	Staff: [Exactly
6	C: Even if you might create a [queue then?
7	Staff: [Exactly
8	C: Okay, then I know that to another [time
9	Staff: [Yes, very good

Excerpt 1: Conversation between C. and Staff after C. moved the car from the pump.

In the excerpt the customer displays uncertainty whether she should have moved the car or not before she entered the store. She states that she got confused as she sat in the car and started to move it. The staff informed the customer that it would be better to leave the car by the pump until the petrol was paid.

There are two reasons why the staff did not like her initiative of moving the car from the pump. They are not made transparent in the conversation, (The staff only hints that it would be better *for his sake* if she didn't move,) but are accumulated throughout the fieldwork.

First, refuelling is more than filling a tank with gasoline you have to pay for it too. Paying for gasoline is highly mundane. Customers refuel and afterwards staffs enforce customers to pay while making sure that they pay for the amount of petrol that they refuelled. The relation between the location of the car and the location of the pump is an index of the purchase of petrol, without it (as in excerpt 1), it is much harder to verify the correct purchase. Secondly, moving the car, prior to paying, is seen as a possible act of "fill up and run", i.e. when customers refuel and drive away without paying for the gasoline. This is a severe problem for the petrol retailing industry.

Still the actions of the woman in excerpt 1 were not made under any illicit pretence. She moved in an effort of making the pump available for other customers. Her concern was how her car occupying the pump would limit the flow of customers using the pumps. She felt she was *in the way* of others using the petrol station. Even though she was only walking into the store to pay for the gasoline. In a situation, as she states, where there is no queue on the forecourt, thus she moved, not only as a response to other customers present, but also as a response to customers that might arrive while she was in the store.

The concern of being in the way of others when entering the store is particularly problematic for those that buy groceries subsidiary to refuelling. Instead of moving the car, other tactics can be used to attend to the risk of being in the way. As in the following excerpt when a woman leaved the car at the pump, after refuelling. While she walked towards the store, picking up her mobile phone to talk. When she arrived at the store she came in eye contact with one of the staff members.

1	D: I'm only going to check a little in the store, is that okay?
2	Staff: sure
3	D: I have refuelled outside there

Excerpt 2: Woman asking permission to walk around in the store.

The woman refuelled and entered the store. Inside, she walked around to buy groceries. However, she was tense and wanted confirmation from the staff that it was ok for her to buy groceries. Thus she informed the staff that it was her car by the pump and they could help her in not being in the way. She incorporated the staff, informing them of the customer's purposes.

Others try to keep an overview of the situation on the forecourt by themselves while they are picking groceries. They walk back and forth in the store, continuously checking the flow of cars on the forecourt to see if they are *in the way*. At several occasions customers approached the counter to pay for the gasoline before they continued into the store in order to buy groceries or other tasks. Thus they finished the "petrol purchase sequence" and the car by the pump was no longer needed as an index (see excerpt 1). Even though they seldom walked out and moved the car before they had picked out and paid for the groceries. By keeping an overview of the forecourt customers can continue buying groceries as long as no queues are forming on the forecourt.

The coordination between various requests and intentions among customers becomes particularly complex as they try to be at two places at the same time making sure that they are not in the way. Whereas some, as the woman in excerpt 1 overcompensated her effort of trying not to be in the way faced the problem of making the payment of gasoline more complicated. Others, such as the woman in excerpt 2 was concerned that she might have been under-compensating the risk of being in the way by purchasing groceries when the car was parked by a pump. Thus, they shared the petrol station by acting, as they found appropriate for the situation, but also by negotiating with others, trying to find out whether their activities where perceived as appropriate.

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 where in the way. The time these activities where expected to take, also played an important role in the way they avoided blocking 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.

DESIGN IMPLICATIONS FOR TECHNOLOGY USE AT PETROL STATIONS

Increased use of mobile technologies at complex settings such as the petrol station is to be expected. However we still have the possibility to design for a limited impact. Through fieldwork at the petrol station we found that:

- Mobile technology use increases the complexity of engaging with the activities at the location.
- Co-presence has a direct impact on mobile technology use and should therefore be accounted for in design
- Customers, while using the services at the petrol station face the risk of being *in the way*
- Being *in the way* is not only limited to the customer but to the customer's vehicle, when the customer is located elsewhere at the petrol station.
- Customers can also overcompensate while trying to avoid being *in the way* when they are not in the way at all

We also found that people at the petrol station attended to various tactics to minimize the ambiguity of being *in the way*, where both the mobile technology user and those that are co-present of its use attend to the situation. The following list is not exclusive, but these tactics where frequently observed:

- Customers and staff divide the location into "zones" where specific activities are more or less appropriate.
- The "zoning" of the place rely on available spatial arrangements.

- Customers use their cars to display how long they intend to stay.
- Customers moved back and forth between the “zones” of the petrol station depending on which service they attended to.
- Customers informed the staff, so that cars could be coupled to their owners.
- Customers walked back and forth in the store to gaze out on the forecourt, to see if their car was in the way.
- Staff occasionally told customers that they were in the way of others.

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. Thus we propose four design approaches for non-obstructive ICT-use.

FOUR DESIGN APPROACHES FOR NON-OBSTRUCTIVE ICT-USE

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 [18]. It is likely 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 [2]. However at locations, like the petrol station, levelling between either taking time or taking place can become even more complex. 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.

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 4]. “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.

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 [7]. 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.

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 or less time. This approach is similar to the proposal for situated information spaces that Fitzmaurice [13] suggests. Even though the motivation for the two approaches differ. Between the user and the technology this

cannot be considered a *calm technology*, however reminding the user of his/her location might create a *calm environment*, as proposed by Intille [17].

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 [10].

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.

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 [17] 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 5, pp92-107]. The vast possibilities of co-presence have only started to be explored in system design for mobile technologies [see e.g. 11]. 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 ICT-use*. 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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To be added later

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