Q

- A closer look at groups and technology in queuing

Anders Eriksson

Blekinge Institute of Technology
School of engineering
Box 520
SE – 372 25 Ronneby
Sweden

Supervisors:
Hans Tap
Isa Hardemo
This thesis is submitted to the School of Engineering at Blekinge Institute of Technology in fulfillment of the requirements for the degree of Master in Human Work Science. The thesis is equivalent to 20 weeks of full time studies.

Contact Information:
Author:
Anders Eriksson
E-mail: mortivore@postmaster.co.uk

Supervisors:
Hans Tap
Isa Hardemo
Abstract
This thesis is the result of a project done on the subject of queuing, looking mainly at the behavior of the people doing it and relating it to the context they are in. The focus is on the notion that queues are not only made up of individuals but also groups, a notion that has previously been overlooked in studies of queues. This thesis is based on ethnographic studies and is strongly related to design of technology for supporting queuing situations. The main focus in the design is on supporting groups, flexibility and mobility in queues.

Keywords: Queuing, groups, fieldstudy, design.
Contents

RESEARCH QUESTIONS ........................................................................................................................... 1
INTRODUCTION ................................................................................................................................. 1

  Thesis Structure ................................................................................................................................. 2

METHODS & METHODOLOGIES ....................................................................................................... 2

  Ethnomethodology ............................................................................................................................ 2

FIELDSTUDY .......................................................................................................................................... 3

  The Café .............................................................................................................................................. 3
  The Pharmacy .................................................................................................................................... 4

WHAT IS QUEUING? ............................................................................................................................. 4

GROUPS AND SPACES IN QUEUES .................................................................................................... 5

  The F-formation .................................................................................................................................. 5
  The importance of the physical space ................................................................................................. 7
  Supporting groups with technology ................................................................................................. 9

WHEN TECHNOLOGY FAILS ................................................................................................................ 10

  Repairing breakdowns ....................................................................................................................... 10
  Aftereffects of breakdowns ............................................................................................................... 12

DESIGN IMPLICATIONS ...................................................................................................................... 13

  Workshop .......................................................................................................................................... 13
  Design process ................................................................................................................................. 15
  Design Proposal ................................................................................................................................ 15
  The design ......................................................................................................................................... 15

DISCUSSION ........................................................................................................................................... 18

ACKNOWLEDGEMENTS ...................................................................................................................... 19

REFERENCES .......................................................................................................................................... 20
Research Questions

The topic of this master’s thesis is queuing. The purpose of studying this public phenomenon is that I want to create a better understanding of how queues are created and maintained. To do this I have chosen a few different angles through which I have aimed the study and analysis, these are what makes up my research questions for the project. Besides looking at the basic structure and organizational features of queuing I have tried to relate it to the physical space in which it occurs. In short this means that I have studied the effects that the physical space has on the queuing itself. One question I have tried to answer is: How does the arrangement of the physical surrounding affect the behavior of the participants in the queue? Another subject that I have explored is queuing technology. This is closely related to the previous subject in that it is also part of the physical space. The difference is that queuing technology is aimed directly at controlling the properties of the queue while artifacts like furniture in most cases are not. My main interest here is to find out how queuing technology shapes the queue and how it can affect the behavior of the people in it. One of the questions I have tried to answer here is: How does the technology facilitate or restrict the participants of the queue to move around while waiting their turn? The last angle and perhaps the most important is about groups in queues. Queues do not only contain individuals but as I will show in this thesis groups are also common. One big question that I have tried to answer here is: What are the special properties of groups in queuing and what does this impose on design of queuing technology?

Introduction

This thesis is the result of a project done on the subject of queuing, looking mainly at the behavior of the people doing it and relating it to the context they are in. My initial interest in queuing comes from the fact that it is a frequent activity in daily life. If you at one point during a day go into a store or use a service you are likely to participate in some sort of queue. Queues are often seen by the participants as something negative, it is time wasted on doing nothing except waiting and in many cases it’s a source of frustration (Carmon et al 1995, p 1806). The fact that a frequent activity such as queuing is often perceived as a negative experience is reason alone to do research on how you can make it better. To do this however you need to develop a better understanding of how queuing actually functions and that is why I have done studies on queuing in my project. This thesis will discuss the findings of my studies and out of these discussions I will develop ideas and thoughts on how you can make queuing better and more enjoyable. These thoughts and ideas will revolve around the use of technology in queuing since I believe that it can contribute a great deal to make queuing a more positive and rewarding experience.

For more information on queuing technology I recommend these websites:
http://www.q-matic.com/
http://maskavia.com/tom.htm
http://www.nemoq.se/
Another big part of my thesis is to go beyond the notion that queuing is done by individuals only. In my studies I often saw groups of people queuing and they behaved differently than individuals. This makes it interesting since group behavior in queuing is a relatively unexplored subject. In this thesis I will try to show that groups are an important part of queuing and that it is a relevant subject to study when thinking of design to support queuing.

**Thesis Structure**

This thesis is structured in what I hope to be a logic way. It will start off with describing the methods and methodology I have used in the project. Then there is a part about the field studies I have done and where they have been located. After this the actual analysis starts off with a brief description of my definition of a queue. This is followed by the first of two parts of the analysis, the discussion around groups and space in queuing. The second part of the analysis will mainly be concerned with queuing technology and its shortcomings as I have witnessed them in my studies. The concluding part of my thesis will naturally be dedicated to the design proposal that I have arrived at through the studies and analysis.

**Methods & methodologies**

When doing research there are countless methods that you can use and you can crudely divide them into either quantitative or qualitative. Although these two kinds of methods can be used together they have many times been presented as rivaling methods (Tashakkori & Teddlie 1998, p 3). People tried to prove one better than the other but now there seems to be more interest in mixing these methods to achieve better results (Tashakkori & Teddlie 1998, p 5) even though these two methods are fundamentally different. Quantitative methods are made to get a lot of information quantity by for example making questionnaires. With this method you get a lot of data but it is not very in depth. Qualitative methods on the other hand are made to get smaller quantities of data but instead it is much more in depth and precise. One example of a qualitative method is ethnographic studies, which are detailed studies located in a real setting, such as a café or airport. In my project I chose early on to focus on qualitative methods, mainly ethnographic studies. I based this decision on the fact that I wanted to get a detailed understanding of the actual activity of queuing such as it happens in a real setting. For this a quantitative method would be unsuited since it does not provide detailed information on behavior in a specific setting. Another reason for me to choose qualitative methods is to avoid abstraction and theorizing, since I am trying to keep to a school called ethnomethodology.

**Ethnomethodology**

Giving an absolute and correct description of what ethnomethodology is would probably be next to impossible. However to get some understanding of it I will use Eric Livingstone’s brief summary of it:
“Saying that ethnomethodology is the study of people’s common, everyday methods gives an initial idea of ethnomethodology’s phenomenal domain.” (Livingstone 1987, p 10)

As I see it ethnomethodology can be used in many different ways, but one of the mainstays of it is that it is concerned with the study of the actual activities as they occur in everyday life. This means that it takes a stand against abstract laboratory studies of human activity and the abstract theorizing that goes along with it. Instead ethnomethodologists want to see what “really” happens and not distance themselves from the actual activity. I believe this to be a great way of thinking when studying human activity, in order to understand it we have to look at it in detail as it happens in everyday life. In my project I have tried to keep true to ethnomethodology, doing ethnographic field studies and trying not to draw abstract conclusions and make theories.

**Fieldstudy**

I have primarily focused my fieldstudy on two locations, a café and a pharmacy. The café has a traditional line up queuing system where you physically place yourself in a queue while the pharmacy uses ticket and display queuing technology. I chose these two places because I wanted to study ordinary queuing opposed to queuing with technology.

**The Café**

The Café is located in the center of Ronneby and besides a wide assortment of coffee they also provide different kinds of food. I wanted to study a place were they did not use technology to arrange the queue. One reason I chose this café is that it has such a small area to queue upon, so at lunchtime it gets pretty cramped in the area between the register and the entrance. I thought that this might create some interesting queuing situations.

The café has one register but the staff often uses both sides of it to serve customers, so two customers can be served at the same time. On each side of the counter there are glass displays. Facing the counter the one on the right contains food, such as salads and baguettes and the left one contains bread and cookies (see fig. 1). On the wall behind the counter there is a big black board with products and their prizes written on it. Further to the right after entering there are tables and seats and this is where people go after they are done queuing.

![Figure 1: Sketch of the café](Sketch_of_the_café)
The Pharmacy

The pharmacy that I did my studies at is fairly middle-sized and it consists of two sections. One non-prescription section where the customers can pick the products themselves and one prescription section with counters at which you buy your medicine with a prescription. I have focused on the prescription section since they have a ticket and display system for supporting the queuing. When a customer enters the prescription section they take a ticket at the ticket-dispenser and then wait for their number to come up on one of the displays above the counters. Behind each counter there is a control box that the staff uses to push the numbers forward. When the number changes a “pling-plong” sound is heard and the number on the display above the counter that is free flashes. To the right of the entrance the place opens up into the non-prescription section (see fig. 2). Along the wall opposite to the counters are chairs for the customers to sit in.

![Figure 2: Sketch of the pharmacy](image)

What is queuing?

Queuing is a socially produced activity that is often arranged by the participants themselves. I have looked closely on queuing and I have seen that there are a lot of signals and behavior from the participants that has the purpose of arranging and maintaining the queue. This means that the queue is produced and maintained through the visible actions of the participants (Livingstone 1987, p 12). In fact if these actions were not made (or made visible) and the social moral that states the rules of behavior in the queue were not followed, the queue would break down. A break down like this can utter itself in someone butting in line, or someone not moving along, creating too much space to the person in front thus “holding up” the line. In these cases one or several people has ignored the behavior of the other participants that show how the queue is produced and how you should adapt to it. The notion that people make their actions visible and that other people arrange their behavior according to it is not new. In Computer Supported Cooperative Work (CSCW) literature there are special terms that address this called awareness and accountability (Martin et al 1997, Hughes et al 1992). So it is a well known fact that our actions are made visible and that others interact according to them.
The physical space is another important factor when looking into people’s behavior in a public space. Before I go further with this I would like to make it clear what I mean with physical space. Paul Dourish distinguishes place from space, where place is concerned with the social interactions while space is all about the physical layout of a setting such as furniture and other artifacts. (Dourish 2001, p89). This description fits nicely with my conception of the physical space. What I mean with this term is how the artifacts and people are physically arranged in the actual setting. The physical space contributes to how the queue is arranged. It can be artifacts such as metal bars that form a path to queue in, or it could just be the way a café is shaped. For instance, if the physical space is small (as in the case of the café in my study) the distance between the members of the queue is likely to be smaller than what would ordinarily be appropriate if the physical space was not restricted. So what would be considered strange and out of place in one setting can be fully acceptable in another. In short, how the queue looks and functions and what is acceptable or not is affected by the physical space. Naturally the physical space can also restrict or improve how well a queue functions. I will dive deeper into this subject later on in this paper.

Groups and spaces in queues

Texts about queuing normally describe a queue as consisting of individuals. Even if the texts consider the whole queue as a group I have yet to read something about groupings in the queue. Groups within queues exist, particularly in places like the cinema or a café where groups of people (or couples) are more common than individual customers. In this part I will account for my findings on groups in queues at the café I have studied. I will try and make visible the fact that groups act differently than individuals in queues, and that this has importance when thinking about the design of new technology for queuing. After this I will discuss a case from the pharmacy study that concerns the physical space and how the queuing technology affects its use.

The F-formation

In Conducting interaction Adam Kendon writes about how people group themselves in public areas. What he calls the F-formation is whenever “two or more people sustain a spatial and orientational relationship in which the space between them is one to which they have equal, direct, and exclusive access” (Kendon 1990, p209). This means that the people in an F-formation create and sustain a space between them that they own and that outsiders are not allowed to share. The “F” in F-formation is not connected to the shape of the formation, it can be of many different shapes. Some examples may be a circle, half circle or even two people facing each other. The notion of F-formation is relevant to my study since the visitors in the café are seldom alone but instead groups of two to four people seem to be the most common. I closely watched these groups and how they grouped themselves in the queue and found some interesting scenarios that support Kendons theories on how groups want to create a private space.

When queuing there are spaces between the participants, it is rare that they stand pressed up against each other. These spaces are acts of respect towards ones own and others personal space. Personal space is the space that surrounds a person, this space is
regarded private and any unwanted entrance into this space is considered an intrusion of privacy (Goffman 1971, p52). Another way of respecting the personal space, as well as maintaining the visibility of the queue, is to stand with your back against the person behind you in line. This behavior sends out the signal that you are not in a group with the person behind you. The private space created in an F-formation also carries the properties of the personal space, but perhaps not in such a strong sense. The point here is that of a small dilemma when trying to uphold some kind of mutual and private space within a group and at the same time maintain the appearance of the queue. I will make this clearer with a scenario I witnessed at the café:

11.25
A group of four young men come into the café. The counter is free so they position themselves there and form an F-formation. They stand in a half circle facing each other, each of them just turning away when they place their order. (see fig. 3)

![Figure 3: F-formation at the café](image)

11.26
Another man, not a member of the group, comes in through the door. At the sight of the man the members of the group turn to face the counter instead of each other, still standing in a half circle. (see fig. 4)

![Figure 4: F-formation dissolved](image)

The interesting thing here is the group’s behavior as the non group member comes into the café. As the group was alone in the queuing area and they formed an F-formation, they probably didn’t feel that they were queuing. When the outsider came in this changed, a queue formation was inevitable. In turning their backs they produced a visible feature of queuing because having your back to the person behind you in line is the normal thing to do in a queue. However, the group was standing in front of the counter when the outsider came in, so even if they hadn’t turned their backs the outsider would
have understood that they were ordering. So why did the group members turn their backs? I believe that the answer lies partly in that it is a queuing area and partly in what Kendon calls r-space. According to Kendon’s observations an F-formation also tend to have a surrounding area outside of the formation which “functions as a buffer, protecting the system from outside influences” (Kendon 1971, p234). The group members are aware that they are standing in a queuing area, so when the outsider comes in they realize that he is going to position himself within their r-space and more importantly he has every right to do this. The fact that they stood in a queuing area took precedence over the groups F-formation. The dilemma of maintaining the visibility of the queue and withholding the F-formation was solved by compromising the F-formation to a half circle where they where not facing each other.

I witnessed more examples of this kind of behavior, compromises in F-formations that allowed the people to keep some kind of mutual space and still maintain the queue. I would like to explicate this further by illustrating one of these examples:

![Triangle formation](image)

Figure 5: Triangle formation

The triangle (see fig. 5) is a formation I saw often when groups of three entered the queue and there was a lot of people already in line. Instead of standing all three next to each other the third person stood close behind the other two. Standing three in a row would have been a more equal formation but in the triangle the one standing behind is kind of outside the formation. In the cases I saw, there wasn’t really a lot of room to stand three people next to each other, this could also make it look like one of the three were standing outside the queue. The triangle formation is normal when three people meet in public places other than in queues, but then everyone faces a space in the middle creating a private space. In the dilemma of maintaining the appearance of the queue this is turned into a formation where everyone stands with their back to the same side, which is normal in a queue.

The point of this discussion around group formations in queues is to shed light to the fact that queuing does not have to be individuals standing in a line. It is also important to see that group formation can be problematic in some queue settings and this can put implications on design of new queuing technology.

The importance of the physical space

“Activity is always located. A person doing something always does it somewhere and his doing always entail a relationship to the space which has in it the objects or people with which the doing is concerned.” (Kendon 1990, p 210)
The queuing at the pharmacy is fundamentally different than at the café. Much of this is due to the fact that the pharmacy uses queuing technology. The ticket and display system changes the way people queue. The responsibility of maintaining the actual order and appearance of the queue is largely transferred from the participants to the technology. Even so, the physical space still plays a big role in the actual queuing. As I explained earlier the pharmacy has chairs along one wall and counters on the opposite side. This means that there is a quite large open space between the counters and the chairs. This area could be used by customers to stand and wait (if the all the chairs were occupied) or to simply walk around on, checking the folders and products that are placed here and there. The reality is that it is almost never used and I have only ever seen it empty (except when people go across it to sit down or to attend a counter). The reason for this I believe lies in two different factors. The first is personal space and the other is how you normally queue opposed to how you do it with the technology. The first reason, personal space, has a lot to do with how the physical space is organized. As I wrote above the personal space is a space that surrounds a person and any unwanted entrance into this space is considered an intrusion of privacy (Goffman 1971, p52). This space can be elongated in some circumstances, for example when watching television the space in front of you up to the television set is claimed space, people walking or standing in this space will be considered intruders. Adam Kendon calls this space transactional segment and it has a direct connection to the activity of the person and the artifacts that are involved (Kendon 1971, p210-211). You might be able to see where I am going with this now. The open space between the chairs and the counters is indeed the sitting people’s transactional segment. I would like to take an example of this from my field study at the pharmacy:

14:55

The pharmacy is pretty full and all except one of the seats are taken. Two girls come in together and they take a ticket and go back to stand at the entrance of the section. After a couple of minutes two seats become vacant and the girls go and sit down.

This is one example of several that I witnessed where people resorted to stand and wait at the entrance of the pharmacy as all the chairs were occupied. It looks kind of odd when people stand in the small space at the entrance with a big open space in front of them that could be used. But as I said above this space is occupied by the sitting people as they look across this open space to see the displays, counters and a television set placed there. This can potentially create problems as the space at the entrance of the pharmacy is where people enter and exit. If enough people have to resort to this space to wait then they will block the entrance, perhaps deterring customers from entering the pharmacy or at least making it problematic.

The second reason for the space not being used is a notion of how queuing normally functions when there is no technology involved. It generally works in a first come first serve manner and people stand in the order that they came in, the first one closest to the counter and the last one furthest away. The physical placement of the bodies indicates the order here and you are not free to place yourself where you like. If you come in and place yourself before people already standing in line you would be breaking the rules of the queue. At the pharmacy the order of the people queuing is not
linked to the placement of the customers’ bodies. This does not mean that you can not cut in line however. If someone was to position themselves in the opens space between the chairs and the counters this could be perceived, by the people in the chairs, as cutting in line. Placing yourself in front of someone is strongly tied to the notion of being ahead of that person in the queue. This makes it problematic to use the open space to wait unless your turn is up next.

This issue also has importance in the group aspect of queuing that I discussed earlier. Although it is not as common in the pharmacy groups or mainly couples exist in this queue setting as well. I have witnessed that people tend to try and place themselves in the chairs so that they don’t sit next to a stranger if it can be avoided. This makes it harder for groups or couples to find seats next to each other. This is exactly what happened in the example above. The two girls could not find two seats next to each other and had to resort to waiting at the entrance.

**Supporting groups with technology**

The issue of the previous part with the unused open space is, to a large degree, created by the layout of the physical space but the ticket and display queuing system also contributes to this. The system creates a focus around the displays so that the customers can feel reluctant to move around freely while waiting. Of course the same is true at the café where the customers are forced to stand at a certain place. The queuing technology relieves this problem at the pharmacy but the focus of the displays and the layout of the physical space still make it harder for groups and couples to queue in a group formation. The problem is the same at both the pharmacy and the café, namely that there is too much focus on one place. The customers can not move around freely while at the same time feel comfortable queuing. Of course there will always be some focus on the actual goal of the queue since that is why people are queuing. However I believe that with new design of queuing technology it is possible to relieve some of that focus. This is not just a question of comfort for the queuing customers but also one of economic interest for the company. In an interview with one of the pharmacy employees my subject told me that they would probably sell a lot more if the customers could move around more freely and look at the products while queuing. This is natural since having the customers see more of the products is a basic strategy in marketing. I will not dive deeper into the economic side of this issue since my interest lies in the customers’ actions and how technology can support the actual queuing better.

Technology that allows the customers to move around freely while queuing can also help make the waiting more enjoyable. It will provide the waiting people with something to do, and it can also be used to provide entertainment. There are examples of this, the Manhattan Savings Bank in New York had entertainment in the lobbies of their offices, such as pianists and even dog exhibits (Larson 1987, p.897). Distractions like this can make the waiting a more pleasant and acceptable experience (Rongrong Zhou, Dilip Soman 2003, p.518). So it is not just a question of allowing customers to move more freely, it is also a question of making it interesting and rewarding to do so. The baseline of this is that by making the queuing more flexible it creates more freedom for the customer. They can move around or stand still but the important thing is that it is their choice and that they can feel comfortable queuing regardless of where they are physically
located. John McDonnell points out that all customers don’t view the waiting and queuing in the same way therefore making a uniform strategy for handling waiting unfitting (John McDonnell 1998, p.1524). This is another reason to make the queuing situation more flexible so that it gives the customers more control over their choice of how to spend their waiting time.

**When technology fails**

When trying to better existing technology I believe it is important to look at the shortcomings that exist. In this part of the report I will account for some of the problems that I witnessed with the queuing system at the pharmacy. In bringing these problems up for discussion my hope is to raise some awareness of them so that they can put implications on the design of new queuing technology.

**Repairing breakdowns**

Most of the problems I saw with the ticket and display system caused breakdowns in the queuing, some small and some bigger. What I mean with breakdown is when the technology fails to its job in one way or another and outside help is needed to repair the situation. The ticket and display system at the pharmacy is an output only system, at least for the customers. The only input that the customer does to the system is to press a button to get a ticket. The displays and the ticket itself are outputs from the system. Since there is no possibility to input anything into the system it makes it really hard to repair the possible breakdowns it may cause. In an ordinary queue (without technology) a breakdown, such as someone cutting in line, can be resolved by the customers. As the customers themselves are responsible for the appearance and function of the queue they can “input” to the other customers by using verbal communication. In the pharmacy the customers are not responsible for the queue, the queuing technology is. As the customers can not input anything to the actor responsible for the queue function it takes away their power to repair breakdowns. I saw some examples of people repairing situations that could probably have become breakdowns at the café.

11:30

There is a medium sized queue now and one man seems to be standing a bit too far out of what you could call the queuing zone. He also has his back turned to the rest of the queue and he is partly facing the display of salads and baguettes. The woman supposedly after him in the queue asks him if he is standing in line and he says that he is not because he is thinking of what to order. (see fig. 6)
In this situation the man has positioned himself in a way that makes the woman behind question whether he is standing in line or not. To solve this dilemma she asks the man and gets an answer. Although this specific situation would probably not occur at the pharmacy there are similar situations that I saw happening there.

16:30
A counter gets vacant and the pharmacist behind it pushes the button and the number changes and a sound is heard. No one comes up to the counter so the pharmacist yells out the number. A man reacts and hurries up to the counter.

When the sound that the system produces at the switch of numbers does not grab the attention of the next customer the staff always have to shout out the number. This is not just true at this particular pharmacy. After reading a report I found that this behavior was also found in a study of another pharmacy using the same queuing technology (Helgeson et al 2002, p.19-20). If someone would not step up to the counter at the café, the other customers behind her could easily remind her to do so. This is hardly possible at the pharmacy because no one really knows who is next in line since that information is the queuing technology’s responsibility to keep track of. As I see it the fact that the staff has to shout out the number at all is a shortcoming in the queuing technology. By shouting the staff brings attention to herself and the potential customer next in turn from all the other customers. Besides the extra work for the staff there could also be an inconvenient factor in this, some people may not enjoy getting the full attention of a whole room full of people. This is not something I have researched enough to claim but it could be something worth looking into for further research in this area.

The main problem with this however is linked back to what I wrote about flexibility earlier. The sound that indicates a shift of numbers does not tell you anything about what number that has come up. This means that in order to be aware of your place in the queue and know when it is your turn you have to keep a close look at the displays during the waiting period. Of course the staff tries their best to keep everything flowing and everyone informed, that is why they shout out the number. Nonetheless its shortcomings like this that has to be avoided to create more flexibility in future queuing technology.
Aftereffects of breakdowns

Some breakdowns don’t just cause problems when they occur, they can also cause aftereffects later on. By aftereffects I mean that they cause problems a while after the actual breakdown occurs. This is an important aspect as it shows the delicacy that handling a queue requires. An error at one point in time may cause complications later on. I witnessed a situation at the pharmacy where the system literally broke down and it had both immediate effects and aftereffects.

15:20
A man walks in and presses the button on the ticket dispenser. No ticket comes out. He presses it several times in a row, still nothing happens. He turns to look around. He turns back to the machine and presses it several more times but with the same result as before. “Now it’s screwed” he says. He walks up to an empty counter and says “The tickets are out” in a loud voice into the staff area. Shortly after one of the staff comes out and opens up the dispenser and sees that the notes has got entangled. She fixes it and hands a ticket to the man.

The ticket dispenser broke down and had to be repaired by the staff. This had the effect that no one could get a ticket for a while. These kinds of breakdowns are hard to avoid completely since technology isn’t perfect and it breaks sometimes. Although as you will see this case does prove my point about how delicate it is to handle queuing situations. Five minutes after the ticket dispenser broke down this happened:

15:25
One of the pharmacists presses the next turn button but none of the two customers (a man and a woman) reacts. She says “Anyone got 388?” but no one answers. The pharmacist continues to say “Or did it get mixed up now with the tickets?” The man, that didn’t get a ticket from the machine before, answers: “I got 390” “Anyone have a number under 390?” says the pharmacist. Both I and the woman shake our heads. “Then I will push it forward” She says and the man walks up to the counter. The sound is heard three times in a row.

The order of the tickets got mixed up when the ticket dispenser broke down and got repaired again. This caused a situation where the system had lost track of the order of the queue. If the system can no longer uphold the order of the queue, the situation has to be repaired by another actor, i.e. the staff. The pharmacist in this case solves the situation by questioning the customers. It took the combined effort of the staff and customers to solve the situation since no one of them knew the whole order of the queue because that is the queuing technology’s responsibility. Aftereffects like this one doesn’t just occur when the queuing technology breaks down, it can also happen if someone does not follow the order of the system. When talking to the staff at the pharmacy and reading queuing literature I got to know that a common problem for the staff is when someone misses their turn (Helgeson et al 2002, p.19-20). What happens is that someone will miss their turn and then come up to a counter pleading to get served anyway. The staff willing to keep the customers happy has to solve the situation so that the customer gets served even though
she missed her turn. The queuing technology lacks the ability to fix situations like this, instead it is yet again up to the staff to repair.

Design implications
The structure of this part of the report is as follows. I will first describe the workshop that I held that proved to be very useful and interesting and it therefore it has its own section in this part of the thesis. After that I will briefly discuss my design process. Last but not least I will get to the actual design where I propose my ideas for dealing with the issues and possibilities with queuing that have been discovered during this project. My design proposal is based on the results from the field studies that I have conducted and analyzed. This is the biggest part of the foundation that I have built my design implications on, concrete findings from actual settings.

Workshop
The workshop was an initiative to get more thoughts into the design of queuing technology. It was arranged by me and two other master students also involved in queuing. There were five participants, all students at Blekinge Institute of Technology and all educated in design of technology. The reason we chose these people was that we knew they could think creatively about design in the short amount of time that we had. We split the participants into two groups and I worked with the group of three people. The structure of the workshop was to first have a critique phase then a fantasy phase and last a proposal phase. In the critique phase the group identified eight main problems with queuing today as they saw it.

- The comparing-problem: The problem that you have to compare the number on your ticket with the display all the time.
- The Mobility-problem: The problem that you can not move around freely because of the comparing-problem and the focus on one place (displays).
- The Awareness-problem: The problem that you have to keep aware of when the number switches so you know if it is your turn or how long it is until your turn.
- The exploitation-problem: The problem that you exploit the waiting time in a bad way, it is spent waiting passively. There should be a better way of exploiting the time you wait on.
- The attitude-problem: The problem that people generally have a bad attitude against queuing. You should be able to change it into a more positive attitude by addressing the problems raised here.
- The time flow variable: The problem that you don’t know how fast the queue is flowing. In a queue without technology you can see how fast the queue is flowing forward, in a ticket & display system you do not.
- The time aspect: Similar to the time flow variable but not the same, the time aspect is the problem with not knowing how long it is until your turn.
- The location-problem: The problem that it can be hard to know how to locate the register you are supposed to go to.

Some of these issues are similar to the ones I have raised in this thesis. They are relevant issues that need to be fixed in future technology. I will skip giving an account for the fantasy phase and go directly to the proposal since the group pretty much made the proposal over these two phases. The proposal was to merge the ticket and the display into
one high-tech ticket. This sort of idea had struck me before as well when thinking about design of queuing technology. I have also seen other examples of similar solutions. It seems that it is a logical solution to merge the ticket and the display together. The ticket was supposed to have an animated circle diagram that indicated approximately how fast the queue was moving forward. This diagram would be complemented with a time in minutes that would show approximately how long you have left to wait. It would also contain directions on what register(s) currently available (See Pic. 1). According to the group this design solution would solve all eight of the problems raised in the critique phase.

First off the lack of a number to compare with would solve the comparing and awareness problems. The idea of combining display and ticket would also to some degree solve the mobility-problem since there would not be any fixed displays to focus on. When solving the mobility-problem you can move around and get more freedom perhaps solving the exploitation-problem. The circle diagram is meant to solve the time flow variable, showing how fast the queue moves forward. The time aspect is solved pretty straightforward through the digits showing the time remaining in minutes. Showing the register that you should go to at your turn solves the location-problem. Last but not least in solving all these problems the group hoped to change the attitude towards queuing in a positive manner thus solving the attitude-problem.

It is important to note that these are the ideas and results of the participants of the workshop and not the author. The design proposal from the workshop does not solve all of the problems completely and it is not founded in any kind of research. This is of course not expected either since the workshop only span during three hours. However some ideas in the design were very similar to the design ideas I had prior to the workshop. The most striking in likeness is the idea of combining the display and ticket to make the queuing situation more mobile and flexible. I do not believe this to be just a coincidence but rather it proves that arriving to this idea is a logical strain of thought. I probably influenced the participants to some degree as well, even if it was not on purpose.
**Design process**

The workshop was a three hour event and the structure of it was made so that the group would have time to find problem areas and design solutions to them. My design process was vastly different from this. I have done studies on the field, learned about queuing as an activity and most importantly my motive has not been to only locate problem areas. The results of my field studies presented and discussed in this thesis is more than just a review of issues and problems to be transformed into some kind of super design. Instead I see them as an account of queuing as the activity it is, carried out in the actual setting. The analysis in this thesis is not just a way of extracting problems but a way of finding interesting areas of queuing to think about design around. The thought of design has been with me during the whole project, sometimes focused and sometimes just at the edge of my mind. A lot of ideas have come up and been discarded and some of them have stuck to the end. This way the design becomes an adaptation of the activity seen during the fieldstudy instead of just a solution to a list of problems identified.

**Design Proposal**

My design proposal is an attempt to address some of the issues and possibilities discovered in the fieldwork. Although I have tried I could not make a super design to deal with exactly everything I found in the fieldstudy, and I honestly do not think such a super design would be any good. I believe it is better to address some issues separately in this case and not try to jam everything into one design. As the title of this thesis suggests the two most important things to address are flexibility and groups. These two subjects go close together as increasing flexibility will also support groups better. If we look back at what I wrote about groups in queuing at the café, the main issue there was the lack of possibilities for groups to act as groups. Because the members of the groups had to uphold the visibility of the queue they could not stand in a group formation. The flexibility in this kind of queue is very limited, you have to stand in line at a certain place. At the pharmacy you do not have to physically stand in line, the queuing technology does that for you. Although as I explicat ed in earlier this did not solve the issues with groups or flexibility. The focus on the displays in combination with the arrangement of the physical space made it hard to wait as a group and gravely impaired flexibility and mobility of the customers. My design proposal is made to be used in many different kinds of queuing settings, but here I will focus on the pharmacy and the café since these are two places that are very different.

**The design**

In my design I have merged the displays with the tickets in a similar way as the workshop proposal. As I mentioned earlier this is an idea that I had even prior to the workshop and the fact that the workshop group also arrived at this solution somewhat verifies its logic. The actual design is that of a small gadget with a display and two buttons, simple to understand and use (see fig. 7).Before the workshop I had thought a lot about how to show the flow of the queue and I was into the idea of a progress bar similar to those often seen on PC’s. After the workshop I realized that the idea of a circle diagram would be more suiting in my design. Showing the flow as a circle resembles the motion of a clock.
and I believe that this will make it easier to relate the diagram to its function. It also has some other functions but I will go deeper into detail later on. The buttons have easy functions because I want to minimize the interaction you have to do with the gadget to increase the freedom of the customer. It is important to note that I want the design to increase flexibility in queuing, not to be flexible itself. Having a flexible design would make the gadget harder to use, which is the opposite of what I want. This does not however mean that customers can not interact with the gadget in a fun and informative way; it just means that she is not forced to do it. The red button is used to control your position in the queue. Naturally you can not move forward at will but you can move backwards. This function will increase the mobility and flexibility of the customers. If they decide to go and do something while they queue they do not need to rush back to catch their turn if they are running out of time, instead they can choose to go back a few steps in the queue. Of course some kind of function to prevent accidentally pushing the button is needed, this can be solved for instance with a double-click requirement. This function can also solve some of the issues that I raised about the system breakdowns. If someone misses their turn this technology has the function to move the customer back instead of leaving it to the staff to fix. To further prevent people from missing their turn the gadget will vibrate when the customers turn is near. The blue button has a special function that I believe will be both useful and entertaining. It can project the time left on the nearest flat surface, similar to a projector clock (see pic. 2). My hope is that this is a function that will make it more fun to use the gadget in that the customer can actually do something with it and get a response. Another important aspect of this function is that it will help people with a visual handicap to see how much time they have left since the projection is bigger than the text on the display. Perhaps this will also create more visibility of the queue. If you see others projecting their time you can figure out who is ahead or behind of you. This would just be a secondary function though since I want people to move freely while queuing and not pursue each other to see where they are in the queue.

The circle diagram has several functions besides showing the flow of the queue. As you can see in figure seven the circle is divided into sections, each of these sections represents an individual or group in the queue. The red section is the “owner” of the gadget and the ones above are people ahead and the ones below obviously people behind in the queue. This function lets the order of the queue become visible even though the customer is not physically standing in line. The reason to show how many people that are ahead of the customer is that she gets a better feel of how the queue is flowing and how she is moving forward. The number of people behind is also important to show because it may prevent the customer from prematurely leaving the queue. People compare themselves with others, and seeing that there are a lot of people behind makes it look like they are in a better position thus it is less likely that they will leave the queue (Rongrong Zhou, Dilip Soman 2003, p.518-519).
As I mentioned earlier the sections of the circle can also show groups. If you look at the last blue section of the circle in picture seven you can see that it is bigger than the others. This shows the customer that it is a group of several people and not just one individual. Besides making queuing more mobile and flexible this is another function that will support groups in this activity. Groups generally spend more time at the goal (the register or counter) than an individual and this can be frustrating for the people behind if they are not aware that it is a group. By showing groups in the circle diagram it makes visible for everyone that it is a group and prepares them for a longer wait. Of course with the time left written out on the display one can argue that it doesn’t matter if it is a group or not, you know how long you have to wait already. This is true in one sense but consider seeing one person in front of you on the display and it says 10 minutes left. This could lead to confusion and anger, since it is not normal for one person to take ten minutes. I believe it is important to show the queue as it really is, groups and individuals. For the group this can also be convenient because only one of the members have to take a gadget as opposed to everyone standing in a line or taking a ticket. This is also where the red button is used, for groups to be able to insert how many they are.

The idea is that these gadgets will be found at the place of queuing, for example in the café or pharmacy and the customers will borrow them for the duration of their stay. I realized quickly that people most people today are already walking around with wireless gadgets such as mobile phones and handheld computers. If my design was to become reality it would not be a hard task to make a version of the software available for mobile phones. This way you can use your mobile phone to queue everywhere (if they have this technology) by simply downloading the program. It would look and work the same as on the gadget (see Pic. 3).

All in all I believe that my design has solved some problems and opened up for more possibilities than the old ticket and display system. I have identified four main points that are the mainstays of my design:

1. **Mobility:** The design increases mobility of the customers by removing the displays and thereby taking away the focus on one spot.

2. **Flexibility:** By increasing mobility and letting customers step back in line the queues flexibility is greatly increased.

3. **Visibility:** By showing a representation of the queue in the circle diagram the customers get a much better visibility of the whole queuing situation.

4. **Groups:** All of the points above and the possibility to see groups on the display create better opportunities for groups to queue satisfactory. This is perhaps the most important aspect of my design.

Although these four points are not the only things my design does for queuing they are by far the most important. They are points that were discovered in my fieldwork and adapted
in my design. One problem with this design is that it doesn’t completely solve the focus problem. There will always be some focus on the registers or counters and this could cripple the mobility. As in the example I had earlier with the two girls at the pharmacy this has a lot to do with the arrangement of the physical space. To better solve the problem with the focus on the counters I believe that you have to combine my design with a well-planned layout of the physical space. This layout has to be designed for the specific setting so that it supports the kind of queuing that is wanted. In the pharmacy you might for example want to have some place with chairs because a lot of the customers are senior citizens and wants to sit down. In the café on the other hand you might want to design the space so that people move away from the register as soon as they have ordered. This combined with my design that allows people to queue in a more mobile and flexible way could prove to be a successful queuing system.

**Discussion**

Looking at the makers of queuing technology today the trend seems to go towards preordering systems. This means that either via internet or telephone you can place yourself in the queue before you even get to the location of the queue. For example the company Nemo-Q² is developing a system that allows you to reserve a queue number using your mobile phone. While this kind of system is appropriate in some settings it would not be suitable for example in a café. Even though you can preorder you position in the queue the need for a good queuing system at the actual location is still needed because people do not always plan their visits ahead. I have looked mainly on queuing and design at the location of queuing but there is a lot of room for further research on queuing outside of the location especially with this trend in queuing technology. One interesting area here could be to look at when queues really start. I have noticed when walking the short distance from my school to a popular food place that people tend to start queuing already during this short walk. Even though you could run or walk past a lot of people thus getting a better place in the queue this seldom happens, people get into the queue in the same order as they walk to the food place.

In this thesis I have tried to show queuing as it actually occurs in two specific settings and I have also tried to shed light on an interesting area within this subject, namely groups. My hope is that I have also shown how ethnographic studies can influence design ideas and make them better adapted for their area of use. Although I perceive this as a successful project it was not always easy and there is still room and need for more research in this area. One of the main problems I had to tackle in the field studies was the inconvenience of studying people unaware of my activity. When in the field you do not want to affect the people you study by drawing unnecessary attention to yourself and this sometimes proved to be more difficult than I expected. At the pharmacy there were two things that made me stand out I was taking notes and I did not have a ticket. I received a lot of glances and suspicious looks and it took some time getting used to it. I had to find ways of looking at people without staring, such as looking just beside a person and catch what happened in the periphery of my vision.

---

2 Found at: [http://www.nemoq.se/](http://www.nemoq.se/)
As far as groups in queuing goes I have raised some issues in this thesis but it is still just a beginning. There is a need for more studies of this subject in other settings to find more important properties of groups in queuing. This is important for our understanding of queues and of course as a base for future design of queuing technology.

**Acknowledgements**

Although I have done this project on my own there are a lot of people who have helped me either directly or indirectly and I would like to give my appreciation to them in this section. First off I want to thank Hans Tap and Isa Hardemo for excellent advice and guidance throughout the project. For participating in the workshop I give thanks to Andreas Tuveson, Christoffer Adelgren, David Lennartsson, Fredrik Andrén and Håkan Nilsson you helped out a lot guys. I would also like to thank Håkan Borgman and Markus Eriksson for the useful discussions and for a lot of fun times in the project room. Last but not least I would like to thank my friend Christian Toft for making this an unforgettable semester.
References


