The practice of queuing is a daily experience for most of us and it is usually difficult to combine it with other activities. This indicates that people involved in the act of queuing become a bit too occupied with maintaining one's position in the queue. Despite that queuing is a common phenomenon, queuing situations are now often equipped with aids based on numbers that help regulating the queuing order. Still, the practice of queuing includes several nuances of social interactions that demands careful attention from its participants. Based on cases and concepts with varying levels of viability, this thesis investigates the practice of queuing as a design space. The thesis further suggests how a more flexible queue could be designed. An overall aim is to examine how to provide greater action space for participants in a queue and enable for new forms of interaction. In order to queue from a distance, much of what traditionally constructs the queue is redesigned. To address these issues from a usability point of view, it is a challenge to create an interaction design that allows different ways of queuing, without deviating too much from features that are evaluated as decisive to maintain.
On the practice of queuing
and new forms of interaction

Isa Hardemo
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There is something new, for example about my hands, a certain way of picking up my pipe or my fork. Or else it is the fork which now has a certain way of getting itself picked up, I don't know. Just now, when I was on the point of coming into my room, I stopped short because I felt in my hand a cold object which attracted my attention by means of a sort of personality. I opened my hand and looked: I was simply holding the doorknob.

Jean Paul Sartre (Sartre 1963)
Abstract

The practice of queuing is a daily experience for most of us and it is usually difficult to combine it with other activities. This indicates that people involved in the act of queuing become a bit too occupied with maintaining one's position in the queue. Despite that queuing is a common phenomenon, queuing situations are now often equipped with aids based on numbers that help regulating the queuing order. Still, the practice of queuing includes several nuances of social interaction that demands careful attention from its participants.

Based on cases and concepts with varying levels of viability, this thesis investigates the practice of queuing as a design space. The thesis further suggests how a more flexible queue could be designed. An overall aim is to examine how to provide greater action space for participants in a queue and enable for new forms of interaction. In order to queue from a distance, much of what traditionally constructs the queue is redesigned. To address these issues from a usability point of view, it is a challenge to create an interaction design that allows different ways of queuing, without deviating too much from features that are evaluated as decisive to maintain.
Stort tack…

Till alla er som på olika sätt varit delaktiga i mitt arbete med avhandlingen.


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7
1. Introduction

The present thesis addresses a common phenomenon, i.e. the practice of queuing, a daily experience for most of us. We queue in many places: at the railway station, a cash dispenser, post office, and pharmacy to mention but a few.

The movie *American Splendor* depicts a common queuing situation in the scene where the main character, Harvey Pekar, approaches a counter in a supermarket. He hesitates for a moment with his trolley to decide which line to choose. At that point there is a close-up of his face. You meet a frenetic gaze that keeps shifting and the text in the speech bubble reads: "Pickin' the right check-out line is an art... there's a lot of things you gotta consider...".
This familiar queuing situation might conjure up a variety of emotions in different people including frustration, hopefulness, security, suspicion, complacency or restlessness. The nature and strength of the emotions vary from person to person of course, but each and every one of us has probably at some stage picked a slow line-up just like Harvey Pekar who chooses the shortest line and ends up behind an older lady. This proves to be a real mistake as the lady pulls out a couple of discount coupons and asks to speak to the manager thereby causing delay.
As in the quotation from the line-up in American Splendor, research on the practice of queuing demonstrates that “there are a lot of things you have got to consider”. Detailed research shows that the practice of queuing exhibits several fundamental and quite intricate examples of social as well as computer interaction. Queuing is a basic phenomenon that most of us take in our stride and without much reflection on what is required of us as we stand in line. But if we are to develop our knowledge of new forms of queuing it becomes necessary to look into details and issues that might otherwise be taken for granted. It was this recognition that formed the starting point of the present research.

During the initial work with this thesis I was at a conference in Berlin waiting to get into the ladies toilets when another significant event took place. We were standing in quite a long queue, and had been waiting for a while. I stood behind two women who were talking anxiously about the risk of missing the next lecture if the queue did not move a little faster. Another woman overheard their conversation and the suggestion that they postpone going to the toilet. At this point the lady who is listening to the conversation becomes involved in the decision-making process by saying: "There is a toilet upstairs as well, and when I was there a few minutes ago it was almost empty." The two anxious women looked at each other thoughtfully and said: "You are suggesting we back down on our investment, we're already queuing up here!" Leaving the position of the queue they were already in would have been too much of a risk, i.e. their position could have deteriorated. They chose to stay in the queue. Perhaps the two women did not dare to take the chance and go to the other, possibly shorter, toilet queue. It seems it is more attractive and safer to
stay with what you have without taking additional risks – even if you could possibly end up in a better position.

So what constitutes a queue? The answer varies according to whom you ask. A simple way of describing a queue is that it consists of a group of people waiting their turn to receive the same service. A person who is an expert on queuing theory\(^1\) would probably say something like “a queue contains a sequence of values where elements can be added at the back, and removed from the front. I asked one of my dearest friends to define a queue and his spontaneous response was “queues are something that I avoid as much as possible because they are boring”.

And queuing is often boring for several reasons, not least because the act of queuing is primarily merely a means of taking part in another activity. It is something you must do in order to reach a point where you do not have to do it anymore. Current forms of queuing and how the queuing practices and queuing aids are devised inevitably influence our preconceived images of queuing. Alternative procedures could be used. And that is how I developed an interest in investigating the practice of queuing. It is also why I posit the idea that queuing should be seen as a design space for new forms of interaction.

\(^1\) "Queuing theory is a product of mathematical research that grew largely out of the need to determine the optimum amount of telephone switching equipment required to serve a given area and population. Installation of more than the optimum requires excessive capital investment, while less than optimum means excessive delays in service." (Queuing Theory, in *Encyclopædia Britannica*. Retrieved November 14, 2006, from Encyclopædia Britannica Premium Service: http://www.britannica.com/eb/article-9062252)
Surprisingly, what is generally considered to be a rather boring practice often generates lively discussions as people give eloquent accounts of their various queuing experiences\(^2\). Many stories concern line-ups in grocery stores: how people jump the queue, the irritation caused by people using their trolley to mark their place in the queue as well as people rushing in unison towards a newly-opened counter etc. The stories never seem to cease, and the interest in the queuing phenomena as well as the feelings evoked is a constant source of inspiration to me.

It is easy to become obsessed with queuing, as I discovered on one occasion when I found myself walking right towards a major line of people queuing up for some free tickets. It was a mere whim. I did not intend to join the queue but was merely looking to find a space in the line-up where I might be able to get through. When I was near the middle of the line I excused myself and asked if those in line could make room for me to pass. The people I had addressed willingly took a few steps back. I started to walk through the line as planned but suddenly I decided to stop and pretended to take a position in the queue. It did not take long before the polite people behind me became less friendly. They grunted and were just about to confront me when I explained that I was playing a prank. We laughed and I walked away having experienced some important things about queuing.

\(^2\) You are also welcome to send your queuing experiences to isa.hardemo@gmail.com
On another occasion, at the airport in Lisbon, I happened to get hold of a queuing ticket that indicated, quite incorrectly, that I had a physical disability. I did not realize my mistake: after having surveyed various buttons such as “lost luggage” and “other errands”, I had inadvertently pressed the “special needs” button. I naively thought that this was a button that would give me special service. Instead, to my surprise, staff came looking for a disabled person who had requested service by pressing the relevant button!

As a consequence of such experiences I have been able to compile quite a large repertoire of queuing stories based on my own experiences and others’; this has proved most useful in my research on the practice of queuing.
1.1. RESEARCH QUESTIONS

Queuing is an everyday experience for many of us and a practice that I believe will become more pervasive in the future. This is not because people want queues, of course; rather, it is because new forms of queuing will merge with other activities thereby allowing people to queue from a location physically remote from the queue itself.

The belief that queuing will gradually become more ubiquitous is not prompted by my interest in ubiquitous computing alone. Other factors include:

- Apoteket’s ongoing commitment to encourage visitors to make more constructive use of waiting time (both with regard to business and health).
- Computer-related research, e.g. Interaction design, CSCW, HCI, etc. which envisages ubiquitous computing and considers how future technologies may change our way of handling certain everyday activities.
- The fact that mobile phone companies and similar institutions are committed to providing applications for mobile services (where queuing applications could be one area of innovation).

My focus on the practice of queuing has developed in different directions during my research. It started with an interest in investigating how people standing in a queue use current queuing technology. It was prompted by a desire to make sense of others’ actions. The result, however, was a vast number of complex and intricate scenarios to reflect upon. I decided to
examine new forms of interaction by taking an even closer look at queuing characteristics. I have carried out a number of investigations which have focused on such questions as “What causes a queue?” “What qualities are decisive within a practice of queuing?” “How do people ‘read’ the queue?” and “How do they respond to fellow queuers’ actions?”. The thesis examine:

- What forms of interaction new technologies enable within the practice of queuing.
- How ideas about new forms of queuing might change and influence the practice of queuing.
- What criteria and ways of acting in the current practice of queuing should be incorporated into new queuing aids.

Furthermore, the concepts investigate whether the practice of queuing could be enhanced by:

- Illustrating order of priority other than numbers.
- Using other members as display.
- Creating another course of events at the queuing site.

The thesis addresses how a queue can be visualized and made more accurate, in order to create a more comprehensive action space for the participants in the act of queuing. The overall aim is to provide greater freedom of action for participants in a queue, and enable for new forms of interaction. Enhancing the visibility
of the queue should transform idle waiting time into a more flexible experience with more room for other simultaneous activities.

The title “On the practice of queuing and new forms of interaction” indicates that the present research is interdisciplinary and concerned with both the practice of queuing and the field of interaction design. There is a special focus on the social interaction between people participating in a queue and how this might change with the introduction of interactive technologies.
1.2. **METHOD**

The research method in this thesis is inspired by practices and traditions from the field of Interaction Design as well as Human Work Science. These are two disciplines that overlap at times when new forms of interaction and computer technology are integrated into current work practices. Consequently, these two fields of research share some traditions and methods.

Within Human Work Science there are, for example, far-reaching studies of social interaction and reasoning on the accountability of people’s acts. This is a type of material, which is generally of great interest in the field of interaction design, where user studies are carried out in similar ways. The interaction design party, on the other hand, can provide Human Work Science with additional analytical techniques for analysing and evaluating design qualities (Hardemo 2004).

**Design space**

The present research began with a feasibility study at a health centre close to a pharmacy, where queuing is one of the main activities and one which affects all other activities at the centre. This insight guided the chosen research approach towards an interest in studying the practice of queuing further. Accordingly, the focus of the present thesis moves from quite a narrow perspective on queues at the pharmacy towards a wider interest in queuing; it then returns to a narrow focus on how to create new forms of queuing.
Despite the separation of the fields above, the research process itself is not as clearly divided into specific and differentiated themes. Fields of interest overlap with each other, and they all include elements of fieldwork, analysis and design. The study of new forms of interaction is a large undertaking and several different perspectives are adopted in the present thesis.

To avoid intruding on people’s integrity and infringing on the privacy that characterizes pharmacies today, the number of photographs has been kept to a minimum and practically no video has been recorded. Instead, field notes have been collected and made as detailed as possible, accompanied by a few photographs or drawings in order to illustrate context. Photographs from the field reproduce entities and settings, while Illustrations of occurrences and sketches of design ideas are also included to complement the written accounts.

The queuing project is grounded partly in the empirical materials from the feasibility study, but the focus has also been widened and narrowed down with new accounts of the practice of queuing. Some cases are even collected in everyday queuing situations not found at pharmacies. The observations related to non-pharmacy situations are made in contexts.
where the same type of queuing aids are in use, or in situations that can be coupled to the subject of this thesis.

As illustrated above, both cases of queuing and design ideas motivate analytical reflections in different directions. Imaginations on new forms of queuing help guiding the principle of selection among the cases, i.e. help deciding what types of cases to analyse further. Or rather, a specific design idea might cause the exploration of a specific area within the design space.

In analysing the cases and evaluating queuing concepts, it is possible to return to the design space and successively build a clearer picture of the research focus. This is in complete accordance with Schön’s (Schön 1987) classical description of how problem setting and problem solving are worked out simultaneously during the design process. This is a way of combining experimental and analytical methods, and gradually shaping an image of the design space and the focus of the research in the present project. This design space is thereby influenced both by observations in the field, design ideas, computational possibilities and assumed needs to enterprises such as pharmacies. During the working process the image of the design space is gradually refined as greater knowledge is acquired of the practice of queuing.

**Materials merge**

A material of varying characteristics forms the basis for investigation. Some issues are examined with empirical material in the cases and other issues are invoked in ideas on new forms of queuing in the queuing
concepts. The knowledge these interventions result in is evaluated and compiled in the form of a concluding concept in the final reasoning. Since the purpose of this thesis is to work with queues as a design space, the goal is also to find suited methods for investigating this space from many angles. As will be evident, the practice of queuing is made visible both in the cases and in the concepts. This reveals the aspiration of using a combination of different materials as a basis for reasoning on queuing.

The primary idea of the design focus is to suggest conscious changes (Fallman 2003) and add new perspectives to how current queuing aids work in practice. Therefore, the descriptions will not always be what is typically regarded as "true" or "verifiable" in a traditionally scientific sense. On some occasions the descriptions are instead mainly fulfilling the purpose of designing new forms of queuing and considering what could be true in the future.

The goal has been to provide a concluding concept as outlined above. The intention is to have the concluding concept both contain the benefits from the current practice as well as generate new forms of queuing. And the idea is also for the concluding concept to be an asset both for analyzing current practices of queuing and in considering what features should be taken into consideration in future forms of queuing.

Both design considerations as well as analyses of queuing cases contribute to the understanding and the creation of corresponding descriptions of the queuing practice. In that way, the design ideas function not only as possible answers to recognized problems but are also an
essential part in the process of making practice visible (Tap 2001) as the
tradition of work-oriented design suggests. Problem setting and problem
solving are worked out simultaneously in accordance with Donald
Schön’s description (Schön 1983).

Similar to how ethnographies of work point back to the practice being
studied (Blomberg et al 2003) the concepts somehow reflects actual cases
that can be recognized in the practice of queuing. This is since the ideas
for possible new forms of queueing are shaped on insights that the cases
have generated.

Comparing the conceptions of what is and what could be (Blomberg et al
2003.) is a way of encircling a void and allowing some room for
innovation. In the present research, cases of queuing represent ”what is”,
while the concepts envision ”what could be”. The concluding concept
should be regarded as a combination of both.

1.3. RESEARCH CONTRIBUTION AND OUTLINE

Queuing is an everyday activity that most of us manage without reflecting
on how we queue. If one aims to develop knowledge of new forms of
queuing it is necessary to reflect on issues that may seem rather
elementary and obvious; such issues are an indispensable starting point.
By investigating a number of fundamental questions and being
sidetracked a few times, I've discovered many interesting phenomena
related to the practice of queuing.

Chapter 3 give accounts of individual queuing experiences and is based
on ethnographic studies. The cases relate to the type of carefully carried out studies of social interaction that are widely recognized within, for example, the field of Human Work Science. The cases described do not always resemble the tranquil accounts a researcher with considerable experience of ethnographic fieldwork and ethnomethodology might give. But the hope is that the reflections on the cases observed in current queuing practices might contribute some findings of interest. The cases reported in the present thesis point to a number of qualities, which I suggest, have a decisive influence on people’s use of current queuing aids.

The majority of the findings are probably made more readily understandable in the descriptions of the concepts in chapter 4. These concepts indicate different directions within the design space and suggest ideas for possible ways of queuing. These first concepts are not to be put into practice but are instead intended to widen our vision of queuing for the purposes of further analysis. Each concept explores a specific point within the design space and many of the qualities mentioned in chapter 4 can be traced back to the empirical observations. With the aid of both the empirical observations and design explorations these qualities are analyzed. In order to obtain a diversity of perspectives on the various qualities concerned, the concepts are evaluated. These evaluations guide the analytical part of the present thesis and help transform the qualities into more useful design principles.

While the queuing concepts explore possible new forms of queuing, the concluding concept in chapter 5 gives a more balanced picture of queuing
practices. The concluding concept gathers together the main points of the previous two chapters and describes the practice of queuing both from the perspective of what is possible in current queuing practices as well as completely new forms of interaction. The above issues are summarized, in the section on conclusions and directions for future work, chapter 6.
2. Theoretical Framework and related work

Queuing-oriented research

According to studies of social interaction (Livingston 1987, Goffman 1963, Kendon 1990), a queue is a typical example of a practice that is sustained by the actions of participants in the queue. Livingston (Livingston 1987) has used the act of queuing as an example in ethnomethodology to describe moment-to-moment interaction. Eric Laurier touches upon the act of queuing in his studies of, for example, café cultures (Laurier et al 2001), and the contact between staff and customers. Daniel Normark (Normark 2006) refers to queuing-related theories as he looks more closely at the situation of drivers stopping at petrol stations. In other fields such as economics, psychology and customer research, studies have focused on satisfaction in queues (Soman and Zhou 2003).

Livingstone’s studies examine from an ethnomethodological perspective how people in a queue arrange their participation on a moment-to-moment basis. Livingstone’s work is thus highly relevant to research on the practice of queuing, although his studies do not consider queuing situations where queuing aids are in use (as is the focus of this thesis). Livingstone shows that queuing, like other types of social interaction, is always to some extent about handling coincidences. This is similar to Suchman’s theory that not only “plans” influence people’s ways of acting but also other more “situated” activities. She focuses on situated action to
demonstrate how people act according to some sort of plan but how coincidences constantly influence the outcome of such plans (Suchman 1987). This corresponds well with the act of queuing, which is very much distinguished by coincidences and responses to other participants’ actions. These studies provide a general picture of how social order is kept but focus primarily on social interaction. Only in a few specific cases do they reflect specifically upon the art of queuing. The queue is used primarily as an example to describe how members situate themselves in relation to one another; queuing is seen as a social act and studied in relation to how people make their acts accountable to others etc. (Kendon 1990). On the basis of the knowledge gained from such studies where queuing is included as one form of social phenomena, there is a great deal to learn from the simplest of queuing situations. This has been demonstrated by among others Livingston and Goffman (Livingston 1987, Goffman 1963).

In addition to the social sciences, other research fields have touched upon the area of how people relate to one another in a queue. The field of consumer research, for example, has initiated investigations of consumers who are part of a queue and how they respond emotionally to the queuing experience. Collected statistics is used to reason on hypotheses that are meant to show customers levels of satisfaction (i.e. customers level of satisfaction with a service they had to queue up for) (Soman et al 2002, Zhou et al 2003). As the gains are greater if participants stay in the queue and successfully fulfil their task, the level of satisfaction is likely to be higher in a queue where most participants stay until it is their turn. People, who are waiting for a service that they pursue, have no choice but
to stay in the queue. A person might, for example, need a particular medicine, or want to catch a specific train. This creates a state of tension between the drive to fulfil a specific goal - being first in line for a service - and other people aiming at the same goal. The more evident this inertial force becomes, the more negative the queuing experience is presumably (Zhou and Soman 2003)

Although the research tradition of studying work practices does not aim to describe the “affective experiences” of standing in a queue, such studies are relevant to the present research. Besides the quite predictable result that participants are more inclined to leave a queue if factors such as “time already spent waiting” and ”the number of people ahead” have high values (Bateson and Hui 1992), other studies within the field of consumer research suggest other interesting tendencies aswell. For example, some researchers mean that a person’s impression of a queue is more positive if there are many participants behind (Zhou and Soman 2003) and that participants that are positioned in the beginning of a long queue are very likely to stay in the queue. Zhou and Soman further propose: “consumers in a queue make downward comparisons with others behind them”. The authors consistently refer to participants in a queue as “customers”, but irrespective of that and despite the fact that their studies are often focused on ways of increasing profit, social comparisons and the conclusion that the number of people behind one matter is an interesting result with
regard to the practice of queuing as such.  

**Ubiquitous queuing**

Although there are a number of different types of research related to queuing, there are as yet no studies focused on queuing situations in relation to current technology. This may be because a queue is not a technology-dense situation. In some ways, a queue resembles a restaurant visit in that respect. Obviously, spending time in a queue does not have the same purpose as a visit to a restaurant, and does not carry with it the expectations associated with a visit to a good restaurant. But the queue does resemble the restaurant situation in one significant respect: it is not an environment that is normally characterised by technical innovation (McCullough 2004). Perhaps the limited availability of technology-rich queues may be one reason why there are no studies that focus on technology and queuing, i.e. how queuing aids that are meant to facilitate the activity give rise to completely different intricate situations for social interaction. There is thus room for studies and analytical investigations of queuing practices using technology.

The practice of queuing, however, has a clear link to a certain field within computer research, i.e. ubiquitous computing. Ubiquitous computing distinguishes much of what is happening within other areas in society. Technology enables new interfaces between users, and activities merge,

---

3 This could even become an extensive design research project in its own right – with an objective of identifying situations when people are likely to remain in a queue or not, and considering how to prevent people from leaving a queue.
craving additional technologies for support. The fact that pharmacies are extending their immediate interfaces is closely related to how the materials of ubiquitous computing merge with the materials of our everyday life. Also, within other work practices, people and working teams are more and more distributed. Hence the link between queuing practices and ideas of extended interfaces, where the vision of ubiquitous computing is partly comprised of what Paul Dourish has termed "embodied interaction". The latter may be defined as “the creation, manipulation and sharing of meaning through engaged interaction with artefacts” (Dourish 2001). Dourish has commented further on how the ideas of ubiquitous computing and tangible computing exploit our everyday activities as a way of designing technology that is incorporated into practice and that technology helps us to make sense of the world and one another. The idea, according to Dourish, is to “tie computational and physical activities together in such a way that the computer ‘withdraws’ into the activity, so that the users engage directly with the tasks at hand and the distinction between ‘interface’ and ‘action’ is reduced.” This is very much in line with Weiser’s theory of how interfaces spread beyond the desktop and into the woodworks of everyday life. (Weiser 1991)

Work practices and the actions prompted by each activity are constantly evolving as new technology is introduced (Winograd 1986). It is, of course, not always the case that changes move in the direction of more distributed activities and groups. But it opens up a possible design space for such changes, as there is a general development towards more distributed group work. When people are not necessarily collocated within their work group, the visible spatial arrangements and the
accountability of acts are lost. But some of the lost nuances of accountability might be compensated for by an increased use of communication technology instead. Such technological features that primarily work to compensate for lost ways of interacting, can be seen as the inevitable result of how new technology is merging with our everyday activities. Thus computers are no longer just designed for single-use situations: they are for groups of people with diverse interests, goals and needs. Design for individual users is more and more directed towards users within a larger context\(^4\). Despite the fact that queuing is an individual act, participants are at the same time clearly part of a community who share a common goal. There is a growing insight regarding the need for undertakings within social interaction and group work: “There is an increasing need for designers to understand social phenomena” (Gaver 1996).

\(^4\) People for example handle their private phone calls in public places and people publishing posts about their private life to an official blogg has long been common. In a way, people seem to become less concerned with their integrity as new technological features are aiming at features of sharing, communicating and cooperating.
3. Cases

The act of queuing does not always involve standing in a line, but it is nonetheless common to refer to queues as “line-ups.” This must be a hangover from what used to be the only way of queuing, i.e. people arranged in order of priority in the form of a line. Hence the word queue literally means "tail" and originates from the Latin words cauda and coda. Encyclopedia Britannica gives a more specific definition of queuing: *A queue is a waiting line, and queuing involves dealing with items or people in sequence. Thus, a queuing problem consists either of determining what facilities to provide or scheduling the use of them.*

Accordingly, a queue appears when more than one person has to wait for a service. When several participants arrive within a short time they spend idle time waiting for the same service as they form a queue. It would be meaningless to speak of queues if all members could be served immediately without having to queue up. Likewise, it would be pointless to create an order of priority if less than one person was waiting for a particular service.

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A customary line-up is in many ways a fairly natural and straightforward way of arranging the order of priority between participants in a queue. The order in which people stand is clearly visible, and there can hardly be any remarkable misconception about who is first, second or third in line, etc. The first to line up is normally the first in turn. Through placement, direction and body language, the participants themselves make clear their position in the queue. The whole idea of a line-up is rational and fair as it is based on an agreement that each and everyone runs the risk of picking the “wrong” queue, i.e. ends up in a slow line, chooses a line where someone cuts in or a queue where there are other forms of delay. Even a shorter line might take longer than expected.
3.1. THE ORIGINAL SET UP

Queuing systems where participants queue according to numbers normally employ *queuing tickets* with numbers printed on them and *displays* showing the number to be served. Queuing tickets are often made available from a machine located by the entrance or at a central spot in the room. The displays are placed above each counter.

*Figure: Display in the ceiling*

When there are no displays placed just above each counter, displays may be in the ceiling or in other locations where they are easy to spot. In such settings, the counters are numbered and the displays do not only show the number in turn but also indicate what counter to approach.
Figure: Plan of the pharmacy

The pharmacy, where many of the queuing cases have been collected, uses displays that are placed in the ceiling. The queuing tickets are provided from a machine in the middle of the room (A). There is an open waiting area to the right and shelves with various products to the left. In the open area there are some chairs placed along the wall facing the counters. The shelves project out to where the pharmacy ends though there are no walls that screen off the pharmacy from what is outside (that is, not until closing hours, when staff pull down a robust roller blind). Instead, some shelves are turned toward the area outside the pharmacy. In the rest of the building there is also a laboratory (B), an area for general practitioner doctors (C), a district nurse clinic (D) and a dentist reception upstairs (E).
At least four different queuing systems govern the activities around the pharmacy where the majority of cases have been observed. The cases focus on observations of people using the queuing aids dedicated to the pharmacy. Even if visitors joined several different queues, the one that most obviously affected people’s actions while being observed was the queue that originated inside the pharmacy. Most visitors end up in that queue sooner or later when cashing prescriptions. The queuing technology used at the pharmacy is quite a common one. The cases described below may thus be applicable to similar public places where similar queuing technologies based on numbers are in use.

Figure: The four queuing systems on site
The Health-Square

The starting point for the focus on queues was a feasibility study of the use of a space located between a pharmacy and a health centre in Lyckeby, Sweden. According to the plan above, the health square is located in an open space (K), framed by thin portable walls in one direction and an open plan towards the pharmacy. This space used to be a waiting area, but since the year 2001 Apoteket\(^6\) have used it for a project termed *the Health-Square*\(^7\), with health education purposes. The aim of the project with *Health-Squares* is to create specific meeting places at pharmacies, where visitors can receive information and advice and take more responsibility for their own health. These explorations have been carried out in cooperation with stakeholders such as health centres, general practitioners and the county council. The work has been concerned with installing *Health-Squares* in under-exploited spaces located close to pharmacies and health centres in Blekinge county primarily.

\(^6\) Hereafter referred to as pharmacy.

\(^7\) The *Health-Square* is a project run in collaboration between Apoteket, the county councils, and a number of municipalities. (Annual Report 2005, Apoteket AB (http://www2.apoteket.se/NR/rdonlyres/109CE6F9-2E79-4FEB-BAA9-97865A08A4AC/5999/Apoteket_Annual_2005.pdf#search=%22%22health%20square%22%20%22apoteket%22%22)
The *Health-Square* in Lyckeby was introduced in April 2001. A nurse from a health-care centre is located at the Health-Square and brochures on various health topics are available, as well as computers with information about health matters. The initial idea of the Health-Square was to work towards a vision of spreading the ideas and services of healthcare to sites other than the normal places where one seeks medical services, i.e. health centres, private doctors, district medical offices, emergency departments and the like. It was hoped that the *Health-Squares* should affect the interaction between staff and visitors.. Interaction should not need to be restricted to over-the-counter service: health squares accommodate meeting places where visitors to the pharmacy have the possibility of initiating discussions on self-service and acquire information on health.

While the analyses and discussions in the feasibility study were related to the use of *Health-Squares* (Helgeson et al 2002) another field of interest appeared at the same time. Since this initial phase showed that the *Health-Square in Lyckeby* was a little used facility, it caused the search for an explanation. Among other things, the initial research indicated how queuing as a phenomenon influenced potential activities in and around the pharmacy in a negative way. Instead of taking advantage of the health related services, visitors tended to be content with monitoring their turn. The *Health-Squares* were rarely the primary reason for visits as the initiators had originally hoped would be the case. Instead, the *Health-Square* was used more as an intermediary activity between errands at the pharmacy and other authorities, or while waiting for personal service. In other words, people often ended up at the *Health-Square* merely because they were visiting the pharmacy.
This phenomenon is depicted in an early illustration of how visitors at the pharmacy become absorbed in an activity where the cluster of queuing people is pressing in upon the pharmacy. The phenomenon is reminiscent of dough: as the dough rises it takes up space. As the number of people in a queue grows, the group of people bulges and moves beyond the framing of the service they are waiting for. The metaphor touches upon some issues that are of interest to interpretations of the queuing practice: to what extent, for example, is one’s progress in a queue determined by other participants within the queue?

*Figure: Dough*
There were no immediate explanations as to why people did not use the health square. It seems that visitors did not feel that there was much time and isolation to study brochures, notice boards and video loops (on themes such as “Quit smoking”, “Food” “Your weight” or “Exercise”). Energy was instead devoted to maintaining ones position in the queue. It was astonishing to learn how monitoring ones position in the queue requires one to focus on the queuing ticket, causing an increase in anxiety as the period of waiting progresses.

After having realized that additional efforts and studies were necessary to stimulate greater interest in the health related services, the expression “active wait” was coined. The idea behind the “active wait” concept was a desire to create a better balance between the goals of making visitors more independent during their waiting time and at the same time convince them to engage in activities while waiting. No explicit objectives were formulated but the general idea was to create a waiting situation that would not encourage visitors to become preoccupied with the act of queuing but instead offer alternative activities to passive waiting, i.e. increase the action space for participants in a queue.

3.2 RIGIDITY OF THE QUEUE

Queuing up
Queuing aids based on numbers have a set of basic features corresponding to the general features of a queue. You queue up by obtaining a queuing
ticket. Changing numbers on the displays indicate the progress of the queue. When the number on your ticket matches the one on the displays it is your turn.

Figure: When your number is displayed, it is your turn.

The use of numbers offers a simple way of regulating the order of participants and is a means of deciding who is next in turn. By having numbers represent your position in the queue, your physical position becomes less important than when you stand in line and are influenced by a sense of fairness. Despite the immediate loss of having a more evident line-up to relate to, the displayed numbers still give an indication of the length of the queue.

Numerical queues are in some ways also more precise than other arrangements, in that numbers follow in a certain order, which is fixed.
But this is to the expense of occasions when it is not completely evident how the queue works, at times when a queuing aid seems superfluous. This is noticeable for example with fewer people waiting for service and visitors can manage to keep track of the sequential order between one another without the visible evidence of a queue in the form of numbers. On such occasions it may be sufficient to keep an eye on other visitors to establish whose turn it is. Regulating a queue with the use of numbers, accordingly assumes that several people require the same service within the same period of time. But during transitions from when there is no substantial queue to when there suddenly is a queue, it is difficult to decide whether you need a number or not. And in a queue based on numbers it is not so easy to suddenly arrange an order from zero, as would be possible with a line up. Such instances occur sometimes when there is initially only one person waiting for service and others drop in after a while. Despite the orderliness, queues based on numbers cause uncertainty when there is initially only one person waiting for service and others appear later:

A man comes into the room. He walks past the queuing ticket machine and positions himself near a shelf looking at some products. At the counter a member of staff is serving another customer. After a while, yet another person arrives. She looks around the room and takes a few more steps towards the queuing ticket machine. The man who first arrived immediately comes closer and addresses her.

**Man who arrived first:** I did not take a queuing ticket since it was only myself here.

**Second person:** Ok I see, then I won’t get one either.
They nod at each other and walk in separate directions but a bit closer to the counters. Shortly afterwards a third person comes in and walks straight toward the ticket machine and immediately gets hold of a queuing ticket. Meanwhile, the other two stay staring at the third person. The man who arrived first seems to be about to approach the third person, but restrains himself. Instead, he (the man who first arrived) positions himself close to the counter so as to make it obvious, both to the staff behind the counter and to others who might arrive later, that he is next in line. The second person also adopts a physical position that marks that she is ahead of the third person.

Figure: Two persons are waiting for service, but are not using the queuing-tickets.
Figure: When another visitor enters, grabbing a queuing-ticket, the first and second person to arrive adopt a physical position.

While you are the only person waiting for service at a place it can be unclear whether it is necessary to adopt a physical position (and form a queue) or not. Even without providing yourself with a queuing ticket, you can probably count on being served next since there are no others around. In other words, there is not a reason for obtaining a number while there are no other visitors. As soon as another visitor arrives and seems to be considering whether or not to take a queuing ticket, the queuing situation suddenly changes and requires some sort of action by all those involved. Between the first and the second visitor (in the case above) it is quite evident who is first in line. But if the second person to arrive were to take a queuing ticket, it would seem relevant for the person who first arrived to take action – either by taking a physical position, by informing the second arriving person about the situation or by getting hold of a queuing ticket.
Or else the staff at the counter would probably simply call the next number without knowing that the first person in line and the second person to arrive have come to an agreement about the actual order. There comes a point when it is no longer a good idea to refrain from using queuing tickets. Agreeing not to use the queuing tickets becomes harder to justify as more and more people join the queue. Since getting hold of a queuing ticket is central to numerical queues, a decision not to get hold of a queuing ticket is in a way equivalent to deciding not to join the queue.

The case above exemplifies two central things regarding queuing with a number. It shows that a visitor is expected to get a queuing ticket to queue up; otherwise adopting a physical position still has a conclusive importance to the regulation of order.

**Limited period of validity**

Holding on to a queuing ticket might be considered sufficient to regard oneself as part of the queue. But that is apparently not all that is expected of one in order to possess and retain a number in the queue. Retaining a number involves some additional obligations besides possessing a number. One of these obligations is related to the act of monitoring one’s position in the queue. Participating in a queue based on numbers assumes that you will notice when it is your turn and then claim service. In the same way as participants in a line-up follow the one ahead (in order to substantiate their position and maintain the queue), participants in a queue arranged according to numbers must be prepared to act when the queue makes progress. From the point when a number is displayed and for an
indefinite time thereafter, the participant with that number is expected to respond and approach the counter. But for different reasons it is sometimes uncertain when it is your turn. This is due both to the difficulty of estimating the progress of the queue and the limited period of validity for each number.

A participant has his/her turn once the matching number is displayed and s/he is called to a counter. And that is the moment all participants in the queue are waiting for. The closer a person comes to his/her number, the more attention s/he tends to pay to the display and calls from the counter. But it is not always the case that someone reacts when a new number is displayed. On such occasions, this is approximately the course of event that comes about:

*After having called a new number, the staff wait for the person with that number, seemingly counting the approximate time it will take for a person to notice the number on display and approach the counter. If nobody starts moving towards the counter, a new number is displayed and the queue moves along.*

Since it is hard to forecast exactly when your number will be called members may miss their turn. It is very much up to the staff to decide when it is time to call another number; the limited period of validity for each number is accordingly not always the same. The progress of the queue is thereby influenced by how soon participants in the queue approach the counter when it is their turn, i.e. how watchful they are. This leads to situations where participants in the queue tend to be especially
watchful, thereby spurring on the progress of the queue. Participants who are less alert run a greater risk of missing their number if the staff unintentionally shortens the period of validity for each position, i.e. by calling new numbers with shorter intervals. Most of the time, however, the staff is very sensitive to different reaction times among participants:

An assistant behind the counter calls out number 41 but the display shows the number 43. A lady holding a queuing ticket with the number 41 printed on it approaches the counter. But another person with the number 43 reaches the counter first. The assistant is probably unaware that the display shows a higher number than the one she has just called and starts serving the person with number 43 (possibly taking her for being number 41). This is revealed as the lady holding number 41 shows her queuing ticket and looks with wonder at the assistant.

**Assistant:** Yes, I called 41, but I’ll serve you next.

The lady with number 41 says something, which is not audible and seems dissatisfied.

**Assistant:** Do not worry; I will serve you next as promised.

The assistant serves the other customer first and then, without changing the number on the display, calls again clearly addressing the lady with number 41.

**Assistant:** 41...

The lady with number 41 approaches the counter again and utters something that is not audible, whereupon the assistant replies kindly.

**Assistant:** Yes, we will manage it. We serve everybody, but one at a time.
Figure: The assistant causes some confusion when calling one number while the display shows another.

Because of the staffs’ way of handling situations as demonstrated in the case above, there is rarely complete disorder even when numbers become disorganized. Nonetheless, the order between participants is somewhat uncertain when the displays and the call from the staff indicate that different numbers have precedence. This ambiguity often occurs when the queue has made unexpected progress and participants miss their turn. Given that staff willingly serves people who have missed their turn, an
assistant can easily find herself serving a number which is different to that on display.

The rigidity of the queue is also the result of the limited period of validity combined with how the queuing aid manages participants who decide to leave the queue. Several participants may have decided to leave within the same period of time. A participant further back in the queue will in effect be next in line earlier than expected and may have situated him/herself far away from the counters – perhaps too far away to take his/her turn. For a participant far back in the queue it is reasonable to make the following assumption: “I have several numbers ahead of me anyway so I have time for another errand before it is my turn.” This is sort of a misjudgement since it only looks like there are several numbers before his/hers; it is less clear that these are numbers that people have chosen to relinquish. The queuing aids do not support the remaining participants and indicate when the number of participants is radically reduced. And besides, there are several coincidental factors that cause participants to leave the queue.

**Returned queuing tickets**

The display shows the number currently served but does not reveal anything about how many participants have joined the queue. So before choosing to become a member, visitors make attempts to read the queue and possibly estimate its length. To be able to estimate the number of participants currently in the queue one must obtain a number to compare
with the number on display. But this is also what you do to become a “proper” member of the queue.

The assumption that visitors are expected to calculate the number of positions ahead on their own causes people to take queuing tickets that they do not necessarily plan to use. Such numbers are used solely to decide whether it is worth queuing up or not. The queuing aid based on numbers does not allow one to estimate the length of the queue and then decide whether to join it or not. As a result, the number of participants missing their turn is increased since the indicated number of positions in the queue is often to a greater or lesser extent misleading. Hence, the queuing aid is quite ineffectual and rigid because participants cannot make an accurate estimation of their position in the queue.

As a participant in the queue you can deliberately try to make it a bit more obvious to others that you have taken a queuing ticket you do not intend to use. By leaving your unused number behind by the queuing ticket machine you announce your decision to leave the queue. Leaving your number behind is a way of justifying your “defection”. It might also leave room for someone else to queue up with an abandoned number.
Once several persons have left the queue, it is difficult for a visitor who withholds a queuing ticket from the machine to make an accurate estimation of the length of the queue. It is not uncommon that several unused queuing tickets can be found by the queuing ticket machine. And this actually indicates that the queuing aids will be displaying several numbers that do not belong to a participant anymore. This might help newly arrived visitors to estimate the length of the queue.

At times, people may decide to renounce their position in the queue by handing over their number to a newly arrived visitor. It is not fair and perhaps neither fully acceptable to do so but it is possible and thus occurs.
on occasions. Even if this does not happen by mutual consent, it is nevertheless a possibility brought about by the person leaving the queue. Irrespective of whether the queuing ticket has been left behind or not, the empty position leaves a gap in the queue for someone else to fill. The gap becomes obvious once a member of staff calls a number and no one approaches the counter. But it is not always easy to make use of an “empty position” without getting revealed. There was a case when a young man tried to make use of a number that seemed to belong to nobody. At one occasion there was a case when a couple did not approach the counter immediately as their number was called, whereas a young man tried to make use of the number that seemingly belonged to nobody:

A man enters the room, looks around at all the people waiting for service, get hold of a queuing ticket and realize the length of the queue. Shortly thereafter, several numbers are called in a sequence without anybody approaching the counters. The man, who has just queued up, seems to realize his chance to get service faster and suddenly decides to approach the counter without holding a valid queuing ticket. At about the same time a couple realizes that their numbers is currently displayed, and approach the same counter. The assistant who has already initiated a conversation with the young man realize that something is wrong and acts to bring order to the confusion.

Girl in couple: We have number 57.

Assistant: Ok, what is your number then? (Addressing the young man.)
The young man starts searching his pockets nervously.

Young man: I don’t know what number I have.
And after that he walks away from the counter and sits down to wait for his number.

While the couple were delayed, the young man further back in the queue takes a chance and pretends he is next in line. But since the couple almost immediately realize that it is their turn and manages to approach the counter, the young man’s mischief is revealed. When the assistant asks to see his queuing ticket and he turns away, it indicates that he was trying to stretch the rules of the queue. But in a way the couple were also at fault as they were slow in responding to their number. The case thereby highlights that it is not all clear what obligations you have as a participant in a queue. There is, for example, no explicit limit for when you are considered to have missed your turn. This uncertainty engenders a sense of rigidity within the queue.

**Vague obligations**

The preciseness which is the characteristic feature of numbers, leads to a reinforcement of rigidity as it only gives a delusion of preciseness. At the very least the system is not always as precise as it purports to be. Some features are always precise and others vary between being imprecise and extremely precise.

Many cases show that the actual use of the numerical queue is not as rigid as its constituent features. As in the case above where a participant has failed to approach the counter in time and staff make what could be
termed a “workaround”\textsuperscript{8}. Instead of denying service to participants who miss their turn, as the queuing aid assumes, the staff can decide to make an exception. In a “workaround” the staff would, for example, simply serve a participant who has missed his/her turn before calling another number, i.e. serving people beyond their turn:

There is a tinkling sound and the display shows number 47. A person immediately approaches the counter and the assistant addresses him. Soon thereafter another person steps towards the latter. The two participants concerned have the numbers 46 and 47.

**Assistant:** What is your number?

The assistant says this facing the customer who arrived first at the counter and he shows his queuing ticket to the assistant.

**Participant:** 47

**Assistant:** All right, then I’ll serve number 46 first.

\textbf{Figure: Staff serving people in-between}

\textsuperscript{8} A workaround is a method for how to perform a certain task when the usual way of doing it is not working.
One explanation for the above case can be that the assistant has possibly been too eager in calling a new number without having waited long enough for number 46. As a result, the person arriving last at the counter is served first since she has the lowest number and was initially first in turn. The queuing ticket functions as "evidence" when claiming that you have a reason to be served after your number has passed by. Even if it is very rare that the staff actually examine queuing tickets to ascertain that the number is valid, the use of a queuing ticket requires that one claims service at a specific time. But the queuing ticket is, as seen above, also a means of ensuring fairness when the queue becomes disorganised for some reason.

Another type of “workaround” occurs when people queue up with more than one number, i.e. they hedge their bets by taking two queuing tickets:

13.54

One female to another woman before joining the queue:
- Why do not you hedge your bets and take two queuing tickets?!

The other woman answers:
- You are right, that is a good way of doing it!

The woman gets hold of a pair of queuing tickets with different numbers, takes a seat in a chair in the waiting area, and catches up on a conversation with the person sitting next to her.

Woman with two queuing tickets:
- She boiled vegetables and got rid of the pain...
After about ten minutes the woman with two queuing tickets rises. It is the turn of one of her numbers, whereby she approaches the counter and asks the staff for something. The answer from the staff is negative and she comes straight back without any groceries. She sits down for a while but her second number is soon called to another counter and she takes her turn.

Figure: Hedging one’s bets with two queuing tickets
The woman in the above case takes two queuing tickets since she is not sure what queue to join in order to get the service she is looking for. By grabbing two queuing tickets, she does not have to decide which queue to choose and avoids running the risk of picking the wrong queue. Hedging ones bets in the queue by using more than one number increases one’s chances of being served. But it is not always necessary to have a queuing ticket at all to be served. Home-helps who run other people’s errands are, for example, an exception to the ordinary rules of queuing since they do not always need to have a queuing ticket to be served. When someone from the home-help service has an errand to perform, he or she quite simply approaches a counter and is usually recognized by the staff (or asked to state his/her errand). In that sense people from the home-help are served in-between other numbers and the original queuing rules are disregarded in the same way as for those who happen to miss their turn.

It is not unusual that members of staff make this sort of exception even with ordinary visitors and in this way get round a problem of rigidity. At the same time, when the validity for a certain number is extended in this way, other levels of rigidity are added. This added rigidity occurs when members of staff is mre forgiving after having understood that miscalculations or misunderstandings may occur. But it is not at all clear what the current rule is regarding when and how a participant may be served, even after missing his/her turn. At the same time, there is also a limit to when it is no longer acceptable to claim service beyond the period when one’s number has ceased to be valid. This makes it even harder to forecast a queue that does not comply with the prevailing rules and
obligations. A queue that is sometimes precise and at other times imprecise cannot be accurately assessed.

In such situations and when the numerical order consists of vague obligations and features, participants often invent ways to bypass the problematic limitations imposed by the numerical features, i.e. they try to make the queue less rigid. Participants are quite loyal to the obligations, but there are still occasions when people stretch the limits in different ways. This exemplifies how people seem to have discovered less rigid ways to queue with a number. At times, participants in the queue even bend the rules a little too far, causing them to miss out on their turn, or at least fail to take advantage of their position in the queue. These types of acts can be grouped under the term “unattended positions”, since that is what they often result in. When unattended positions occur, the initiator is generally one of three types:

- one who is forced to take a queuing ticket in order to estimate the queue
- one who has chosen to leave the queue (This includes both those who were never sure about queuing up and those who decide to leave early.)
- one who takes a chance and leaves the queue to return at a later time in the hope of getting served.

All three types of unattended positions influence what form the queue takes, but they are difficult to unravel. If a room is full of people each holding on to a number and waiting for his/her turn, it is at least evident that there are several participants in the queue. But if one and the same
person has two numbers it may appear as if there are more participants in
the queue than there actually are, if considering the displayed numbers.

**Opaque queue**

Stretching the obligations of queuing could be seen as a way of
counteracting the rigidity of the queue; queuing becomes a little more
flexible, at least for participants who benefit from it. But for others in the
queue, the result might be that it becomes harder to estimate the length of
the queue.

The sequential order of the queue is displayed in a way that makes it hard
to make accurate estimations of the length of the queue. It almost
presupposes that participants monitor the progress of the queue by
studying the displays continuously, although each participant is only
obliged to respond to his/her number. Since the estimation of the queue is
decisive for participation it is particularly important that the indicated
length of the queue is accurate. Moreover, since queues based on numbers
seem to be precise the issue is confused still further when these forms of
queues allow more flexibility than expected. However, in reality the
queuing aids do not reveal much of the queue at all. The queuing aids
merely display the number currently served and the number each
participant is assigned. In between those sources of information, however,
the structure of the queue is not revealed. For newly arrived visitors who
have not decided whether to join the queue or not, the length of the queue
is even less apparent. Since there is no reference point at the end of the
queue that indicates where the queue ends, visitors who have not joined
the queue are given no explicit help in estimating the queue. Until you join the queue and get hold of a number, you do not have a reference point from which to estimate the length of the queue. As long as you do not have a reference point, the displayed number is merely the number currently being served. The latter conveys little information. The only additional indication of the length of the queue is that given by the queuing ticket machine as you join the queue, since the number issued is currently last in the numerical order. But unless you have a queuing-ticket, the displayed numbers do not reveal much about the queue, i.e. the queue is not visible to non-participants. Before obtaining a queuing ticket, the only source of information about the queue is the numbers on display and the number of visitors residing in the room. Of these two, the more reliable indication of the length of the queue is the number of visitors in the room.

Contemplating how numbers are mediated on a display, trying to grasp whether the queue seems to be progressing at a fast or a slow rate is otherwise the only type of estimation a visitor can make based on the displayed numbers and without a reference point of his/her own. But you do not see many people who are merely monitoring the numbers on display as most visitors choose to take a queue number to use for comparative purposes as well (and not only to join the queue). With the right equipment it is thus possible to calculate the number of positions ahead of you. You do this by comparing the displayed number and the number on your queuing ticket. One’s ability to estimate the entire length of the queue is thereby restricted to participants who have recently joined.
But after having queued for a while you will only have an indication of
the numbers ahead of you and no appreciation of the numbers after you.

To sum up, you must become a participant by acquiring a number in order
to have a reference point from which to compare your own number with
that on display, in order for the queue to become comprehensible. In other
words, visitors provide themselves with queue numbers for the wrong
reasons. This makes the problem worse as continued attempts to assess
the length of the queue by obtaining a number inflate the real number of
people in the queue.

When comparing the visibility of an ordinary line-up to a queue based on
numbers, it is quite obvious how opaque the latter is in many senses, and
also how the acts of participants in a line-up are immediately apparent.

<table>
<thead>
<tr>
<th>Queuing in a line-up</th>
<th>Queuing with a number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before joining a queue</td>
<td>Estimating the length of the different line-ups.</td>
</tr>
<tr>
<td>Joining a queue</td>
<td>Positioning yourself at the end of the line.</td>
</tr>
<tr>
<td>Resigning from the queue</td>
<td>Leaving your position in the line-up, whereby the people behind move on.</td>
</tr>
<tr>
<td>Performing another task</td>
<td>Leaving the trolley in your position in the queue or</td>
</tr>
</tbody>
</table>
making an agreement with the person behind. (But this is not a guarantee that you will be allowed back though.)

while your number is waiting to be displayed. (If you return after your number has been displayed you might be served in-between other numbers.)

<table>
<thead>
<tr>
<th>Follow progress of the queue</th>
<th>By moving when the person ahead moves.</th>
<th>In monitoring the displayed numbers and comparing them to your number.</th>
</tr>
</thead>
<tbody>
<tr>
<td>In turn</td>
<td>When first in line</td>
<td>When the number on display matches the number printed on your queuing ticket.</td>
</tr>
<tr>
<td>Getting served</td>
<td>While staying first in line</td>
<td>By approaching the counter.</td>
</tr>
</tbody>
</table>

### 3.3. CATEGORIES WITHIN THE QUEUE

In a queue based on numbers, as opposed to a regular line-up, it is not always so easy to distinguish participants from non-participants. Therefore, the following section makes distinctions between the *actual queue* (the number of participants actually in the queue), the *physical queue* (the number of participants that are present in the physical place of the queue) and *the displayed queue* (the number of positions represented by numbers on display). The idea is to show how categories sometimes coincide in such a way that visitors might understand the queue in
different ways, depending on what they base their estimate of the queue on.

**Representation of the order of the queue**

A single glance at a queue organised with numbers might well give the appearance of a crowd of people. Within this crowd there are different types of participants and different ways of being part of the queue. Such categories are not immediately evident but they exemplify how the progress of the queue is affected by people’s different ways of acting. The categories that have been recognized are, for example, people marking a position in the queue without watching for their number to come up, participants taking more than one number, and participants sharing a number with someone else.

When compared with a line-up, a queue that is organised on the basis of numbers resembles a crowd of people rather than a group of people arranged in a particular order. Since there are, for example, no clearly perceptible lines of people, participants in the queue blend with other visitors. A trained eye could probably make out the different categories and distinguish between those who are “merely visiting” and those who can be considered participants in the queue. But a queue based on numbers does not really reveal the participants it is composed of.

But when one studies the physical queue more closely, and in particular how participants move and arrange themselves in relation to other people present, there are some visible differences that determine, for example,
who is in the queue and who is not. Sometimes people’s ways of acting and positioning themselves even reveal something about their level of participation in the queue. For example, a person who uses two queuing tickets or visitors who queue in pairs and share a queuing ticket with someone else are particularly obvious. A person who shares a queuing ticket with someone else often monitors the numbers on display with his/her companion and also makes decisions with that companion. Their participation is made visible by the ways in which they use their queuing tickets. But in the displayed queue their companionship is not unveiled.

Once a new number is displayed and called out from the counters it is obvious to other participants in the queue who "the next person in line" is, since this person will then probably approach the counter. While the person who is "first in line" is identified as his/her number is called, the remaining participants are still just a crowd. It is a crowd with a specific order, but the order is mainly visible by means of the queuing ticket that each participant holds. And the displayed queue is not accurate, as it does not correspond to the actual queue. All that is visible is the number whose turn it is and the number of one’s queuing ticket. But beyond these two sources none of the other numbers in between is made visible. The categories of participants making up the queue are not represented.

Even if all positions assigned to participants are included in the numerical order, the displays show each and every number in a sequence, even positions that have, in fact, already been abandoned. As a result, the number of positions you have ahead of you (which can be calculated on the basis of the displayed queue) may not be an accurate reflection of the
present status of the queue. Hence, the numerical queue does not display any characteristics about the participants in the queue at all; it is merely a sequential order which helps to keep track of who is first in line.

In other words, the representation of order is not always accurate in a numerical queue. Basing one’s estimate on the number of participants physically present does not provide an accurate estimate of the length of the queue either. You cannot trust the external appearance of the queue. Therefore, even if the queue seems long, there is no guarantee that you are entitled to take a chance as a member and temporarily leave the queue in the belief that you will make it back in time. Any attempt to make the practice of queuing more flexible entails a risk. The complication lies not only in the fact that the numerical queue is rigid but that it is occasionally more rigid than usual. The problem is not only that the queue is not concise it is also a question of how the staff at the counters sometimes manage to serve more and at other times fewer customers. Staff can, for example, be located at a counter and not serve any customers at all. Also, it is not always possible to decide how long a customer may take to be served once it is his/her turn. In other words, there are complications resulting from the rigidity of the queue that makes it hard to estimate the queue:

09:15

*There are about four visitors in the waiting room on entry. The displayed number as compared to the number on the queuing ticket you have taken states that there is several numbers ahead of you. According to the number on display there are approximately five people ahead of you in*
the queue. But two out of the four visitors present are already being served at the counters. This means that there are actually only two people waiting for service. At the third counter there is also an assistant and it looks as if she is preparing to call a new number.

If queuing up in a situation like the one above, it would be risky to leave the room if only for a short while since there are only two people waiting their turn in the physical proximity of the queue. The other numbers ahead of yours will probably not be used. One can thus assume that the queue consists of just the two who are present. All visible evidence indicates that the queue should progress quite fast with three counters open and a queue consisting of just three persons (the two customers that are being served and oneself). But in this case the two customers being served happen to take an unusually long time. And it seems that the assistant at the third counter is working with journals and documentation and will not be able to serve anybody for a while.

Categories of participants

It is obvious that one becomes a participant in a queue by providing oneself with a number. Other obligations associated with participation are, however, less obvious, e.g. how do you go about leaving a queue in a proper way?

There are a number of ways of leaving a queue either on purpose or by missing one’s turn. Whichever method you choose, you may look like a participant in the queue without actually being one. Inversely, you can be
a participant in a queue without making it apparent. This is the result of
the fact that the participation of several categories of members in the
queue affects the progress of the queue (as described below). There are
examples of people who are not in the queue who in fact appear to be
participants, and inversely. Given that there are so many ways of
participating in a queue, there can be several categories of participants as
well as variations in these categories all at the same time.

THE DISPLAYED QUEUE APPEARS LONGER THAN THE
PHYSICAL

A. Getting hold of a number in order to estimate the queue.
B. Hedging one’s bets in the queue by holding several numbers at the
same time.
C. Taking a chance by temporarily leaving the queue.
D. Taking a chance by temporarily leaving the queue.
E. Participants who do not appear to be participants in a queue.

THE PHYSICAL QUEUE APPEARS LONGER THAN THE
DISPLAYED

F. Someone appears to be a member of the queue while merely
accompanying someone else, or staying in the same physical place
as the queue but for some other reason.
G. Present and holding a number, which has already been called.
H. Numbers already called being served inbetween current numbers.
I. Accompanying a participant in the queue and being served
without holding a number.
J. Queuing up without a number by mistake.
When the actual queue is hard to read

A number of qualities contribute to making the displayed queue appear longer than it actually is. These include: the limited period of validity each number has, that it is easy to miss out on your turn, that you must get hold of a number in order to estimate the length of the queue, and that members do not always settle for just one queuing ticket but instead hedge their bets by taking several numbers.

As a newly arrived visitor you get hold of a queuing ticket and calculate your position on the basis of the displayed number. The more members who take a ticket merely to estimate the length of the queue and then leave again, the greater the risk of forming inaccurate estimations, i.e. believing that the queue is longer than it actually is. Imagine that about three people enter a room and each of them takes a number in order to estimate the length of the queue. All three people subsequently decide not to use their numbers and leave again. Should a newly-arrived visitor take a queuing ticket at this time and make a calculation on the basis of the number currently displayed, his/her assessment of the length of the queue would not be accurate. The queue would appear longer than it actually is, i.e. the displayed queue includes seven numbers while the actual number of people queuing is only four. A queue with as many as three abandoned numbers will progress much faster than one might think at first sight.
Figure: The displayed queue appears longer, while the physical queue corresponds with the actual queue.

Participants in the queue who are used to calculating their position on the basis of the number of queuing tickets printed out could combine this method with making a reasonable assumption of how many queuing tickets have been abandoned. This could indicate that the queue is not as long as it appears on the display. And it is often possible to make a more realistic estimation by taking note of how many participants are physically present.

A misrepresentation by three numbers as in the case above would not result in such a wide margin of error that it affects the progress of the queue much. However, if four people were to take numbers without using them, the danger that inaccurate estimates of queue length will be made increases significantly. Imagine that more than one member of the queue decides to leave the queue. On the basis of the incorrect representation
that the queue has seven members one might be tempted to leave the queue and run other errands. Perhaps one member decides to take a stroll inside the room and another leaves to go and pay for parking. In such a situation it is almost impossible to estimate the actual length of the queue.

![Diagram of queues](image)

*Figure: The physical queue appears shorter and the displayed queue appears longer than the actual queue.*

The queue in such a situation is difficult to read. The displayed queue indicates that there are seven numbers ahead while the physical queue consists of only two participants. In reality, there are at least four numbers in the actual queue if one presupposes that the two absent participants make it back in time to take their turn. The uncertainty as to whether an absent participant will make it back in time affects the composition of the queue for a short while after his/her number has been displayed as staff may still choose to serve him/her.
In a situation such as the one described above where the displayed queue appears much longer than it actually is, categories could easily level out. When other visitors happen to be present and stand next to the queue without having a number, discrepancies can disappear. This is either because many participants in the queue are accompanied by another visitor or because of a workaround where the staff has chosen to make an exception and serve someone who has missed his/her number on display.

As a result, the queue suddenly becomes shorter just like when visitors take a ticket with the sole purpose of calculating the length of the queue whereupon several unattended numbers are called to the counter. When the queue progresses faster than expected in this manner, participants in the queue easily miss out on their turn, as it is hard to predict such sudden progress. The consequence is that new numbers are called to the counter at a rate that is faster than usual. When this happens, people without valid numbers may be served beyond their turn, and are thereby considered as belonging to the queue. This is a typical example of a misleading representation of order that is not immediately apparent at first glance.
In other words, it looks as if the numbers on display correspond to the number of physically present participants (it is of no concern that these people are not proper participants in the queue). This coincidence could cause a newly-arrived person to believe that the queue is longer than it really is (i.e. the displayed queue appears to be about as long as the physical queue). But such an assessment is not based on true fact.

3.4. GRAVITATION

Value related to staying in close proximity to a queue

In contrast to queues arranged by line-ups, a simplified view of the numerical queue is that it enables more flexible queuing since participants are less bound to a line of people. Once you have a queuing ticket and a number you are entitled to do what you please while waiting your turn. But despite the fact that a queue based on numbers does not demand any
specific physical position and does not place immediate importance on 
following the progress of the queue by changing physical position, 
physical proximity does matter even when queuing with numbers.

Implementing the use of numbers must have been prompted by the desire 
to get away from the importance of each member’s physical placement. 
Queuing practices that use numbers do not require that participants follow 
their turn in the queue by physically moving forward and following those 
ahead. Once you have become a participant in a queue that uses numbers 
you are quite simply expected to be present when it is your turn. In 
practice, the act of acquiring a queuing ticket makes you become a proper 
participant in the queue and you are guaranteed a position in the queue 
without having to physically follow its progress. There is actually no 
obligation for participants to follow the progress of the queue at all. The 
only point when it is important to notice the number on display is when it 
is your turn. But noticing when it is your turn is not easy without paying 
attention to the rest of the queue. Since the features of the numerical 
queue are by definition rigid, as described earlier, you cannot estimate 
when it is your turn unless you keep in close proximity to the queue.

In a numerically based queue there thus seems to have emerged a way to 
discern the length of the queue by separating participants from non-
participants and in this way becoming more aware of the progress of the 
queue. In addition to the obligation of being present once it’s your turn, 
people tend to act in a way that helps demonstrate the length of the queue. 
Queuing thus involves the obligation of acting in response to the progress 
of the queue. Again, this is not decisive for one’s participation in a queue,
but it almost seems to have become a habit among people waiting their turn.

Even if you are not obliged to remain in close proximity to the queue, other values related to the practice of queuing are linked to the principle that one should be physically present. In other words, the values one may discern by staying in the proximity of the queue are decisive when it comes to managing the queuing practice in a smooth way. So there is a good reason for staying in close proximity to the queue. But there are participants who try to break away. At times participants in the queue take risks in moving away from the rest of the queue. This happens, for example, when a visitor takes a number and subsequently decides not to follow the numbers on display and instead temporarily leaves the proximity of the queue. This is similar to the case mentioned earlier where a person takes a number and decides not to monitor the numbers on display but temporarily leaves the proximity of the queue; this is a gamble.

[Figure: Leaving the proximity of the queue temporarily]

As we see, it is possible to move away with your number and focus on other things and yet hold on to your number. But in spite of this people often choose to stay near the queuing aids and the queue itself. Moving away involves a risk that you lose your turn, a risk which is quite pronounced. In other words, you are allowed to move away in a physical sense but are somehow restricted in your movements due to “social obligations”. How far away from the context a participant finally decides
to move is based on an assessment of the arbitrary balance between the risks and profits a person makes of the situation, e.g. the risk of leaving temporarily and the losses incurred by not having to monitor one’s turn. In general though people decide to stay near the queue. But this decision is not based on purely arbitrary estimations. The risk of missing your turn grows if you allow yourself to reside far away from the queue or if you do not monitor your number carefully.

The risk of missing your turn is probably a major reason for why people stay in close proximity to a queue even when this seems unnecessary. Staying in close proximity to a queue cannot, however, be dismissed as something unnecessary: it is essential for the practice of queuing. Again, queuing is a collaborative act in that it assumes that it involves several people who share a common obligation to follow the changing progress of the queue. Describing participants’ gravitation towards the queue exemplifies what is expected from participants within the practice of queuing – to follow the progress of the queue. Since several things might influence the progress of the queue, the displayed numbers are not consistent enough for you to rely on them for the purpose of assessing the length of the queue. So to be sure of being present when your number comes up you must be aware of the progress of the queue. Similar types of estimations and interpretations that are relevant for a line-up thus also characterise queues based on numbers.

People are in other words careful in monitoring their number. But careful monitoring does not always seem to be a conscious decision. For example, a member of a queue might not have anything better to do while
waiting than watch for his/her turn. At other times, people tend to act more out of loyalty when monitoring their number and in a way doing what they are expected to do.

**Acting in response to change**

Looking closer at what causes participants to stay in close proximity to the rest of the queue and act to sustain the queue gives a better picture of what gravitation towards the queue entails. The majority of queues are on many counts about noticing of the changing progress and being prepared for one’s turn. In a line-up such an activity is quite simple in that you just need to follow the person ahead of you. It is a person’s turn when he or she is first in line. The person standing last in line is the person who last in turn. In order to notice changes, a member in a line-up simply follows the person ahead in the line. Basically, a line-up is a visible type of queue. You are bound to the place; the progress of the queue is clearly evident and little effort is required of the participant. It is, for example, obvious should some trouble occur at the counter\(^9\) or if the queue suddenly starts moving faster. Moreover, when you join the line it is immediately visible to others that you have done so, and if you decide to leave it it is equally visible that you are no longer part of the queue. It is also possible to estimate the queue at some distance and calculate how many people are ahead of you. Before lining up you can also make an approximate estimation of whether it is a fast or a slow line by determining how the queue is progressing. Factors such as how many participants a line has,
how much service time people ahead of you might require and how work at the various counters is progressing all determine one’s assessment. These are examples of factors that do not have obvious counterparts in queues based on numbers – yet some similarities exist.

Participating in a queue involves obligations. “Each member of a queue has a ‘moral requirement’ to be aware of their changing place in the order of the queue and to take their turn promptly or they will be susceptible to justified complaints from people further down the line.” (Laurier et al 2001) As already pointed out, queuing with a number does not require that you position yourself in a certain way, however. It is sufficient for you to note when it is your turn. But participants in the queue tend to act as they are expected to act, and keep monitoring their numbers to ensure not to miss their turn. Since the queue is rigid with respect to turn-taking participants sort of keep confirming ”it is still not my turn, it is still not my turn, it is still not my turn”, and follow the progress of the queue on display instead of memorizing their individual number.
Figure: Participant confirming that it is still not his/her turn.
To compensate for the risk of missing one’s turn, participants choose to stay close to the queue and confirm that they are still rather far away from the goal instead of taking a chance in estimating the progress of the queue. In a way this is explained by the fact that acting in response to your own priority involves noticing how other priorities change, while waiting for your own number to be called. So, participants in a queue are all waiting to become the one holding the number that is next in turn.

Every time a new number comes up this is what tends to happen:

The staff responsible put a new number on display, call out and look around in the room in expectation of a response. No reaction. A woman with a queuing ticket is the person standing closest facing the counters with her queuing ticket ready to hand. She looks like someone who could be next in turn. When a member of staff calls the number on display a second time and looks around for the person she is ready to serve, the woman seems to lower her gaze deliberately. In the calm that has arisen, where the person with the valid number has still not made herself known, the woman walks with a clear step towards one of the shelves with skin lotions lined up for sale as if to indicate that she’s not the one in turn. She then remains at that spot looking at some of the lotions when a member of staff presses the button to call the next number instead. At this time a man immediately walks toward the counter with resolute steps. There is no doubt he is the person with a queuing ticket matching the number on display, i.e. it is his turn at this point.

If a person is not holding a number called to the counter, it is not unusual to see him or her make responsive acts that divert attention. This goes for
people who could otherwise be mistaken for being the person in turn and thereby be expected to approach the counter. When acting in response to the progress of the queue it is sometimes enough just to avert one’s gaze to indicate a desire to be separate. At other times a person needs to take a few steps away from the counter. This is just enough to quietly announce a temporary but conscious lack of concern about the current number.

Figure: People are waiting around with their queuing tickets to hand.

Figure: Suddenly a new number is called and displayed with a tinkling sound.
Figure: Participants in the queue look up at the display...

Figure: Some participants follow up by looking down at their queuing ticket to check their number.
Figure: Some of them even take a second look at the display.

Figure: The participant with the matching number approaches the counter, and other people might follow this movement.
You can identify how members of a queue, just as in a line-up, follow changes in the queue according to a sort of pattern. When one member moves up to the counter, another participant with a number that is close to taking his/her turn approaches the counters. Just as a participant approach the counter when in turn, the rest of the queue often follow this changing progress physically.
Figure: Three persons are waiting for their turn. As a new number is displayed the man in the foreground and the man further away look up at different displays. The man further away approaches a counter (located to the right outside the pictures), whereupon the woman in the fur takes a few steps towards the counters aswell, acting in response to progress.

When a new number is called, participants take a look at their queuing ticket, glance at the number on display and then take a few steps closer to the counter as if to confirm the progress of the queue. Occasionally someone even brings out his/her wallet, looks through his/her chosen goods, or takes other courses of action as a means of preparing for taking one’s turn.
After a new number has been called, a little time elapses and the staff might repeat that number two or three times. If there is still no reply after they call a new number. From the point that your number goes on display until when the staff decide to call another number you are expected to notice the change in the queue, identify the number on display, compare it to your own number - if it corresponds to the number on your queuing ticket you are expected to approach the counter. It is your turn for only a limited time though this time may be indefinite as the staff make the arbitrary decision that your turn has passed. If you fail to respond to your number, now on display, may be deemed invalid, and suddenly you have missed your turn.

In this sense there is a natural gravitation in that you need to be present within audible/walking distance to the queuing aid. Gravitation incorporates both a need to be situated where you hear the sounds that notify changing priorities, a constraint in placing yourself so that you can identify the numbers that are displayed, but also some dependency on other members in the queue in order to predict progress.

**Compare displayed queue to people present**

In the numerical queue it is not always only the displays and the numerical order printed on queuing tickets that in combination reveal the progress of the queue. As a member you can watch the changing numbers on display and as a complement also interpret other members’ actions. The displays indicate that there are a larger number of people ahead than there actually is but by noting the others in the queue you can make a
better estimation of the accurate queue. It is more or less difficult to do this in a satisfactory way.

Since there is no absolute match between your own queuing ticket and the queuing order it is up to you as a participant to sustain the queue and form an impression of the queue. In the numerical queue there are at least two factors that might indicate something about the actual composition of the queue – the people present in the proximity of the queue and the displayed priorities. The limited possibilities of estimating and predicting the progress on the basis of the displayed queue are not sufficient. Staying in the proximity of the queue and making sense of other peoples actions’ creates an awareness of the queue that the numerical order does not provide. Given that both these factors can be equally misleading, for different reasons, any estimation of the queue is most accurate if combined and compared with one other. With a goal of estimating the number of priorities ahead, you benefit from noting both how many people appear to be participants of the queue and the number of priorities ahead on display.

If, on the other hand, you decide not to stay in proximity of the queue you have no chance of recognizing either of the factors that help to estimate progress. (The displayed queue is not accurate, the queuing ticket is not autonomous and the categories of participation are not represented). The features of the queuing ticket and the numerical order, and the fact that it is not autonomous but dependant on people being collocated are perhaps the main reason for the gravitation.
Cases concluded

The queuing ticket demonstrates qualities that most of us recognize. The system with queuing tickets and numbers on display is also rather common and we have learned to manage its limitations and disadvantages. Some of the limitations might even be turned into advantages at times. The indicated precision in the use of a numerical order is, as pointed out earlier, quite correct since you can follow the progress of the queue gradually and you can learn how the specific queue you are participating in is working. This is visible when numbers are displayed and in the way people in the queue respond when it is their turn. A novice at queuing can apply an approach of “learning by doing” and participate as a regular visitor. Even if you have not been participating in a numerical queue before it is possible to join and gradually find out how it works.

In following progress and waiting your turn you develop a sense of the queue – how much time each number requires to reach the counters, how strict the staff are with serving the right number at the right time and so on. The fact that you are holding on to a queuing ticket signals that you are a member of the queue. The advantages of this are obvious to other participants but the system is also an acknowledgement of the individual’s situation. There is, of course, no obligation to display one’s queuing ticket, but there is an obligation to be present when it is your turn. As demonstrated before, you are not in earnest if you only marginally miss your turn since the staff may compensate and serve you in between priorities. But excuses like “I went to the wrong counter” or “I didn’t manage to get here until you called the next number” will not
necessarily be accepted. Despite a range of reasonable excuses you eventually reach a point where you have actually missed your turn. In other words, members of staff are willing to oblige up to a certain point, but one can assume that other participants in the queue may resent this.

A queuing aid might be much more flexible and less precise than it seems with, for example, the limited validity and expectations of queue participants’ responses. But some sort of limitation or obligation, a clear rule or agreement of when a certain number is no longer valid is still necessary. This statement might work as a sort of concluding thought about the practice of queuing and new forms of interaction. The numerical order system used today is not always precise, which must be seen as something positive, but it might at times seem vague. In a vague queue, other participants might have different opinions as to what is fair and perhaps claim that you have missed your turn even if the staff are willing to compromise.
4. Concepts

The cases describing queuing situations illustrate something about the ways in which people act to obtain an awareness of the composition and progress of the queue and watch over their changing position in it. These types of acts are especially evident in queues based on participant’s physical arrangements in lines; the same thing has been observed, however, in queues arranged by number. Queues arranged by number do not give an overview of the queue, and the possibility of forecasting how the latter might progress depends to a great deal on the accountability of other people’s activities. Accordingly, the concepts: Queuing with a color; Others as display; Inversed Course of actions, are explorations in making the practice of queuing less constrained by the ways in which participants currently act to sustain a queue. These concepts trigger reflections on the basic conditions of queuing when changing some attributes and imagining features that differ from our habitual ways of queuing.

The recurring themes for investigation in the concepts reflected on in this chapter are concerned with creating more intelligible queues and more action space for participants. In many queuing aids, variations in other peoples’ actions are not represented and are not necessarily accountable through social interaction either.

The concepts below are concerned with the creation of:
a less punctual and more flexible queue. With numbers presented as colors a queuing practice allows different forms of participation and makes progress visible to others by using a display system a more visible queue, showing more of the progress of the queue a setting where you queue more individually to get away from the gravitation towards the rest of the queue in an inversed course of actions

The concepts explore:

if replacing numbers by colors could decrease the rigidity of the queue
if the visibility of one’s position in relation to others in the queue increases the understanding of one’s progress in the queue
if an inversed course of actions could transform the ordinary idea of how we queue up

4.1 QUEUING WITH A COLOR

Replacing numbers

Queuing with a color is a concept aiming to represent the order of priority in more pervasive ways. Replacing numbers with another form of representation is an effort to reveal less precise information on the number of participants a certain queue contains and rather give a pervasive feeling of how the queue is making progress. The idea has been to try and achieve this by illustrating the progress of a queue with a range of shifting colors.
The queue is displayed using a range of colors where every shade represents a position in the queue. When queuing up you have a queuing ticket with a color instead of a number. Imagine you are given a green ticket. The visitor that arrives after you gets a similar shade and will be served within the same scope of time as you. It would not necessarily be absolutely evident how to separate between the two closely located shades since they blend with each other, but that is also part of the point. It opens up for creating a less rigid queue, causing an extended period of validity for each position. -

Figure: A range of colors and visitors with queuing tickets in similar shades.

Adding and reducing color priorities
Visualizing the queue in colors should cause a more accurate mediation and make the queue more intelligible to participants. With another
representation than numbers, it should be easier to add and withdraw positions from the queue, in a way that would make it intelligible to people in the queue. The conviction that it would be fruitful to use colors instead of numbers is hence strengthened by the thought that a color scheme could better handle new priorities being added and others falling off, by simultaneously adjusting the sizes of the displayed colors. Events of people being added to the queue does not literally occur though, but the idea has to do with instances when people miss out on their turn and later hope to be excused and allowed service beyond their queuing tickets validity. A participant with a red color missing out on his/her turn would result in a reduction of the red shade, making the red color pass faster on display. Should a visitor first join the queue and be assigned a color, but later decide to leave again - his/her color is subtracted from the represented queue. The color that a participant resigns from is simply not monitored any more. Changes in the queue become immediately evident by the counters. Without demanding participants in the queue to observe every instance of the progress, as is often the resulting reaction when a new number goes on display, the displayed colors illustrate a more corresponding image of the queue. It shows the queue more visually in the periphery and does not prerequisite the same focus of attention from people following how the queue makes progress. If several participants decide to leave the queue, which sometimes happen during busy hours, several shades within the range of colors pass by fast and are displayed only casually (in a short time).

Investigating the use of color priorities was an effort to find a solution where it would be possible to add and withdraw priorities from the queue
gradually as obstacles occur. But these aspects proved to be relatively hard to work with, having for example that even a small change in the queue would lead to several other features of the system being affected with the need of revision. And the fact is that some results of queuing with colors are not far from what is caused when queuing with numbers. A setting covered with displays and fabrics in changing colors would show the changing progress like numbers previously did, but only now in more abstract and perhaps a bit more palpable colors.

Figure: The physical place of the queue, with surfaces covered with fabrics in changing colors.

**Increasing the period of validity**

The idea of using colors hold an innovative thought that concern the fact that each number is originally only valid for a short time. This is perhaps the main reason for why many participants fall out of the queue, which makes it hard for other participants to have an accurate awareness of the queue. It does not primarily have to do with the use of numbers and
difficulties of estimating the number of people ahead because this could be done with some efforts of comparison. But it is caused rather by the rigidity of queuing with numbers. Accordingly, numbers that pass by without any participant being served have a lot to do with the fact that each number is valid for such a short period of time. In other words, if the validity had wider margins and if an increased number of participants would make it in time for their turn, the representation of the queue could thus become more reliable.

In order to counteract occasions that cause participants to fall out of turn, each range in the color scheme, i.e. each color, delay on display for a fixed period if time. As a participant in the queue you would not have to act in response immediately as your color is displayed, but there is wider margins. This means indirectly that each color in a way claim more validity, not in stealing time from other participants but merely in that each color is valid for a longer period of time. Just this added feature of an extended validity could contribute to less people missing their turn and immediately make the displayed queue more accurate.

The colors convey, that is true, that it's more obvious and clear that a color is valid during a longer period of time. And it is probably naturally acceptable that an orange color, could count as valid even when the color has passed on to a yellow field, at least more acceptable than it would be if the number 12 counted as valid even if the current number on display was 16. The margins with colors are less explicit so to say. Wider margins and thus a less precise arrangement could finally accomplish a wider action space for participants.
The difficulty in calling colors verbally

All this talk of replacing numbers with colors are attempts to prevent the rigidity that the use of a numbers has shown to hold in the earlier descriptions of the queuing practice. But the question is how much of it that is inhabited in the numbers as such. The rigidity lies more in factors beyond the numerical order and simply replacing them with something more abstract as colors does not supply much more action space. In fact, an order of priority illustrated with colors complicates one decisive part of the queuing practice. As of today, the staff-person calls each new position (participant) to the counter by verbally shouting the number in turn. But when not using numbers, what are they supposed to shout when the next color shade is to be called to the counter?

![Staff calling a non-verbal order of priority to the counter](image)

One important quality that the queuing ticket actually holds is accordingly that it works as a certificate for claiming service (getting access to service when in turn). You know that it's your turn once the number on your queuing ticket is called and shown on display. At any stopping, as when
more than one participant is convinced that he or she is in turn, the queuing ticket works as an evidence to settle on who is rightly in turn. That is how the queuing ticket admits access to service and these qualities are partly eliminated when using the more unique representation of colors. Colors are not as natural to call out and it's harder to compare them with other priorities within the order.

**A more forgiving queue**

In some respects the punctuality one might experience when queuing with numbers is not as strict as sometimes imagined. Both other participants in the queue and the staff people’s ways of handling the punctuality in a queue have some spontaneity to it, and do not always follow strict rules. The obligations of queuing are adjusted to fit the circumstances of each situation. Extenuating circumstances are taken into consideration and often excused, for example if people miss out on their turn with a small margin or due to misunderstandings.

The queuing aids build much on the qualities of punctuality and rigidity, while people’s ways of using the features are more varying and not always so punctual. This is not a development that should necessarily be counteracted, but a desirable tendency, to some degree, and a possible fruitful direction for future queuing practices to take. Perhaps it is not rewarding to implement queues arranged with colors, but creating queues that afford forgiveness, could bring about a wider action space for participants.
In queuing practices where numbers are used to arrange the queuing order between participants, it is possible to estimate the number of positions ahead by differentiating between the number currently served and the number on your queuing ticket. But since the amount that such calculation gives does not always equal with the actual number of people you have ahead of you, the amount you end up with is quite uncertain.

To sum up, the advantages of replacing the numerical order with colors are few or at least fewer than the disadvantages. But still the digression in ideas of an illuminated progress leads on to other insights. These insights help deciding on the importance of certain features and to take position on issues as for example the affordance of numbers, the habits of calling numbers verbally, the aspiration to find a form that illustrate changes in the queue etc.

4.2. OTHERS AS DISPLAY

A more intelligible progress of the queue

The idea of having other participants display the queue, takes off from where queuing with a color explored how to represent each position in the queue with something other than a number. The vision is to find additional ways of avoiding the focus on numbers and how they are displayed – attributes that tend to demand much of visitors attention. When using others as display, the intelligibility of the queues progress is
(in this concept) more important than knowing your precise position in the queue. (A queue where the progress is made more intelligible and the features (queuing aids) are less rigid could leave room for a wider action space and a more forgiving attitude among the participants in that queue.

**Instead of numbers**

Representing the order of priority with a narrative sequence of images was a primary idea that could contribute in adding meaning and content to the practice of watching over your turn, having that the collected priorities displayed also supply a story. There would in other words exist some underlying meaning in watching over your turn - pure content-wise. Since the act of queuing consist in watching over priorities it seems relevant to make the priorities as such more interesting.
Therefore and as a reflection of how participate in a queue actually have something in common simply because they are sustaining the same queue, there was the idea of sharing something else with each other. The idea was to let the participation in a queue involve the obligation of sharing a personal quote. Instead of calling out a number, the staff would read out loud the quote belonging to the person next in turn and thus have something with significant meaning to call out. And each time a new participant is in turn and his/her number is displayed, the others in the queue would take part of that person’s contribution (which could of course be less personal at times).

Even if the idea with quote queuing is not all plausible to introduce, it nevertheless led to reflections on how to use portable displays to visualize the priorities among participants in the queue. Envisioning how each quote does not only cause changes on the common displays but also in personal handheld devices is achieving a visual effect with changes mediated among members. This leads to the reasoning of using others as display, which is a step towards an even more autonomous solution.

**Queuing displays**

With *Queuing Displays* the idea is to make it possible to follow the progress in having other participants act as intermediary, as they do already in the practice of today. This is to get away from the need of
having a precise understanding of how many you have ahead of you. Envisioning others as display is in line with eliminating the common displays and to have the progress rely more on the personal displays. This is in order to transport the gravitation from the common displays and instead situate the queuing features to solely rely on your Queuing Display in relation to others participants Queuing Displays. Since there would be no common displays placed in the ceiling or close to the counters as in ordinary setups, the participants in a queue relies solely on the progress revealed through the distributed displays. Each participant choose whether to queue independently or to stay in the proximity of the queue in order to also get a sense of ones order of priority in relation to others.

This involve for the participants in the queue to be present so that all features can be made use of in full. If a majority of the participants in a queue choose to queue independently the effect of others as display is naturally diminished/decreased. On the contrary if many participants in the queue are present, it could give the effect of a surface of displays pulsating at different rates and thereby revealing the progress of the queue progress.

It is still sufficient, however, to merely use your Queuing Display independently and have a sense of your own order of priority and rate of progress without knowing very much about the other participants in the queue except the extent to which they affect your own progress. Even if you are not in close proximity to the rest of the queue the displays
indicate the relative positions of the different participants as they move forward at different rates.

Each display emits a steady light when its owner is in turn for service. This does not require that the individual approaches the counters immediately as some leeway is built into the system. Several participants may have their turn and a steady light in their Queuing Display at the same time.

Figure: People equipped with Queuing Displays.

Up to a certain point it is sufficient to have a rough feeling about your position in the queue relative to that of the other participants and it is not necessary to know how many people are in the queue. (To visualize the
progress in this way requires that it is sufficient to know that it is your turn when it is almost time to be served. In other words, you do not know how many you have ahead of you. You simply wait for the green light to indicate that it is your turn and you do not need to pay attention to how many others are waiting. Even if you know exactly how many you have ahead of you, there is always the possibility that the queue will progress faster or slower than expected. Hence you have no use for exact information about the number of people you have ahead of you unless the information is accurate and unless the number is updated gradually, e.g. when participants leave the queue. One can say that the queue has been mediated sufficiently if it is possible to establish when you should round off what you are involved in and prepare for approaching the counter.

Thus, *Queuing Displays* are more autonomous than queuing tickets and the queue based on numbers works only in combination with the displays that show the numbers in order. The idea is to make your personal display adequate for queuing purposes and allow you to put a distance between yourself and others waiting. Compared to a common line-up it is quite hard to form a picture of the whole queue when using a numbers. Queues based on numbers require that you stay in the proximity of the queue and watch over the changing priorities in order to interpret the length of the queue. *Queuing Displays* makes progress more immediately visible by giving each member an indication that can be used either individually or for comparing with other members’ priorities. It also enables participants to recognize how many are behind one in the queue. This allows participants to regard information about others participants as a form of added value.
At a pharmacy in Linköping, a feature has been introduced whereby you are given an indication of how many minutes the most recent errands have taken. The feature is a display with such as the following: “The most recent visitors have been served in about 4 minutes”.

Devices similar to Queuing Displays are already in use here and there within the restaurant industry. At a café, for example, you might after having ordered a sandwich be handed a small device that will emit a whistle-like sound when your dish is ready. Unlike Queuing Displays, these types of devices do not give you any advanced warning of one’s progress.

4.3. INVERSED COURSE OF ACTIONS

In queuing situations based on numbers, the displays showing order of priority are often placed close to the counters. For some reason the counters have long been regarded as the goal of the visit, the reason for queuing. But there are actually no obvious advantages with limiting the point of service to the counters. In trying to make the queuing practice more flexible it is therefore important to consider other courses of action.

If the aim is to reduce the unnecessary gravitation towards the rest of the queue and eliminate the phenomenon of participants anxiously monitoring their number without much room for performing other activities in the meantime, one needs to re-model present-day systems. We have become used to the procedure of beginning to count once we
have received a number and adjusting our behavior to the exact moment when our number comes up. It might just be that we have become so used to this course of events that we have not really considered alternative methods of queuing.

Is it necessary to end up at the counter if it is possible to build other constellations of queuers? Why should a queuing practice entail that we limit ourselves to a specific moment to be served when in reality seems difficult to predict progress of the queue? Why is the visit restricted to performing the limited events of queuing in a certain order when other types of participation could be made possible?

**Stating errand in advance**

A new system not based on numbers entails a completely new way of thinking about how to build queues. Creating an inversed course of actions includes an idea of equipping the staff with handheld devices that helps them coordinate the order of the queue. Visitors queue up by reporting their name at a stationary computer when entering. On arrival each visitor would be given a time-code that will decide his/her position in the queue. After that you are free to give additional details about your errand at any of the computers terminals and whenever convenient. At times it could also be an idea to work with different ways of participation, where visitors give an indication of whether they want to be served quickly or if they need some time. At the handheld devices, the staff gets a list of the people in the queuing order, and possibly their errands if they have been described. This may be achieved by people reporting the nature
of their errand(s) in advance thereby making it possible for staff to work efficiently by preparing your errand while you go about other business. In that way, the staff can also coordinate the customers in between one another so that a member of the staff who has the competence needed will serve a visitor with a specific errand. When a new customer is in turn, the staff simply calls out his/her name or locate the person according to any descriptions s/he might have given.

**Occupied while waiting**

The field-studies demonstrated variations in how visitors plan and carry out participation in a queue. Not all visitors equip themselves with a number right away. Some customers make sure, for example, they have all their groceries first and then queue up. This is perhaps most common when it is clear that there are a large number of visitors and where the waiting time is unlikely to change in the near future. It would be interesting to introduce a new form of queue where participants only queue up when they wish to be served.

In the reverse situation, it is not until you have announced that you are ready to be served that your number is set. Accordingly, you are not an actual participant in the queue until you have made it known that you are ready to be served. As a result, you do not count as a participant in the queue until you are actually ready to be served. Besides it is possible to be given an estimated arrival time without actually using it to take a number and participate in the queue.
Even though this is a concept that focuses on individual needs, it should also include features that make it apparent if there are many visitors ahead in the queue. A person with an earlier arrival time would get a better position than visitors arriving later. This means that a person with a ‘good’ position in the queue can drag out his/her visit and then suddenly cut in before others in the queue. Despite the focus on the individual and getting served when ready, there is still a form of underlying order of priority. This order of priority is quite flexible and affected by participants’ choices; it must still, however, be obvious how long the queue is. In other words the underlying order and fairness within an inversed course of events needs to be visible or at least include features that facilitate estimation of the length of the queue.

Announcing yourself as ready to be served by using a positioning system is a possibility in this concept. This also enables members of staff to locate you once it is your turn. While waiting, participants can choose to occupy themselves and await to be located and served once it is their turn – assuming that the staff have made the necessary preparations. This also enables the staff to work more efficiently and prioritize a ready-prepared mission.

Queuing in this manner makes participation more individual and fair. It also eliminates the eventuality of missing your turn, thereby allowing participants to become absorbed in other activities with the full knowledge that they will be served at the appointed time.
No more monitoring

Participation in a queue using an inverse course of action is no longer affected by how carefully you decide to monitor your place in the queue. Instead, it places greater emphasis on individual choice, with the hope that you do not have to be so aware of the progress of the queue. In other words, the other participants do not directly affect your position within the queue.

As visitors are assigned a position in the queue as they indicate the desire to be served, one may not always have an accurate overview of the queue. You are, however, assured of being served once you have indicated your readiness. Reliability creates some flexibility in the system both with respect to the participants and staff. As a participant in the queue you may feel restricted to some degree by having to rely on the fact that the staff will actually locate you. But as the market for positioning systems becomes better and more reliable, this disadvantage should gradually disappear and the features of a reversed queueing system be reinforced.

A mobile staff

The idea of an inverted course of action was initially prompted by a desire to have a mobile staff. During interviews with the staff at the pharmacy in Lyckeby, it appeared that they believe they work in a mobile and flexible way. Their goal is to increase mobility still further. (The Health-Squares are a move in this direction as the aim is to make exchange between staff and visitors more spontaneous.) There are a number of arguments for increasing mobility among staff. Let's imagine a
queue based on the idea that the staff target participants in the queue in turn. The assumption is that participants could complete other tasks while waiting and be served at the spot where the products or services they require are located (i.e. by the shelf where the sun lotion is located when enquiring about UV protection or by the ‘quit smoking’ section when considering giving up smoking).

Figure: Visitor waiting to be located by mobile staff.

Figure: Visitor about to be served by mobile staff.
With a mobile staff a portable device would replace the counter. The staff gain access in advance to each visitor’s errand in order to be able to prepare and collect all relevant products. When the customer is being served they go through the errand in the normal way as if they were serving at the stationary counter. (This vision could also be applied in totally different queuing environments such as in a furniture store or perhaps even in a grocery store where staff could locate customers and guide them through certain purchases instead of offering separate products in separate places. This depicts the common type of attendance where customers serve themselves. No professional person has an overall picture of one’s needs and a more mobile staff could ensure a more personal service.)

Some businesses today already exemplify how practices are changing. They do this in what seems to be strategic directions where their areas are planned and furnished in such a way that visitors are less restricted as they queue. Svensk Kassaservice, which has replaced the Swedish Post Office, does not provide a conventional waiting room, for example. It uses a minimum of space, which encourages visitors to wait outside instead. There is often a crowd of people standing outside Svensk Kassaservice indicating that there are many people waiting to be served.
5. Concluding concept

The studies of queuing practices and investigations on which the present research is based, have led to the following reflections. Ideas for new forms of queuing constantly overlap and incorporate new areas. The concluding concept as it is presented here focus on efforts to increase the action space and freedom of choice within a queue.

Irrespective of what kinds of queueing systems will be in place in the future, we must assume that some qualities are more compelling than others. It is, for example, reasonable to assume that enabling for more flexible ways of queuing will gradually become an important use quality. One of the starting points for the concluding concept presented here has thus been to design a technology that gives participants more action space while queuing.

In order to enable people to queue outside the physical place where the service is being offered, it is essential that the queue is visible, and that its length can be estimated accurately. Variations within the queue must be permitted and such new forms of queuing should be made compatible with queuing aids already in use. To sum up: variations in a queue seem decisive in creating more action space in a queue. To accomplish this, the creation of a more visible queue has been one part of the challenge underlying the present research. The main focus in the concluding concept is accordingly to support more variations in the queue, and as a consequence ensure that the creation of a more flexible queue becomes a
fundamental goal. The aim of creating an visible and flexible queue that supports variations includes:

- making a queue less restricted to a particular physical place
- providing participants in a queue with more action space
- enabling people to join a queue from a location removed from the queue itself

5.1 SPOT THE QUEUE

Spot the queue (STQ) is a concept, which includes design principles for evoking more action space and freedom of choice for people involved in a queue. The idea is also to create new forms of interaction, where the main features consist of a visualization of the complete queue, a webpage with some extra functionality and a mobile application incorporating all the features of STQ.

The aim is to facilitate for participants to gain an understanding of the queue and be able to change their premises for participation. STQ should give both a sense of one’s position in relation to other participants and an understanding of the queue as such. In other words, by combining the features supplied by STQ it becomes possible to estimate one’s involvement in the queue and interpret the queue by identifying variations, even at a distance. Visualization forms the basis of STQ first and foremost by enabling one to discern the queue. Visualization is, however, just one part of a greater whole of new and old features. It is
necessary in order for participants to make sense of the queue; it is meant to give a sort of stability on which to rely while exploring new features and forms of queuing.

Figure: STQ visualization

Ways of participating

STQ enables three different ways for queuing up:
- By getting hold of a queuing ticket, i.e. a number, at the physical place offering the service. This is a low-tech form of participation.
- In accessing STQ via the web and being issued with a place in the queue. This system allows more action space than the former, low-tech alternative since it is possible to make use of more STQ features.
- By joining the queue from a distance using a mobile application, which gives constant access to the STQ features.

STQ thus provides several means of participating in a queue, either at the place of service or from a distance. You can participate on different conditions, either in the usual way of obtaining a number on arrival to the physical place of service or by joining a queue from a distance by means of the STQ application.

Given that the practice of queuing is such a deeply rooted tradition, and that one will have to prepare for making changes successively, new features ought to be added gradually. The STQ concept therefore consists of three basic components, which leave room for both traditional and new ways of participating. The different features that these components include provide different premises for queuing and monitoring one’s position in the queue. One way of participating is reminiscent of the familiar form of queuing with a queuing ticket and a number. However, if this is combined with other features of STQ brand forms of interacting with the queue are created. The basic feature of STQ is the visualization of the queue. The visualization can be accessed both in the physical place, on the web and via a mobile application.

**Visualization of the queue and its variations**

STQ visualization represents the actual queue with spots arranged in sequential order on a surface. (This surface can be a flat screen mounted on a wall, a projection on a canvas, several stationary computer screens or
any another kind of surface that fulfils the task.) The visualization is mediated both on surfaces within the physical place of service and in an STQ application that can be accessed through a mobile device or on the web. This means that participants do not need to stay in the proximity of the area of service to sustain the queue since the visibility of the queue is “portable”. This creates a foundation for participating at a distance, helping people joining the queue from a distance to form a picture of the queue.
Figure: STQ visualization in a queuing setting.
Each spot in the visual representation represents a participant in the queue. Some spots are more intense than others, some are more transparent, and others are gradually becoming transparent. All spots consistently react or change appearance as the queue makes progress, some much less than others. Several spots are still while others are constantly moving forward to the right.

The moment you queue up you are represented with a spot in the visual representation. Depending on the premises for your participation, your corresponding spot will have different qualities. The qualities of your spot is determined by factors such as whether you are joining the queue from a distance or if you are to be waiting for your turn at the physical place of service. Depending on how you act while participating in the queue, the qualities of your spot may or may not change. Changes in the appearances of spots thereby illustrate activities in the queue. The visualized queue is a feature for making peoples undertakings accountable.

Figure: Intense spot, ghost spots and empty spot.

The spots in the middle level (A) represent participants queuing in the physical place of service. The intensity of these also illustrates that the
people they represent are queuing in the physical place of service. If you are joining the queue from a distance, your corresponding spot will be a transparent spot, i.e. a *ghost spot*, which is placed in the upper level (B) of the STQ visualization. Using *ghost spots* is a way to make your distance to the physical place of service visible to others. This enables other participants to conclude that there might be few people present on site but that there are actually many participants in the queue. The *ghost spots* will eventually merge with the middle level and become intense spots. This occurs when a participant who has been queuing at a distance finally arrive at the physical place of service. And equally, an intense spot at the middle level might temporarily pass into the upper level. This reveals that a participant in the physical presence of the queue has decided to digress from the queue for a while and is making use of his/her action space. The empty spots, i.e. the vague spots that are heaped up at the lower level (C) of the STQ visualization represent participants who have left the queue for some reason.

**Motion:** The way the spots progress forward in the STQ visualization is influenced by how a participant chooses to act. Progress will be impeded if one does not respond to the progress of the queue. To some extent it is also possible to govern the movement of your spot.

**Order:** The sequential order is established at the time of queuing up and is later affected by participants’ actions within the queue.

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10 There is no simple way of controlling whether a participant will also remain in the physical place of service, but it is an assumption.
Levels: The levels separate participants present in the physical place of service from those who are queuing at a distance (or those who have left the queue).

Spots: The intensity of the spots illustrates a participant’s premises for participation, e.g. whether he or she is participating at a distance or not. If a person participating at a distance fails to act in response to the progress of the queue it will eventually lead to an empty spot. This participant will lose his/her position in the queue.

Acting in response to the progress of the queue

With STQ you are able to recognize your position (your spot) in relation to others in the queue. Each time a new position takes its turn, the spots in the visualization react and move forward. In this way, variations between participants in the queue are more easily visible than previously. In order to make variations more visible, however, and put the representation to practical use it is imperative that participants respond to changes. In an STQ visualization, spots move forward only when participants respond as expected.

Participation in the queue changes depending on what features of the STQ you decide to utilize. One important difference between participants queuing in the physical place of service and those queuing at a distance is how one confirms one’s position in the queue and acts in response to changes. People already relate to each other when queuing, and position themselves in accordance with the rest of the queue. There are also use qualities of relating to others in the queue even when queuing at a
distance. Acting in response to changes is a way of confirming one’s position in a queue and may facilitate accurate estimations of the length of a queue (for other participants).

Queuing in the physical place of service could be regarded as a more loyal participation, in that the participants dedicate time to be present while waiting for his/her turn. Up to now this has been more or less taken for granted. It is reasonable to assume that a participant who is physically present at the place of service is more likely to stay in the queue and will complete his/her errand. There is at least a greater risk that people queuing at a distance encounter such obstacles as an unexpected traffic jam, an important phone call that cannot be ignored etc.

It hardly seems probable that such delays occur to a great extent among participants staying in the physical place of service. When participating in a low-tech manner by using a number, STQ features are uncomplicated. STQ does not necessarily make any difference for people queuing with a number when it comes to how they confirm progress in a queue. That is to say, if you join the queue in the physical place of service, you do not have to learn new ways to sustain your position in the queue. But when using other features provided by STQ, several new types of use scenarios are possible, some of which will be mentioned in the following discussion. Accordingly, people queuing in the physical place of service with a queuing ticket wait their turn in the ordinary way. But further confirmations are required for people using an STQ application. This is in order to avoid people misusing the possibility of joining a queue from a distance. Confirmations from ‘distant’ participants are also necessary for
a queue to make any progress at all. Thus, when queuing at a distance you are expected to confirm participation continuously, thereby ensuring that the visual representation of the queue is as accurate as possible.

The spot of a person participating at a distance will accordingly be a ghost spot in the STQ visualization until that person is present in the physical place of service. While queuing at a distance with the STQ application, you confirm your participation at regular intervals in order to keep making progress in the queue. A simple reply provides the confirmation of notification of progress. When the queue makes progress, you receive a notification via the STQ application and your ghost spot moves forward in the STQ visualization. Subsequently, you are to reply to the notification and either confirm your position in the queue or choose to make a pause. If you confirm your position in the queue, your ghost-spot will move forward when the queue makes progress. If you have chosen to make a pause, your ghost spot will stay quite still while other spots move forward in the STQ visualization. The progress of a queue is mediated in real time in your STQ application, but the notifications you are expected to confirm appear at wider intervals.

If you receive a notification of progress but choose not to confirm it your ghost spot is delayed at its current position in the STQ visualization; in other words, you do not make progress in the queue. If you consistently fail to confirm, other participants will pass you by. A non-answer is interpreted as a deviation and your spot is temporarily delayed until you respond again. When you have been on delay for a period of time and the permitted period of delay has been exceeded, you receive a notification indicating that your participation is about to be cancelled. Sooner or later
you will drop out of the queue. You will then be represented by an empty spot which ends up at the lower level of the STQ visualization. Once this has happened, you must queue up again if you wish to be served.

**Changing the premises of your participation**

You may wish to leave for a while and create more action space even if you initiated your participation in the place of service. If you wish to leave the queue temporarily you change the premises for your errand via an STQ application (supposedly via an STQ webpage that can be accessed in the physical place of service). You may for example announce that you want to be assured to have at least five minutes for conducting another errand. This is how it is possible for you to be queuing in a low-tech way but on similar premises as a person using a mobile device and an STQ application. Only participants using a mobile device may confirm his/her position in the queue and continue making progress while not being present at the physical place of service.

Changing the premises of your participation means that your corresponding spot in the STQ visualization changes appearance. Your spot goes from being an intense spot located at the middle level of the visualization to a spot, which closely resembles a ghost spot. Your ghost spot will then move along at the upper level of the visualization while you are away. Should you be on the verge of returning when it is about to be your turn, your spot will stand still for a period of time to allow the spots of other participants to pass by until you are back. Meanwhile, your spot is delayed and visualized as an empty spot that is not making progress,
showing that you are not in the physical proximity of the service area. Once you return to the place of service again, however, you locate your spot in the STQ visualization, reactivate your participation, and soon it will be your turn. You are not allowed, however, to delay in this way for an unlimited period of time. After a certain period of delay and without updated premises, you eventually lose your position in the queue and your ghost spot gradually becomes an empty spot. Your empty spot will pass to the lowest level in the STQ visualization and end up among the heap of spots caused by other participants leaving empty positions behind. Accordingly, when resigning from the queue you do not have a position in the queue anymore, and your spot lands among the other empty positions at the lower level of the STQ visualization. When this occurs often, the STQ visualization will show several empty spots, making it possible to see if many people have resigned from their positions in the queue. The STQ visualization not only gives an overview of the queue as it is now but also illustrates previous changes in the queue.

In addition to enabling people located in the physical place of service to change their premises for participation, people queuing with a mobile device have similar possibilities. With a mobile STQ application you change your premises on the spot and rarely in advance. If, for example, you have been queuing at a distance for some time but suddenly arrive at the physical place of service, you might wish to confirm your presence. You do this either when you receive the next notification of progress, or at your own volition at any time. As a result, it is possible to change one’s premises again and again should any premise prove incorrect.
A decisive point

Irrespective of what premises for participation you choose to use while queuing, you eventually reach a decisive point in the queue. This is when the varying premises for participation are rectified. From this point onwards everybody participate on the same premises. When reaching the decisive point it is thus necessary to be present at the physical place of service.

The visual representation illustrates the decisive point with the aid of distinguishing lines. When your spot reaches the this point it is meant to move inside those lines, separating your spot from others that will not have their turn in the near future. If you were already present at the physical place of service when reaching the decisive point, your spot is already on the level of the distinguishing lines and it simply moves forward without changing qualities. If, on the other hand, you have been queuing at a distance, with a ghost spot moving forward at the upper level of the visualization, your spot will pass to the middle level once you are present at the place of service. Your spot will also take on the qualities of the spots on the same level and become an intensive spot. The intensive spots already located on the middle level give way for you once your spot merges with that level.

A participant queuing with an STQ application who has not yet arrived at the place of service at this decisive point runs the risk of losing his/her position in the queue. Since this is such a decisive point, it is possible at this stage that many participants must resign from the queue and a heap of
empty spots will land at the bottom of the STQ visualization, representing participants who have left the queue.

The decisive point is a vital feature in order for users to combine ways of participating and make it work in a practice of queuing. The queue becomes readable and fair by introducing an element of conformity, which replaces the earlier variations. Regardless of whether you have been making use of your action space while queuing or not, all participants ultimately have the same premises for participation. If you do not fulfil the criteria for the ultimate stage in the queue, you will no longer be considered a part of the queue. Participants should be able to trust that any spot that enters inside the distinguishing lines actually belongs to a participant who will claim service once it is his/her turn. And a participant who has been queuing at a distance must arrive at the physical place of service sooner or later. If not, he or she will lose his/her turn.

From now on it is my turn

There are other improved features in the STQ that aim at reducing rigidity, e.g., limited validity. Adding a wider period of validity for each position and thereby creating a more flexible system diminishes the risk of participants missing their turn by mistake. The fewer participants who miss their turn, the more accurate is the visualized queue in other respects.
An extended period of validity, however, is also needed for people queuing using the STQ application. The assumption is that it would be difficult for a participant joining from another activity to time his/her arrival at the physical place of service to coincide with the moment of taking his/her turn, especially if one’s turn lasts for only a short while. The idea behind STQ is thus to move from “it is still not my turn”, to “from now on it is my turn”.

When you are in line for service, your corresponding spot moves from in between the distinguishing lines and into the vertical frame located far to the right of the STQ visualization. This is what happens each time another participant takes his/her turn for service. The queue makes progress and all the spots in the visualization move forward on the basis of their given premises. The further to the right your spot is located, the sooner you can expect to take your turn. This means that it is not always the spot with the lowest number that is first in line. Instead, your position in the queue is influenced by your actions while participating in the queue.

Based on an extended period of validity, STQ allows freedom of action even when your spot is located in the vertical frame far to the right,. It is not necessary for you to respond immediately when in line since STQ has “wider margins”. This enables participants to avoid missing their turn by mistake. Instead of merely being entitled to service for a short time you are allocated a longer period of time for taking your turn. While your spot is still within the vertical frame, you are entitled to service and can approach a counter at your convenience. This means that if a participant has his/her turn and does not respond immediately, the period of time
during which he/she can take his/her turn will be extended. Meanwhile, the staff has time to serve another participant in-between thereby utilizing the available resources to the full.

Several participants might thus have their turn at the same time and possibly also come to claim service concurrently during an overlapping period of time. The goal is that possible collisions be handled by the people concerned thereby generating greater mutual understanding and coordination between parties in the queue.

If a participant, contrary to all expectations, does not claim service within the margins for his/her turn, the corresponding spot will gradually fade away. The spot eventually disappears from its position in the vertical frame and leaves only a vague trace of a spot until another participant’s spot takes over the same position. The rest of the queue moves on.

5.2. NEW FORMS OF INTERACTION

The criterion for a queuing concept that it enables people to participate in a queue beyond the physical place of service is double-edged. On the one hand it creates a more intelligible queue. On the other, the idea is to have the sequential order of a queue fade into the background while leaving room for other activities to take place in the foreground. The sequential order of a queue is secondary, while other activities become primary. Participants must still be aware of their position in the queue. In order to make room for other activities, however, and create more action space within the queue, a support for variations in the queue must be
incorporated. Visualization of the queue is a central factor, although this needs to remain on the periphery. Creating new forms of interaction within the practice of queuing is thus a balancing act between criteria and qualities.

**Complementary interfaces**

The concept of “alternative interfaces” was formerly often used and referred to within HCI research as a contrast to interfaces that supported activities performed in more traditional ways. This notion has gradually been replaced by more specific expressions, e.g. haptic, augmented, tangible, ubiquitous, immersive, pervasive, peripheral, etc. to describe how new technology is used to accomplish the best practices. Designing for new forms of queuing has been more concerned with the creation of what could be described as *complementary interfaces*, i.e. interaction designs that can be implemented as complements to a work practice in interplay with current artifacts and work procedures. The idea has been to try and create concepts that would fit with the current practice, thereby partly restricting the concepts. As things are at present, the aim has been to keep it simple, and have the concluding concept work as a complement to current queuing aids. The challenge is to create a concept where users’ efforts correspond with the benefits they gain without demanding too much restructuring of what has already proved to be functional.

**Not a coherent crowd**

As described in the cases, variations and different ways of participating exist already, but they are not always visible or understandable. Rather
than trying to counteract the variations that occur within the practice of queuing, STQ is an attempt to justify variations by making them visible. By making variations visible in different ways a queue becomes easier to interpret. Visualizing variations in a queue does not necessarily determine whether a queue will include a larger action space or not, but it probably gives a more readable queue and may enable more action space as a consequence of confident participants.

Regarding the participants in a queue not as a coherent crowd but to consider individual values and allow for different ways of participating. Regardless of whether the variations in a queue are visible or not, the variations among participants influence the progress of the queue considerably. The purpose of including spots with many different qualities in STQ is to reveal variations among participants. Where STQ visualization can help members to better estimate the actual length of the queue and determine its progress, it makes room for a less anxious wait and more action space.

It is not the intelligibility of the variations alone that is decisive for the queue but also the forms of interaction permitted while still allowing for variations. Other queuing aids are often based on the idea that people always participate on the same conditions and in the same ways. In STQ, the aim is instead to exclude additional variations that might affect the intelligibility of the queue.

Several different values can be used as sources of information in STQ and help participants to gain a better understanding of the queue. In the future
one may aim to adjust the size of the spots in order to increase their use as a source of information, and represent the scope of each participant’s errand, e.g. what type of service does a person require, how many different prescriptions does he/she wish to cash, does he/she have a variety of missions etc.? Larger spots in the mediated queue should clearly represent more complex missions; smaller spots should represent less demanding missions. Variations in the size of the spots illustrate that less complex missions will presumably take up less time than those indicated by larger spots. Announcing the details of an errand in advance contributes to the creation of a more accurate queue. It can even speed up a members’ position in the queue if the details of a mission are accurately rendered in that the staff can make full and adequate preparations, so that the mission is complete as the customer approaches the counter. At the same time, it is beneficial for other members in the queue to receive an indication of the extent of other errands as this clearly affects the progress of the queue. Giving details in advance may also result in better, faster service as the staff have a chance to prepare one’s order in advance. The staff can also plan their resources at the counters in accordance with demand.

Today in Sweden people from the home-help service are often given priority in a queue; if this were not the case they would do nothing but queue. With the current queuing aids, however, there is no way to make this unwritten “rule” known to other participants in a queue, e.g. when you have been for a medical examination and need to queue up for the
necessary medicine. In such cases you should be entitled to a better position in the queue. STQ could be a step in the right direction.

Focusing on one’s position relative to others in a queue remains a feature of queuing today. Even if members of a queue are not acquainted with one other, there will always be levels of coordination incorporated in a queue. Participants in a queue share the same goal, and each participant’s progress is affected both directly and indirectly by how others in the queue respond to changes.

Current systems do not incorporate this feature. Normally you can only see how many people you have ahead of you. But in STQ you can also make an estimate of how good your position is in relation to the rest of the queue. This affects people’s level of satisfaction. A position may seem better if you have many participants behind you (Zhou 2003). With STQ your position in the queue is clear. Not wanting to put your current position at risk and end up in a worse situation causes participants to stay in a long queue.

People refrain from leaving a queue where they know their position for an alternative which is more uncertain. You never know just how much you will sacrifice by leaving one queue and hoping for better luck in another. “I know this queue has not made much progress for a long while, but on the other hand there are quite a few participants behind me with an even worse position than mine.” It is as if your own position in the queue looks better and more advantageous if seen in relation to the rest of the queue.
It might thus be more important to be able to compare your position to others in the visualized queue than monitor your specific position. This may be true irrespective of whether you have been in the queue for a while or just arrived. Knowing that you have a lot of participants behind can cause you to decide to stay in the queue and see it as a relatively good position after all. “However you look at it, I’m at least better off than many others at the end of the queue”. You take a malicious satisfaction in reasoning in this way. In other words, seeing your own position in relation to the rest of the queue is beneficial. Instead of merely being able to count the number of participants you have ahead of you, being able to form a picture of the queue is simplified.

**At a glance**

The possibility of enjoying portable visibility of a queue or being able to form an accurate estimation of the queue from a distance is a central feature of the concluding concept proposed in the present thesis. The use qualities are that participants do not have to stay in the place of service, and there is neither a necessity of initiating the participation in the place of service.

The idea of STQ is to produce a queue where the progress of the queue is made more visible by illustrating the extent of the participants’ involvement. This is especially important when envisioning future forms of queuing where participation in a queue may be carried out by mobile means. In a queue where it is practically speaking possible for everybody to be waiting his/her turn beyond the boundaries of the physical place of
service, visual representation of the queue is decisive. STQ visualization becomes a meeting place around which the queue evolves. Making it easier to recognize variations within a queue would among other things enable one to observe when a person joins a queue from a distance.

The idea, in other words, is to make a queue visible from a distance. With a minimum of effort you should be able to spot the queue. This is in line with the overall aim of supplying participants with an “at-a-glance” understanding of the queue which reflects the entire number of participants in the queue.

Improving the intelligibility of a queue is thus a precondition for new forms of queuing as one envisions allowing participants to focus on other activities at the same time as queuing. There must be ways of forming a picture of a queue at a glance. With a more drastic measure where the queuing practice could be made more flexible so that the majority of participants’ could choose not to stay in the proximity of the service area, there would be no queue worth mentioning.

**Features of recognition**

One can assume that people will often queue at the physical place of service even if they are given the option of participating from a distance. This is partly because we have become used to queuing in a certain way, but also because it does not suit everyone to be mobile while queuing.
For those who queue often and are not comfortable with queuing in new ways, e.g. the elderly or those without any desire to use new technology, there should be the option to queue as previously. Numerical order affords a legibility that goes beyond changes in generations and is sufficiently established to be regarded as a regular way of queuing. So for those wishing to queue up as usual, there should still be a machine similar to the old type of number machine. The major difference is that it is now possible to recognize your position in a mediated queue as well and even change the premises for your mission. Despite the plans to replace the numbers with another type of representation, numbers are still in use. Using participants’ names as a personal representation would probably be the most personal representation. But the queuing situation is not the typical place where people would assumingly be eager to expose their names in public.

Numerical order is a form of identification, and the "Spot the queue" concept is still based on the use of numbers. Those who are not inclined to queue up in new ways possibly regard numbers as a form of recognition and can queue up as they have always done. There is, however, an additional possibility to use a larger action space once one has discovered how to make use of the new features. A participant can try to queue up at a distance and experience the advantages with it gradually.

Even if the use of numbers can complicate the progression of a queue at different levels, it is probably not the main reason for the rigidity of queues as described in the section on specific cases. The rigidity that the numbers seemed to cause where participants happened to miss out on
their turn was more related to the limited period of validity and less with the numbers as such.

Looking at the current queuing practices it is not always necessary to actually reveal your valid number to claim service. As long as the queue progresses smoothly there is no reason for stating your position. Should any misunderstanding occur, however, e.g. when two people claim that it is their turn at the same time, it becomes necessary to show and compare positions. In the concluding concept, the use of numbers is not all central, but the numbers function in a way that can be useful without restricting the practice with rigidity. And in addition to making participants feel at ease by using numbers in the STQ concept, other features of recognition are also included. A common line-up has features that the system with queuing tickets and a numbers has unintentionally disregarded. The concluding concept presented here thus incorporates a suggestion to recreate a selection of the features that sometimes occur in a line-up. The STQ concept is in many ways similar to the regular line-up; it is a way of reusing traditional ways of queuing. STQ can be regarded as a newer version of a traditional line-up. As in a traditional line up, people queuing with an STQ application can form an accurate picture of a queue before they even queue up.

Introducing a mobile queuing application can be justified by its avoidance of some of the limitations associated with using the old style number system. When a participant is queuing with a queuing ticket and a number, for example, it is hard to estimate the progress of the queue without monitoring one’s position carefully. You need to stay in the
proximity of the service area in order to respond when it is your turn. It is not enough to monitor your turn with merely a queuing ticket so to say. To create greater action space in a queuing system, it is not sufficient to mediate the queue at the physical place of service: mediation should be somewhat portable. (Attempts to visualize the progress of a queue in a wider area have been made, for example, at a pharmacy in Lidköping. The waiting area has been extended by having displays placed not only inside the pharmacy but also in the area round about, allowing participants to monitor their positions remotely while engaged in other activities. They are still, however, restricted to the physical areas where the displays are placed.)

As a result, a primary feature of a mobile application is that it mediates the complete queue and shows simultaneously each participant’s position. A mobile STQ application with these features could enable participants to adjust the time of their arrival at the place of service, thereby reducing waiting time and making it possible to queue at a distance. A mobile application becomes autonomous in the sense that the application is sufficient in its own right for monitoring your position.
6. Conclusions and future work

The queuing project on which this thesis is based has allowed me to use descriptions of queuing practices as materials for design. The process of creating a queuing concept that reflects the practice of queuing does not constitute a series of answers; rather, it is a way of raising questions about the suitability of specific designs, or a reason for posing further questions. Some of the most central factors that form the basis of the suggested concluding concept are thus some of the most central factors in the practice of queuing. This has opened up for the possibility of actually working consciously on transforming selections of an ongoing practice into new forms of queuing. It has been a way of filtering the practice to find some central factors related to queuing; they are the grains out of which to form new concepts. In proposing the concluding concept the aim has been to incorporate both the qualities of current queuing practices as well as prepare the way for new experiences within that practice by adding new features. This exemplifies how ideas for new ways of queuing can reflect both an existing practice and simultaneously suggest new features of the same.

The concluding concept can be of use both in analyzing existing practices and in reasoning on what functions to consider when creating a new queuing concept. The elements of queuing practices described in the present thesis redirect attention to the actual design situation in the same way as ethnographic accounts point back to the practice being studied (Blomberg et al 2002) In other words, the concepts presented in the
present thesis exemplify how consideration of features contributes to an understanding of a practice. For me, the sketching of ideas has been an essential part of the process of making the practice of queuing visible as the tradition of work-oriented design suggests. From a pure human work science perspective, it could be argued that the present thesis does not give a true picture of queuing practices. And that is somewhat true. Instead, I have aimed at consciously changing it (Fallman 2003) by adding new perspectives based on how people act today. I claim that descriptions with such a research agenda do not have to be true with respect to multiple dimensions and perspectives on queuing. Where the present thesis is concerned, it is sufficient if the descriptions are justifiable from the perspective of designing new forms of queuing systems, and that they are based on real practices. In comparing the conceptions of what is and what could be (Blomberg et al 2002) the practice of queuing is a design space, which incorporates potential room for new forms of interaction.
7. References


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ABSTRACT

The practice of queuing is a daily experience for most of us and it is usually difficult to combine it with other activities. This indicates that people involved in the act of queuing become a bit too occupied with maintaining one’s position in the queue. Despite that queuing is a common phenomenon, queuing situations are now often equipped with aids based on numbers that help regulating the queuing order. Still, the practice of queuing includes several nuances of social interactions that demands careful attention from its participants. Based on cases and concepts with varying levels of viability, this thesis investigates the practice of queuing as a design space. The thesis further suggests how a more flexible queue could be designed. An overall aim is to examine how to provide greater action space for participants in a queue and enable for new forms of interaction. In order to queue from a distance, much of what traditionally constructs the queue is redesigned. To address these issues from a usability point of view, it is a challenge to create an interaction design that allows different ways of queuing without deviating too much from features that are evaluated as decisive to maintain.

ON THE PRACTICE OF QUEUING AND NEW FORMS OF INTERACTION

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