Timeline Collaboration

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ABSTRACT
This paper explores timelines as a web-based tool for collaboration between citizens and municipal caseworkers. The paper takes its outset in a case study of planning and control of parental leave; a process that may involve surprisingly many actors. As part of the case study, a web-based timeline, CaseLine, was designed. This design crosses the boundaries between leisure and work, in ways that are different from what is often seen in current HCI. The timeline has several roles on these boundaries: It is a shared planning and visualization tool that may be used by parents and caseworkers alone or together, it serves as a contract and a sandbox, as a record and a plan, as inspiration for planning and an authoritative road, as a common information space and a fragmented exchange. Serving all these roles does not happen smoothly, and the paper discusses the challenges of such timeline interaction in, and beyond this case.

Author Keywords
Timeline interaction, collaboration, social navigation

ACM Classification Keywords
H.5.2 User Interfaces, H.5.3 Group and Organization Interfaces, H.5.4 Hypertext/Hypermedia.

General Terms
Design, Experimentation

INTRODUCTION

In this paper we look into how timelines can serve as artifacts of collaboration between citizens and municipal caseworkers. We see timeline-centered collaboration as a good alternative to the document-centered collaboration that is often found in government/citizen settings and to the form-based collaboration of the World-Wide Web.

This paper presents a case study focusing on the interaction and collaboration involved in the planning, and control of parental leave within the sphere of Danish parental leave legislation. This involves several citizens along with a municipal office and several other stakeholders such as the parents' employers and labor unions. We take collaboration to be a set of activities that shape each other in terms of content, form, and outcome. An important part of the case study was the development a series of prototypes relating to the idea of CaseLine: a web-based tool for timeline collaboration. The paper addresses the challenges of timeline collaboration based on these experiences.

In recent years HCI has made approaches to describe how collaboration technology is moving out of the work sphere and into the rest of human lives. Designs for fun has replaced that of rationalization and automation of work; empirical studies and design methods have similarly moved away from specific work settings towards people's home lives [14]. In our case study, collaboration crosses the divide between work and home life. CaseLine was designed to support parents' planning of their shared leave and to help the municipal office counsel and control the plans and doings of the parents. In addition, CaseLine can be seen as a means of communication and sharing of plans in ad-hoc communities of leave-takers, e.g. a group of friends. It also has the potential of ultimately forming the basis for the agreement between each parent and their employer.

In order to better understand the potentials and challenges of the design of CaseLine, we focus on dynamics of common information spaces [1] and the more recent framing of social navigation [11]. In any cooperative work situation [1], there is a need for some form of communication or information sharing between actors, be it implicit or explicit. We have used timelines in order to create a trajectory of past and future activity at two levels: The actual parental leave and the information and decision processes surrounding it. Whether this information is immutable and ready to travel across (organizational) boundaries or open for manipulation, scrutiny and interpretation, is one such central tension [1], where the notion of boundary objects helps the analysis: Boundary objects are *"...both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual site-use.*" [24]. The work of [9] on fragmentation of communication spaces addresses the issue of boundaries -

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"*greater attention must be paid to questions of boundary management - especially who is within (and outside) the space for particular types of communication*."

The paper focuses on the extent to which the use of CaseLine is a common information space, and to what extent it may be understood as a more fragmented exchange [10] across organizational boundaries, i.e. the extent to which sharing happens behind boundaries while boundary crossing is controlled. In other words, the extent to which CaseLine opens the information space within groups and communities, and the extent to which it aids participants in changing, blurring, strengthening, and dissolving these boundaries. We focus on how these design choices penetrate the interaction between parents and caseworkers around CaseLine.

The parental leave case is part of project eGov+, which explores e-governance services and infrastructure [8]. The goals of the project are to explore how citizens may be supported in achieving as much as possible on their own and in cooperation with other citizens, and how collaboration between citizens and municipal services can be improved. Based on empirical studies of parents and municipal caseworkers, CaseLine was designed in participatory design processes with parents and caseworkers [6, 15].

The empirical background consisted of 6 hours of focus group interviews with expecting and new parents in mothers' groups (we explain the nature of mothers' groups later in the paper). We conducted field studies in three municipal offices, including three full days of workshops focusing on work and document flow and one full day of participant observation in each of two different offices.

The participatory design process focused on alternative ways of providing shared web-based planning and overview tools [5]. We evaluated these prototypes in iterations of five workshops with municipal caseworkers. Workshops with caseworkers included walkthroughs of paper prototypes, situation game-inspired discussions of social network and adaptive document technologies, and scenario-based, hands-on use of software prototypes [15]. We did initial analyses with parents in the focus group interviews and explored prototypes in seven hours of pluralistic prototype walkthroughs [4]. In and between these activities, prototypes were developed and altered to capture ideas, progressions, and alternatives. The empirical data from all of the above field studies and design activities were recorded in the form of audio, video, pictures and notes (see also [6]).

The paper prototype had a wider horizontal scope to facilitate user feedback on functions. The development of the software prototype focused on vertical functionality, and has been continued after the official span of the parental leave case to explore the challenges of timeline collaboration further.

RELATED WORK

Time plays an important role in a collaborative setting, be it engaging in a collaborative game [3], working in a hospital [19] or collaborating in school [13]. In [18] the authors argue that timelines are useful alternatives in government settings. Moreover [16, 23] and others have developed timeline-based interaction on the WWW, mainly though to summarize personal web history. The relationship between information work and temporal rhythms in collaborative, everyday activities is addressed in [20], where the authors point out that "*in an information-rich environment (...) the critical property of information is that it is available at-a-glance*". Making information available at-a-glance is one of the goals of our work, whereas we have a different approach to time in relation to collaboration. In [13], timelines are used as a visualization tool to create activity awareness. In contrast, CaseLine visualizes past and future decisions and activity. Such activities are e.g. application documents sent, processing time, or periods with unemployment benefits.

Timelines have been deployed in many different settings, mostly to visualize information to create an overview of e.g. medical records as in [18] or organizing search results using time [20]. Mostly the timelines visualize the information, while the manipulation of the information takes place elsewhere, and indirectly. A number of websites (see Table 1) provide timelines, utilizing sophisticated web interfaces, as their primary or secondary structuring mechanism. These timeline tools are mainly used for presenting existing or pre-authored content, often with support for users to register and author their own, personal timelines that can optionally be shown to others. The generated timelines usually consist of a number of multimedia entries placed in time, sometimes supplemented with geographical information.

Direct manipulation of a timeline is known from multimedia programs such as Macromedia Flash, GarageBand, or Windows Movie Maker, where the timeline is used to place events in relation to each other. In these examples the outcomes that are tightly connected to time–music and movies are time-linear media. Some websites use timelines as a visualization of news feeds or search results. CaseLine shares with these that the parental leave period is a slice of time that needs to be manipulated in planning and decision-making. At the same time our CaseLine has an overlay of documents, etc.

Most websites are site-centric, as the timelines are only available at the respective sites, whereas a few (e.g., TimeLineIndex) allow for timelines to be embedded elsewhere. For the author-driven sites, it is generally the case that users create timelines that can subsequently be shared with others. Collaboration as such is rare, though a few sites, notably Miomi, feature a global timeline onto which "moments" authored by the users are mapped.

Name	Primary Purpose	Content generation
Bee Docs Timeline 3D	Presentation	User
TimeGlider	Personal, shared	Shared, user
TimeRime	Personal, shared	Shared, user
TimeLineIndex	Embeddable content	Shared, user
Miomi	Personal, shared, global view	Shared, user
Google News Timeline	Enhanced browsing	Derived from news sources
AllOfMe	Searches mapped to time	Derived from multiple sources
SmartHistory	Art history	Largely preauthored
SIMILE Timeline	UI Widgets	Data-driven
Google TimeMap	UI Widgets	Data-driven
CaseLine	Collaborative planning	Users, regulations

Table 1. Designs utilizing the timeline metaphor

Judging from the timelines presented at the listed sites (Table 1), the predominant purpose of a timeline is to present historical events in an orderly fashion, beautifully typified by the Smarthistory project.

Given the availability of powerful widget sets such as SIMILE Timeline and Google Timeline, we expect to see more websites using timelines as UI elements in the future.

Following the work of [19], information spaces, such as timelines, should not be understood as where information is stored and retrieved, but where work is done. This means that to study "pure" visualization properties isolated from manipulation and actual work can be misleading. We are, however, not aware of any mature HCI research within the full spectrum of qualities of timeline interaction and collaboration. Currently we are left with the visualization literature. The tensions that we exemplify with our design all contain elements that are new in relation to the technologies and the related work we have discussed here.

COLLABORATION IN PARENTAL LEAVE PLANNING

In order to present and explore timeline design, we outline our understanding of the parental leave process (see further details in [6]). We focus on the legislation, the actors, primarily (expecting) parents and municipal caseworkers, the available information resources, and the collaboration between these actors.

The Parental Leave Legislation

Danish parental leave legislation is a complex composition of laws and regulations supplemented by a wide variety of trade union agreements and local agreements between employer and employee. According to Danish legislation the municipality subsidizes salary for parental leave takers to a certain extent, after which the employers cover the costs. The municipally subsidized parental leave can be divided into: Maternal pregnancy leave (4 weeks prior to expected date of birth, automatically extended to actual date of birth); maternal postnatal leave (14 weeks after actual birth); paternal postnatal leave (2 weeks), and parental leave (32 weeks, can be split between parents). The 32 weeks of parental leave can be extended with 8 or 14 weeks, if this is done in direct extension of the 32 weeks. The overall disbursement paid to the citizen is the same, only over a longer period of time. The 32 weeks can be divided into arbitrary periods (from weeks to hours) covering the first nine years of the child's life.

The Danish work force is heavily unionized and many trade union agreements include full salary for a part of the parental leave period. In these cases, the municipality subsidizes the employer who then pays the full salary to the citizen. Apart from general union agreements, there exist many local or personal agreements between employers and employees pertaining to the benefits during the leave period. Consequently, the scheduling and administration of parental leave typically involves the expecting parents, their respective employers, and their local municipality.

The above description of Danish parental leave conditions is a highly abbreviated version of the rules and regulations. Given that at least one parent's income will be dependent on the configuration of the leave, it is vital for families that the applied for leave periods are correct and that the consequences of the specific leave schedule are fully understood in advance. However, the very flexibility has rendered the application for and the administration of parental leave difficult, and entails large amounts of manual administrative labor done by the caseworkers. This leaves less time for the caseworkers to counsel citizens.

The Actors

It is symptomatic for the coordination of parental leave that it is a process that involves many potential stakeholders: The parents need to coordinate the leave plan between them. This coordination is to a large extent affected by the parents' respective agreements with their employers. These agreements can, as mentioned, either be the outcome of overall agreements negotiated by their union, or local bargaining between employee (the parent) and employer. No matter which of these, it is the specific plans agreed upon between each parent and their employer that legally binds the subsidy from the municipality.

Moreover, the parents may have more than one child, not only with each other, but also from previous relationships. As the leave plan potentially spans over a period of nine years, the plan for one child and its parent may overlap or collide with the leave plans of other children and previous partners.

A web of actors surrounds the primary stakeholders. This web consists of e.g. relatives and friends of the expecting parents, and the circles of mothers, organized by the visiting nurse into what are called mothers' groups. These groups are an important source of information, and often

facilitate the exploration of possibilities and constraints of the legislation among parents.

CaseLine aims to facilitate this coordination between actors by acting as a common collaboration object, where coordination and exchange of information can take place. This is explained further later.

Technologies and Information Sources

At the time of writing, the number of online information sources was vast, but very limited in scope. They were provided by unions, employers, or in the form of private online communities (e.g., www.navlestrengen.dk). Typically these information sources provide information specific to either a single workplace, or a single agreement. As goes for the privately hosted online communities these are mostly regular public forums, with no exclusive focus on parental leave. As such there exists no one single place that gives either an overview of the complex legislation and myriad of agreements, or professional guidance to specific cases. The only way to obtain such guidance is by contacting the municipality, the union, or the employer. When facts from all three of them are needed, citizens frequently feel thrown around between agencies that do not really care about solving their problem. As for creating an overview, the complex composition of legislation and stakeholders means that the unions and/or the employers are often the only actors able to give correct information on the specific conditions pertaining to the citizen. However, our studies showed that citizens often sought answers to questions in which they did not necessarily wish to involve their employer.

The current situation

To summarize our knowledge of the current situation and to pinpoint what we design for, we introduce Mette and Jacob, parents of Magnus, five months of age. Mette and Jacob are personas, and the described situation is a compilation of our research findings, intended to illustrate our design idea.

Mette studies Political Science and expects to graduate this summer. She had a student job at the university, but she quit before giving birth to Magnus. Jacob is an economist working for a local bank.

Mette uses her cell phone frequently, not least for text messaging. She also uses the Internet where she browses for information about her new role as a parent, career planning and the job market. Normally she also books her fitness classes online, but she is a little out of the loop because of the baby. When Magnus sleeps and she needs a rest, she goes on Facebook or talks to her mother over the phone. Mette uses Internet banking from a major bank.

Mette knows her way around the Internet, but doesn't see herself as a geek. She gets massive amounts of text messages everyday from Jacob and her friends. Mette was recently in touch with the municipality to sort out her parental leave: They discussed her situation, and Jacob's possibilities for sharing the leave. Mette searched the Internet for information, but in the end had to call the municipal office. They have had many good discussions in her mother's group about how to share leave, and what to do if/when the right job presents itself.

Mette manages to coordinate her plans with the municipality, and Jacob has filled in all the forms for his employer.

One day Mette gets a call from an old friend from school– how would she like a job starting in a month? Mette finds the job very attractive, but the start is earlier than she was planning. Mette and Jacob try to figure out what their options are: Could Jacob start his leave earlier? What would this mean for their budget? Would his employer agree? Could he use some of his vacation instead? It is quite difficult for them to figure out what the rules are, and how much money they will get. They try out various what-if scenarios and Mette, who is at home and has the time, has to make several phone calls to the municipal office, to Jacob's union, and to a couple of friends who have been in similar situations recently. Finally, both parents have to go through the same paper work again.

Challenges and Shortcomings of Collaboration

As explained, the planning process is typically a product of the negotiation between the parents and the surrounding stakeholders. The legislation constrains this planning, as does e.g. the parents' vacation rights and agreements with each employer, if there is one. Establishing the best possible solution in terms of total leave time split between mother and father, total income during the leave period, the possibility of spending leave-time together, and saving leave time for later, calls for the consideration of various "what-if" scenarios. Currently, parents often do not have all the information necessary to calculate these scenarios, and the legislation is difficult to work with due to its flexibility and thus inherent complexity.

Even when parents have decided on the best solution, this has to be communicated to, and negotiated with the respective employers. If parents are employed, it is through reports from these employers that the municipal office gets informed about the parental leave of both parents. The municipal office is only directly involved at this stage, if the parents are unemployed. Moreover, despite having settled on even the best of plans, parents may wish to change this plan. Often, when the time comes for the child to start daycare, the parents need to adjust their plans e.g. to the actual starting date of the daycare. Such changes need to be reiterated with all of the above stakeholders. As a consequence of the above complexity and the problems this poses for parents in understanding the legislation and financial constraints, friends become an important source of inspiration and advice. However, sharing experiences is also complicated and often the municipal office gets questions from expecting parents, who cannot understand

why and how their situation differs from that of their friends and relatives. This is also true for parents who search for information from the Internet.

THE CASELINE DESIGN PROCESS

CaseLine was designed with an outset in the above-described challenges to collaboration.

CaseLine is to support:

- the individual parent in exploring her possibilities.
- the parents together in obtaining an overview, both when they are together, and collaborating across time and space.
- negotiation and contractual agreement between a parents and their respective employers.
- communication of the legislation and rules to parents, and advice to parents from the municipality.
- commitment to decisions between parents, the municipality and the employers.

Here, we outline the methods that provided the foundation for the exploratory design process of CaseLine.

The Idea, Realization and Iteration of CaseLine

The essential purpose of our prototyping was to expose the challenges to, and potentials in creating a tool that enables citizens to help themselves and each other in understanding, planning, and applying for parental leave funding. In the early parts of the process, we worked with various alternatives. However, it soon became apparent that a timeline-design would support the challenges well. Here we focused on timelines as objects that are negotiated from many perspectives [21, 22]. Hence, we also wished to facilitate the communication and collaboration between citizens and municipal caseworkers, and ultimately also between e.g. employers and unions.

Accordingly, the design idea consisted of the following:

- Visualize the leave for both parents using a timeline.
- Enable changes of the leave plan via direct manipulation.
- Provide shared means of negotiation between citizens and caseworker, through the WWW, or in face-to-face contact.
- Enable the evaluation of alternative scenarios and their consequences concerning time and money.
- Ease and streamline the application process by eliminating unnecessary parts of forms through the use of adaptive documents that continually validate input and, with the citizen's permission, can retrieve already known information.
- Validate the proposed leave plan construction.

To design a timeline that visualizes the parental leave and the regulations and administrative procedures surrounding it, we developed a web-based solution [5].

The explorative prototyping indicated that it is essential for both parents and caseworkers to be able to work with CaseLine and its documents separately from one another, as well as to share these when needed. Consequently, CaseLine has a sandbox mode, which allows parents to explore the legislation and see how their periods of planned leave fit together and understand the economic consequences of their choices. When done experimenting, parents can submit the leave constellation as a concrete application.

CaseLine allows for more than one person to work on the same timeline, synchronously or asynchronously, from one or more computers. As such, both parents have access to CaseLine, and can make and submit changes. These changes will then propagate to others manipulating the same case in CaseLine. Moreover, parents can choose to invite caseworkers to join the collaboration, providing hands-on guidance, either via phone, face to face or electronically in a chat-like form. This form of sharing and collaboration will allow parents to discuss plans and share experiences with their employers and unions, as well as other parents. Municipalities, unions, and employers can provide rules and constraints as plug-ins. However, these ways of sharing have not yet been fully explored .

A screenshot of CaseLine in its most recent prototypical form is shown in Fig. 1. Casework happens over time. In order to give citizens an overview of their case CaseLine must function both as a planning tool, showing what is to come, and as a history tool, showing what has already occurred. As available parental leave is determined by how much has already been spent, such an historical overview is crucial. The timeline can be manipulated with the tools in the upper right corner via clicking, dragging, and dropping.

The timeline planning cannot be used in isolation; there are still bureaucratic procedures to follow, and actual applications to fill out. In CaseLine, these applications are constructed using adaptive documents and by collecting as much information from the timeline as possible. This way the user has to type in as little information possible. Some further information may have to be filled in, but basically users only have to sign the application with his/her digital signature. It is essential for applications to be submitted at the right time to comply with legislation and for the leave to be granted. As such, keeping track of the state of applications is a second, important dimension of CaseLine.

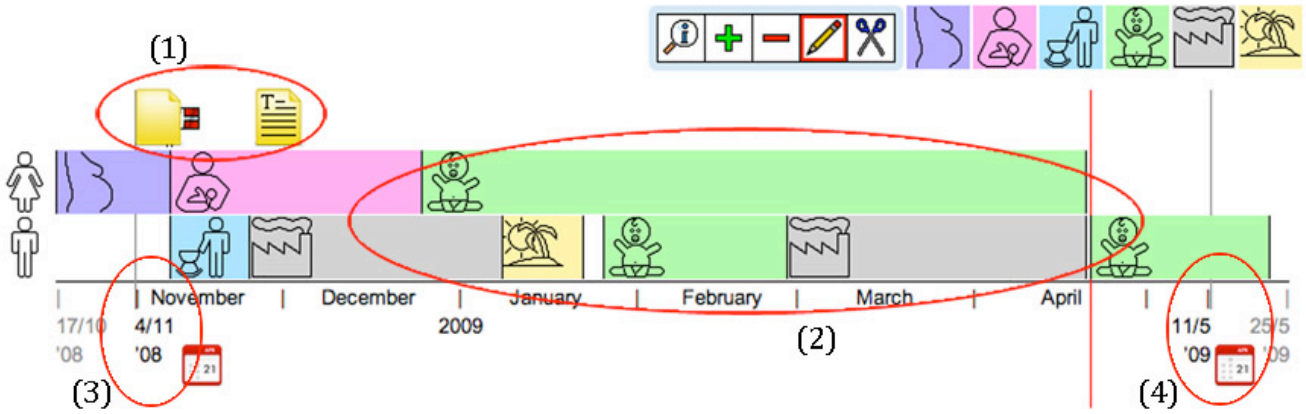

Figure 1: The CaseLine interactive prototype, allowing for dragging and dropping of time periods, and for zooming of the timeline. Labels and interaction are explained in text in the below.

To keep track of the entire application process we introduce two ways of structuring time: Events and periods. Events are single occurrences that happen at a single point in time, such as application documents, and birth or due dates.

Events are shown in the uppermost part of the timeline (label 1 in Fig. 1). Events in CaseLine reflect their current state, if any, by way of different icons. For example, a document can be empty, partly completed, submitted to the municipality, accepted by the municipality, or rejected by the municipality. Using icons to display the state of events helps users to gain a quick overview of the process.

Periods are the other time-structures (label 2 in Fig. 1). These make up a central part of CaseLine and contain the bulk of the information. As described, parental leave consists of several different types of periods, depending on the leave-taker and the time of the leave. Apart from these different types of leave periods CaseLine also displays work and vacation. The reason for this is two-fold. Firstly, both work and vacation can influence the validity of the constellation chosen by the user. Secondly, work and vacation have great influence on the fiscal flow of the leave plan. The economic overview is an essential part of CaseLine concept. Fig. 1 presents an interactive prototype, which, in its current version, implements some (but far from all) of the many rules of the parental leave legislation. Parts of the legislation that have not been implemented are e.g.: employer-specific agreements, and salary calculation contributed as plug-ins by employers; and regulations pertaining to child death.

Displaying the entire timeline on one screen may seem to be a good way of providing an overview. However, as the timeline can span nine years, this would either give a very small scale or the need for a very wide screen. Our solution to this challenge is inspired by the fisheye view, known from several applications [12]. We chose not to highlight through hovering, but to have a zoom "window" in the center of the timeline (between labels 3 and 4 in Fig- 2) with shrunken sections in either end. The user can zoom in and out by changing the start and end point of the main window. The shrunken sections show a compressed view of everything before and after the main window. Consequently, the user can gain a quick overview and change the span of the main window to zoom in on areas of interest.

The Design Process

In the iterative design process, the initial ideas were first consolidated as rough mockups illustrating alternatives. These mockups evolved into more detailed paper prototypes, which were evaluated over several iterations with users. Fig. 1 is a snapshot from an interactive prototype, supporting only a limited set of rules, and limited collaboration between distributed users. The explorative design process led to ideas that will be discussed in the below, illustrating the differences between user communities.

With parents we focused on the citizens' understandings of the timeline and documents. We learned how they would manipulate CaseLine. The fisheye view did not work well and needed replacing. In addition, the selection of dates had problems and needed attention. With caseworkers, we focused on CaseLine for counseling, the use of CaseLine to summarize rules and regulations, and on the potentials of adaptive documents. They primarily saw themselves as secondary users of CaseLine, and their concerns were mainly with rules and documents coming out of the process.

Considering the complexity of e.g. document handling, stakeholder constellations, and the intricate rules parental leave legislation in general we decided against a trial use of CaseLine. Instead, we lessens learned provide the basis for continued development of the explored interaction form and web architecture, which have been generalized. This exploration and evaluation of CaseLine will continue in

settings where we have greater control over rules and data feeding into the design.

Scenario of Future Use

To summarize the totality of what we learned from the prototyping process with regards to future use, we return to our two personas, Mette and Jacob:

When Mette and Jacob were first planning their leave, they visited the municipal website to use CaseLine. They found a software plug-in provided by Jacob's union, which made the timeline specific to his situation regarding salary. This helped a lot in understanding the relationship between time on leave and money paid.

Mette has a friend from the University, Anne, who recently was on leave. Mette asks her if she can see her timeline. Anne shares this with her, and points out that several other friends have uploaded anonymized versions of their timelines to a Facebook group, which can be found through the municipal website.

Once Mette and Jacob have decided on their plan, Mette shares her part with the municipality, and Jacob places a request to his employer to fill in the necessary information, sign his plan, and send it to the municipality.

One day, Mette gets a call from an old friend from school: He asks her how she would like a job starting in month? Mette finds the job very attractive, but the start is earlier than she had planned. Mette and Jacob try to find out what their options are: Can Jacob start his leave earlier? How will this affect their budget? Will his employer agree? Can he use some of his vacation instead? They look at CaseLine again. Obviously not everything can be changed now, after all Mette has spent 5 months of her leave. They sit down at the computer and try out various what-if scenarios. They look at what other people have done by browsing the Facebook group. The sandbox allowing for what-if explorations gives the couple a very good feel for what the legislation allows, what is most beneficial with respect to Jacob's salary agreement, etc.

Once they have decided, Jacob shares the plan with his employer to get an approval of the change of plans. Mette does the same with the municipality, before finally accepting the job offer.

CASELINE FOR COLLABORATION?

CaseLine crosses the boundaries between the work community of municipal caseworkers on the one hand, and ad-hoc communities of leave takers on the other; the parents, the network of friends, etc. Hence, CaseLine is not design for work interaction in contrast to leisurely interaction [7]. Accordingly, interaction needs to be understood differently on these boundaries. Inspired by [1] we consequently look further into the relationships between the parents, as individuals and together, with their shared parental leave; the relationship between exploring the laws and regulations, and making binding decisions with the municipality; the role of the timeline as a plan, versus that of a record of past events; the timeline as a reflection of authoritative knowledge versus that of capturing improvised traces; and finally the tensions that lie in timelines' crossing of communities of professionals and parents.

Alone or Together?

As the future situation illustrates parental leave often involves two parents. The conditions of one parent affect the other. For instance, a parent working in the public sector has the right to higher financial assistance if the partner does not work in the same sector. Therefore, the visualization of both parents' conditions is vital. Consequently, we operate with two interconnected timelines. At the same time these two (or even more, in complicated family relations) overviews have to afford separation e.g. to enable parents to negotiate with their employers separately. Hence, parents need the support of fragmented exchange [9].

However, a shared timeline poses a number of concerns even among the parents: Do parents of a child wish to share with each other all information about their interaction with employers, and government? Even if this is the case, can such openness also be assumed if the parents are divorced, but share joint custody over the child? Can parts of the information be displayed in a way that allows one parent to cooperate with an ex-spouse at arm's length [22]? Who gets to decide which information is shared? Should the consent of information sharing expire after a certain period of time, and how is this visualized?

Previous research has characterized situations similar to our parental leave case as *adversarial collaboration* [10]. Conceptualizing collaboration as partially adversarial has been used as a steppingstone to argue that various CSCW settings should provide privacy. With CaseLine, it seems that even between two parents, an ongoing negotiation of what is shared and what is not is important rather than a static definition of privacy boundaries.

Binding Contracts or Sandboxes?

The concept of a timeline restricted by the current rules and regulations seems to provide leave takers, such as Mette and Jacob, with a better understanding of the complexity of parental leave. In the sandbox users can manipulate different parameters and see the consequences in terms of time and money, until a certain constellation seems promising. They can then turn this constellation into a formal application. Both caseworkers and leave takers saw CaseLine as a useful pedagogical tool for understanding rules and constraints.

It is important for all parties to be explicitly aware of when a certain application gets shared with the municipality, and when it is approved and hence binding. Similarly, it is important that parents can explore the parental leave legislation, along with the financial options, in private. In this respect it was a challenge for the design of CaseLine to make

these boundaries clear, and to help parents in particular understand when they share their timeline and with whom. When can Jacob's employer see his plan, and how does Mette share their total plan with her caseworker, when asking for advice? In our future situation, the caseworkers also have to be able to do their work behind closed doors.

Turning a certain sandbox solution into a binding contract is the equivalent of freezing the constellation of manipulated parameters so as to be able to share those with the municipality in a binding form. The fact that such sharing of information only takes place when a formal application is generated is central to CaseLine. As described by [6] the citizens as well as the municipality invariably need to withhold certain information from each other. Consequently, the citizen needs to be able to make a clear distinction between exploring possibilities and sharing information with other stakeholders such as employers and the municipality.

Record or Plan?

Applying for parental leave for the one child often happens more than once, as we saw when Mette and Jacob needed to change their plans. As described, parents may wish to change their application several times. Plans are resources for action more than they are prescriptions of future action [2, 25], yet in this case, more and more parameters are restricted by previous choices made. For instance, the law prescribes that vacation between periods of parental leave prevents further leave under certain conditions. Hence, the history of the specific leave plan is central to understanding the possibilities within the leave time remaining.

As our future situation illustrates, parents often need to explore their possibilities at a given time, and basically remember which contracts have already been made with the municipality and why. CaseLine serves as a record of this past history, both with respect to what applications have been approved by the municipality and what paper flow is still to be taken care of. Due to the length of the parental leave, parents often have difficulties remembering and reconstructing such trajectories. In the current setting this leads to numerous phone calls to the municipal office, simply to inquire e.g. the number of leave days left.

As illustrated, whenever parents need to revise their plans, they may need to do further sandbox exploration of their possibilities, while understanding what binding contracts they have already made. They may also have to critically examine which decisions affected particular conditions in their current situation.

Inspiring Abstractions or Authoritative Generalizations?

In the design of the increased sharing supported by CaseLine in the form of recommendations between citizens or between the municipality and citizens, it should be carefully considered what kind of information is to be shared. At least two ideal types can be identified:

1: To only display authoritative knowledge. [25] defines authoritative knowledge as "*knowledge that is taken to be legitimate, consequential, official, worthy of discussion and useful for justifying action*". Here, the municipality would decide on a few timelines that are "worthy" of sharing. Comments would not be possible, as such comments might include incorrect or useless information.

2: Users are able to share everything they enter into the CaseLine, and other users are free to comment on it, and reuse the information for their own cases as social navigation. This is much like information is shared on e.g. Flickr, Wikipedia and through other web 2.0 sites based on user contributions.

Through working with the prototypes it became clear that the municipal workers and managers prioritized correct information over existing, but potentially incorrect, content from citizens. This included guiding citizens to third-party web sites with user-created content. In addition, many citizens may not wish to share their quite private CaseLine.

Assuming that the timelines are in compliance with the law, the caseworkers were quite enthused at the prospect of sharing these with the citizens. However, citizens wanted to evaluate information based on personal relationships, and found it inspiring to see what others had done. Contact with the caseworker does not seem imperative. As such, it would be enough for citizens to be inspired by other citizens' CaseLines, and then trying the same configurations on their own particular conditions and seeing the consequences in terms of time and money. We therefore propose that CaseLine should be shareable, but in different forms. What is needed is the possibility to make abstractions, where concrete details such as personal data are omitted. Parents may want to share more details directly with a close friend, than when they are posting a CaseLine e.g. in a Facebook group. The question of exactly how to configure privacy settings between citizens is, however, a design element that we need to explore further.

Open Space or Closed?

In line with [1]'s focus on the tensions in constructing common information spaces, it is possible to look at the individual parental leave case as a common information space, involving several actors with different needs for submitting and retrieving information over time.

In continuation of [9] the space where such timelines and recommendations are shared is preferably a *fragmented space* [6]. As discussed above, parents do not necessarily wish to give too much personal information to neither other parents, nor the municipality. Often this is simply because they do not feel they can fully appreciate their rights and the consequences of the choices made.

Introducing a collaborative technology allowing contributions from citizens, municipal caseworkers and e.g. labor unions severely challenges the caseworkers' understanding of their own role in relation to the citizens. CaseLine raises

both legal and ethical issues in relation to the municipality's responsibility of validating information contributed by other parties. For instance, our data suggests that one of our CaseLine designs caused the caseworkers to feel a pressure to be competent in supervising citizens about collective agreements, which at present is highly segregated from their current supervision.

Work Application or Home Technology?

Our empirical domain and timeline design is not one that gives up the focus on work for that of fun and happy engagement outside work [7]. Neither is it one that gives up the focus on home life and leisure for work. Interaction-wise there is a significant difference between the frequency and perspective of use of the two groups of users: Caseworkers are familiar with the legislation surrounding parental leave and handle many cases and documents on a daily basis. Parents experience every childbirth as unique, and to be enjoyed in the best possible ways. At the same time they see themselves as in a situation of hardship [6], making sacrifices for each other and their child. They use other parents in similar situations to ease this trouble and to share experience. Accordingly the direct sharing of plans and experience among citizens has been our main focus up until now and we have seen CaseLine as a secondary tool for caseworkers. A focus on CaseLine primarily for work application might have entailed concentrating on input efficiency and compliance to other caseworker tools, whereas the focus that we have chosen has rendered these issues less central.

Obviously, juggling the participation of two very different user groups, and doing participatory design for infrequent, yet quite intense use are among the issues brought about in this case study. Crossing the divide between work and home-life has lead to a number of methodological challenges, to be explored further in a later paper.

THE CASELINE SUMMARIZED

In analyzing timelines for collaboration and manipulation, we have found a number of central design choices in our case. As a boundary object, a timeline can function as a formal contract between the involved stakeholders *while being* a sandbox allowing for the testing of alternative solutions. Moreover a timeline is potentially *both* an account of a particular series of events and a plan for the future. However, it is possible that the timeline will not seamlessly support both equally well, or at the same time. A timeline has the potential of supporting both authoritative generalizations and emergent traces: The paved road and the trodden path in the forest, to use the terminology of social navigation [12]. It is essential for parents and caseworkers alike to understand and be able to control when activity takes place behind closed doors (in the sandbox), and when documents are shared or formally submitted.

If we render sharable on the WWW not only the actual CaseLine of a particular leave, but also the abstracted concept behind it, we create new roles for the municipality, municipal caseworkers, as well as for parents who take on the role of counselors to other parents. These roles are not a simple extension of existing roles but pose new challenges. They may even pose new challenges to the timeline interaction, e.g. interaction across web sites.

CONCLUSION

The timeline as metaphor for collaboration in time seems to be an interesting alternative to other common metaphors in interface design, such as the document metaphor.

Our timeline-based design highlights important aspects of timeline collaboration not previously reported in HCI or CSCW. Many features of CaseLine as a visualization and planning tool are not limited to parental leave, and as discussed above, we expect to see more of such designs. While some citizen-municipality interactions are short and simple, others take considerably more time and involve the passing of information back and forth between the citizen and the relevant bodies within the municipality. Just to mention one example, building permits potentially require interaction between several departments and business partners.

In this paper we have explored CaseLine in order to understand design choices regarding timeline collaboration in general. Our work has shown that timelines have potential outside of visualizations, and that they can be used for collaboration and as a boundary object between parents, caseworkers, and other stakeholders. CaseLine helps provide a common information space between parents, and in the collaboration between parents and other stakeholders. The interaction between these parties is by no means simple, and CaseLines help understand and control the boundaries between groups. Addressing these issues will be one of the many challenges facing successful e-governance initiatives in the future.

A next stage of CaseLine design is to provide the tools for making generalizations of individual timelines to be placed in common, either on municipal websites or in more advanced parental leave web-forums. Such technical possibilities need to be further explored.

Developing the timeline prototype in interaction with caseworkers and parents has been a challenging step. Finding ways of putting it into sustainable use is an even more challenging next step.

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