Calendars as User Context Providers in a E-learning Environment

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Abstract

User context is a key issue in context-aware systems' ability to adapt to the contextual environment. Within the area of context-awareness there is a lack of research on the contextual information that specifies the context of the users. In this thesis a study of the capturing of user context from calendars is conducted. The work include a study on calendar users and their motivation for using calendars, a study on real-world calendars' reliability as sources for context extraction and a study on the users' preferences on how they manage and organize their calendars. We found that motivation is of key importance for the users' attention to the calendars' content and it is strongly correlated to the calendars' content. We also stress the necessity of introducing user models - based on the low quality of real-world calendars, and we identify contextual features that users consider during calendar usage.

Keywords: *calendar, user context, context-awareness, personalized learning*

Preface

This Master thesis is the final work done at the Master in Media Technology study in the Faculty of Computer Science and Media Technology at Gjøvik University College.

First of all, I would like to thank to my two girls, Ida Kristin Knutsen and Ella Andersdatter Gule for the patience and support throughout my studies at HiG, without it, this project would not have been possible.

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1 Introduction

1.1 Topic

Technology has long been attached to education, and digital media are frequently used for educational purposes. New technology enables new tools and methods to organize and structure learning that utilize digital media. In this area there are systems that are made to support and administrate learning, most commonly these system are categorized as "Learning Management Systems" or "LMS". Such systems are web-based tools for administrating and supporting educational activities between students and teachers. Some learning platforms also introduce adaptivity and context-awareness to customize the process of learning to the student or user's preferences. Such adaptation is based on the parameters that affect the user's learning process, and the fact that different learners have different learning styles, previous knowledge, skills and different environmental conditions [1, 2]. All of such has been considered with adaptation purposes in e-learning systems [3] to achieve customization for each individual during the process of learning. Anind K. Dey [4] define context-aware systems as:

> "A system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task."

In electronic and mobile supported learning, not only the user's educational preferences, but also the situations can be completely different each time the user connects to the learning platform. The user's suitability and availability of certain learning activities vary, depending on the user's features and particular context. Environmental features such as *location*, *time*, *people* and *resources* etc. changes and are the key issue for capturing context. Dey [4] defines context as:

> "Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves."

According to this definition, this work specify an entity to be a person or user, thereby user context as the situation information about the user. With a know user context (past, present or future) a context-aware system could adapt, customize and/or assist the user in a number of different ways. Mainly this research field is focused on adjusting the learning material to the user's learning styles and previous knowledge, but from an LMS point-of-view, a student's context information enables possibilities related to organizing how a course is structured. Johnstone [5] points out the importance of strategic planning for e-learning, and that student completion rates are directly related to the courses' quality and level of customization for distant learning. Because, one of the main assumptions about E-learning is that learning can be improved by guidance. Normally such guidance come from the teacher organizing the learning process, and the fact that it matters for the efficiency of learning in which order learning resources are offered.

However, E-learning today offers several learning resources that are linked together in a logical way (e.g. hypertext linkage), which makes the learner able to organize the resources without the teacher's guidance. This creates disturbance between the roles of the teacher and learner, where the learner suddenly face the task of organizing learning objects and resources.

Learning systems are diverse, in general they are targeted to either professional cooperations, together with course material and content, or educational institutions where the course content are produced by the institution itself, commonly the LMS forms the bridge between students and teachers. Either way, the target users are different - educational institutions generally consist of users that are fully committed to learning, cooperations and organizations tend to involve users that are educating themselves parallel to their jobs, or as a part of their jobs. The fact that users who are taking web-based courses and have hectic and important jobs simultaneously, often neglects the courses to, for instance, prioritize an important deadline. Which results in an unwanted situation that is not ideal for the user's learning. This fact motivates the use of user context to structure a course, to better suite the premises of a user's situation. The base of this thesis is the issues concerned with the capturing of user context, user context that can be utilized an ease situations like described above.

1.2   Problem description

Adaptive system has been extensively researched (especially adaptive learning) for a long period of time. However, according to Schmidt [6] the focus has been on adapting learning according to the personal characteristics of the users, moreover the concept "learning on demand" also suffers from the lack of research on "user metadata". Schmidt points out three challenges:

> **1)** Capture the context of the learner and the situation in which learning occurs. This encompasses both the work context (the individual's position and role in the organization, current process or task) and the personal characteristics with respect to learning (previous knowledge, personal goals, cognitive style etc.). This context should be managed in a way so that several applications can view and update this context in a mutually enriching way.
> **2)** We need to provide context-aware delivery methods to account for the fact that a learner in a company is not primarily learning, but usually working and interrupting their work for learning. Current methods are only suitable for long-term strategic learning, but not for immediate learning on demand (although there is some research in that direction).
> **3)** We need to perceive that resources themselves are created in context and interrelated with other resources and this context makes a difference in making sense of the individual resources.

And in [7] Schmidt and Winterhalter states that the most crucial point in context-aware applications is the acquisition of contextual information.

Further, there are several sources where user context information can be extracted from. Direct physical sensors [8] (light, pressure, sound, movement, GPS-location etc.) that state real-time information about the present (right here, right now). Such sensors are frequently found on mobile devices and are relatively inexpensive and easy to exploit, but is problematic when trying read the actions a user is performing and social environment the user is in. However, other sources can be considered. Logical sensors, are sources which provide inferred information

about users, it is unmeasured information that states the context of a particular user (or group). Calendars are schedules that define the actions an entity is undertaking, has undertaken or planned in a given set of time, and potentially form a reliable and stable source for accurate information about a user's context. By utilizing calendars in learning systems, students and users could get courses tailored to suite their needs and restrictions.

Calendars, in general answer questions concerning what the actions users are performing in a given set of time, and the where it is undertaken. Typically, these descriptors are specified separately, and by interpreting them correctly one can utilize the information to support user adaptation.

However, the main problem is complex, the first issue lies within the nature of context, context is inconsistent - it always changes, depending on the surrounding environment. Secondly, calendars only provide information that is stated by the user, one can only infer or assume that the information is correct, it is not possible to confirm it based on the calendar alone. This brings us to the third issue: the information contained in calendars are made by the users, and we do not know how users utilize their calendars. Despite a calendar's potential as source for capturing user context, its success or failure, it all depends, as mentioned, on the users themselves.

Much is done on the area of recommender systems, most of this work is focused on developing algorithms, methods and systems for recommending items to users. However using context data for personalization purposes is not extensively researched, but its importance has been acknowledged [9, 10]. The existing research is mainly focused on the functionality that utilize contextual information, and not where and how to capture it, this is further discussed in the related work Chapter 2. Therefore, this thesis' contributions lies within the accommodation for this lack of research by investigating calendars as sources for contextual information.

A user's context could be utilized in a number of different types of systems. An LMS which accesses its users' context information could adapt or select the different learning material accordingly [11]. With the access to its users' calendars, the system could assist users to structure a courses' progression to suite the users in a best possible manner, because it ables the extraction of future context information. In either usage area, such systems depend on knowing how to respond to certain context situations, which again is user dependent. Users are expected to relate to context situations differently, but are there generalizable perceptions and preferences usable for creating stereotypic user models?

1.3 Research Questions

This project is threefold, and is limited by the the following research questions. Firstly, the task is to study the users' motivation for keeping and maintaing calendars. The second task is to study the calendars and their contents. Lastly, the task is to obtain and investigate how users' context preferences and calendar managing methods can be utilized by a context-aware planning assistant. Of the many possible questions that can be formed, the following three research questions are answered in this thesis.

1.3.1   Research question 1

Initially, the first task is to examine why users' keep and update calendars, what motivates them, and investigating whether these reasons affects the calendars' content. The purpose of this study is to identify the key motivation criteria needed to extract user context data from a calendar.

- How do the correlation between different user types and users' motivation affect the contents in their calendars?

1.3.2   Research question 2

The second question, relates to the investigation of real-world authentic calendars and their contents, for the purpose of identifying the calendars' strengths and weaknesses.

- How suited are real-world calendars as candidates for user context extraction?

1.3.3   Research question 3

Utilizing the findings from the previous studies in a proof of concept prototype is the goal for the last part of this thesis, were a study of how users manage their calendars is conducted. This, together with the knowledge from the previous research questions constitute a part of the foundation for the implementation of a prototype of a calendar planning assistant.

- What user context features should be considered in a context-aware planning algorithm, and how do they affect the result?

In this context the "user context features" is the environmental considerations the users make when managing their calendars.

1.4   Methodology

1.4.1   Research question 1

The contextual information in calendars are produced by users, thus in order to create knowledge and understanding about the users motivation for producing such information, the study starts by investigating the users themselves. To obtain qualitative background information, an interview approach was selected to be carried out on a low number of participants. From these conversations the goal was to map the core elements related to the reasons behind users' motivation, that could be used as a foundation for a study with more participants. This approach was selected due to the limitations of our previous knowledge about users, and because of the nature of this project - where large quantitative methods would be considered too comprehensive for our purpose. The initial interview's purpose was to establish guidelines as a foundation for a study on a larger set of users, more participants would able us to observe the variety between different user types and to conclude on the reasons for motivation. To achieve this, a survey was made for, and distributed through the internet.

The work was intended to decide whether there are relations between the users' motivations and the contents in their calendars.

1.4.2   Research question 2

The second research question concerns the calendars, and the investigation of whether calendars contain sufficient data that could be used for extraction of the user's context. In order to confirm

and complement the findings from the first research question, a study of the users' calendars is appropriate. By gathering a data set of authentic calendars, one can observe the containing information and investigate the strengths and weaknesses, more specific: their level of detail, the differences between user types, and distribution of the entries over different time spans. Moreover, how the contextual information is categorizable, and generalizable for larger user groups.

The findings from the first two research questions intended to contribute an assessment of the calendars' potential as a source for capturing user context, both in terms of reliability and its suitability for context-aware systems.

1.4.3   Research question 3

Lastly, the topic was concentrated on the utilization of user context provided by calendar, a system acting according to contextual information needs instructions stating how to adjust to a particular context. Thus, these "instructions" needs to be defined on the base of the users' own preferences and actions. Since users respond to context differently, a interview approach was selected to investigate how a number of calendar users reflect on their calendar usage. Based on our previous findings, again performing a qualitative study on the users was the most natural method to select. Performing interviews/conversations should able the identification of context features that are significant to users' when managing their calendars - ultimately this, in theory, the same considerations should be assessed by the system.

2   Related Work

The following chapter describes the most important theory together with references to related work.

2.1   Context-awareness

Context-awareness has been researched since the first mobile computing devices emerged in the beginning of the 1990s. The term *context* is generally used to describe the environment, situation, state, surroundings, task, etc. Building systems that have knowledge about their situational context is important to understand what context is. Research in context-awareness has largely been focused on location [12] and mobile devices [8], which has been the primary concern in context-awareness for mobile computing of the physical environment. As pointed out by Schmidt et al. [13] and Schilit et al. [14] context is more than location, further features contribute to context, particularly the set of environment variables. Schmidt et al. distinguish context related to human factors and the context related to the physical environment:

- Human factors
  - User
  - Social Environment
  - Task
- Physical environment
  - Physical conditions *light, pressure, etc.*
  - Infratructure
  - Location

A system with the capability to exploit these can examine the computing environment and react to the changes accordingly. Human's actions can often be predicted according to their situation, for instance, there are certain actions related to different locations: office, school, or in a meeting, a fact context-aware systems aim to exploit.

2.2   Calendar as context provider

Calendars serves as organizers for daily activities and task and is a valuable tool for time management and scheduling, both for private and professional contexts. Usually, a calendar contains important information about the user's availability, location and activity in a given set of time. For instance, where a calendar's entry states a *meeting* from 13.00 to 15.00, there is significant

probability for the user appear in a situation with the presence of more than one person. This implies that certain conditions apply to the user's time management before and after this entry, the user might, for instance, want to prepare for this meeting.

Khaili and Connelly [15] points out that calendars offer a simple and inexpensive source to contextual information, and the information could be used by cell phones to dynamically change their configuration. But they have not found any studies that examine the usage pattern of cell phone's calendar, which the related work research for this thesis also conclude about calendar usage patterns in general. Khaili and Connelly's study consisted of 20 cell phones users, where the participants stated that their cell phone calendar is rarely used, and when it is used, it is used as a reminder/memo rather than a scheduler. These days the situation could be different, 5 years after the publication date, with the growth of smart phones (with extended synchronization abilities), the usage of the calendars may have increased. However more interesting is the users that participated in this experiment were told to fill in more detailed daily activities in their calendars than they would usually do in real life. They were told to schedule in advance all activities that were expected to last more than 15 minutes. Which undermines any conclusions about the tested calendars' performance and reliability. Other systems like MyVine [16] uses a calendar as a supplementary "sensor" to a speech detection sensor, to model the users availability for communication. In [17] they utilize calendars through Bayesian theory when predicting the likelihood of a user's attendance at a particular event, and in [18] they use calendars and the users' previous computer activities to predict the availability of the users. In [19] calendars are used to annotate photos.

Commonly the usability of the mentioned systems are partially or fully dependent on calendars as sources for contextual data. The research conducted through the implementation of these systems center around the algorithms and functional advantages they may provide, despite not having the knowledge about whether calendars can be considered reliable. Consequently - such systems could experience low performance when subjected to real-world calendars.

2.3 Calendar studies

Work on users' calendar behavior and usage has been conducted, both studies of calendar usage in general and work that use certain context descriptors (*location*, *notes/keywords*, etc.) from calendars as input to systems. These, however without being defined as context-aware.

Early research by Kelley et al.[20] (1982), Kincaid et al. [21] (1985) and Payne [22] (1993) studied users of paper calendars motivated by the belief that electronic calendars could offer least the flexibility and convenience that paper calendars could. Kelley et al's study predated the widespread availability of electronic calendars, Payne and Kincaid et al. studied users exposed to electronic calendars for some time. Their findings are in many ways obsolete obviously due to the research's age, however they found that professionals' calendar usage suffers from great diversity in terms of calendar management strategies. The participants also reported calendars as organizational tools, to be highly important in through their work day.

Blandford and Greene's work [23] done on users' behavior and requirements in terms of time management, researched calendars and how the individuals users behaved when using shared calendars, more specific: calendars that were accessible and viewable for colleagues. Among their

findings, participants reported that some users use others' calendars as a information resource to get the availability of a colleague in a certain point of time. Participants also reported a curiosity-driven reference to others' calendars, for example wondering where a colleague is. Moreover, the most interesting observations was that users tend to write to their audience; they tend to be more exact and detailed when they know the calendar is shared and viewed by others. In the contrary, when using non-shared calendars the users tend to be "sloppy" and not as detailed, which is important information together with Sell and Walden's work [24] that identified through interviews with 10 workers using PDA-calendars, that the main motivations for using mobile digital calendars were: a) a strong personal need, b) organizational need, c) personal interest or sense of duty. These observations are highly related to the first research question in this thesis.

Blandford and Greene also reported that calendars were used as a record of past activities; for traveling purposes - to calculate travel expenses, reflecting over their past time management, to support future planning etc. And that actions like: preparing a lecture, phoning someone or working on a report was not allocated in the calendar, an observation closely related to the topics investigate in this thesis.

Komninos and Dunlop's [25, 26] prototyope tries to identify a calendar event's category based on the keywords contained in the event. E.g. "Toronto" should imply that the event involves a travel of some sort and if combined with the keyword "hotel" the probability of the event for being a trip would be further strengthened. Moreover the participants in the experiment also were given clear instructions to be precise in their event keyword descriptions. This again (as with [15]) seems to be problematic, because it models a "perfect" world where all the users fills out their calendars perfectly. Again this problem is pushed aside. However the experiment shows a higher hit-rate when adding calendar information to the pre-caching queries, but then again, this is not helpful if the calendars are not "authentic".

The prototype's automatic categorization of the calendar entries implemented. An experiment consisting of 200 "authentic" calendar entries where analyzed and depending on the information it contained it was given a score, indicating the probability for the entry to belong to a given category. Refer to the paper to see the algorithm details. The entries was categorized by the users and again by the algorithm, the results show that the algorithm performed a 73% categorization accuracy.

3   Calendar usage

The first part of this thesis started with an initial study of the benefits of introducing contextual information to learning systems. Moreover, conversations with professional LMS developers and interviews with experienced calendar users were conducted in order to map central aspects of the research area and some of the users' preferences.

3.1   Conversation with Dag Olaf Berg

When studying the literature on the topic of utilizing user context information in learning systems, we found that existing research were limited on this particular area. Therefore we consulted Dag Olaf Berg, a Product Manager at Apropos Internett - a cooperation providing E-learning services through an LMS named SmartLearn. Discussing our topics with a professional within this particular area, was considered to be useful in the initial process of understanding the research field. Also a chance to get valuable insight to the work and challenges faced by a professional cooperation driven by commercial basis compared to academic research organizations.

There was no formal list of topics produced in beforehand, however Berg was aware of our findings from the literature, the purpose i this session was to create a natural conversation around the already presented topics.

3.1.1   Summary

When our literature findings were presented together with the idea of making calendars the primary source of contextual data. Berg's reaction was positive, expressing interest to the benefits user context could have on the process of learning. In addition to the potential of providing contextual data about users, calendars have properties that other "sensors" do not have: the possibility to provide contextual data from the past, present and future. Which ables a context-awareness to be based on previous actions - the user's history, his current activity, planned activity and in the same time together with e.g. location data.

Berg introduced some relevant problematic areas had been unveiled. Firstly, in terms of the gap between system and user - where the LMS and user play on different arenas. Whereas traditional learning between the learner and teacher are conducted in classrooms - sharing the arena, most of the learning systems are web-based, located on remote servers available through internet browsers, where no knowledge (as discussed in 1.2 about its learners exist. The learners are left to themselves with no other option than to seek the arena of the LMS and its premisses. Berg explained this issue to be highly general, but indeed an issue our research on user context could improve. In relation to the same issue the crew at Apropos Internett also had feedback concerning some of the users' viewpoints on E-learning. It seemed that managers in cooperations instruct their employees to take courses or certifications trough E-learning and web-based courses due to their simplicity - "*just make sure to take this web course by the end of this month*", but fail to provide them with excess time to fulfill the course's requirements. The employees' workload is

therefore increased, a result that in many cases causes the course to be de-prioritized in favor of the more "important work".

To accommodate for both of these issues, Berg mentioned that a context-aware LMS may include the user's contextual information to narrow the gap between users and the learning providers, by adapting the course's progression according to the users calendar. Avoiding the neglect of web-courses by reserving sufficient time in the calendar. Further he suggested functionality that could assist the user when planning a course's progression, for instance, a "planning assistant" that according to the best curriculum/"learning path" layout could interweave the course in the users' own calendars.

In order to achieve this, a rule-based approach might be considered, an *if-then* type algorithm that suggests learning objects/modules to specific time spans in a user's calendars. However, the concern discussed was related to the availability of calendars, how should the LMS access them? Schmidt and Winterhalter [7] describe this a minor problem, and from our point of view, this issue would be a part of the implementation stage - if such were to come. It should also be mentioned that the drawbacks may be overshadowed by the benefits from including awareness to user context.

Our conversation with Dag Olaf Berg provided knowledge and viewpoints that would not be available by only studying literature. This real-world experience combined with our literature findings created a broader understanding of the issues concerning this research area. In addition Berg was also available for discussion throughout the duration of this project, which we consider to be highly important and valuable for this thesis' final result.

3.2   User Interviews

An important aspect of this thesis is the knowledge about the calendars users' motivation for using calendars, and their habits for using calendars. Interviews/conversations with experienced calendar users were conducted for the purpose of studying how they administrate their calendars is to establish a understanding of the elements and reasons for the users to keep and maintain their calendars. Investigating this is an essential part of understanding what motivates the user to keep an updated calendar, and to investigate the relation between the user's motivation and the content in his calendar.

Under the agreement for full confidentiality Two representatives from "Apropos-Internett" and one student from Gjøvik University College answered questions about their calendar usage. The conversations were based on the following:

- General perception of calendars

- Dependency of calendars

- Motivation

- Availability of calendars

and our goals were to map the:

- . . . variations between participants/users.

- . . . participants' key motivation reasons.

- . . . participants' attention to content details.

- . . . motivation reasons related to content.

3.2.1 Motivation

Both participants from Apropos-Internett, a manager and a developer were full time employees, and had different views on their use of calendars, which again reflected their position in the company. The manager considered his calendar as extremely important, every appointment was recorded, he kept one calendar for both private and professional appointments while it was synced across his mobile phone and laptop. He firmly stated that no appointment existed until he had listed it as an entry in his calendar. On the other hand, the developer had a flexible relationship to his calendar, more of a week by week guide rather than a hour by hour strict schedule. His calendar reflected different periods, in periods with frequent meetings his calendar was much used. The calendar in periods of projects containing lots of coding and development were relatively thin and contained less details, compared to the manager's calendar. However, the student provided a third view on holding a calendar updated, which reflect the same tendency as the other two participants. As opposition to the employees at Apropos-Internett the student described a calendar with a low number of entries and a low degree of detail. Although the student had synchronized the calendar across mobile and laptop, he expressed the reason was to be reminded of the birthdays and "todos" registered in the calendar.

To understand why different users have different views on calendars we need to look at the aspect of motivation. Understanding the process of how and why an entry is created was the first step of investigating the users' behavior. When users administrate their calendars, underlying parameters affect how this is done. Whilst some users (as it appeared in this interview) are dependent on their calendar, others are not - they have different motivations. In order to understand what the interviewees' motivations were, they were asked to give their personal reasons for creating and maintaining their calendar and rank them according to importance. Table 1 and 2 show these results. It immediately became clear that the second hypothesis could be confirmed on the base of this. According to the participants' background and working environment the motivation changes, as for the three participants these parameters are different which shows that motivation must be subject to further investigation.

Table 1: Professional's reason for motivation

Rank	Reason
1	"show colleagues when i am available"
2	"prevent others from reserving space on my calendar"
3	"remember events"
4	"organize meetings with colleagues"
5	"read details about a meeting (location etc.)"

Table 2: Students reason for motivation

Rank	Reason
1	"remember events"
2	"register deadlines and important dates"

3.2.2 Attention to content

The main difference between the student and the professionals is not only themselves and that they are in two different stages of life, but the fact that in a corporate environments calendars are often shared on the intranet. Colleagues have access each other's calendars to see where people are located and be can invite them to meetings. This results in a different type of calendar than the calendar of a student, whilst a student mainly keeps a non-shared calendar for his own benefit and therefore have no need for extensive elaboration of the data contained. Blandford and Green [23] states that calendar owners tend to write to their audience and we can draw the parallel to our scenario. Shared calendars needs to contain better and more precise information, so that the colleagues can read and understand the content which eventually leads to a different (and stronger) motivation of keeping the calendar updated.

Based on the interviews we have not proven that motivation is correlated with the content of a calendar, but this is certainly a possibility, and we must investigate this further.

These two types of calendars, a detailed one and "non-detailed" one, respectively, represent the key issues when considering a calendar as a source for context information. People have different motivation for keeping their calendars and in this case differences between the manager, developer and the student clearly reflect how they usually work. Does this mean that calendars only are suited as context providers when the factor of motivation is given or is it possible to teach the users to use their calendars correctly, in this case is there a way to teach the users motivation?

In addition to the quantity of data in a calendar, context extraction from calendars also concerns the quality of data, how detailed are the users when describing entries and how pedantic can we expect different users to be? If context is to be extracted from a source, we want to know how reliable the data is and how calendars are suited for this purpose. Such details are meta-data values connected to an entry; location, date, time, keywords, alarm, status, etc. these values are in a context extraction point-of-view important since they can easily be parsed and read by a system, but there is no standard way of describing how to define them, which means that the user again plays the key role.

Again, the interviewees behaved differently. The manager and the developer answered the question on the base of a precondition, the attention to the level of details added in the calendar differed according to this precondition. For instance, when describing the location of an event the professionals usually knew the location of where the event was taking place, and did not explicitly describe accurate data. However, in those cases where the event had a new location, which the user had not visited before, a high level of detail were registered. The student expressed little or no attention to the location, this mainly due to the usage of other aids.

3.2.3   Summary

- **User variations** - Both student and professionals confirm general assumptions one might have about the these user types. However the three participants all expressed different usage patterns, indicating a high diversity among users evan within particular user groups.

- **User motivations** - There are different reasons for motivation, the professionals express motivation as a result mainly of their job environment, where the student is motivated by personal reasons.

- **Attention to content** - The specific situation decide to what level of detail the participants describe the content in the calendar.

- **Motivation and Content** - From the participants' answers, it is hard to establish a correlation between the users' motivation and their calendars. However it was possible to see that shared calendars motivated them, and that was a reason for providing more attention to the accuracy of the content.

Though none of these findings could be considered conclusive, due to the low number of participants and informal setting, however they were indicators to the next step in the investigation of the user's calendar behaviors.

4   Study of Calendar Users

In this chapter the study of calendar users based on the initial findings from the interviews described in the previous chapter is described. A more thorough investigation of the users is conducted, the first section presents the study, the second the results and the last a discussion of our findings.

4.1   Introduction

As observed in section 3.2, there were different reasons for motivation between the student and the professionals. This suggests that calendars coming from these two user types also could differ in terms of content, and that the reliability of these calendars would be different. Sell and Walden's [24] identified motivations for mobile digital calendar users (as mentioned in 2.3) seem to fit these observations, is it possible to confirm these for users in general?
In order to study the first research question:

> How do the correlation between different user types and users' motivation affect the contents in their calendars?

and establish a conclusion, a closer analysis of the calendar owners needed to be conducted. The following analysis is a study of the users and their usage patterns, based on the gathered data from a internet survey where the contributors answered questions about their use of calendars in their everyday life.

4.2   Survey

The reason for selecting a survey as the method for studying calendar users, was the initial interviews in section 3.2, together with the requirements from the research question. Measuring the different user types' correlation between motivation and attention to content, would require data in a suitable format - which a survey could provide if implemented correctly. Based in this the survey questions were divided into four groups:

- motivation

- accuracy

- details/content

- calendar availability

4.2.1   Questions

The questions were mainly presenting a selection of statements were the participants answered by rating each statement according to *1 - disagree, 2, 3 - neutral, 4, 5 - agree*. By using this

scale, the participants had the rate the statement *neutral -* which was important because of the possibility of a question to be irrelevant. In this type of small study where there goal is to identify variables within different aspects of calendar usage, there must be a possibility for the participants to state their indifference. The survey question can be found in appendix A.

4.2.2 Distribution

This survey were to be distributed to as many people that used calendars as a daily tool for managing and structuring their time. In the attempt to gather more data from a broader population of calendar users the survey was distributed as a internet survey through contacts at Apropos Internett and directly via email to the campus' master students.

4.2.3 Participants

A total of 43 unique users answered this survey, where 10 of them did not use calendars in their everyday life, which gave an effective result of 33 participants that answered all the relevant questions. In addition to the four groups mentioned above, we asked the participants to state their:

- year of birth

- gender

- profession

So that it was made possible to interpret the different sub-results based on the user segment each group of users belong to. Of the 33 participants:

- 18 (54,5%) were women

- 15 (45,5 %) were men

and of those:

- 7 (21,2 %) were higher degree students

- 23 (69,7 %) were professionals/employees

- 3 (9,1 %) were both students and professionals

According to the observations from the interviews (section **??**), professionals indicated to have a higher level of motivation than the student and therefore potentially a more "reliable" calendar. This meant that a professional's calendar is potentially better suited for context extraction compared the calendar of a student. And when 23 of the 33 survey's participants were professionals we felt that the data set is a correct representation of our field of interest.

4.3 Results

This following section presents the results from the Internet survey grouped by topic. We present the results from students and professionals separately.

It is important to stress the different number of participants between professionals and students are 23 to 10 and this have to be taken into consideration when reading these results.

Unless described otherwise all questions provided were answered by a grading from 1 to 5

where 1 - disagree, 2, 3 - neutral, 4, 5 - agree.

4.3.1 Motivation

To identify the users' main reasons for motivation they were asked to identify themselves with 5 different statements.

I keep my calendar updated because:

1. *... it helps me organize my work.*

2. *... my work/job encourage/requires me to do so.*

3. *... I always forget things if I don't.*

4. *... my colleagues/fellow students/friends depend on it being up-to-date.*

5. *... my colleagues/fellow students/friends can see whether I am available or busy.*

Table 3: Professionals reason for motivation

Rank	Statement	Reason	% agree
1	1	*"It helps me organize my work"*	100
2	5	*"my colleagues can see whether I am available or busy"*	81.5
3	4	*"my colleagues depend on it being up-to-date"*	79.3
4	2	*"my work/job encourage/requires me to do so"*	69.6
5	3	*"I always forget things if I don't."*	67.4

Table 4: Students reason for motivation

Rank	Statement	Reason	% agree
1	1	*"It helps me organize my work"*	60
2	2	*"my work/job encourage/requires me to do so"*	54
3	3	*"I always forget things if I don't."*	42
4	5	*"my fellow students can see whether I am available or busy"*	30
5	4	*"my fellow students depend on it being up-to-date"*	28

As the results presented in table 3 and 4 suggest, we observe a high level of agreement among students and professionals for calendars to be very helpful when organizing work. However, when comparing students and professionals we see that all 23 professionals "agree" upon this as opposition for students where only 60 % of students "agreed" on this topic. Despite this, the students' result show that this is the most important reason for motivation.

Another observation was made to the overall overview of the answers from the students compared to the professionals'. While the students answers were mostly distributed over the entire scale in every statement, the professionals are mostly providing the same overall result, the
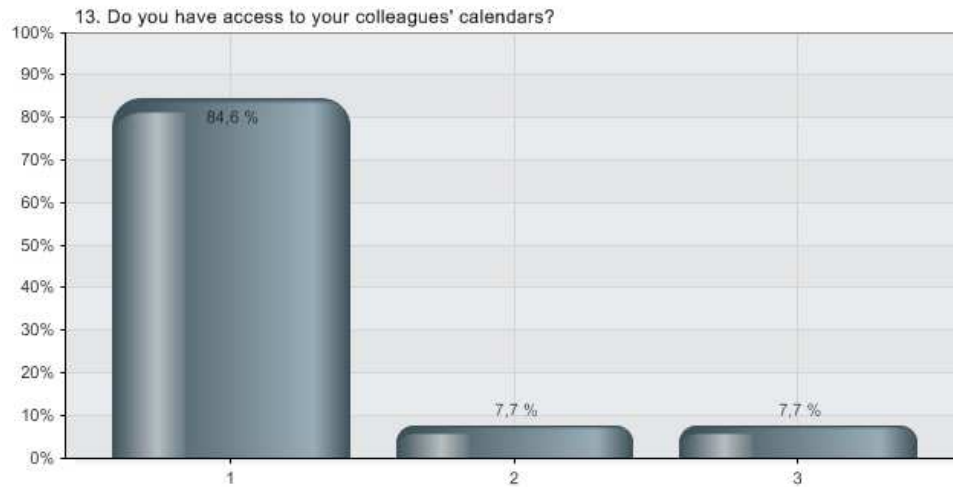
Figure 1: Professionals' result from "*Do you have access to you colleagues' calendars?*".

professionals agree upon 60 % of the provided statements. This again implies that professionals are more aware of their calendar's role and function.

Equally interesting is the fifth statement *my colleagues/fellow students/friends can see whether I am available or busy*, because professionals largely agree (81.5 %) on this to be an important motivation, this implies that they share their calendars and that they are aware of this feature when using them. Enlightened by figure 1, showing the results from the question "*Do you have access to you colleagues' calendar?*" (*1 - yes, 2 - no, 3 - not relevant*) where 19 (84.6 %) of the professionals states that they share their calendars through calendar systems. We can infer that a shared calendar produces a motivation for keeping a calendar updated. This is further discussed in section 4.4.

In order to investigate how users prioritize different calendars, we asked the participants how important their private and personal calendars are to them by introducing two statements (figure 2 and 3). Between the professionals there is a large agreement over the "work/job" (figure 2) calendar being the most important. Results also showed that their private calendars (figure 3 are not as important, their attention to their personal calendars differ. Whilst a majority (40.9 %) states that it has importance as much as 31.8 % state their indifference to this statement.

4.3.2 Accuracy

The second area of interest was the users' attention to accuracy. Firstly, investigating how accurate existing calendars are, is interesting because this could provide data that indicate whether these calendars are suitable candidates for context extraction. Secondly, we asked the participants how they normally provide their calendars with accurate information, and investigate how accurate users are in general.

Those of the professionals who stated that they have access to colleagues' calendars were asked to state their agreement to the following statements "*I often experience a colleague being busy when his calendar shows that he is available*" and "*I often experience a colleague being available*
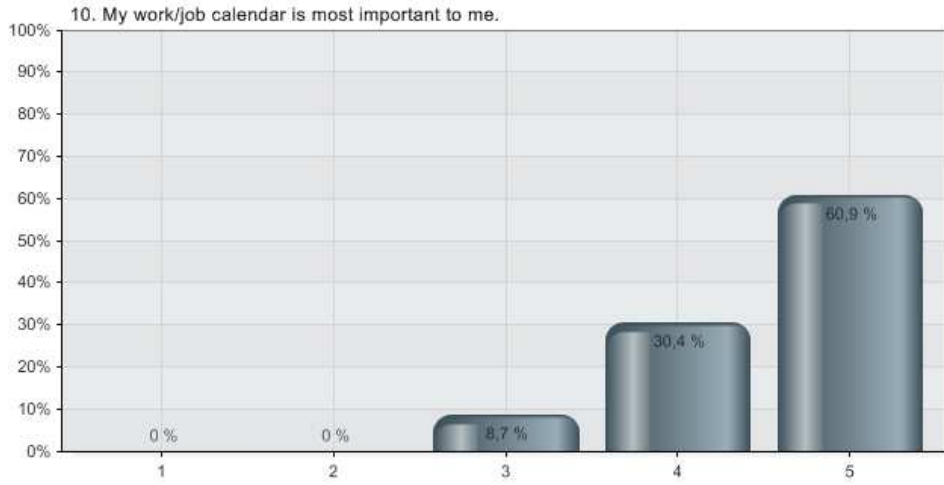
Figure 2: Professionals' result from "*My work/job calendar is most important to me*".
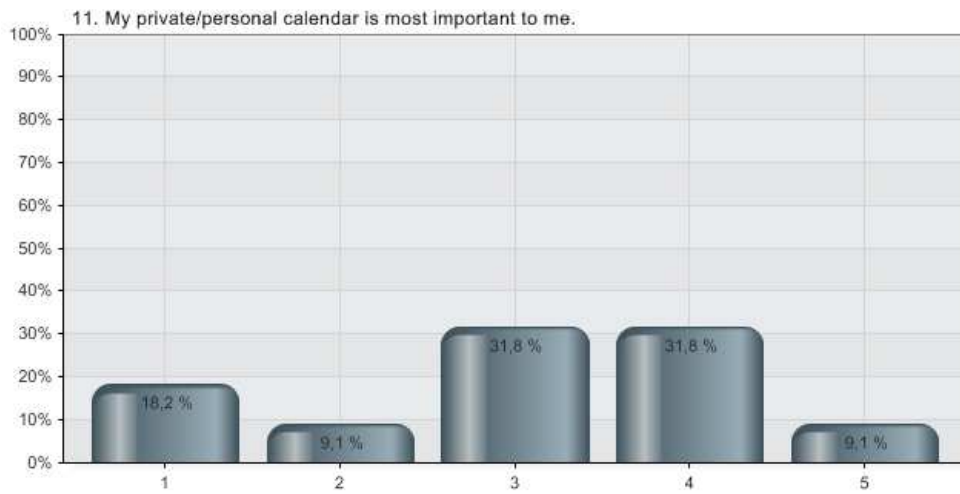
Figure 3: Professionals' result from "*My private/personal calendar is most important to me*".
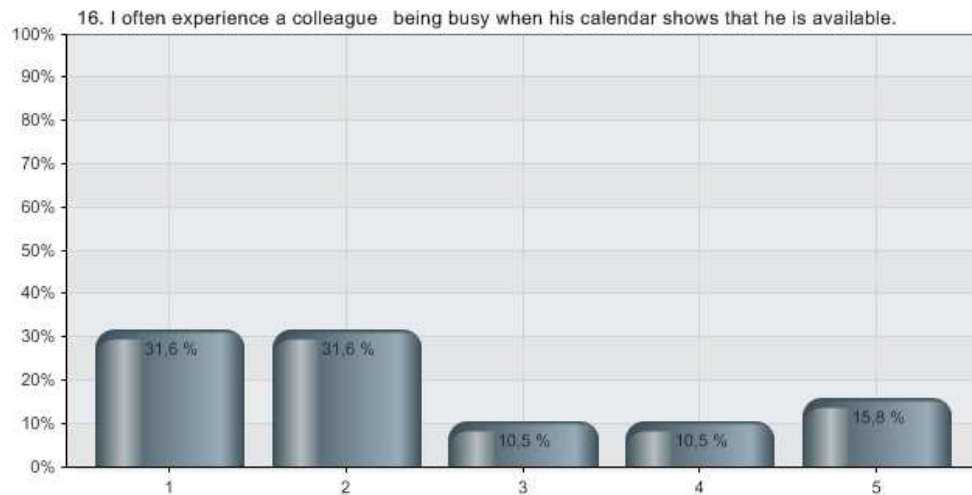
Figure 4: Result from "*... busy when his calendar shows that he is available*".

when his calendar shows that he is busy". The results are shown in figure 4 and 5. Here we see that users are available when the calendar states this, however, when the calendar states the user to be busy, the results indicates that this is correct. Even that this could be interpreted as a consequence of this scenario not happening as often as the first.

In order to investigate how good users are to provide accurate data into their calendars, we asked a set of questions related to their habits of updating certain data fields. Firstly, in a user context point-of-view, location is an valuable attribute, knowing this value could create a base for reading where the user is. The results show that the majority of professionals always provide this attribute when creating new entries, and they also update this value if this were to change.

When presented with the following question: "*When describing the location of an event I prefer the following methods.*" where the participants could choose one or more of these alternatives.

1. *GPS coordinates*

2. *Web services (GoogleMaps etc.)*

3. *Place names (example Oslo, Lysaker)*

4. *Room number (example E112)*

5. *Address (example 2821 Gjøvik)*

6. *Other, please specify*

Table 5 presents the results. An issue to be aware of is the fact that are no standard that describe how these inputs are to be defined, at least there is no common perception of how to define location.

Where location can describe where a user is, time could define when the user is at this location. On the base of this the participants were asked "*How accurate are you when describing*

22
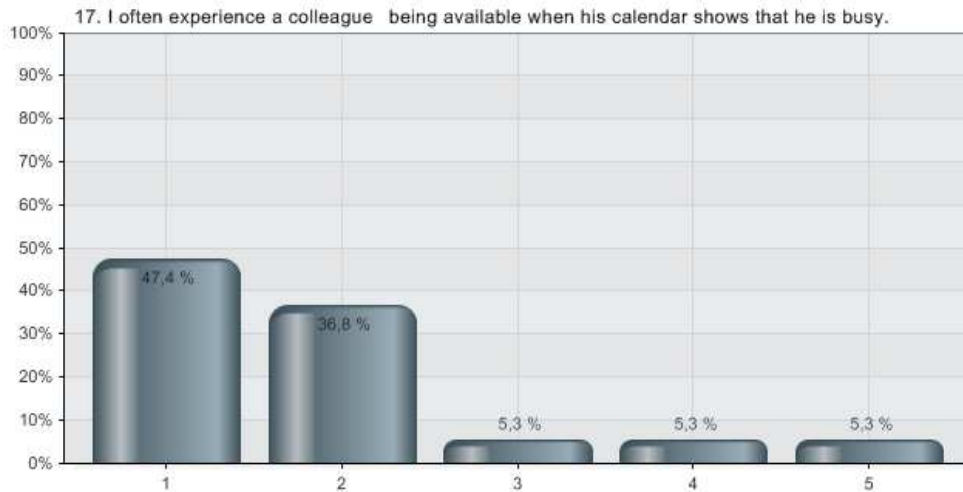
Figure 5: Result from "... *available when his calendar shows that he is busy*".

Table 5: Preferred method of defining location.

Rank	Statement	Reason	%
1	3	*Place names (example Oslo, Lysaker)*	21 (69.7 %)
2	4	*Room number (example E112)*	21 (69.7 %)
3	5	*Address (example 2821 Gjøvik)*	7 (21.2 %)
4	6	*Other*	4 (12.1 %)
5	1	*Web services (GoogleMaps etc.)*	0
6	2	*GPS coordinates*	0

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start-time of an entry?" and "*How accurate are you when describing end-time of an entry*". In other words, to what extent can we trust the existing entries in a calendar, and are the differences between start- and end-times? From these results we can draw a conclusion about calendar users as a whole, there is little differences between students and professionals. More than 50 % of the participants stated "*to the minute*" start times for their entries(table 6), whereas for the end times the results (table 7), as expected are not clear. It is often easier to estimate the beginning of an entry rather than the end, this related to the nature of for instance meetings where important issues are discussed, it is hard to define an estimate due to the inconstancies appearing in these scenarios.

Table 6: The participants' accuracy for defining start time.

Statement	Reason	%
1	*by the hour*	9.4 %
2	*by every 30 minutes*	18.8 %
3	*by every 15 minutes*	9.4 %
4	*by every 5 minutes*	6.3 %
5	*to the minute*	56.3

Table 7: The participants' accuracy for defining end time.

Statement	Reason	%
1	*by the hour*	31.3 %
2	*by every 30 minutes*	31.3 %
3	*by every 15 minutes*	15.6 %
4	*by every 5 minutes*	3.1 %
5	*to the minute*	18.8

4.3.3 Details

Investigating how users normally provide calendar details is highly important, this knowledge give an assessment of the reliability of calendars, to conclude whether they are reliable candidates for context extraction? The participants were asked a set of questions about the most common attributes they normally used (location, description, status etc.). Overall, the majority of participants state a frequent use of the attributes we presented, this can be interpreted positively for calendars as context providers.

4.3.4 Availability

An important issue to assess is the availability of calendars, evan "perfect" calendars are useless if their are inaccessible for a context-aware system. The main concern is the distribution of calendars; where our results show that 28 (84.8 %) of all participants have calendars on several devices, and that the majority (53.6 %) have these synchronized. 32.1 % state that non of the devices are synchronized, this number however are dominated by students where 66.1 % state

no synchronization as for professionals only 15.8 % state that non of their calendars are synchronized. Again professionals as a group resulted to be the more reliable and interesting group to include in further investigations.

4.4 Findings

The findings made in the study of usage patterns can be grouped into three headings;

- Content and accuracy

- Motivation

- Type of users

4.4.1 Content and Accuracy

The calendars' content is the source for interpreting any information about the user; the ideal calendar would contain such information in any given scenario, however this is not a realistic scenario. Our results show that users are frequently using the basic attributes and keeps this information updated.

From the questions about accuracy, we can summarize the following findings. In general, a positive impression of the participants' ability to maintain data in their calendars is established, however professionals show greater ability than students. When defining the location of an entry, there are underlying preconditions to consider. Either participants define location more accurate in the presence of a personal motivation or in situations where the provided information are critical for the common understanding of the content in shared calendar environments. We also confirmed that an entry's start time is easier and more likely to be more correct as opposed to the end time, where the users' ability to estimate correctly also depend on certain preconditions (type of entry, for instance a meeting or dentist appointment).

Our results indicated that users tend to define location according to the particular situation. Place names and room numbers are the most preferred definitions among the participants. Some of them also expressed this question to be highly dependent on context; if the calendar owner does not know where, for instance, a meeting is taking place, the user will be more accurate in describing this attribute.

There are three ways of interpreting these results, firstly it could imply that the users describe this attribute accurate when there is a need for storing this information to serve as a reminder, and therefore motivated by personal reasons. Secondly, it could imply that the user define location so colleagues know where he/she are located in a particular period of time. It, however, is possible that the users provide accuracy whenever a personal motivated reason exist, for instance to serve as a reminder, they apply more attention to accuracy, and when this personal motivation is absent there is no strong reason for accurate description of this attribute. Thirdly, in corporate environments where shared calendars are important tools for scheduling meetings and events, a third reason could affect the accuracy, because we would assume that these notices are written in a readable manner creating a common understanding of the content, and this to be a reason for providing accurate details.

4.4.2 Motivation

The following conclusions could be drawn from these results. Professionals and students produced results that met the expectations and pre-discussed assumptions about these groups as a whole. Where we could identify reasons for motivation preferred by the professionals as a group, the students' results expressed a disagreeing behavior, where the no distinct conclusion about their preferences can be made. By this observation and with a comparison of students and professionals in terms of motivation our initial perception about these groups are confirmed. Professionals have a stronger motivation to keep and use their calendars than students.

We were able to identify and rank motivation reasons for the participants in this survey. These results show that professionals are motivated by their job environments, students are motivated by personal reasons and gains. Having identified and analyzed reasons for motivation, we were able to show a correlation between a motivated user and the calendars content - both in terms of accuracy and detailedness. This is an observation of high importance because it showed that a user with an understanding of the benefits of utilizing calendars, automatically would produce a better calendar, which again is a better candidate for extracting user context.

4.4.3 Types of users

This survey divided the participants into two main groups; professionals and students, in order to confirm an initial presumption; these groups have different behaviors and approaches to their calendar usage. It immediately became obvious that students and professionals produce contrasting results when presented with the same set of questions. When comparing the numbers we saw that professionals largely agreed upon the alternatives, students were not this "united" in their answers, this observation shows that through a limited study professionals as a group are more aware of their calendar usage. Further, based on this and the results showing stronger reasons of motivation assume that a professional's calendar is a better candidate for capturing user context in contrast to a student's. Another observation worth mentioning is that gender have no effect on motivation.

Overall the results showed such high precision in users' calendar usage that further investigations had to be undertaken.

4.5 Study limitations

The study had limitations, the most important weaknesses are discussed in this section.

4.5.1 Survey

The analysis are centered around the perception of students vs. professionals. However, conclusions can not be made on the summed numbers for each user groups, instead the variations between the participants' answers provide more information about the users. The reason for these variations to be more important than initially planned, was due to the small amount of participants, and because we observed that different types of questions resulted in either a high level of agreement (within the groups) or a low level of disagreement.

It is assumed that the participants do keep two separate calendars, for professional and for personal purposes, from these results there is no way of reading whether they incorporate both "types" of calendars into another and therefore see this as "one" calendar. As for the students the

results do not show results that can be used to draw discrete conclusion about this groups, this relates to the general perception of students belonging to a different life span.

4.5.2 Participants

The most important weakness in this study is the low number of participants. To be able to draw conclusions on a general basis, the number of participants had to be much higher. The number of participants also weighted in the professionals' favor, where 23 of them were professionals - leaving the number of students to 10 (including participants considered students and professionals). This makes it hard to compare the results between the two user groups - and to make conclusions that are strongly rooted in the results.

It is also important to stress nature of people. People have different opinions and preconditions that might been affecting these results. For instance, when a person is not keeping attention to details, there would be a relatively high possibility for him not to bother about other people's attention to detail. However, these concerns are will to some extent always be present.

5 Study of Calendars

In this chapter a description will be made of the gathered calendar material and the observations that were undertaken. The first section describe the data, the second describe the results, and the last section describe the main findings and observations.

5.1 Introduction

Our study of calendar users in chapter 4 provided important knowledge about the users' motivation and their attention to the content. However, the results only tell us about the users' usage of calendars, the findings do not provide knowledge that ables the decision of embracing or discarding calendars as sources for contextual information to be made. Therefore, a closer study of the calendars is followed in this chapter, in order to investigate the data found in the users calendars. The second research question forms the base of this study:

> How suited are real-world calendars as candidates for user context extraction?

5.2 Study

As opposed to the calendar user study, the comparison of calendars and their contained data, ables us to observe their weaknesses and strengths. Further, our goal is to extract contextual information, therefore, it is necessary study the calendar from the computer's point-of-view. A context-aware system parsing a calendar, have different requirements to the content, opposed to humans.

The main topics for this study were as follows:

- Categorization of entries

- Entries' contents

- Entry clusters

- Calendar owners

5.2.1 Calendars

For the purpose of this research and under the agreement of full confidentiality, 13 people volunteered to provide two weeks (2×7 days) of original calendar data. Among these users 5 (39 %) of them where students and 8 (61 %) where professionals, however all participants claimed they used calendars frequently for scheduling and reminding purposes. A total of 442 entries spanning over 26 weeks (182 days) of calendar material where used in this analysis.

5.3   Results

Categorization of entries

According to Kincaid et al [21] (as discussed in 2.3) users tend to use their calendars mainly to keep a record of meetings, appointments, events, travel, reminders, notes and as "to-do" lists, Komninos [27][25] confirmed this, and presented the following categories (ordered by highest to lowest occurrence):

- Meeting (group)

- Meeting (another person)

- reminder

- Travel

- Social event

- Work task

- Class (to attend

- General Task (to-do)

- Miscellaneous

- Birthday

These categories are the result of the research participants' own assessment of which category their entries belonged to. This analysis is based on our (or a computer program's) ability to categorize the entries in our data set. On the base of this, the main concern was that a categorization algorithm could fail to categorize a high percentage of the specific categories above. Because a system of such sort would not have the same insight to the calendar data as the calendar owner.

Table 8: Categorization results

Category	% (total 442)
Meeting	18.7 % (83)
Private appointment	14.2 %(63)
Travel	11.9 % (53)
Social event	8.1 % (36)
Work task	7.9 % (35)
Other/unknown	*38.9 % (172)*

"*Meeting*" was identified 83 (18.7 %) times throughout the data set and therefore was the category most frequently occurred, however two additional interesting observations were made. Firstly, the category "meeting" is the much more specific in contrast to for instance *Social event* - which could be interpreted as "party" or "at the movies" both with differences in terms of user context. Secondly, in the data set it was the easiest category to identify by reading the small bits of information contained in the entries, as showed by figure 6, mainly because the word

Figure 6: Example of meeting entry.

Figure 7: Example of private entry.

"meeting" frequently occurred. This means that when a common perception of how a "meeting" is defined and when the investigations show that the category can be identified with high accuracy, there conditions are suited for a computer program to be able to identify and produce the same results.

Also when categorizing the entries, frequent occurrences of entries described only as "*private appointment*" (figure 7) in the calendars provided by professionals were observed (14.2 %).

In contrast, 38.9 % of all entries were unidentifiable, and if the "*Private appointment*" category were defined as unidentifiable content 53.2 % of all entries would show as unidentifiable. It is important to stress that even where the numbers show that it is possible to categorize about 60 % (not including "*Private appointment*") of the entries in our data set, it is still a result of human intuition where it is possible to "read between the lines", and with a high degree of accuracy can categorize the entries correctly.

A note concerning the unidentifiable entries is the difference between students and professionals. Of the total of 172 entries, 83 (48.3 %) of them originated from students, this enlightened by the fact that only 5 students provided calendars to the research, this indicates that students as a group; provide calendars with higher occurrences of unidentifiable entries.

Entry content

The entry information were found to be of different quality, depending which type of user it originated from, however a close study of the entries gives a positive impression of the users' attention to the data attributes. From a user context point-of-view there are certain attributes that are of particular interest; the entry's category (as previously discussed), the entry's location, the status of the entry and the user specified event descriptor. In any situation where the location for an event is defined different from "home" location it is possible to deduce that the user is in the context of traveling.

From the 442 gathered entries 182 (41 %) were defined with the location attribute, this supports the results from the user study where about 53 % of all users stated that they always or

frequently registered the location of an event. We were also able to confirm that "place names" and "room number" are the two most frequently used methods for describing the location. These two methods differ, where a place name can be identified an localized directly (if spelled correctly), "room number" is not self-described when isolated, an additional value describing the location of this building is needed. This is the key issue concerning location as a parameter for determining the context of a user, certain prerequisites are needed. It show the necessity to define additional information (preferences) about the calendar owner, in a user model. These observations highlight location as an important feature candidate for defining user context, but it also highlights the need of a user model where user data is stored.

A closer study of the differences between entries where "status" were either defined as "*available*" or "*busy*" unveiled, not only that 12.5 % were defined "available", but also about 4/6 of them were re-occurring events defined to repeat themselves in a predefined frequency. From observing this there were two main findings; firstly, where 74.6 % of the total amount of entries had status defined as "busy" (and these again largely originating from professionals' calendars), there is a clear tendency for entries mainly to exist when the user needs to state himself as "busy" or "unavailable". Unveiling that the most frequent information in a calendar is of mainly high importance, which is an important observation because it implies that calendar entries (when updated) can be considered of high relevance to the context of a user. Secondly, it may seem that entries either with a defined status "available" or "undefined" often appear to serve as "reminders" or "to-do's", and are of less or no importance to the users' daily schedule, as they frequently appear as double booked together with entries that can be considered as more important.

To describe an entry, a string can be defined by the users, this is of particular interest to us as it is the main (often the only) source of user context information. Often this string contains both a description of the event and the location, this inconsistency is the main concern. There is no formal standard or common understanding of how this descriptor is to be defined, though corporations frequently define internal "rules" for the string to be parsed by the calendar system, which in turn can perform a given action (like redirecting phone calls). As a result, a number of different description methods appear which describes the key issue and the primary concern for the reliability of this feature.

Our data set showed that the number of different methods (or input styles) is almost equivalent to the total number of calendar providers. We also observed that this feature is defined in almost every entry, resulting it to be the most reliable feature in terms of most frequent defined information. In contrast, this information suffers from large differences in accuracy which is of consequence to our ability to categorize entries (as previously discussed). As a result the potential of this feature is dramatically reduced, and an decrease in entry categorization accuracy could be expected. This observation unveils that where a common perception of how this feature should be defined is absent, the calendar's potential as a context providers suffers. A long with the findings from the User Analysis (chapter 4) a parallel can be deduced to the correlation between the users' motivation and the contents in their calendars. Where a calendar's content were found to be "better" when coming from a motivated user - a user understanding the benefits from keeping an accurate and updated calendar. Consequently, we stress the need for a set of rules to be defined in situations where calendars are considered candidates for user context

extraction. Such rules could, for instance, consist of predefined categories that entries would be obligated to represent.

Calendar owners

The entries' distribution across each week is interesting because it ables us to investigate in what way calendars differ between users and what are the most typical usage patterns and features users tend to use. As already mentioned, students and professionals show different usage patterns, but among professionals there are slight variations. Where some professionals tend to define large entries spanning over large portions of the day describing the main topic for this day and have many conflicting events, others have their center of attention around details. They precisely define the events' details and watch their time management throughout the day - avoiding conflicting events. Based on this information alone it is possible to understand what type of job they possess. This initial observation perfectly confirms Komninos' [27] conclusion about the calendar users tend to fall into three categories. About 50 % are users who produce a small amount of entries with a minimal level of detailed content, around 15 % are users who act highly organized and tend to include many details int their entries, and approximately 35 % are users who include only the most important details. These findings suggest that about 50 % of calendar users tend to produce calendars that are readable and identifiable.

5.4 Findings

The identification and evaluation of potential user context features inside calendar entries are important, establishing whether a feature are to be considered reliable or unreliable, forms a understanding of the current issue and a starting point for further investigation. Localizing the content and investigating the accuracy of information is beneficial in terms of confirming the results from the user study, identifying weak, or missing features.

From analyzing calendars there were several findings that were assessed as being of severe importance to a calendar's ability to express information about the a user's context. Generally this is mainly concerned with the accuracy of the entries' content. Firstly, the high number of unidentifiable entries (38.9 %) is a consequence of inadequate data, the issue, however is not the lack of quantitative data, but the lack of qualitative data. Which is a confirmation to the general perception of people being "lazy", and further to the observation of the motivation's significance to the calendar's content quality. Secondly, there seem to be three types of users depending on their input styles and calendar content; users who:

1. ... produce a small amount of entries with a minimal level of detailed content (50 %).

2. ... only include the most important details (35 %).

3. ... act highly organized and produce a high amount of detailed content (15 %).

Where students make up the majority of the first type. These observations complement the results from the user study where the majority of participants stated that they used to define the "description" of a calendar entry. Evidentially, the findings identify the relationship between quality and quantity.

Thirdly, there are small fragments of information missing, for instance where the location of

an event is defined, we need to know the user's home location/base, to infer this event to be of type *Travel*. This observation indicate that whenever a calendar entry is not self-explanatory, this piece of user information would be beneficial for a system's success when capturing user context. Therefore our findings identify the need for introducing user models/profiles to such a system.

Considering the data contained in the calendar entries as a whole, it was possible to infer to some extent, large amounts of precise information about the calendar owner's context. When stating this, it is important to stress that the observants (us) sometimes recognized the owner of particular calendars and that this may able us to take some of these users' preconditions into account. In relation to this issue, when in the process of reading a user's context, our success were frequently constrained by missing fragments of particular user information. Therefore we stress the necessity of this information and suggest that if such a user model were introduced, an improvement of an algorithm's or system's accuracy of determining user context could be achieved.

5.5   Study limitations

5.5.1   Entry categories

Categorizing the entries, frequent occurrences of entries described only as "*private appointment*" in the calendars provided by professionals were observed. Relating this to the findings in chapter 4 where 82.6 % of professionals stated that their work calendar was shared amongst colleagues, we could assume that users withhold this presumably "sensitive" information. It is highly likely that the entries are originating from different categories, as a consequence, and observing this type of entry occurring 63 times in the data set, it is presented as a own category. Our findings presented in table 8 show it as the second most occurring event, about twice as frequent as *Social event* and *Work task*, making it an important observation to take into further investigation.

6 Utilizing Calendar Features

This chapter's topic is a result of the findings from the previous two studies. The following sections describe our study, elaborates the results and discuss the findings.

6.1 Introduction

The undertaken analysis and assessment of the calendars' owners and contents suggest that calendars have a potential to serve as a source for user context extraction. This founds a base for further investigations, and this chapter describe the gathering of data followed by analysis and a conclusion/assessment of the findings. The following topic concerns the third research question: *What user context features should be considered in a context-aware planning algorithm and how do they affect the result?,* since one of this thesis' planned contributions was to suggest an algorithm for planning a module based course according to a calendar's user context, it was necessary to approach the investigations from the users' viewpoints. Moreover, tie these observations into a "proof of concept" prototype that could get the user context from a calendar and find the most suitable placement for a new entry. There were no obvious methods of approaching this topic, several issues had to be discussed and evaluated. First of all; are there existing research on this topic, are there existing systems or prototypes that could be adapted or modified to our needs?

As mentioned in the related work Chapter 2, there are several projects based on the utilization of calendars as a source for user context [16, 17, 18], where calendars are looked upon as a valuable resource for context information, however these projects are mainly focused on the particular system's benefits to the users and not the calendars' performances. In our research we only identified one system, described by Khalil and Connelly [15] to solely depend on the information provided by calendars. But even here, the discussion about whether calendars are "good" or "bad" is outside their project's scope, nor is the mechanism for extracting the user context defined or discussed in particular detail. As a consequence, this thesis try to accommodate this lack of research by approaching the implementation of a prototype based the users' actual planning methods. Again, studying and observing the users' routines were considered as a natural and logical method, as for the first part of this thesis.

Our goal for this study is to understand the users' planning preferences, and identify their preferred context features. Further, are there global features that are valid for general user groups, or are they specifically attached to individual users? From the previous studies on users and calendars, indications were observed about the variations between user groups and the users within the groups - are these observations also valid in terms of calendar organizing and planning?

6.2 Study design

This study was designed to investigate the circumstances involved to the users' calendar management methods, by dividing the study into two sections. First, when identifying *what* features the users take into consideration when planning, a qualitative approach was selected. The par-
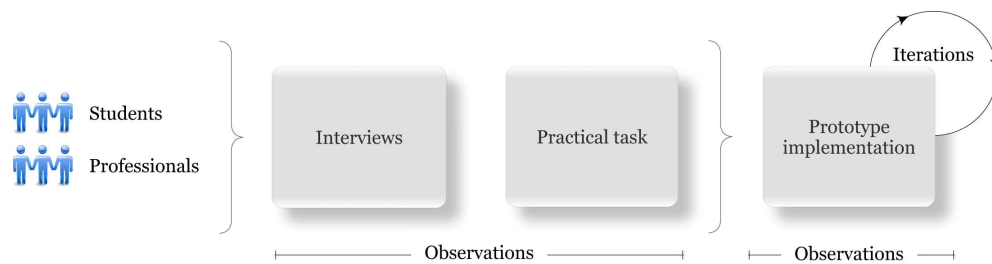
Figure 8: The design of the study.

ticipants were interviewed about their personal calendar preferences and were told to solve a practical "planning" task, both are described in section 6.3.2. Second, to investigate whether the features could be utilized in a prototype and the effect they might have, a iterative approach was selected and it is elaborated in section 6.3.3. As shown in figure 8 observations were made during the interviews and the prototype implementation.

6.3 Setup

This study was facilitated to encourage the discovery of features relevant to users that manage their calendars. By not adding strict guidelines for how the study should be conducted, the foundation for unveiling interesting findings should be made.

6.3.1 Participants

Two groups of volunteers participated in this study, 5 students and 5 professionals. All of the students were from the *Faculty of Computer Science and Media Technology* at Gjøvik University College The professionals consisted of three employees also from Gjøvik University College and two were teachers from Firda videregåande skule.

As discussed in the previous chapters, there are large differences between students and professionals both in terms of usage behavior and calendar "quality", where the calendar of a professional proves to be the best suitable candidate for our intentions. Therefore it may seem as a obvious decision to discard the group *students* as a whole, and not include them in further research. However, in this part of the thesis we try to identify what features users take into consideration when managing their calendars, and there was at this point no data that indicated that students' calendar management capabilities are poorer compared to professionals'.

6.3.2 Data gathering

The participants were asked questions about their usage of calendars within a work day (between 07.00 and 16.00, from Monday to Friday) and given a practical task to solve, each session lasted between 30 to 45 minutes.

Interviews

The interviews could be described more as a conversation rather than an actual interview. Creating a natural dialog between the interviewees and the observer was beneficial for the study as it resulted in relevant observations that often were outside the main scope of the initial question.

However, there were 4 main areas of interest that formed the base for a total of 6 questions.

- Day of week
- Time of day
- Time between entries
- Context of existing entries

The following four paragraphs elaborate our goals for each of the topics above, all of them motivated by our initial suggestion that one particular activity can be suitable in one contextual situation and inappropriate for another. Further, our general goal was to understand which context features would be valid for user groups, and which would be valid for individual users (that, of course, if such differentiating would be possible).

Day of week and time at day

The first topic of interest was intended to investigate if the participants preferred certain weekdays better than others. Are people, in fact, more tired and unmotivated on mondays, compared to fridays, for instance? The participants were asked to state which day they considered as *best*, *worst* and *ok*, so that a study of the variances between participants' answers could be performed. In relation to *day of week*, one also had to consider *time at day* and the participants' preferences related to the different times within a work day. Would participants, for instance, prefer morning sessions or late sessions for important appointments?

Time between entries

This question was intended to investigate how users ideally would plan a new entry according to an existing entry - what considerations do they take into account when placing two entries close to each other, do they need time to "reset" their "mood"? Participants were explained our intention of this question, the reason for this was to ensure that all of them were approaching the question on equal premisses. The following scenario was established:

Consider you are planning a 90 minutes long graded test, or a highly important meeting (figure 9), ideally how much time would you prefer to have:

1. *. . . before the test/meeting, figure 10a*

2. *. . . after the test/meeting, figure 10b*

3. *. . . before and after the test/meeting, figure 10c*

Remember that both existing entries and new entry are at the same location.

Context of existing entries

This topic was intended to investigate how the context of existing entries in a calendar affect how users manage their calendars. How do users rank the different entry categories - which category is preferable according to its context? For instance, in a planning scenario, one could have two

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Figure 9: New test/meeting entry, duration: 90 minutes.

(a) Time before.   (b) Time after.   (c) Time before and after.
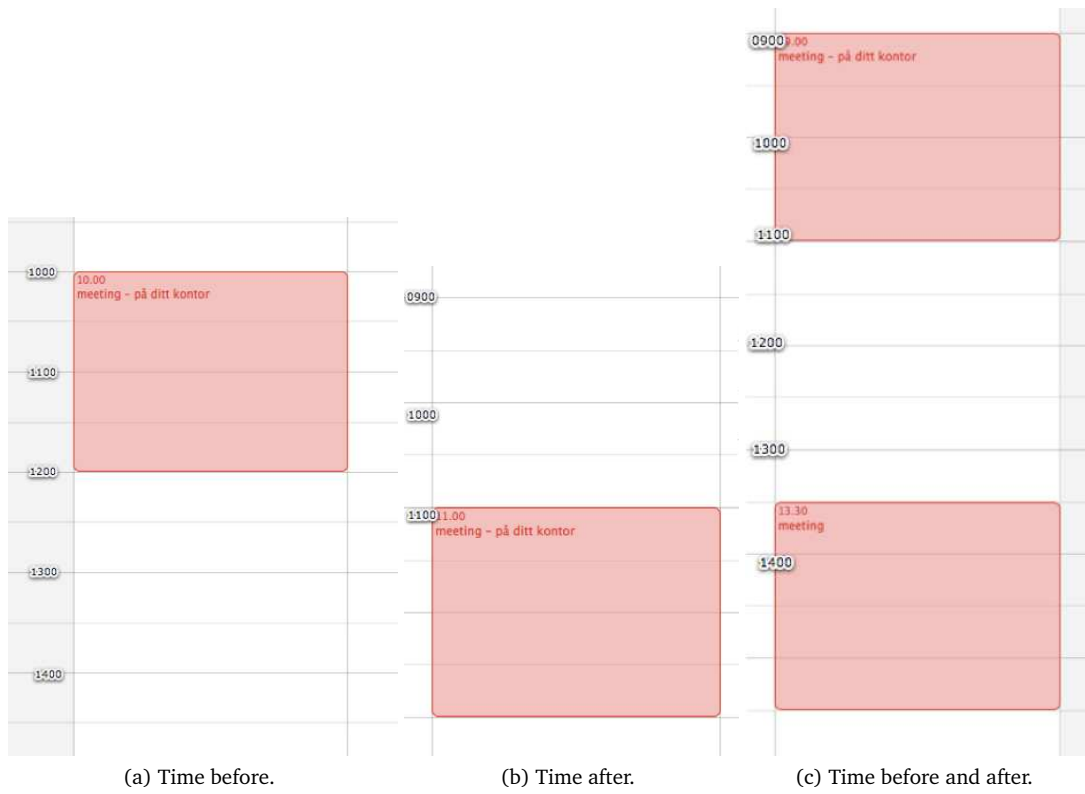
Figure 10: Question 5, scenarios.

alternative slots available for the creation of a new entry, the first directly after an existing entry of category "Meeting" and the other directly after an entry of category "Travel" - which of the two alternatives would be preferable for the users?

To investigate this, the participants were presented with a list of categories from the calendar study conducted in Chapter 5, where 5 entry categories were identified (presented in Table 8) from the calendar data set. The reason for not choosing the entire list presented by Komninos [27] was that these categories were produced by the calendar owners themselves - categorizing their own entires, whereas the categories presented by the calendar studies in this thesis were founded of the discrete data in each entry.

In order to make the categories understandable for the participants, a short description was added to each, the category "Travel" was divided into "short" and "long" distance to ensure that participants would interpreted the category equivalently. The categories (listed below) were juxtaposed to each other as a list of 15 "scenarios" (D.1.6), forcing the participants to choose their preferred category.

- Travel (long distance) - *extensive traveling, ex. several hours of travel.*
- Travel (short distance) - *ex. minor local traveling, ex. 1 hour of travel.*
- private appointment - *ex. dentist, doctors appointment, family.*
- Office work - *ex. in an office, working.*
- Meeting - *ex. with colleagues.*
- Social event - *ex. party, friends, informal event.*

The reason for choosing this method rather than asking the participants directly to rank the 6 categories, was simply to ensure that the participants would not try to adjust the results according to what they think is correct, or what they think is the observer's wanted result. Instead the ranking would be a result of a careful consideration.

Initially, the questions were not comprehensive, the general intention was to use the questions as a guide or road map through the interview. Each of the questions were intended to introduce the interviewee and investigate whether he/she felt a personal relation to the current topic, make the participant ask themselves: "*do I consider this when I am managing my calendar?*". If such a relation could be confirmed, the question (appendix D.1) was asked, finally the participant was asked to elaborate and reflect over his/hers answers. This interview-setup was chosen for two reasons. Firstly, this approach was necessary because there was no present knowledge in beforehand concerning what features users tend to take into consideration when managing their calendars. These features had to be established before conduction further investigations. Secondly, our initial areas of interest were only a guide to some the topics/features that seemed likely for users to relate to, therefore it should be possible to identify additional features. To achieve this, the context of the interview were presented as a conversation between the interviewees and the observer. A qualitative study like this, with a low number of participants, can not be analyzed in quantitative metrics, therefore a type of Protocol analysis was chosen to approach the data. This kind of analysis does not conclude based on the summaries of data, but look at the

	type	approx. length	description	Technical Requirements
1	Questionnaire/quiz	20 minutes	10 intro questions on the topic	internet access, laptop
2	Audio slides	60 - 90 minutes	Slides with comments from the lecturer	internet access, headphones/speakers
3	Deliverable/exercises	120 minutes	6 exercises, tasks, cases/scenarios	pen, paper, lecture notes
4	Formal exam	max 30 minutes	MultipleChoice questions + open length questions	internet access, laptop

Table 9: Kari's "HMS" course.

data's variances - in our study this meant answering questions like:

- Where are the differences between the participants?

- How do the data look like?
    . . . is it generalizable?

- What do the differences mean, what are they indication?

- What needs to be investigated further?

Practical Task

To complement the questions, the participants were asked to solve a practical planning scenario and were presented with 2 weeks of calendar data, a course-description and a persona (definition given by Jenkinson in [28]) describing *Kari Bakken* and the situation. In compliance with this information the task was to plan the course into Kari's calendar and explain the reasons for each step in their planning process.

Our motivation for choosing this particular approach, was the simplicity it offered. As with the rest of the interview questions, a qualitative approach would be appropriate when exploring new and uncertain grounds. For this practical task, the participants elaborated each of their choices, giving the interviewer a chance to ask related follow-up questions. Consequently, a natural and reflected conversation could take place.

The whole scenario was based on a generated, non-authentic calendar and course description. In this experiment the course, described in Table 9, consisted of 4 modules with different settings and parameters, which meant that the participants would have to consider the difficulties and contextual preferences of each module when planning. The participants were told that the modules were sequential, and had to be placed in the calendar in the same order as they appeared on the course description, this was done to achieve a natural approach to the task as this reflects the normal structure of a real world course.

The calendar was provided digitally through the Apple iCal [1] calendar program, simply to

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[1]Wikipedia - http://en.wikipedia.org/wiki/ICal
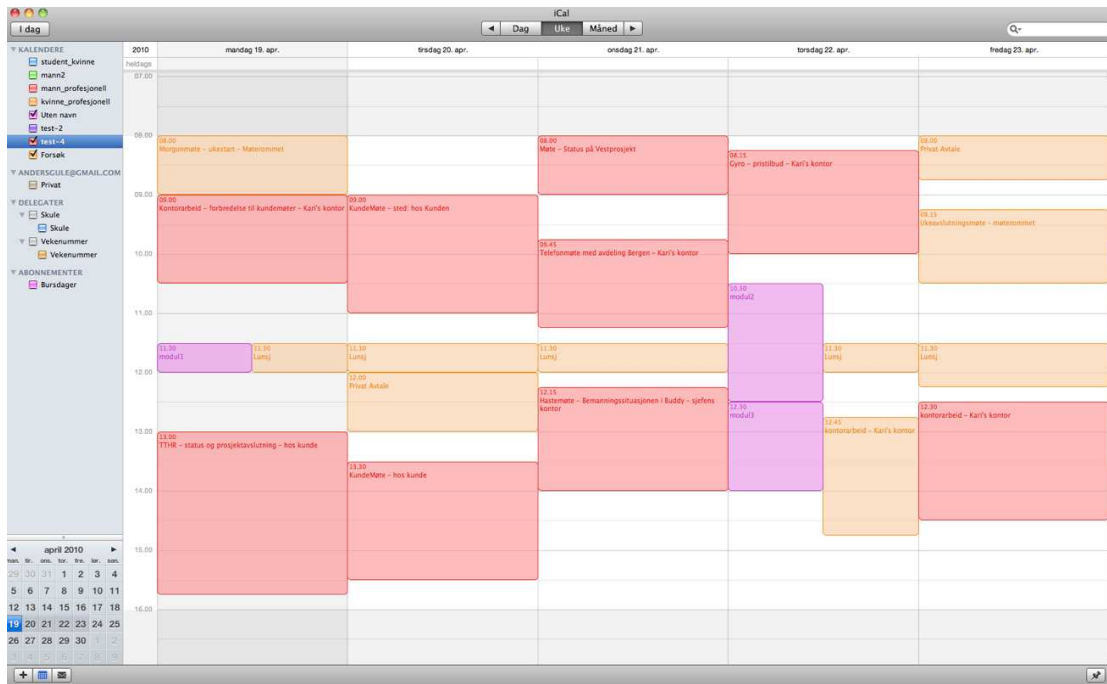
Figure 11: Screenshot of calendar, purple entries show the planned modules.

ease the process of rearranging and organizing the existing entries as much as possible for the participants. In the calendar, there were two sets of entries, yellow and red (Figure 11), in order to separate the entries according to *status*, if stated as *busy* they appeared red and if stated *available* they appeared yellow. The only reason for this was ease the readability of the entries, and by mapping them in different colors they were easily separated for the participant. However the participants were not told directly that they could reorganize the entries, in order to examine whether this was normal for them to do or not.

The actual process of planing the course into the calendar, was done by creating new "blocks" in the calendar program, one can observe them in Figure 11 where the purple entries are the modules added by a participant.

During the planning of each module the participants were asked to elaborate their choices and explain why they considered the particular placement as the best choice. Finally they were asked to rank each of the placed modules according to the *1 - Ok, 2 - Inappropriate and 3 - unacceptable*.

6.3.3 Data utilization

The identified features and observations were implemented into a prototype as a "proof-of-concept-investigation" to act as a planning assistant for calendar users, and is described in section 6.4.2. The prototype's task was to simulate "*the planning of a course module into a calendar according to the identified context features*", where these features were directly ported from the observations made from the interview sessions.

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When implementing the functionality of each feature, we observed issues/problems that occurred, and how these were solved (if solvable). The biggest issues were concerned with the assessment of slots in the loaded calendar, because these were inspired by the answers form the participants - which sometimes were contradictory. The prototype is further explained in section 6.4.2.

When testing the prototype, the major concern was not its performance or its efficiency, but how the different contextual features and planning procedure affected the results, therefore, two test scenarios were introduced in the testing.

Test - feature properties

To investigate the contextual features' properties, how would the planning algorithm's result be affected when the features where, for instance, missing? The test was intended to investigate how changes in the prototype's planning approach would affect the resulting suggestion to the user. This was done by rearranging the planning procedures' steps and testing different approaches, and comparing the results and console outputs.

6.4 Results

The results are divided in two parts. First the results from the initial interviews are presented in section 6.4.1, which notes are found in appendix D. Secondly the results from the implementation of the prototype comes in section 6.4.2.

6.4.1 Data gathering - interviews
Day of week

Firstly, the participants were asked to state which day(s) from Monday to Friday they personally preferred to be "*best*", "*good/ok*", "*worst*", "*bad/inappropriate*". Hypothetically, one may think that different days would be of relevance to the users when managing their calendars, for instance, if they had to choose between Monday and Tuesday, then Tuesday might be the preferred alternative. The intention of this question was to establish whether the participants considered days differently, in case which days are preferred, and why this was relevant to them.

Table 10: Students' results. Score in parentheses, higher is better.

Day	Best(3)	Ok(1)	Inappr.(-1)	Worst(-3)	Tot. score	Rank	
Monday				5	-15	5	*worst*
Tuesday		2	3		-1	4	
Wednesday		5			5	3	
Thursday	1	4			7	2	
Friday	4		1		11	1	*best*

Immediately, it became apparent that the differences between students and professionals again, as discussed in Chapter 4 and 5, would be significant. Table 10 and 11 shows the students' and professionals' preferences, respectively. The students in this case largely agreed on which days are better than others, as showed in Table 10 the days progressively becomes better

Table 11: Professionals' results. Score in parentheses, higher is better (score × vote = total).

Day	Best(3)	Ok(1)	Inappr.(-1)	Worst(-3)	Tot. score	Rank	
Monday		1	2	2	-7	4	
Tuesday	3	2			11	1	*best*
Wednesday		4	1		3	3	
Thursday	2	2	1		7	2	
Friday			2	3	-11	5	*worst*

the closer they get to the weekend; where Friday is the best day and Monday the worst, whereas in contrast, the professionals states that Tuesday is the best day and Friday, the worst. Professionals' result also show a broad agreement of which days that are preferable, and the different days are largely weighted either as positive or negative. When comparing the distribution from students and professionals, students as a group, in general had a more prominent agreement, than the professionals. This could indicate that the variety of the participants themselves inside the groups affect the group's ability to appear united, where the professionals have different jobs and roles, and the students largely consist of people with the same roles.

Combined, Mondays are ranked as the worst day in the week, two participant stated:

> "Monday gives me no time to plan the upcoming appointments that day and I would have to use the weekend instead."
> - professional

> "Monday is a hard day for me to work, but from Tuesday to Friday it only gets better."
> - student

The results showed large differences between what the two groups prefer as the best day of the week, Friday and Tuesday, students and professionals respectively, however between the groups Wednesday and Thursday achieve exactly the same rank. This indicates the necessity for treating users from different groups differently, but also common preferences between the participants in this study.

Time at day

Question 2, 3 and 4 were intended to determine whether the users have particular concerns to the different time spans during a work day, for instance, are 07.00 - 12.00 better than 12.00 - 16.00, in case, why? Also we were interested in identifying time spans that *not* should be considered an alternative when planning.

In question 2 "*Are there particular time-periods during a day that you feel not should be subject for creation of entries?*" 7 of 1 participants pointed out "early morning" as the worst time to have appointments:

> "It gives me no time to prepare, also, if it was a meeting all the other participants would be tired and unfocused. This is also the case when having meetings late at day because people are more focused at the clock than on the topic."
> - professional

"I need an hour to get start the day, prepare myself. From 09.00 to 13.00 I feel in top shape - lunch break is not so important as long as I can get some food."
- student

When presented with these questions, the participants expressed different reasons and answers. Overall, in *question 3*, 6 of 10 participants (3 students and 3 professionals) stated to "perform" better in the timespan between 12.00 and 16.00. One participant stated:

"I always tend to very efficient after midday, it think it has something to do with the type of tasks that I have before me, I can be more concentrated. Often I don't want to leave, because I'm so into the task."
- professional

3 participants (1 student and 2 professionals) stated that 07.00 to 12.00 suited them better, and one student stated his indifference to the question.

Table 12: Result from Question 3

Statement	Students	Professionals
S1, 0700-1200	1	2
S2, 1200-1600	3	3
S3, none	1	0

Collectively, there were two approaches to these results, the data showed that the majority of participants preferred the timespan from 12.00 to 16.00, which is a result that could be directly fed into the prototype's decision functions. However, this particular question is related to the participants' personal preferences, this means that while this result would be correct for the majority of users, it is incorrect for the rest, which consequently affects the prototype's ability to act on behalf of different users. Hence the results should be treated as an indication to whether this is an issue that concerns the users or not, and not as a general perception of what *all* users prefer. While only one participant (10%) stated his indifference, the issue is clearly significant to the remaining participants - and should be accounted for when planning.

Another interesting observation made, was that several professionals' mentioned the surrounding environments as a crucial factor to how they managed their calendars. For instance, when planning a lecture, the decision would also depend on the students attending, scheduling the lecture at 13.00 rather than 15.00 could be preferable due to the students' level of concentration. One of the participants stated:

"...if it was a meeting all the other participants would be tired and unfocused. This is also the case when having meetings late at day because people are more focused at the clock than on the topic."
- professional

From the participants' answers it is not possible to extract specific timespans that not should be subject for creating new entries, several participants pointed out that, for instance, lunch

(food) is important, but as long as it is possible to plan ahead it seems like the specific time is of high importance.

> "If you are aware of the meeting/appointment it's all ok. Then you can always plan accordingly."
> - professional

> "For me it is always a matter of planning the day ahead. Unforeseen circumstances are never ideal anyway, but there is no way to plan them."
> - professional

One also needs to consider the variety of roles of which the participants possess, persons who largely manage how their days are organized themselves might have a flexible standpoint to this particular subject. Which could produce opinions that are non-representable for other types of users who have less "control" over their work day.

Time surrounding an entry

Question 5 concerns the time surrounding an entry, does the time between entries affect how the participants organize their calendars, do they need time to "reset" their "mood", how much time?

Despite our efforts to create a scenario that could produce comparable results between the participants, they still had different approaches to this question, and the main difference was related to the phrasing of the question itself. Participants were asked to plan a graded test or an important meeting, this however resulted to produce different conditions for answering the question. A graded test (or exam) for some were considered as a "mental discharge" with the urgent need for time to recover, its user context also differs from meetings. Where test/exams are centered around the user itself and his personal preferences with a fixed end-time, meetings include a relation to other people, and due to the nature of meetings, the end-time is often hard to determine.

Table 13 shows the participants' preferences when presented with the scenario. We see scenario *1 - time before new entry*, *2 - time after new entry* and *3a - before & 3b after* above the students' *s1, ... s5* and professionals' *p1, ... p5* answers.

Table 13: Question 5 results.

Participant	1	2	3a	3b
s1	60	30	30	30
s2	45	15	10	50
s3	5	20	15	45
s4	60	30	30	30
s5	60	60	45	15
p1	60	30	60	0
p2	60	15	15	45
p3	30	30	30	30
p4	30	30	10	30
p5	30	30	10	30

Context of existing entries

The results from the participants' ranking of the categories are presented in Table 14 and 15. An interesting observation was the modest variance between the participants' ranking, there are more or less agreement upon the entries' ratings within the two groups. The professional participants *p2, p3, p4* and *p5* have only minor variance, whereas *p1* clearly rate "Travel (short)" as much better than "Social" as opposition to the others, a deviation which could be a result of a different interpretation of the categories. The students' answers do not provide any of such major deviations, their numbers are mostly uniform, but "Travel (short)" is not preferable for *s4* and *s5*.

Table 14: Professionals' category rank (ranked order).

Category	p1	p2	p3	p4	p5	Sum	
Office work	4	5	5	4	5	23	*highest*
Meeting	3	4	3	3	4	17	
Private appoin.	2	3	4	5	2	16	
Travel (short)	5	1	1	1	2	10	
Social	0	2	2	2	1	7	
Travel (long)	1	0	0	0	1	2	*lowest*

Table 15: Students' category rank (ranked order).

Category	s1	s2	s3	s4	s5	Sum	
Office work	3	4	5	5	4	21	*highest*
Private appoin.	3	4	2	4	5	18	
Travel (short)	5	4	4	2	2	17	
Meeting	3	2	2	2	2	11	
Social	1	0	2	2	2	7	
Travel (long)	0	1	0	0	0	1	*lowest*

Overall, "Meeting" is the only category that differs from the students' and professionals' ranking, Professionals preferred it over "Private appointment" and "Travel (short)" whereas the students do not. This may have to do with the fact that meetings are more frequent in a professional's work day compared to a student's.

Both user groups rated "Office work" as the most preferable category to have, the reason for this category to be preferred might have to do with the user context. Working at the office normally is quiet with little distractions and interruptions, which would be a suitable entry to have before an exam in contrast to, for instance, traveling. "Travel (long)" was ranked as the least preferable category, not surprisingly, since traveling often is a hectic and exhausting activity, and not a suitable event to have directly before an important exam. However, more interesting is the "Travel (short)" category, which ended up at fifth place, one point after "Meeting" on the combined results (Table 16. One can observe that students rated this category higher than

professionals, 17 to 10, respectively, but overall short distance traveling is preferable over social events. One of the participants stated:

"Never after travel. For me all entries that are related to leisure are negative."
- professional (*p2*)

Which is confirmed by both students' and professionals' results, as the "Social" and "Travel (long)" category is least preferred categories.

Table 16: Professionals' and students' rank combined.

Category	P	S	Sum
Office work	23	21	44
Private appoin.	16	18	34
Meeting	17	11	28
Travel (short)	10	17	27
Social	7	7	14
Travel (long)	2	1	3

The viability of these results are discussable, since they are the result of the "exam" scenario, this is discussed further in section 6.6.1.

Practical task

When the participants were presented with the practical task, and asked to plan the given course into "Kari's" calendar, they reacted differently. Most of the participants noted the course modules' "type" (i.e. *lecture slides* or *formal exam*) and their length, others only noted the modules' duration and set to find suitable slots in the calendar.

Planning strategies

From the observations made from the participants' actions, a pattern emerged, there were two main methods used:

1. Planning modules according to importance, where the most important or challenging module (i.e. the exam - *module 4*) often was planned first, and while doing this relocating/adjusting the existing entries to suggest a "better" entry layout. In general this method was centered around the course, to ensure the best possible structuring of the course, optimizing the pedagogical progression.

2. Planning modules sequentially, *module 1* first and *module 4* last, and almost no relocation/adjusting was done to the existing entries. The modules also tended to be more scattered across the calendar, often *module 1* was planned on Monday the first week, and *module 4* Friday the last week.

Most of the professionals used the first approach, and overall used more time to complete the task, compared to the students. The simple reason for this is their attention to the modules'

context and the entries in the calendar, which takes more time to ensure the best distribution of modules.

The second approach was mainly used by the students, and an interesting observation made off the participants that chose sequential approach were asked to grade the placements according to *1 - Ok, 2 - inappropriate and 3 - unacceptable*, several of them discovered better and more suitable placements for the modules. This could imply two things, either the participants were lazy, not spending enough time on their initial placement, or this is a result of the sequential approach not being thought trough. Because, after the first 2 modules were placed in the calendar, there was suddenly a lack of good alternatives to place the remaining modules, and the participant was forced to select a less preferable alternative.

Several participants mentioned the course's progression as an important aspect during planning, avoiding large time gaps between modules would be beneficial for learning the course topic. Several participants focused on placing the modules as close to each other as possible, Figure 12 shows the grouping of the three first modules over the span of two days. In contrast, several participants did not accomplish such a desirable grouping because they did not reorganize the entries.
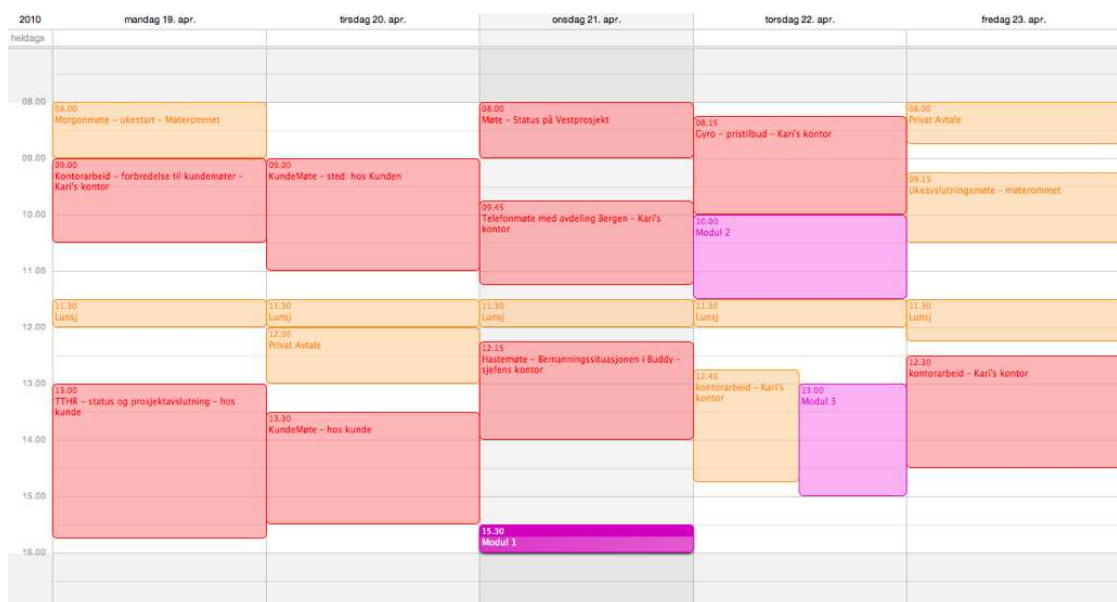
Figure 12: Screenshot of p1's week 1

6.4.2 Data utilization - prototype

As a result, the following list presents the findings from our study that are relevant for the implementation of a prototype "planning assistant":

- categorization procedure
- assess/rank open slots in the calendar
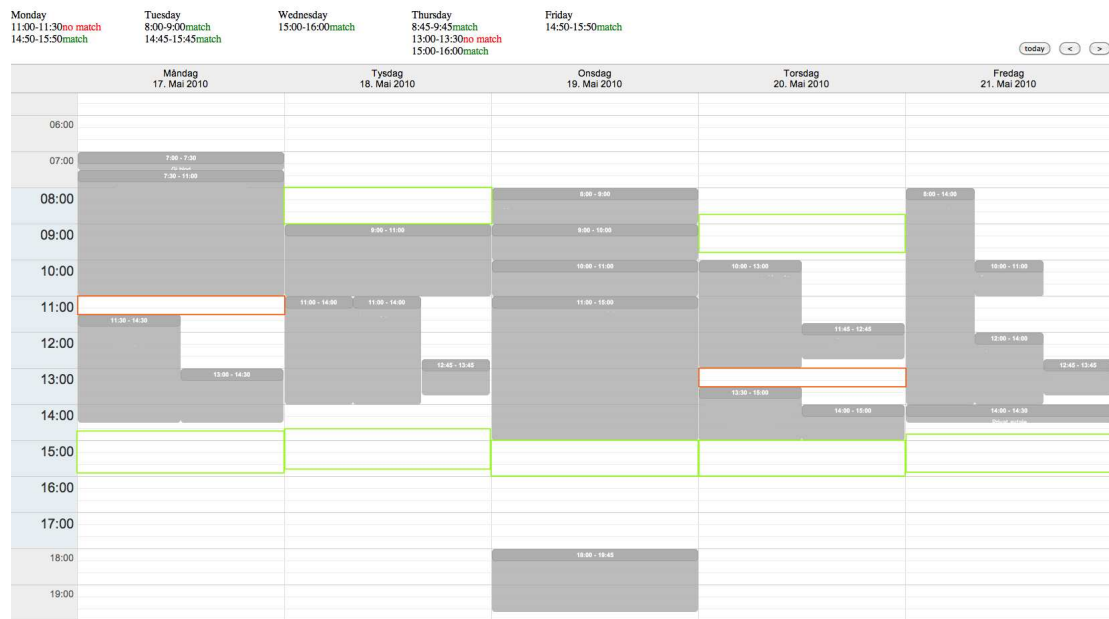
Figure 13: Screenshot of the prototype, green rectangles show matching alternatives.

- which day
- time at day - according to user model
- time before and after proposed slot
- entries (user context) before and after the proposed slot
- suggest alternatives to the user

Implementation

The prototype was implemented in such a manner that allowed the different operations to be isolated from each other, performing one operation after another, creating a structure that could be tested in different settings and configurations.

As input to the prototype, a calendar and the module's length in minutes were given, and the loaded calendar's *.ics*[2] was parsed into the system memory. After this step the prototype automatically analyzed the calendar depending on the length of the subject module and the information contained in the parsed calendar. Figure 13 shows a screenshot of the prototype's appearance after analyzing the calendar though the scope of a 60 minute long module. One can see the red and green rectangles, showing unmatched and matched slots, respectively, the red slots are simply not big enough to fit the module. At this stage the slots are only adjusted to ensure some spare time before and after (if possible), and not ranked, the unmatched (red) slots are discarded and not included in the further analysis.

To rank the slots, the prototype rate the "green" slots according to the following steps:

---

[2]iCalendar - http://en.wikipedia.org/wiki/ICalendar

```
Trakk 4 "dags"-poeng på slot med id: 4 - 2010-05-17
Trakk 1 "dags"-poeng på slot med id: 1 - 2010-05-18
Trakk 1 "dags"-poeng på slot med id: 5 - 2010-05-18
Trakk 3 "dags"-poeng på slot med id: 5 - 2010-05-19
Trakk 2 "dags"-poeng på slot med id: 1 - 2010-05-20
Trakk 2 "dags"-poeng på slot med id: 5 - 2010-05-20
Trakk 5 "dags"-poeng på slot med id: 6 - 2010-05-21
Trakk 2 context-poeng på slot med id: 4 - 2010-05-17
Trakk 3 context-poeng på slot med id: 1 - 2010-05-18
Trakk 2 context-poeng på slot med id: 5 - 2010-05-18
Trakk 3 context-poeng på slot med id: 5 - 2010-05-19
Trakk 2 context-poeng på slot med id: 1 - 2010-05-20
Trakk 2 context-poeng på slot med id: 5 - 2010-05-20
Trakk 2 context-poeng på slot med id: 6 - 2010-05-21
Trakk 1 plasserings-poeng på slot id: 4 - 2010-05-17
Trakk 5 plasserings-poeng på slot med id: 1 - 2010-05-18
Trakk 1 plasserings-poeng på slot med id: 5 - 2010-05-18
Trakk 1 plasserings-poeng på slot med id: 5 - 2010-05-19
Trakk 2 plasserings-poeng på slot med id: 1 - 2010-05-20
Trakk 2 plasserings-poeng på slot med id: 5 - 2010-05-20
Trakk 1 plasserings-poeng på slot med id: 6 - 2010-05-21
Trakk 3 startavstands-poeng på slot med id: 4 - 2010-05-17
10Trakk 5 sluttavstands-poeng på slot med id: 4 - 2010-05-17
Trakk 5 startavstands-poeng på slot med id: 1 - 2010-05-18
120Trakk 1 sluttavstands-poeng på slot med id: 1 - 2010-05-18
Trakk 1 startavstands-poeng på slot med id: 5 - 2010-05-18
15Trakk 5 sluttavstands-poeng på slot med id: 5 - 2010-05-18
Trakk 5 startavstands-poeng på slot med id: 5 - 2010-05-19
0Trakk 5 sluttavstands-poeng på slot med id: 5 - 2010-05-19
Trakk 1 startavstands-poeng på slot med id: 1 - 2010-05-20
120Trakk 1 sluttavstands-poeng på slot med id: 1 - 2010-05-20
Trakk 5 startavstands-poeng på slot med id: 5 - 2010-05-20
0Trakk 5 sluttavstands-poeng på slot med id: 5 - 2010-05-20
Trakk 3 startavstands-poeng på slot med id: 6 - 2010-05-21
10Trakk 5 sluttavstands-poeng på slot med id: 6 - 2010-05-21
```

Figure 14: Screenshot of console output.

- which day

- surrounding entries

- placement - early/late at day

- distance to previous/following entry

For each of the above steps, each slot is given a score depending on, for instance, which day the slot is on. Table 17 shows an example of such mapping. According to which day the slot is on, it gets a score, for instance if the day is Monday the score is 5 (low number is better). The same principles are undertaken by the other steps, and each score is added to each other resulting in the final score for that particular slot. Eventually the slots' score are compared and the slot with the least score is presented as the best alternative. In figure 14 the output from this procedure is displayed.

Table 17: Example of score mapping

Score	Day
1	"Friday"
2	"Thursday"
3	"Wednesday"
4	"Tuesday"
5	"Monday"

6.5 Findings

6.5.1 User interviews

The observations made during the user interviews confirmed previous and unveiled new findings. Participants have significant opinions to which days are preferable when planning important events, the professionals and students have different opinions, which stress the necessity to treat individual user groups differently, because they have different preferences. Where difference between user groups are significant, the difference between individuals also must be taken into consideration. From the "time at day" results, it was obvious that two people with different types of jobs, also had different personal opinions to what time at day they preferred when working with challenging tasks. For instance, where the High school teacher *p4* preferred to work with such tasks in the time span from 12.00 to 16.00, the IT-Manager *p3* preferred the opposite times from 07.00 to 12.00. An observation that emphasize, not only the need for such information to be stored in a user model (as discussed in Chapter 5), but also that the participants relate to this issue, which means that these considerations has to be accounted for when a system is planning on the behalf of a user.

There were also results and observations which showed that participants were considering the existing user contexts in a calendar, and that these user context categories could be ranked to display which category was better then the other. To utilize this in a system, a categorization procedure has to be used in the process of analyzing the available user contexts, in order to rank the alternative available slots according to the inferred user context.

Observing how the participants plan the given course into Kari'a calendar unveiled two main approaches used to initiate the procedure: planning important modules first and planning the modules sequentially, which mainly formed the difference between professionals and students, respectively. Professionals used more time and organized the calendar with more experience compared to students, which together with their module-ratings generally show a higher level of satisfaction, indicate that the first planning approach is the method of choice in a planning assistant system. However, we also observed that grouping the modules close together was preferable for the majority, however the majority of students did not achieve their desirable grouping because they did not rearrange the entries in the calendar. This observation creates a challenge to the development of such a system, if it were to rearrange the existing calendar entries, it must be done with the acceptance and control from the user, also the accuracy requirements for such a procedure would be demanding.

6.5.2 Planning simulation

Already within the implementation stage, certain procedures of the program unveiled to be more important compared to others. Our procedures were (as mentioned above) based on the features, and some features were more vulnerable to the calendars' content than others. Features, e.g. the context of surrounding entries were obviously dependent on the entry content. For the program to relate a certain existing entry to one of our specified categories (6.4.1), the entry had to be sufficiently described by the calendar owner. Which is an issue that is not related to the prototype, but to the calendars, however, the accuracy of categorization procedure became highly important.

User model

Among the findings from the calendar study 5.4, certain missing attributes were identified and suggested to be in a user model. User models, as defined by [29], are sources containing explicit assumptions relevant to the dialog between user and system. We identified several of the features that participants considered when planning their calendars. The different features had different effects on the planning results. The features that mirrored the users preferences and were stored in the user model did perform as intended, the only challenge identified is the process of capturing the users' preferences. This could be considered as a practical implementation issue, however, it is crucial that the data is stored on the correct preconditions (as discussed in section 6.6.1). Those features based on the calendar's content, unveiled themselves to dramatically affect the resulting slot rank. When presented with different calendars of different "quality" we observed that where the features were unable to interpret the content, the entire procedure had no effect on the slot rank. As a consequence, a slot that were less preferable, could be ranked as a better suggestion by the prototype. The most important feature of this kind was the "surrounding entries" feature, it depended on the categorization procedure to correctly categorize each of the entries surrounding the candidate slot. In these situations the categorization procedure did not recognize any keywords within the current entry, and were unable to categorize it. Obviously, this procedure has severe weaknesses in terms of content retrieval theory, nevertheless we have showed the importance of this functionality, and that despite having a "perfect" calendar, there must be an accurate algorithm for reading and interpreting the content.

6.5.3 Findings - an overview

From the interviews and the implementation of the prototype, we supply the findings from the previous studies conducted in this thesis.

6.6 Limitations of this study

The study had limitations, they are discussed in this section.

6.6.1 Users' preferences

During the interview, participants stated that they sometimes had difficulties to answer certain questions. They explained that the "correct" answer to the question was depending on the question's preconditions. This is a weakness that we observed during the interviews, which means that it affects all of the answers. It is important to keep this in mind when interpreting the results, because this means that a similar study with different preconditions could produce contrasting results.

6.6.2 Participants

Our participants, in general, were not selected according to achieving a representative selection of a population, but selected based on their availability to participate. There were only two females participating, something that could have been better. And since we had few participants (10) all findings made on the user groups as a whole, must be considered as indications and not conclusions.

Despite this study to be considered as qualitative, there are still variations within the results

that suggest that a higher number of participants would be preferable. However, due to time constraints, and the necessity for approaching the study on qualitative basis, we refer to this as future work.

7   Discussion & Conclusion

One of the main goals in this thesis is to evaluate calendars' potential as a source for contextual information, the key issue however, is not the calendars, but the users/owners. The users decide in what extent the calendars contain sufficient information about their own context, and therefore decide whether they can improve the contextual adaptation process within a context-aware system. The fact that users, or people, have different opinions, preferences and tasks depending on different types of conditions, is the main challenge when attempting to model people's characteristics. By knowing these characteristics, several usage possibilities are unveiled.

The findings from our studies, confirm that there are large variations between users' distinct needs and preferences. Already in the first interview, in Chapter 3, there were differences between the interviewees, and further in Chapter 4 we observed that students and professionals produce contrasting results when presented with the same set of questions. Moreover in Chapter 5 we identified three types of users depending on their input styles. At a glance, the task of modeling calendars' usage characteristics seems unstructured, but when the task is structured. When differentiating characteristics about user groups from individual users - the problem becomes more clear. Our findings suggest that there are large variations between different users groups, in our findings we distinguished *students* and *professionals* and found differences between their motivation, preferences and approaches to task given to them. From the viewpoint of a context-aware system, the more generalizable information known of its users would ease the complexity of the adaption process, because individuals' needs and preferences present much more variance, than the variance between user groups.

In our studies, we identified certain aspects of the users' preferences, we saw that our two user groups had different motives for using their calendars. Where students were mainly motivated by personal needs, the professionals were mainly motivated by their work/jobs. It is unclear however, if the introduction of sub-groups (e.g. type of jobs) would unveil other motives, but it is, as discussed, of severe importance that users understand why the use of calendars is beneficial. Consequently, users not having a personal motive to the use of calendars, or not being part of an environment that encourage calendar usage, ultimately do not create calendars suitable for our intentions. This is an important limitation to be aware of, and which of an LMS point-of-view can be problematic due to the often large variation of users.

The calendars in our study varied in quality, majority of calendars were suffering from low levels of detail, however, shared calendars combined with strong motivation produced calendars of high readability for humans. It was possible to infer relatively large amounts of information about the calendar owner, the information however were often pieces of information that would not be sufficient for a computer program to utilize. For instance were an entry's location was defined, the program would obviously not be able to infer *travel* without knowing the user's home location. Consequently, the need for a user model was suggested. The introduction of users models could complement the calendars and improve certain weaknesses, as the mentioned

example.

The potential usage of calendars in context-awareness is divided. In a learning environment calendars providing user context can be used in the adaption process of learning material. Learners could receive adapted learning material, for instance, according to their physical location and their (mobile) device, or course-modules could be suggested to them accordingly. Since calendars are unique in such way that they offer future context, it is possible to assist users to schedule course modules into the calendar. In either use, an understanding of the users' preferences is important. We identified several weaknesses during the implementation of the prototype; features depending on the calendar's content must be able to correctly interpret the content, and features only depending on the data stored in the user model are less likely to fail.

An issue concerning the features is related to the weights given, each of the features gives a weight to the candidate slot depending on the score mapping. All of the context features gave similar weights and thereby the slot rank was affected equally by each features. For instance, the assessment of *day* would affect the slot rank as much as the *entry context* on the surrounding entries. This study have no results that assess the importance of each feature, it might, for instance, be possible that the environmental context within the calendar is more important than the other features, and therefore should affect the slot rank more.

7.1 Research question 1

How do the correlation between different user types and users' motivation affect the contents in their calendars?

In the first part of this thesis we have seen that users who understands the benefits of keeping calendars produce better calendars than users that not understand these benefits. Motivation is the key issue for the users' attention to the calendars' content and there is a strong correlation between users and their calendar content.

Motivation

A user's motivation is related to his/hers environmental setting, our result show a that motivation reasons are generalizable for the tested user types.

Users are diverse, personal differences have affect the motivation.

It is important to notice that reliable calendars are realistic only if they are owned by users who understands the benefits of keeping calendars. Users that not understand these benefits are consequently not motivated.

Shared calendars

Users who share calendars between colleagues/friends describe their content a manner that is understandable for "external viewers", consequently a affecting the content positively with more details and accuracy.

7.2   Research question 2

How suited are real-world calendars as candidates for user context extraction?

For a calendar to be a good candidate for context extraction, its needs data that is accurate, consistent and updated.

Real-world calendars overall suffer from unstructured data with low accuracy. Among the calendars in the data set, there is little presence of consistent input styles.

Based on the isolated view of the calendars in the data set, they are containing sufficient data. However, if knowledge and preferences about the user were included, calendars could be better suited.

7.3   Research question 3

What user context features should be considered in a context-aware planning algorithm, and how do they affect the result?

Participants had different preferences to how the context features should be defined, but all stated a relevance to each of our candidate features.

- day of week
- time at day
- time surrounding entries
- context of surrounding entries

Features that are based on the content in the calendar are highly sensitive to the procedures' and and calendars' precision. Consequently, the requirements and the needs for the calendars' content increase.

Features that solely depend on the user's preferences would provide a reliable weight to the candidate slot every time.

8   Future Work

8.1   User study

Our study of users was approached by qualitative measures, we identified and looked at variation within the results. A further study on users could be approached with quantitive measures, comparing the differences between users groups to confirm or oppose our data. Further work could explore the users' calendar usage in terms of differences between private and professional calendars, are they separated or incorporated with each other? Further questions could be: are families sharing their calendars, how are calendars distributed across different devices, are there more differences between people of different ages when it comes to calendar usage? A further study on the users planning behavior is appropriate, finding the threshold for how far ahead calendars are reliable (1, 2 or 3 weeks?). This would provide valuable information about a planning assistant's usability.

8.2   Calendars

We found the calendars to be less detailed, which undermines their potential for context extraction. However, is it possible to able the users to produce better calendars? Can they be taught to describe their calendars better, or is there standardization of the descriptors to be developed? This would be highly valuable for calendars used in context capturing.

Further, is the availability of calendars a simple implementation issue, or is it problematic in terms of the variations of users?

8.3   Feature utilization

Our implementation of the prototype was severely simplified, for such functionality to be usable, several aspects must be further studied.

What is the best method for estimating the "correct" user context?

- Overall context throughout a day?

- Specified by user, or specified by system?

For an accurate estimation of the user context in a calendar, the functionality play the key role. Further work could investigate the threshold between manual and automatic context capturing. What can be automatically be decided by the system an what preferences must the user define in the user model?
What possibilities can machine learning provide a context-aware learning system?

Metadata

For an algorithm to be able to assist the user in the process of planing a course's progression, we need information about the course. Are there existing standards (SCORM, LOM) that already have defined such metadata?

Context features

The most important to investigate further, is the weighting issue between the context features. What features should are of more severe importance compared to others? Are there additional context features to take into consideration when reading user context?

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A Survey: questions

This appendix presents a preview of the survey and its questions. The boxes show the "rules" that take affect according to the participants' choices. It is possible to see what questions only presented to students or/and professionals.

This survey is part of a master thesis carried out in the spring semester 2010 at Gjøvik University College by Anders Gimmestad Gule

The thesis' scope is to explore whether elctronical/digital calendars can be used as reliable sources to capture context information (time, place, resources etc.) about a user. And to see whether this information could be used by a Learning Management System to adapt learning material to suite the user in a best possible matter.

The survey is guaranteed to be anonymous and will only take a couple of minutes to finish.

The Master Thesis is collaborated with Apropos-Internett, project homepage Master Thesis: Calendars as Context Provider.

Thanks for your participation!
Your identity will be hidden
Read about hidden identity. (Opens in a new window)

This box is shown in preview only.

These actions will take effect for the following alternatives:

- Nei : Goto end

---

1) Do you use digital calendars?

○ Yes
○ No

2) * Year of birth

Select answer

3) * Gender

Select answer

4) * I am

○ Student (high school)
○ Student (college student)
○ Professional (working)
○ Both student and professional

I update my calendar because:

5) ... it helps me organize my work

○ 1 - **I Disagree** ○ 2 ○ 3 - **Neutral** ○ 4 ○ 5 - **I Agree**

6) ... my work/job encurage/requires me to do so.

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○ 1 - **I Disagree** ○ 2 ○ 3 - **Neutral** ○ 4 ○ 5 - **I Agree**

7) ... I always forget things if I don't

○ 1 - **I Disagree** ○ 2 ○ 3 - **Neutral** ○ 4 ○ 5 - **I Agree**

8) ... my colleagues/fellow students/friends depend on it being up-to-date.

○ 1 - **I Disagree** ○ 2 ○ 3 - **Neutral** ○ 4 ○ 5 - **I Agree**

9) ... my colleagues/fellow students/friends can see whether I am available or busy.

○ 1 - **I Disagree** ○ 2 ○ 3 - **Neutral** ○ 4 ○ 5 - **I Agree**

10) My work/job calendar is most important to me.

○ 1 - **I Disagree** ○ 2 ○ 3 - **Neutral** ○ 4 ○ 5 - **I Agree**

11) My private/personal calendar is most important to me.

○ 1 - **I Disagree** ○ 2 ○ 3 - **Neutral** ○ 4 ○ 5 - **I Agree**

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- Jeg er - Student (videregående skole)
  or
- Jeg er - Student og Profesjonell
  or
- Jeg er - Student (Høyskole/Universitet)

---

12) Do you have access to your colleagues'/fellow students' calendars?

○ Yes
○ No
○ Not relevant

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- Jeg er - Student og Profesjonell
  or
- Jeg er - Profesjonell (i jobb)

---

13) Do you have access to your colleagues' calendars?

◯ Yes
◻ No
◯ Not relevant

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

• Har du tilgang til dine medstudenters kalendere? - Ja

14) I often experience my fellow students being busy when his calendar shows that he is available.

◯ 1 - **I Disagree** ◯ 2 ◯ 3 - **Neutral** ◯ 4 ◯ 5 - **I Agree**

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

• Har du tilgang til dine medstudenters kalendere? - Ja

15) I often experience a fellow student being available when his calendar shows that he is busy.

◯ 1 - **I Disagree** ◯ 2 ◯ 3 - **Neutral** ◯ 4 ◯ 5 - **I Agree**

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

• Har du tilgang til dine kollegers kalendere? - Ja

16) I often experience a colleagues being busy when his calendar shows that he is available.

◯ 1 - **I Disagree** ◯ 2 ◯ 3 - **Neutral** ◯ 4 ◯ 5 - **I Agree**

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

• Har du tilgang til dine kollegers kalendere? - Ja

17) I often experience a colleagues being available when his calendar shows that he is busy.

◯ 1 - **I Disagree** ◯ 2 ◯ 3 - **Neutral** ◯ 4 ◯ 5 - **I Agree**

18) My job/work calendar is always up-to-date

○ 1 - **I Disagree** ○ 2 ○ 3 ○ 4 - **I Agree**

19) My private/personal calendar is always up to date.

○ 1 - **I Disagree** ○ 2 ○ 3 ○ 4 - **I Agree**

20) If one of my appointments' location changes I update the appointment with the new location.

○ 1 - **Never** ○ 2 ○ 3 - **Neutral** ○ 4 ○ 5 - **Always**

21) I always register the location of an event/ appointment in my calendar.

○ 1 - **Aldri** ○ 2 ○ 3 - **Neutral** ○ 4 ○ 5 - **Always**

22) When describing the location of an event/ appointment I prefer the following methods.

☐ GPS coordinates

☐ Web services *(GoogleMaps etc.)*

☐ Place names *(example Gjøvik or Kallerud)*

☐ Room number *(example E112)*

☐ Address *(example 2821 Gjøvik)*

☐ Other, please specify

23) How accurate are you when describing end-time of an entry?

○ 1 - by the hour

○ 2 - by every 30 minutes

○ 3 - by every 15 minutes

○ 4 - by every 5 minutes

○ 5 - to the minute

24) How accurate are you when describing end-time of an entry?

○ 1 - by the hour

○ 2 - by every 30 minutes

○ 3 - by every 15 minutes

○ 4 - by every 5 minutes

○ 5 - to the minute

What of the following data do you specify when registering a new calendar entry?

25) Do you specify "description" when registering a calendar entry?

○ 1 - Never ○ 2 ○ 3 - Neutral ○ 4 ○ 5 - Always

26) Do you specify "start-time" when registering a calendar entry?

◯ 1 - Never ◯ 2 ◯ 3 - Neutral ◯ 4 ◯ 5 - Always

27) Do you specify "end-time" when registering a calendar entry?

◯ 1 - Never ◯ 2 ◯ 3 - Neutral ◯ 4 ◯ 5 - Always

28) Do you specify "date" when registering a calendar entry?

◯ 1 - Never ◯ 2 ◯ 3 - Neutral ◯ 4 ◯ 5 - Always

29) Do you specify "satus" (available/busy/...) when registering a calendar entry?

◯ 1 - Never ◯ 2 ◯ 3 - Neutral ◯ 4 ◯ 5 - Always

30) Do you use "alarm" when registering a calendar entry?

◯ 1 - Never ◯ 2 ◯ 3 - Neutral ◯ 4 ◯ 5 - Always

31) Do you use "keywords/notes" when registering a calendar entry?

◯ 1 - Never ◯ 2 ◯ 3 - Neutral ◯ 4 ◯ 5 - Always

32) Appointments/entries that occure regularly I use the calendar applications' "repeat/regular appointment" functionality.

◯ 1 - Never ◯ 2 ◯ 3 - Neutral ◯ 4 ◯ 5 - Always

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- Jeg er - Student (videregående skole)
  or
- Jeg er - Student og Profesjonell
  or
- Jeg er - Student (Høyskole/Universitet)

33) I register time for self-studies which is outside my regular schedule (lectures) in my calendar.

◯ 1 - Never ◯ 2 ◯ 3 - Neutral ◯ 4 ◯ 5 - Always

34) Do you have and use calendars on several devices (example mobile phone, ipod, laptop)?

◯ Yes
◯ Nei

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

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- Har du kalendere på flere enheter (f.eks. mobiltelefon, ipod, laptop) som du vanligvis bruker? - Ja

35) How many devices?

Select answer

This box is shown in preview only.

The following criteria must be fulfilled for this question to be shown:

- Har du kalendere på flere enheter (f.eks. mobiltelefon, ipod, laptop) som du vanligvis bruker? - Ja

36) Are they syncronized?

- Yes, all of them
- Some of them
- No, non of them

37) I use the following calendar systems/ applications/services:

- Microsoft Outlook
- Apple iCal
- Sunbird/Lightning/Evolution
- Google Calendar
- Other, please specify

- I don't know

B   Survey: Professionals' result

Survey: the usage of digital calendars

Published from 04.02.2010 to 26.02.2010
23 responses (1 unique)

Current filter: pro
"I am" = "Professional (working)"

1. Do you use digital calendars?

Alternatives	Percent	Value
1 Yes	100,0 %	23
2 No	0,0 %	0
Total		23

2. Year of birth

Alternatives	Percent	Value
1 1994	0,0 %	0
2 1993	0,0 %	0
3 1991	0,0 %	0
4 1990	0,0 %	0
5 1989	0,0 %	0
6 1988	0,0 %	0
7 1987	0,0 %	0
8 1986	4,3 %	1
9 1985	0,0 %	0
10 1984	4,3 %	1
11 1983	0,0 %	0
12 1982	4,3 %	1
13 1981	0,0 %	0
14 1980	0,0 %	0
15 1979	0,0 %	0
16 1978	4,3 %	1
17 1977	4,3 %	1
18 1976	0,0 %	0
19 1975	0,0 %	0
20 1974	4,3 %	1
21 1973	0,0 %	0
22 1972	8,7 %	2
23 1971	0,0 %	0
24 1970	0,0 %	0
25 1969	4,3 %	1
26 1968	4,3 %	1
27 1967	0,0 %	0
28 1966	0,0 %	0
29 1965	8,7 %	2
30 1964	4,3 %	1
31 1963	0,0 %	0
32 1962	0,0 %	0
33 1961	13,0 %	3
34 1960	13,0 %	3
35 1959	8,7 %	2
36 1958	0,0 %	0
37 1957	0,0 %	0
38 1956	0,0 %	0
39 1955	4,3 %	1
40 1954	0,0 %	0
41 1953	0,0 %	0
42 1952	0,0 %	0
43 1951	0,0 %	0
44 1950	0,0 %	0
45 1949	4,3 %	1
46 1948	0,0 %	0
47 1947	0,0 %	0
48 1946	0,0 %	0
49 1945	0,0 %	0
50 1944	0,0 %	0
51 1943	0,0 %	0
52 1942	0,0 %	0
53 1941	0,0 %	0
54 1940	0,0 %	0
55 1939	0,0 %	0
56 1938	0,0 %	0
57 1937	0,0 %	0
58 1936	0,0 %	0
59 1935	0,0 %	0
60 1934	0,0 %	0
61 1933	0,0 %	0

3. Gender

Alternatives	Percent	Value
1 Female	52,2 %	12
2 Male	47,8 %	11
Total		23

4. I am

Alternatives	Percent	Value
1 Student (high school)	0,0 %	0
2 Student (college student)	0,0 %	0
3 Professional (working)	100,0 %	23
4 Both student and professional	0,0 %	0
Total		23

5. ... it helps me organize my work

Alternatives	Percent	Value
1 1 - I Disagree	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	0,0 %	0
4 4	0,0 %	0
5 5 - I Agree	100,0 %	23
Total		23

6. ... my work/job encurage/requires me to do so.

Alternatives	Percent	Value
1 1 - I Disagree	0,0 %	0
2 2	4,3 %	1
3 3 - Neutral	30,4 %	7
4 4	17,4 %	4
5 5 - I Agree	47,8 %	11
Total		23

7. ... I always forget things if I don't

Alternatives	Percent	Value
1 1 - I Disagree	8,7 %	2
2 2	13,0 %	3
3 3 - Neutral	17,4 %	4
4 4	26,1 %	6
5 5 - I Agree	34,8 %	8
Total		23

8. ... my colleagues/fellow students/friends depend on it being up-to-date.

Alternatives	Percent	Value
1 1 - I Disagree	13,0 %	3
2 2	0,0 %	0
3 3 - Neutral	17,4 %	4
4 4	39,1 %	9
5 5 - I Agree	30,4 %	7
Total		23

9. ... my colleagues/fellow students/friends can see whether I am available or busy.

Alternatives	Percent	Value
1 1 - I Disagree	8,7 %	2
2 2	4,3 %	1
3 3 - Neutral	8,7 %	2
4 4	13,0 %	3
5 5 - I Agree	65,2 %	15
Total		23

Alternatives	Percent	Value
1 1 - I Disagree	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	8,7 %	2
4 4	30,4 %	7
5 5 - I Agree	60,9 %	14
Total		23

11. My private/personal calendar is most important to me.

Alternatives	Percent	Value
1 1 - I Disagree	18,2 %	4
2 2	9,1 %	2
3 3 - Neutral	31,8 %	7
4 4	31,8 %	7
5 5 - I Agree	9,1 %	2
Total		22

12. Do you have access to your colleagues'/fellow students' calendars?

Alternatives	Percent	Value
1 Yes	0,0 %	0
2 No	0,0 %	0
3 Not relevant	0,0 %	0
Total		0

13. Do you have access to your colleagues' calendars?

Alternatives	Percent	Value
1 Yes	82,6 %	19
2 No	8,7 %	2
3 Not relevant	8,7 %	2
Total		23

14. I often experience my fellow students being busy when his calendar shows that he is available.

Alternatives	Percent	Value
1 1 - I Disagree	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	0,0 %	0
4 4	0,0 %	0
5 5 - I Agree	0,0 %	0
Total		0

15. I often experience a fellow student being available when his calendar shows that he is busy.

Alternatives	Percent	Value
1 1 - I Disagree	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	0,0 %	0
4 4	0,0 %	0
5 5 - I Agree	0,0 %	0
Total		0

16. I often experience a colleagues being busy when his calendar shows that he is available.

Alternatives	Percent	Value
1 1 - I Disagree	31,6 %	6
2 2	31,6 %	6
3 3 - Neutral	10,5 %	2
4 4	10,5 %	2
5 5 - I Agree	15,8 %	3
Total		19

Alternatives	Percent	Value
1 1 - I Disagree	47,4 %	9
2 2	36,8 %	7
3 3 - Neutral	5,3 %	1
4 4	5,3 %	1
5 5 - I Agree	5,3 %	1
Total		19

18. My job/work calendar is always up-to-date

Alternatives	Percent	Value
1 1 - I Disagree	4,3 %	1
2 2	8,7 %	2
3 3	30,4 %	7
4 4 - I Agree	56,5 %	13
Total		23

19. My private/personal calendar is always up to date.

Alternatives	Percent	Value
1 1 - I Disagree	13,0 %	3
2 2	34,8 %	8
3 3	34,8 %	8
4 4 - I Agree	17,4 %	4
Total		23

20. If one of my appointments' location changes I update the appointment with the new location.

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	4,3 %	1
3 3 - Neutral	4,3 %	1
4 4	34,8 %	8
5 5 - Always	56,5 %	13
Total		23

21. I always register the location of an event/appointment in my calendar.

Alternatives	Percent	Value
1 1 - Aldri	0,0 %	0
2 2	8,7 %	2
3 3 - Neutral	21,7 %	5
4 4	47,8 %	11
5 5 - Always	21,7 %	5
Total		23

22. When describing the location of an event/appointment I prefer the following methods.

Alternatives	Percent	Value
1 GPS coordinates	0,0 %	0
2 Web services (GoogleMaps etc.)	0,0 %	0
3 Place names (example Gjøvik or Kallerud)	73,9 %	17
4 Room number (example E112)	69,6 %	16
5 Address (example 2821 Gjøvik)	21,7 %	5
6 Other, please specify	13,0 %	3
Total		23

Alternatives	Percent	Value
1 1 - by the hour	4,3 %	1
2 2 - by every 30 minutes	8,7 %	2
3 3 - by every 15 minutes	13,0 %	3
4 4 - by every 5 minutes	8,7 %	2
5 5 - to the minute	65,2 %	15
Total		23

24. How accurate are you when describing end-time of an entry?

Alternatives	Percent	Value
1 1 - by the hour	22,7 %	5
2 2 - by every 30 minutes	22,7 %	5
3 3 - by every 15 minutes	22,7 %	5
4 4 - by every 5 minutes	4,5 %	1
5 5 - to the minute	27,3 %	6
Total		22

25. Do you specify "description" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	21,7 %	5
3 3 - Neutral	13,0 %	3
4 4	26,1 %	6
5 5 - Always	39,1 %	9
Total		23

26. Do you specify "start-time" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	4,5 %	1
3 3 - Neutral	0,0 %	0
4 4	18,2 %	4
5 5 - Always	77,3 %	17
Total		22

27. Do you specify "end-time" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	8,7 %	2
3 3 - Neutral	13,0 %	3
4 4	17,4 %	4
5 5 - Always	60,9 %	14
Total		23

28. Do you specify "date" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	4,3 %	1
2 2	0,0 %	0
3 3 - Neutral	0,0 %	0
4 4	4,3 %	1
5 5 - Always	91,3 %	21
Total		23

29. Do you specify "satus" (available/busy/...) when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	13,0 %	3
2 2	0,0 %	0
3 3 - Neutral	26,1 %	6
4 4	34,8 %	8
5 5 - Always	26,1 %	6
Total		23

30. Do you use "alarm" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	8,7 %	2
2 2	17,4 %	4
3 3 - Neutral	0,0 %	0
4 4	52,2 %	12
5 5 - Always	21,7 %	5
Total		23

31. Do you use "keywords/notes" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	8,7 %	2
2 2	34,8 %	8
3 3 - Neutral	30,4 %	7
4 4	21,7 %	5
5 5 - Always	4,3 %	1
Total		23

32. Appointments/entries that occure regularly I use the calendar applications' "repeat/regular appointment" functionality.

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	8,7 %	2
4 4	52,2 %	12
5 5 - Always	39,1 %	9
Total		23

33. I register time for self-studies which is outside my regular schedule (lectures) in my calendar.

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	0,0 %	0
4 4	0,0 %	0
5 5 - Always	0,0 %	0
Total		0

34. Do you have and use calendars on several devices (example mobile phone, ipod, laptop)?

Alternatives	Percent	Value
1 Yes	82,6 %	19
2 Nei	17,4 %	4
Total		23

35. How many devices?

Alternatives	Percent	Value
1 1	15,8 %	3
2 2	57,9 %	11
3 3	21,1 %	4
4 4	5,3 %	1
5 5	0,0 %	0
6 6	0,0 %	0
7 7	0,0 %	0
8 8	0,0 %	0
9 9	0,0 %	0
10 10	0,0 %	0
11 more than 10	0,0 %	0
Total		19

36. Are they syncronized?

Alternatives	Percent	Value
1 Yes, all of them	68,4 %	13
2 Some of them	15,8 %	3
3 No, non of them	15,8 %	3
Total		19

37. I use the following calendar systems/applications/services:

Alternatives	Percent	Value
1 Microsoft Outlook	78,3 %	18
2 Apple iCal	13,0 %	3
3 Sunbird/Lightning/Evolutio n	4,3 %	1
4 Google Calendar	21,7 %	5
5 Other, please specify	34,8 %	8
-1 I don't know	0,0 %	0
Total		23

C Survey: Students' result

QuestBack export - Survey: the usage of digital calendars

Survey: the usage of digital calendars

Published from 04.02.2010 to 26.02.2010
23 responses (1 unique)

Current filter: pro
"I am" = "Professional (working)"

1. Do you use digital calendars?

Alternatives	Percent	Value
1 Yes	100,0 %	23
2 No	0,0 %	0
Total		23

2. Year of birth

Alternatives	Percent	Value
1 1994	0,0 %	0
2 1993	0,0 %	0
3 1991	0,0 %	0
4 1990	0,0 %	0
5 1989	0,0 %	0
6 1988	0,0 %	0
7 1987	0,0 %	0
8 1986	4,3 %	1
9 1985	0,0 %	0
10 1984	4,3 %	1
11 1983	0,0 %	0
12 1982	4,3 %	1
13 1981	0,0 %	0
14 1980	0,0 %	0
15 1979	0,0 %	0
16 1978	4,3 %	1
17 1977	4,3 %	1
18 1976	0,0 %	0
19 1975	0,0 %	0
20 1974	4,3 %	1
21 1973	0,0 %	0
22 1972	8,7 %	2
23 1971	0,0 %	0
24 1970	0,0 %	0
25 1969	4,3 %	1
26 1968	4,3 %	1
27 1967	0,0 %	0
28 1966	0,0 %	0
29 1965	8,7 %	2
30 1964	4,3 %	1
31 1963	0,0 %	0
32 1962	0,0 %	0
33 1961	13,0 %	3
34 1960	13,0 %	3
35 1959	8,7 %	2
36 1958	0,0 %	0
37 1957	0,0 %	0
38 1956	0,0 %	0
39 1955	4,3 %	1
40 1954	0,0 %	0
41 1953	0,0 %	0
42 1952	0,0 %	0
43 1951	0,0 %	0
44 1950	0,0 %	0
45 1949	4,3 %	1
46 1948	0,0 %	0
47 1947	0,0 %	0
48 1946	0,0 %	0
49 1945	0,0 %	0
50 1944	0,0 %	0
51 1943	0,0 %	0
52 1942	0,0 %	0
53 1941	0,0 %	0
54 1940	0,0 %	0
55 1939	0,0 %	0
56 1938	0,0 %	0
57 1937	0,0 %	0
58 1936	0,0 %	0
59 1935	0,0 %	0
60 1934	0,0 %	0
61 1933	0,0 %	0

3. Gender

Alternatives	Percent	Value
1 Female	52,2 %	12
2 Male	47,8 %	11
Total		23

4. I am

Alternatives	Percent	Value
1 Student (high school)	0,0 %	0
2 Student (college student)	0,0 %	0
3 Professional (working)	100,0 %	23
4 Both student and professional	0,0 %	0
Total		23

5. ... it helps me organize my work

Alternatives	Percent	Value
1 1 - I Disagree	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	0,0 %	0
4 4	0,0 %	0
5 5 - I Agree	100,0 %	23
Total		23

6. ... my work/job encurage/requires me to do so.

Alternatives	Percent	Value
1 1 - I Disagree	0,0 %	0
2 2	4,3 %	1
3 3 - Neutral	30,4 %	7
4 4	17,4 %	4
5 5 - I Agree	47,8 %	11
Total		23

7. ... I always forget things if I don't

Alternatives	Percent	Value
1 1 - I Disagree	8,7 %	2
2 2	13,0 %	3
3 3 - Neutral	17,4 %	4
4 4	26,1 %	6
5 5 - I Agree	34,8 %	8
Total		23

8. ... my colleagues/fellow students/friends depend on it being up-to-date.

Alternatives	Percent	Value
1 1 - I Disagree	13,0 %	3
2 2	0,0 %	0
3 3 - Neutral	17,4 %	4
4 4	39,1 %	9
5 5 - I Agree	30,4 %	7
Total		23

9. ... my colleagues/fellow students/friends can see whether I am available or busy.

Alternatives	Percent	Value
1 1 - I Disagree	8,7 %	2
2 2	4,3 %	1
3 3 - Neutral	8,7 %	2
4 4	13,0 %	3
5 5 - I Agree	65,2 %	15
Total		23

Alternatives	Percent	Value
1 1 - I Disagree	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	8,7 %	2
4 4	30,4 %	7
5 5 - I Agree	60,9 %	14
Total		23

11. My private/personal calendar is most important to me.

Alternatives	Percent	Value
1 1 - I Disagree	18,2 %	4
2 2	9,1 %	2
3 3 - Neutral	31,8 %	7
4 4	31,8 %	7
5 5 - I Agree	9,1 %	2
Total		22

12. Do you have access to your colleagues'/fellow students' calendars?

Alternatives	Percent	Value
1 Yes	0,0 %	0
2 No	0,0 %	0
3 Not relevant	0,0 %	0
Total		0

13. Do you have access to your colleagues' calendars?

Alternatives	Percent	Value
1 Yes	82,6 %	19
2 No	8,7 %	2
3 Not relevant	8,7 %	2
Total		23

14. I often experience my fellow students being busy when his calendar shows that he is available.

Alternatives	Percent	Value
1 1 - I Disagree	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	0,0 %	0
4 4	0,0 %	0
5 5 - I Agree	0,0 %	0
Total		0

15. I often experience a fellow student being available when his calendar shows that he is busy.

Alternatives	Percent	Value
1 1 - I Disagree	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	0,0 %	0
4 4	0,0 %	0
5 5 - I Agree	0,0 %	0
Total		0

16. I often experience a colleagues being busy when his calendar shows that he is available.

Alternatives	Percent	Value
1 1 - I Disagree	31,6 %	6
2 2	31,6 %	6
3 3 - Neutral	10,5 %	2
4 4	10,5 %	2
5 5 - I Agree	15,8 %	3
Total		19

Alternatives	Percent	Value
1 1 - I Disagree	47,4 %	9
2 2	36,8 %	7
3 3 - Neutral	5,3 %	1
4 4	5,3 %	1
5 5 - I Agree	5,3 %	1
Total		19

18. My job/work calendar is always up-to-date

Alternatives	Percent	Value
1 1 - I Disagree	4,3 %	1
2 2	8,7 %	2
3 3	30,4 %	7
4 4 - I Agree	56,5 %	13
Total		23

19. My private/personal calendar is always up to date.

Alternatives	Percent	Value
1 1 - I Disagree	13,0 %	3
2 2	34,8 %	8
3 3	34,8 %	8
4 4 - I Agree	17,4 %	4
Total		23

20. If one of my appointments' location changes I update the appointment with the new location.

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	4,3 %	1
3 3 - Neutral	4,3 %	1
4 4	34,8 %	8
5 5 - Always	56,5 %	13
Total		23

21. I always register the location of an event/appointment in my calendar.

Alternatives	Percent	Value
1 1 - Aldri	0,0 %	0
2 2	8,7 %	2
3 3 - Neutral	21,7 %	5
4 4	47,8 %	11
5 5 - Always	21,7 %	5
Total		23

22. When describing the location of an event/appointment I prefer the following methods.

Alternatives	Percent	Value
1 GPS coordinates	0,0 %	0
2 Web services (GoogleMaps etc.)	0,0 %	0
3 Place names (example Gjøvik or Kallerud)	73,9 %	17
4 Room number (example E112)	69,6 %	16
5 Address (example 2821 Gjøvik)	21,7 %	5
6 Other, please specify	13,0 %	3
Total		23

Alternatives	Percent	Value
1 1 - by the hour	4,3 %	1
2 2 - by every 30 minutes	8,7 %	2
3 3 - by every 15 minutes	13,0 %	3
4 4 - by every 5 minutes	8,7 %	2
5 5 - to the minute	65,2 %	15
Total		23

24. How accurate are you when describing end-time of an entry?

Alternatives	Percent	Value
1 1 - by the hour	22,7 %	5
2 2 - by every 30 minutes	22,7 %	5
3 3 - by every 15 minutes	22,7 %	5
4 4 - by every 5 minutes	4,5 %	1
5 5 - to the minute	27,3 %	6
Total		22

25. Do you specify "description" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	21,7 %	5
3 3 - Neutral	13,0 %	3
4 4	26,1 %	6
5 5 - Always	39,1 %	9
Total		23

26. Do you specify "start-time" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	4,5 %	1
3 3 - Neutral	0,0 %	0
4 4	18,2 %	4
5 5 - Always	77,3 %	17
Total		22

27. Do you specify "end-time" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	8,7 %	2
3 3 - Neutral	13,0 %	3
4 4	17,4 %	4
5 5 - Always	60,9 %	14
Total		23

28. Do you specify "date" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	4,3 %	1
2 2	0,0 %	0
3 3 - Neutral	0,0 %	0
4 4	4,3 %	1
5 5 - Always	91,3 %	21
Total		23

29. Do you specify "satus" (available/busy/...) when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	13,0 %	3
2 2	0,0 %	0
3 3 - Neutral	26,1 %	6
4 4	34,8 %	8
5 5 - Always	26,1 %	6
Total		23

30. Do you use "alarm" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	8,7 %	2
2 2	17,4 %	4
3 3 - Neutral	0,0 %	0
4 4	52,2 %	12
5 5 - Always	21,7 %	5
Total		23

31. Do you use "keywords/notes" when registering a calendar entry?

Alternatives	Percent	Value
1 1 - Never	8,7 %	2
2 2	34,8 %	8
3 3 - Neutral	30,4 %	7
4 4	21,7 %	5
5 5 - Always	4,3 %	1
Total		23

32. Appointments/entries that occure regularly I use the calendar applications' "repeat/regular appointment" functionality.

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	8,7 %	2
4 4	52,2 %	12
5 5 - Always	39,1 %	9
Total		23

33. I register time for self-studies which is outside my regular schedule (lectures) in my calendar.

Alternatives	Percent	Value
1 1 - Never	0,0 %	0
2 2	0,0 %	0
3 3 - Neutral	0,0 %	0
4 4	0,0 %	0
5 5 - Always	0,0 %	0
Total		0

34. Do you have and use calendars on several devices (example mobile phone, ipod, laptop)?

Alternatives	Percent	Value
1 Yes	82,6 %	19
2 Nei	17,4 %	4
Total		23

35. How many devices?

Alternatives	Percent	Value
1 1	15,8 %	3
2 2	57,9 %	11
3 3	21,1 %	4
4 4	5,3 %	1
5 5	0,0 %	0
6 6	0,0 %	0
7 7	0,0 %	0
8 8	0,0 %	0
9 9	0,0 %	0
10 10	0,0 %	0
11 more than 10	0,0 %	0
Total		19

36. Are they syncronized?

Alternatives	Percent	Value
1 Yes, all of them	68,4 %	13
2 Some of them	15,8 %	3
3 No, non of them	15,8 %	3
Total		19

37. I use the following calendar systems/applications/services:

Alternatives	Percent	Value
1 Microsoft Outlook	78,3 %	18
2 Apple iCal	13,0 %	3
3 Sunbird/Lightning/Evolutio n	4,3 %	1
4 Google Calendar	21,7 %	5
5 Other, please specify	34,8 %	8
-1 I don't know	0,0 %	0
Total		23

D   Interview Questions

The following appendix contains the re-written notes from the interviews. They can not be considered as the entire data-collection as many of the observations were hard to formulate to written form, nevertheless they provide the outline of the most important observations made.

D.1   Questions

The interviews were conducted as a conversation between the interviewer and the subject, the following questions were the general guidelines for the interview. Additional and follow-up questions were in some cases added.

D.1.1   Question 1

Imagine you are having an exam or a meeting of high importance, and you could decide which day (Monday - Friday) to have it. Consider the following:

- What day is the best day?

- What days are good/ok days?

- What day is the worst day?

- What days are bad/inappropriate days?

- Why?

D.1.2   Question 2

Are there particular time-periods during a day that you feel not should be subject for creation of entries?

- What time of day is the worst time to have an appointment?

- What times of day is inappropriate times to have appointments?

- Why?

D.1.3   Question 3

Which of the following statements fits you best?

- S1 - I work best early in the morning (from 0700 to 1200)

- S2 - I work best after midday (from 1200 to 1600)

- S3 - It doesn't matter for me.

- Why?

D.1.4   Question 4

Grade the following scenarios according to:1 - ok, 2 - unfortunate, 4 - unacceptable. You have no choice but to take a 30 minute graded test/exam or have an important meeting.

1. . . . just when you arrived at the office at 08:00

2. . . . just before lunch at 11:00

3. . . . directly after lunch at 12:00

4. . . . at 15:00

5. Why?

D.1.5 Question 5

In the following scenario we are interested in understanding the user's needs/preferences for having some time between appointments. How important is it and how much time is preferable?

   The participants were asked to place a new entry in a calendar according to the already existing entries, and only considering the time they personally needed to change their "mood". In this case; do they need time between a meeting and a test/exam?

   Consider you are planning to take a graded test directly after an existing appointment.

   Evaluate and choose between the following scenarios:

   Time-gap between previous entry and new entry?

   Time-gap between a new entry and the following entry?

   Close to previous entry or close to following entry?

D.1.6 Question 6

The following entry categories are the resulting categories from the analysis of gathered user calendars. We are interested in understanding how users rank the different categories according to their personal "mood". Travel was divided into "long" and "short" distance.

- Travel (long distance) - *extensive traveling, ex. several hours of travel.*

- Travel (short distance) - *ex. minor traveling, ex. 1 hour of travel.*

- private appointment - *ex. dentist, doctors appointment, family.*

- Office work - *ex. in an office working.*

- Meeting - *ex. with colleagues.*

- Social event - *ex. party, friends, informal event.*

Imagine that you were having an exam, and you were to take this exam directly after one of the above entries. Consider choosing between:

   1. Travel (short dist.) - private appointment
   2. Social event - Office work
   3. Travel (long dist.) - Meeting
   4. Travel (short dist.) - Social event
   5. Social event - private appointment
   6. Office work - Travel (short dist.)
   7. Meeting - Travel (short dist.)

(a) Time after.   (b) Time before.   (c) Time before and after.
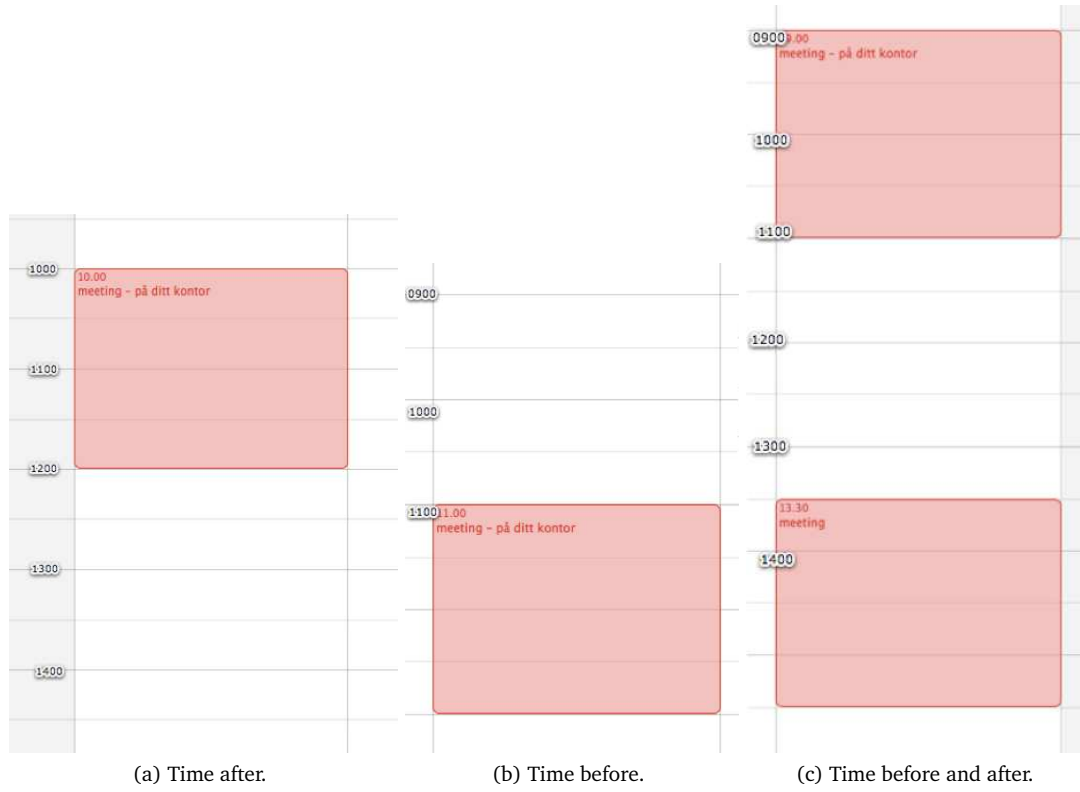
Figure 15: Question 5, scenarios.

Figure 16: Test entry, duration: 90 minutes.

8. Meeting - private appointment

9. Travel (short dist.) - Travel (long dist.)

10.Social event - Meeting

11.Travel (long dist.) - private appointment

12.Office work - private appointment

13.Travel (long dist.) - Office Work

14.Meeting - Office work

15.Travel (long dist.) - Social event

D.1.7 Question 7

Given the course "HMS" and Kari's calendar (spanning over 2 weeks). Distribute/plan the 4 course-modules into Kari's calendar according to her context and entries that already exist in the calendar (if necessary provide several alternatives).

Keep in mind :

- Day of week

- Time at day

- The type of appointments before and after already in the calendar how close the entries are to each other.

Evaluate the 4 modules' placements by giving them grades:
1 - Ok, 2 - unfortunate, 3 - unacceptable

Personas/scenario (in norwegian)

- Name: Kari Bakken

- Age: 24

- Occupation Title: Consultant manager

Ansatt hos Buddy IT Consult i Oslo og har akkurat blitt HMS-ansvarlig (Helse, Miljø og Sikkerhet) i denne bedriften. Dette medfører at Kari må gjennomføre et obligatorisk HMS-kurs og ledelsen har bestemt at den mest hensiktsfulle måten å gjennføre dette på er å ta et pass/fail kurs over internett. Ledelsen har også gitt Kari en frist på 2 uker til å gjennomføre kurset, ut over det må Kari selv sørge for å gjennomføre kurset, hvor og når hun gjør dette avgjør hun selv innenfor de 2 ukene.

Kari sin arbeidsdag starter kl. 0800 og slutter kl. 1600 og siden hun arbeider 100% jobber hun alle hverdagene i uken fra Mandag til Fredag. Ut over dette jobber ikke Kari med jobb-relaterte oppgaver så hun må gjennomføre nett-kurset i arbeidstiden da hun sitter på kontoret.

En typisk arbeidsuke for Kari består av mange forskjellige arbeidsoppgaver; ukens 2 første dager starter ofte med hyppig møtevirksomhet, der det blir gjort opp status i de forskjellige prosjektene Buddy IT Consult har pågående, det er heller ikke uvanlig at disse møtene foregår ute på lokasjon i de bedriftene som leier inn Buddy IT C. noe som medfører at reising er en del av arbeidsdagen. De 3 siste dagene i uken består som regel av kontorarbeid der hun holder kontakt

	type	approx. length	description	Technical Requirements
1	Questionnaire/quiz	20 minutes	10 intro questions on the topic	internet access, laptop
2	Audio slides	60 - 90 minutes	Slides with comments from the lecturer	internet access, headphones/speakers
3	Deliverable/exercises	120 minutes	6 exercises, tasks, cases/scenarios	pen, paper, lecture notes
4	Formal exam	max 30 minutes	MultipleChoice questions + open length questions	internet access, laptop

Table 18: Kari's "HMS" course.

med kunder, og driver markedsføring mot potensielle nye kunder.

Nettkurset består av 4 moduler og er spesifisert i tabell 18.
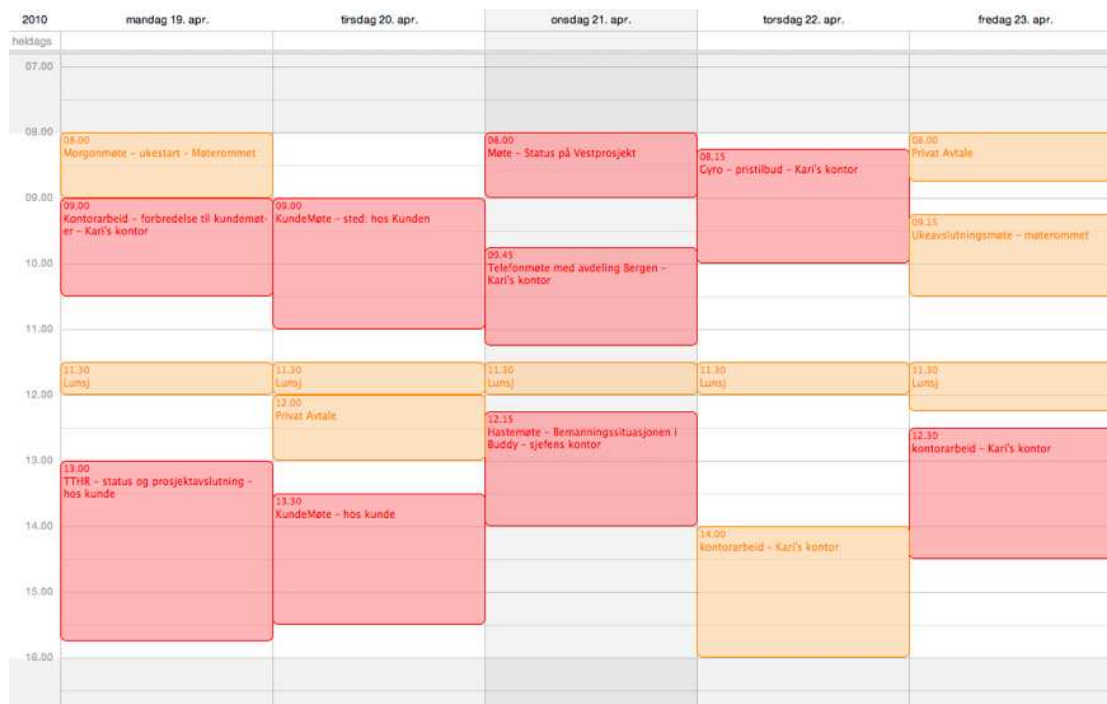
Figure 17: Kari's calendar week 1

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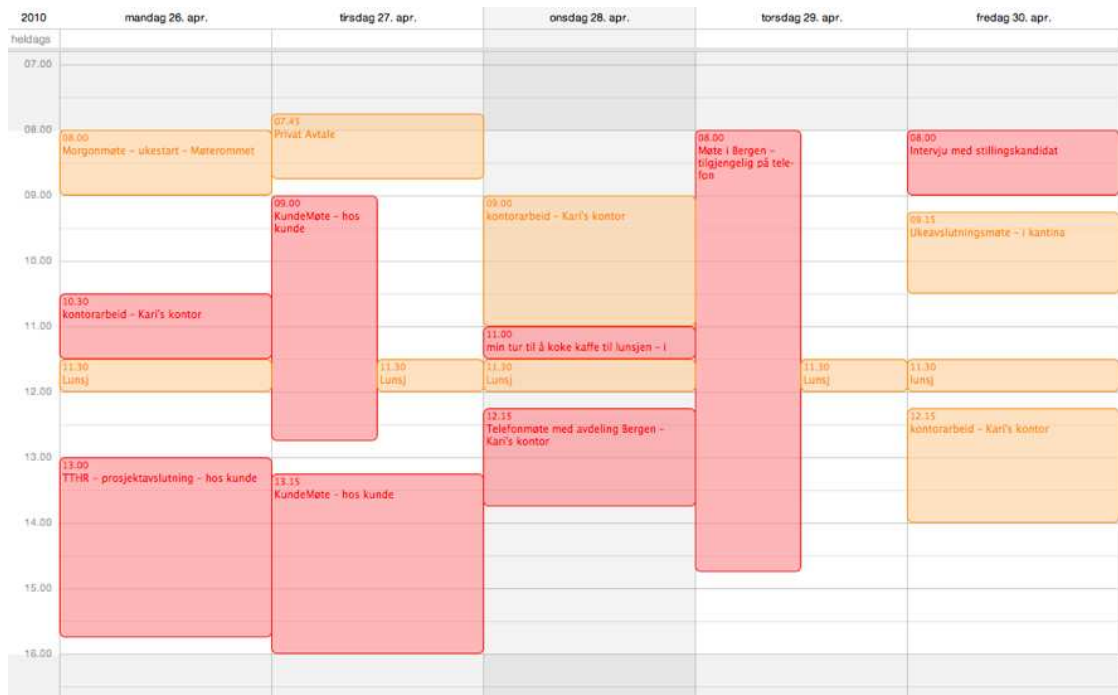
Figure 18: Kari's calendar week 2

D.2 Collected data - students

D.2.1 Subject One

- Man, 27 years, full time student, calendar usage: fewer than 10 entries a week.

Question 1

Best day: Friday
Ok/good days: Tuesday, Wednesday, Thursday
Worst day: Monday

"Monday is a hard day for me to work, but from Tuesday to Friday it only gets better."

Question 2

Worst time: early at 07.00 to 08.30 in the morning and 15.00 to 16.00
Bad times: around lunch time - 12.00

"I need an hour to get start the day, prepare myself. From 09.00 to 13.00 I feel in top shape - lunch break is not so important as long as I can get some food."

Question 3

S3 - It doesn't matter

As stated in the previous question; "I feel best from 09.00 to 13.00."

Question 4

1 - ok, 2 - unfortunate, 4 - unacceptable.
1 - unfortunate (2)
2 - ok (1)
3 - unfortunate (2)
4 - unfortunate (2)

Question 5

1 - 60 minutes

"The best scenario is to enough time to prepare for the test, but I don't need more than 50 minutes to change focus."

2 - 30 minutes

"After the test is finished I do not need much time focus on the next task, 30 minutes is just fine."

3 - 30 minutes after, 30 minutes before

"Considering the three important meetings, it would be best to have an equal amount of time before and after."

Question 6
    1 - travel (short)
    2 - office work
    3 - meeting
    4 - travel (short)
    5 - private appointment
    6 - travel (short)
    7 - travel (short)
    8 - private appointment
    9 - travel (short)
    10 - meeting
    11 - private appointment
    12 - office work
    13 - office work
    14 - meeting
    15 - social event

Question 7
Module 1:
Observations:
Plans module 1 first, only looks at the first day. Looks at the surrounding entries.
    grade:unfortunate
directly before lunch.
module 2:
Observations:
Doesn't pay attention to the entries earlier that day.
    grade:OK
Simple module, a bit late, but still manageable.
module 3:
Observations:
Subject states that this was the only place that had enough time available, but he doesn't consider moving other entries.
    grade: unfortunate
Late at day, considering this module is "head bothering".
module 4:
Observations:
Since the last module where placed where it was, there was no other choice but to put module 4 on friday (the last day).
    grade: OK
Since Kari's day is rather "light" with little to attend to, still the placement is ok.
    General observations
The participant does not seem to care to much about the process of planning the course. He do

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not have a particular strategy when planning. The modules seems to be placed nicely distributed over the two weeks.

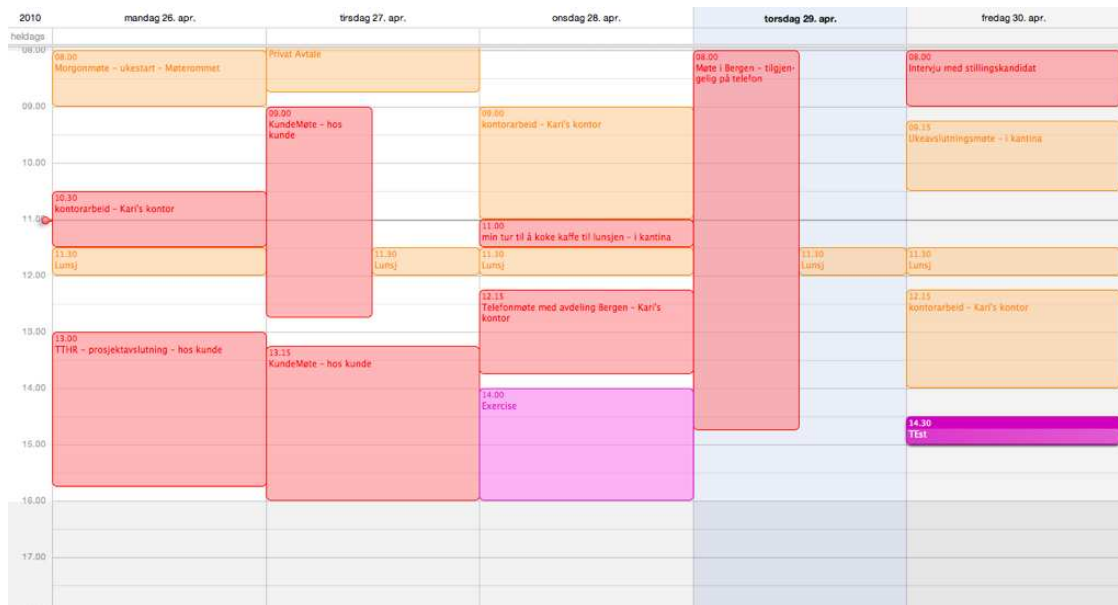Figure 19: Screenshot of week1 - s1
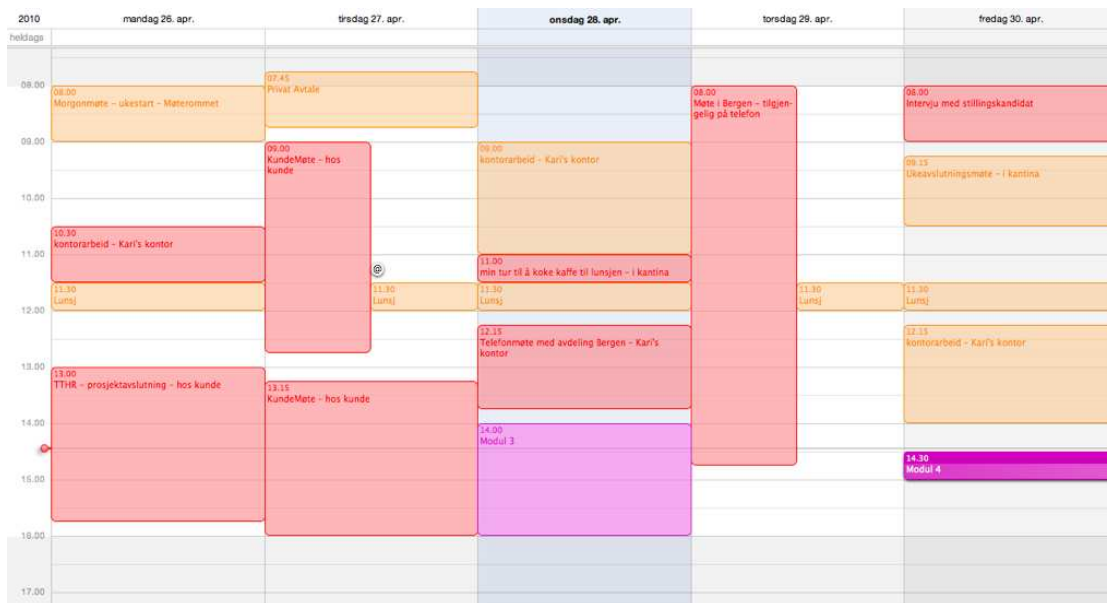
Figure 20: Screenshot of week2 - s1

D.2.2 Subject Two

- Man, 24 years, full time student, calendar usage: between 10 and 15 entries a week.

Question 1

    Best day: Friday

    Ok/good days: Wednesday, Thursday

    Worst day: Monday

    Bad days: Tuesday

    "Friday is a day where I feel motivated, because the week is almost over."

Question 2

    Worst time: early at 07.00 to 08.30 in the morning and 15.00 after midday.

    Bad times: around lunch time - 12.00

    "Depend on eating around midday."

Question 3

    S2 - I work best after midday (from 1200 to 1600)

    "I am a "b-person", need my coffee and news updates before I can start the day properly."

Question 4

    1 - ok, 2 - unfortunate, 4 - unacceptable.

    1 - unfortunate (2)

    2 - unfortunate (2)

    3 - ok (1)

    "if one planned to take an earlier or shorter lunch."

    4 - unfortunate (2)

    "would be hungry at that time, unsuitable time."

Question 5

    1 - > 45 minutes

    "The more, the better. Needs some time to change focus."

    2 - 15 minutes

    "No need for any more time than this, the hard part (test) is over."

    3 - 10 minutes before, 50 minutes after.

    This is contradictory to his two previous choices, he stated: "If I were to have an important meeting just after the exam, I would prioritize having some time to prepare for the meeting. for the exam/test I would have studied on beforehand."

Question 6

    1 - travel (short)

    2 - office work

    3 - meeting

    4 - travel (short)

    5 - private appointment

    6 - Office Work

    7 - travel (short)

    8 - private appointment

    9 - travel (short)

    10 - meeting

    11 - private appointment

    12 - private appointment

    13 - office work

    14 - office work

    15 - travel (long)

Question 7

Module 1:

Observations:

Plans module 1 first, only looks at the first day. Looks at the surrounding entries.

    grade:OK

module 2:

    grade:OK

module 3:

    grade: OK

module 4:

    grade: OK

    General observations

Uses a lot of time to look at the existing entries in the calendar. Respects the distribution of the modules, to prevent them from being to far apart - so Kari doesn't forget the topics between modules. Also after evaluating his settings, he changes/moves two of the modules.
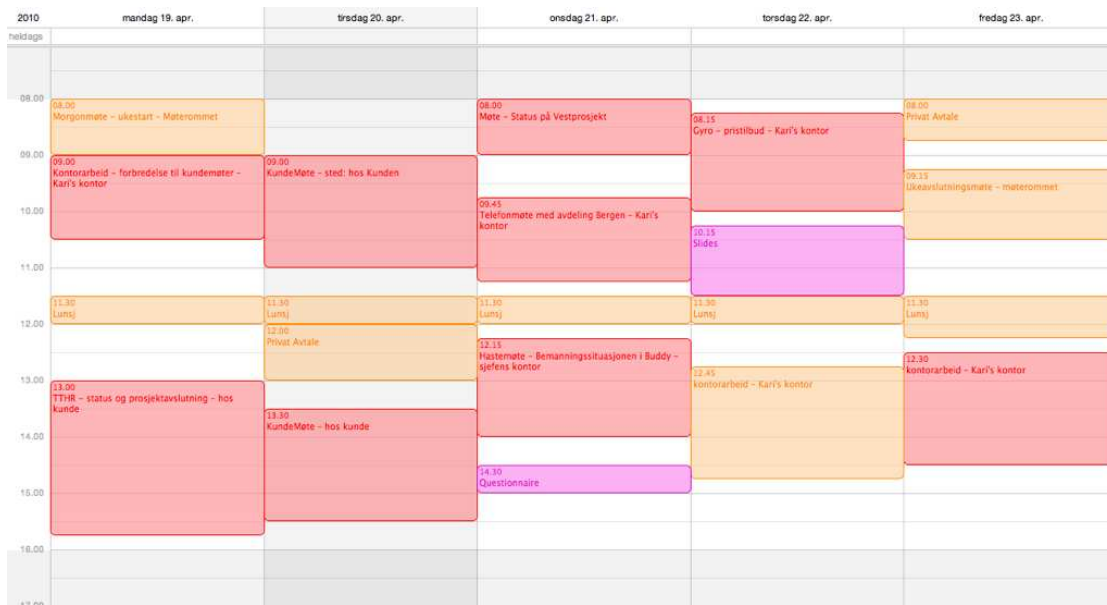
Figure 21: Screenshot of week1 - s2

Figure 22: Screenshot of week2 - s2

D.2.3 Subject Three

- Man, 24 years, full time student, calendar usage: fewer than 10 entries a week.

Question 1

Best day: Thursday
Ok/good days: Tuesday, Wednesday
Worst day: Monday
Bad days: Friday

Doesn't like fridays - they're too close to the weekend, can't focus on the tasks. Thursday is the best day because he feels the most productive.

Question 2

Worst time: early at 08.00 in the morning and at the end of the work day.
Bad times: around lunch time

Question 3

S2 - I work best after midday (from 1200 to 1600)

"My day often start at 10.00, from there on the a couple of hours is needed before I feel to be at the "top"."

Question 4

1 - ok, 2 - unfortunate, 4 - unacceptable.
1 - unfortunate (2)
2 - ok (1)
3 - unfortunate (2)
4 - unfortunate (2)

Question 5

1 - 5 minutes

Since there the two entries are at the same place (in Kari's office). "I never study for an exam the same day, therefore I don't need to much time."

2 - 20 minutes

"I get totally exhausted after having an exam, - since this is a relatively short exam I don't think I need more than 20 minutes."

3 - 15 minutes after, 45 minutes before

"I need more time after a important appointment than before, I tend to always be prepared."

Question 6

    1 - travel (short)
    2 - office work
    3 - meeting
    4 - travel (short)
    5 - private appointment
    6 - office work
    7 - travel (short)
    8 - meeting
    9 - travel (short)
    10 - social event
    11 - private appointment
    12 - office work
    13 - office work
    14 - office work
    15 - social event

Question 7
Module 1:

    grade:OK
Enough space, simple task, informal
module 2:

    grade:OK
Enough space, passive exercise
module 3:
Observations:
He does not consider moving the entry, to a better location.
    grade: unfortunate
Only day with enough time available, would avoid placing this module here.
module 4:

    grade: OK
Best to take before lunch, limited space.
    General observations
This participant is very observant of the existing entries, and plans the modules according to how he feels they fit best. He does not consider relocating the entries to get a better fit for the third module.
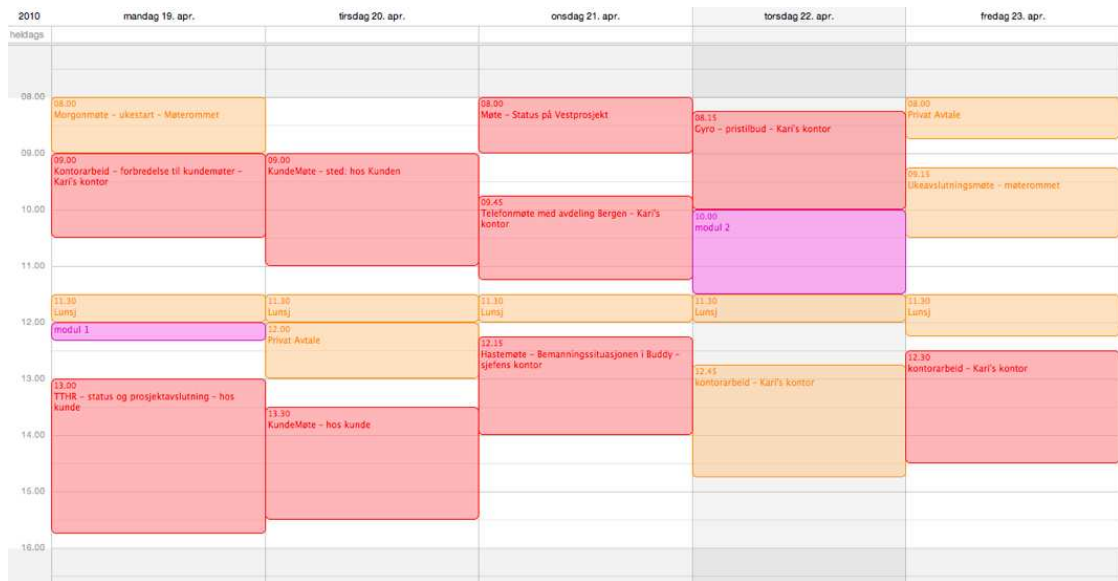
Figure 23: Screenshot of week1 - s3

Figure 24: Screenshot of week2 - s3

D.2.4 Subject Four

- Man, 26 years, full time student, calendar usage: fewer than 15 entries a week.

Question 1

103

Best day: Friday

Ok/good days: Wednesday, Thursday

Worst day: Monday

Bad days: Tuesday

Question 2

Worst time: early at 08.00 in the morning

Bad times: late at day

Question 3

S2 - I work best after midday (from 1200 to 1600)

Question 4

1 - ok, 2 - unfortunate, 4 - unacceptable.

1 - ok (1)

2 - ok (1)

3 - ok (1)

4 - ok (1)

Question 5

1 - 60 minutes

"The best scenario would be to have an hour available before, to be able to focus on the task ahead."

2 - 30 minutes

"To prepare for the meeting."

3 - 30 minutes after, 30 minutes before

"All appointments are important, I would prefer to have en equal amount before and after."

Question 6

    1 - private appointment

    2 - office work

    3 - meeting

    4 - travel (short)

    5 - private appointment

    6 - office work

    7 - meeting

    8 - private appointment

    9 - travel (short)

    10 - social event

    11 - private appointment

    12 - office work

    13 - office work

    14 - office work

    15 - social event

Question 7
Module 1:

    grade:OK

Plenty of time, and time to process the input afterwards.

module 2:

    grade:unfortunate

The best alternative, but not the best. Maybe push the lunch further down, to get more "air".

module 3:

    grade: unacceptable

This entry has to be moved, changed, not appropriate to have a this kind of demanding work so late.

module 4:

    grade: OK

    General observations

This participant is has many of the same characteristics as some of the previous participants and almost the same result. However he is not satisfied with the results, and states that existing entries should be relocated or cut in two pieces.

Figure 25: Screenshot of week1 - s4
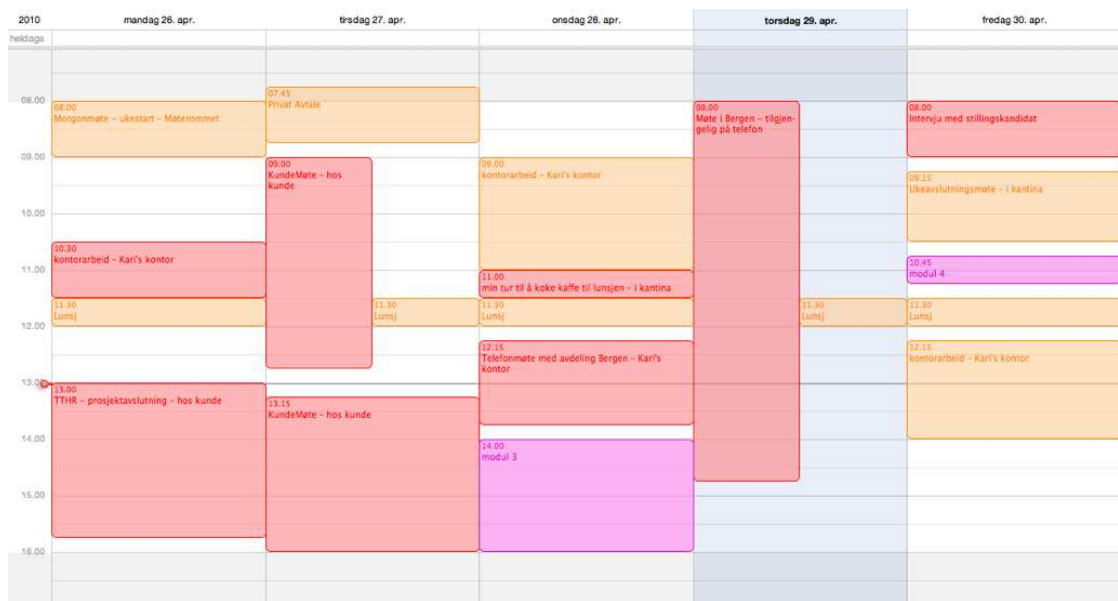
Figure 26: Screenshot of week2 - s4

D.2.5   Subject Five

- Man, 24 years, full time student, part-time employee, calendar usage: about 15 entries a week.

Question 1
   Best day: Friday

106

Ok/good days: Wednesday, Thursday

Worst day: Monday

Bad days: Tuesday

Question 2

Worst time: after lunch

Question 3

S1 - I work best before midday (from 0700 to 1200)

Question 4

1 - ok, 2 - unfortunate, 4 - unacceptable.

1 - unfortunate (2)

2 - unacceptable (3)

3 - unfortunate (2)

4 - ok (1)

Question 5

1 - 60 minutes

"The best scenario would be to have an hour available before, to be able to focus on the task ahead."

2 - 60 minutes

3 - 45 minutes after, 15 minutes before

"Meetings tend to be hard to know when they end, often smart to be prepared for such coincidences."

Question 6
    1 - private appointment
    2 - office work
    3 - meeting
    4 - travel (short)
    5 - private appointment
    6 - office work
    7 - meeting
    8 - private appointment
    9 - travel (short)
    10 - social event
    11 - private appointment
    12 - private appointment
    13 - office work
    14 - office work
    15 - social event

Question 7
Module 1:

    grade:OK
Some time to prepare and accommodates for the previous appointment, if it were to take longer time than planned/expected.
module 2:

    grade:OK
A good alternative, since the previous entry also is in Kari's office. And if the module should take longer time to finish, she has the lunch and additional time to finish the module.
module 3:

    grade: OK
"It was better to put this module early at the monday rather than late on wednesday. The definite best alternative (if the modules were not to be split in two)".
module 4:

    grade: OK

    General observations
This participants has a job in addition to his studies, which is reflected in his way of planning Kari's calendar. He accounts for flexibility and unforeseen coincidences that often happen, like that meetings often takes longer time to finish than planned. Also plans the most important module (no.4) first, to make sure that conditions are optimal. He also wants the get finished with the

course as fast as possible, so that the course doesn't get stretched over too long a period of time.
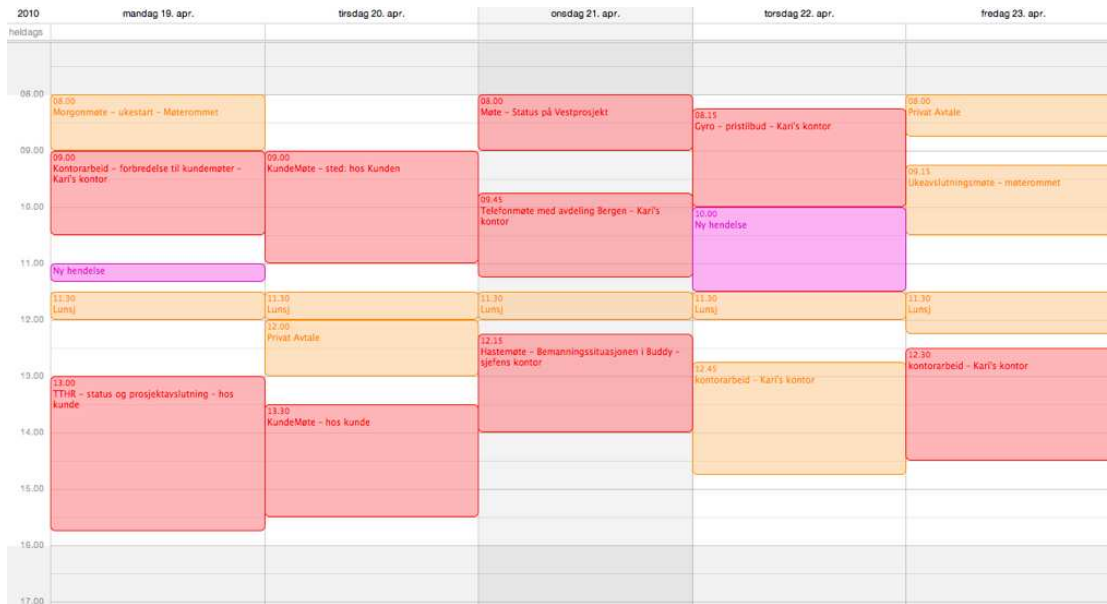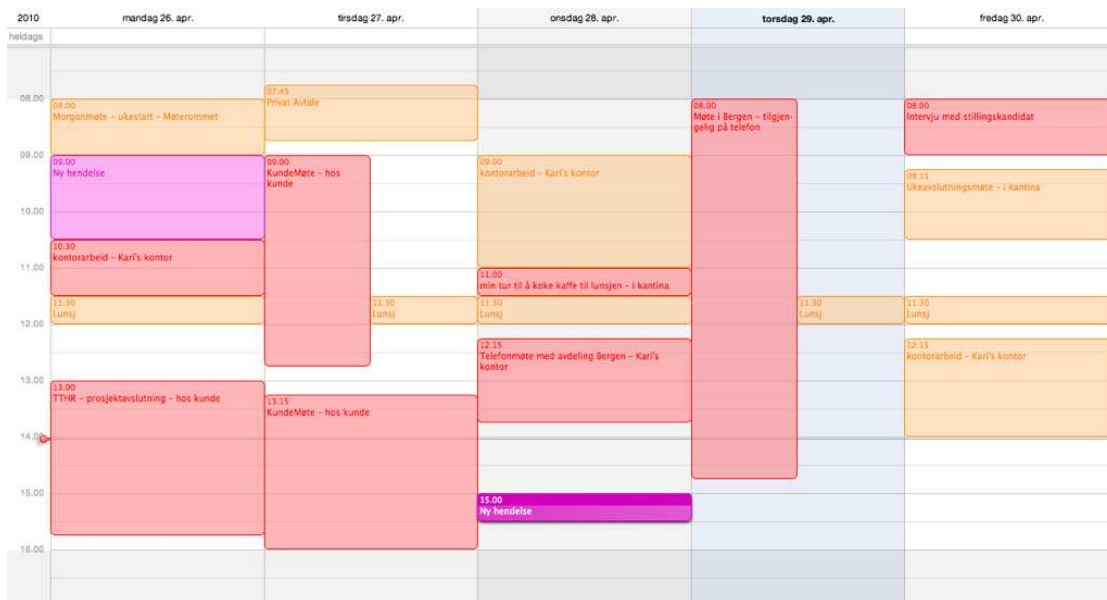

Figure 27: Screenshot of week1 - s5

Figure 28: Screenshot of week2 - s5

D.3   Collected data - professionals

D.3.1   Subject One

- Woman, 34 years, High school lector, calendar usage: about 30 entries a week.

Question 1

Best day: Tuesday
Ok/good days:Wednesday, Thursday
Worst day: Monday
Bad days: Friday

"Monday gives me no time to plan the upcoming appointments that day and I would have to use the weekend instead."

Question 2

Worst time: 08.00
Ok time: 08.30 - "If I get 30 minutes, then it's no problem"
Bad times: directly after lunch - "I need some time to 'recover'."

"It gives me no time to prepare, also, if it was a meeting all the other participants would be tired and unfocused. This is also the case when having meetings late at day because people are more focused at the clock than on the topic."

Question 3

S2 - I work best after midday (from 1200 to 1600)

"I always tend to very efficient after midday, it think it has something to do with the type of tasks that I have before me, I can be more concentrated. Often I don't want to leave, because I'm so into the task."

Question 4

1 - ok, 2 - unfortunate, 4 - unacceptable.
1 - unfortunate (2)

"If you are aware of the meeting/appointment it's all ok. Then you can always plan accordingly."

2 - ok (1)
3 - unfortunate (2)

"Unfortunate if it's a short notice."

4 - unfortunate (2)

"For me personally it's no problem, but it's frustrating to work with other people at these times, they are not concentrated, they want to go home."

Question 5

1 - 60 minutes
2 - 30 minutes
3 - 60 minutes after, 0 minutes before

"Then I would have some time to prepare and get some food."

Question 6

    1 - travel (short)

    2 - office work

    3 - meeting

    4 - travel (short)

    5 - private appointment

    6 - travel (short)

    7 - travel (short)

    8 - meeting

    9 - travel (short)

    10 - meeting

    11 - private appointment

    12 - office work

    13 - office work

    14 - office work

    15 - travel (long)

Question 7

Module 1:

grade:OK

- "a nice ending to a rather busy day."

module 2:

grade:unfortunate

- "a bit close to the previous entry, but since the lunch is directly after, any kind of delay are manageable."

module 3:

grade: OK

- "this placement is good, when the existing entry is moved (or pushed to a later time)."

module 4:

grade: OK

- "nice placement, if Kari plans the day accordingly."

    General observations

Looks for open spots in the calendar, and plans the most important module first - where she reserves an hour for the 30 minute module. Then takes the second most important module (no. 3) and observes that there is few alternatives for this module. However she places the module on thursday the first week, and overruns the office work entry that is already there. Module 2 she places before lunch the same day. The simpler module 1 is placed late the day before. By doing this she achieves a nice grouping of the modules - which she emphasizes as a good strategy.
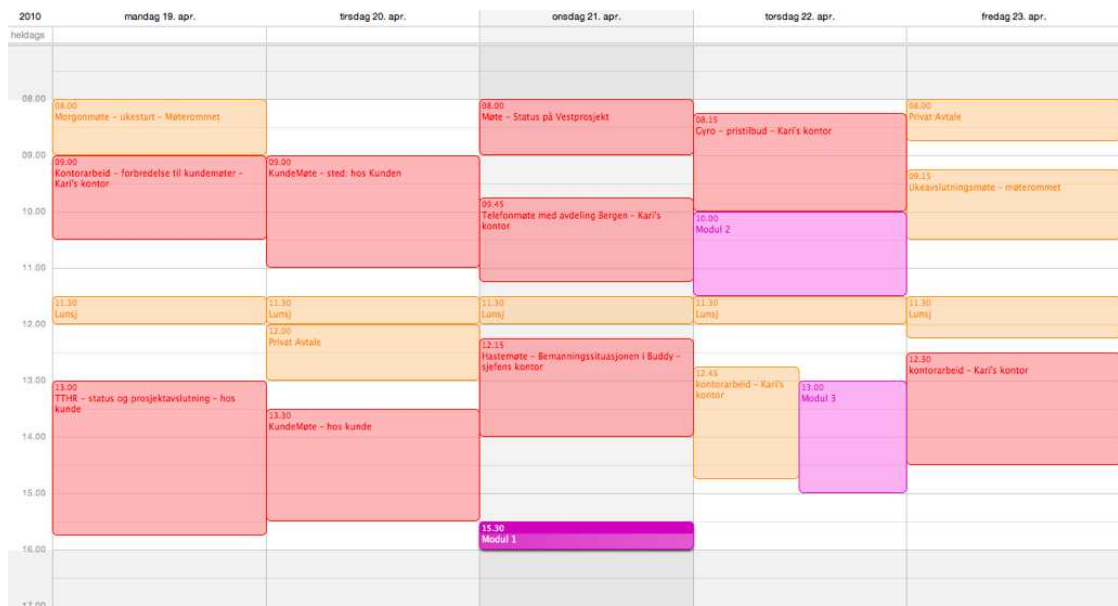
111
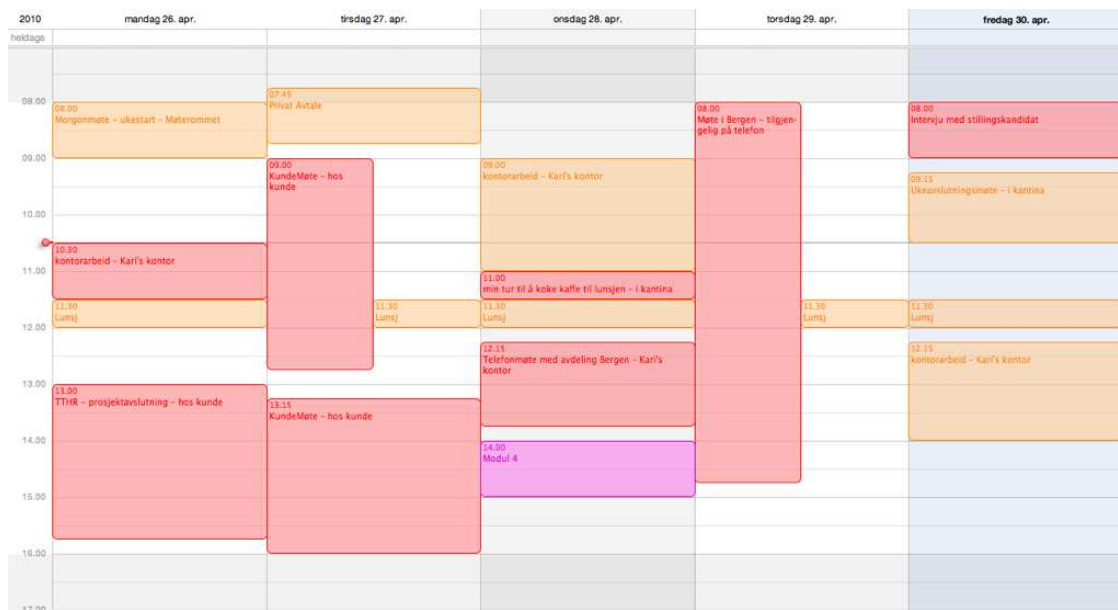
Figure 29: Screenshot of week1 - p1

Figure 30: Screenshot of week2 - p1

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D.3.2   Subject Two

- Man, 37 years, High school lecturer, calendar usage: about 30-35 entries a week.

Question 1
    Best day: Tuesday
    Ok/good days: Monday, Wednesday
    Worst day: Friday
    Bad days: Thursday

    "My performance is bad at the end of the week."

Question 2
    Worst time: Right before end of the work day.
    Ok times: "early: before 13.00"

    "I never plan lectures after lunch, my performance is really bad from 14.00 to 16.00".

Question 3
    S2 - I work best after midday (from 1200 to 1600)

Question 4 *1 - ok, 2 - unfortunate, 4 - unacceptable.*
    1 - OK (1)
    2 - OK (1)
    3 - OK (1)
    4 - unfortunate (2)

    "For me it is always a matter of planning the day ahead. Unforeseen circumstances are never ideal anyway, but there is no way to plan them."

Question 5
    1 - 60 minutes

    "It's a two hour meeting, some time in between is a 'must'."

    2 - 15 minutes

    "No problem - I only need some time for practical purposes."

    3 - 15 minutes after, 45 minutes before

    "I need some food."

Question 6

  1 - private appointment
  2 - office work
  3 - meeting
  4 - social event
  5 - private appointment
  6 - office work
  7 - meeting
  8 - meeting
  9 - travel (short)
  10 - meeting
  11 - private appointment
  12 - office work
  13 - office work
  14 - office work
  15 - social event

"Never after travel. For me all entries that are related to leisure are negative."

Question 7
Module 1:
grade:OK

Module 2:
grade:unfortunate
- "not ideal to have this after lunch, personally I can't focus much after lunch."
Module 3:
grade: OK
- "ok placements, but had to reorganize the entries."
Module 4:
grade: OK

General observations
As with the previous professional, this one starts with the most important entries first and relocates some of the existing entries, producing a 'better' schedule.
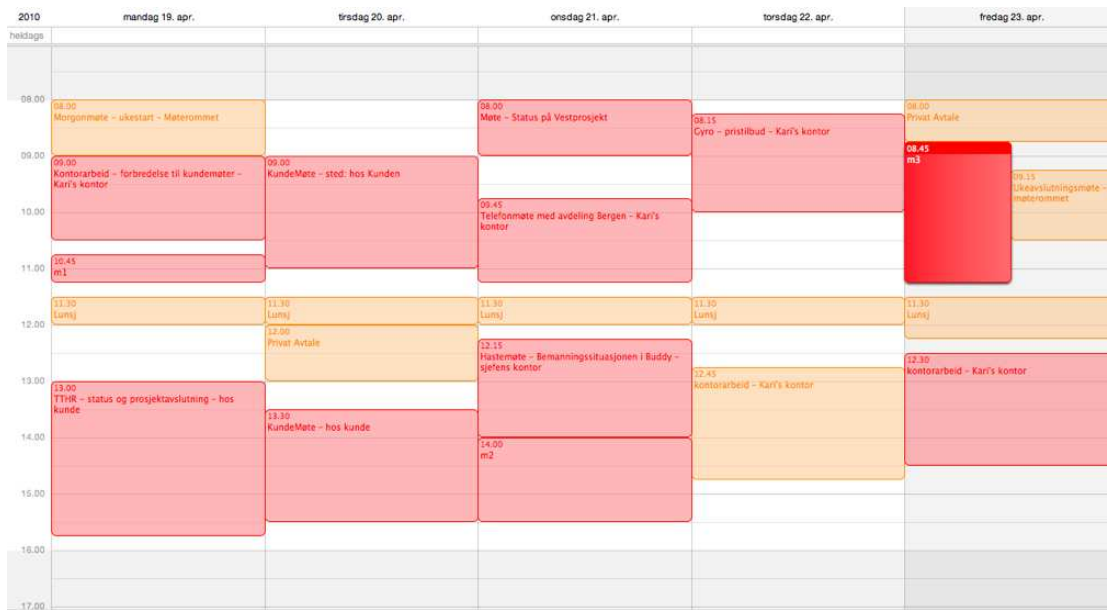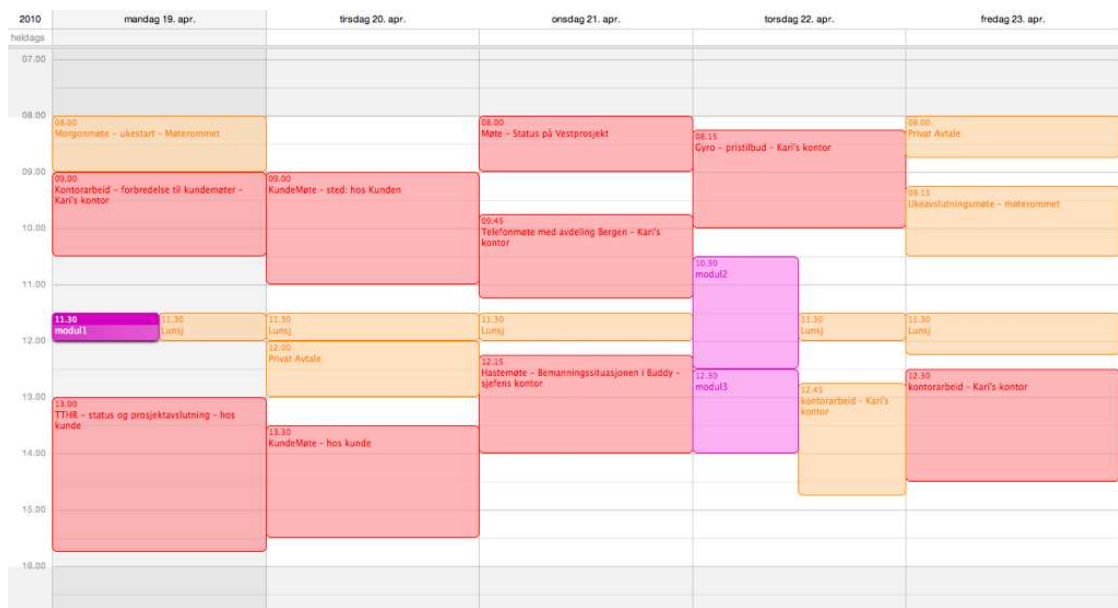
Figure 31: Screenshot of week1 - p2
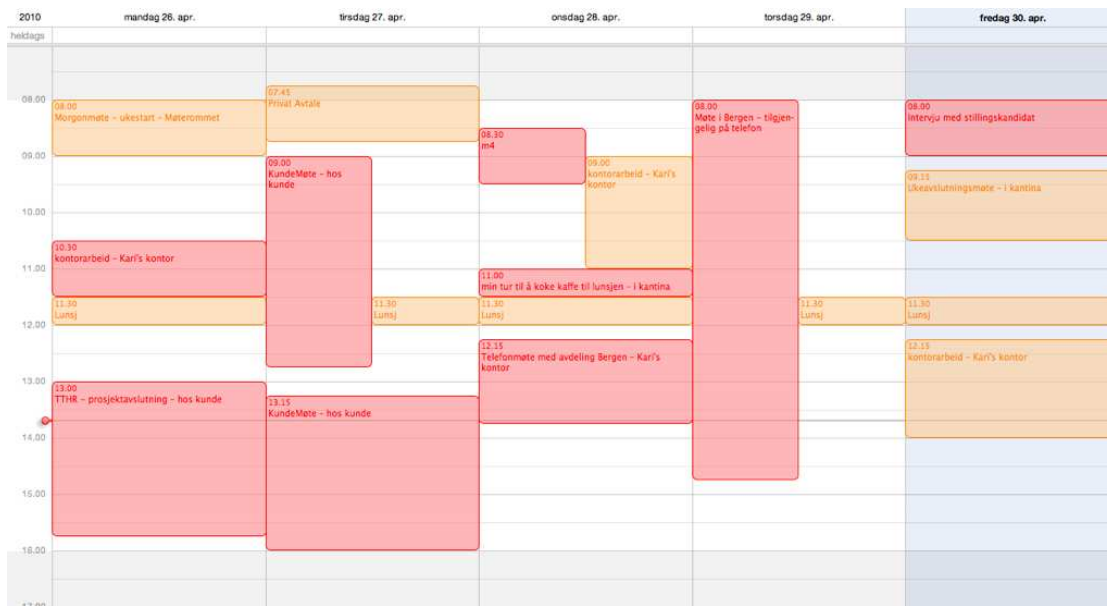
Figure 32: Screenshot of week2 - p2

D.3.3 Subject Three

- Man, 36 years, IT Manager, calendar usage: about 30-35 entries a week.

Question 1

    Best day: Thursday
    Ok/good days: Tuesday
    Worst day: Monday
    Bad days: Wednesday, Friday

Question 2

    Worst time: 08.00
    Ok times: 10.00 and 14.00

    Why? - "many external factors." "Actually I work best from 19.00 to 22.00 at home, then there are no interruptions and I can be efficient and concentrated."

Question 3

    S1 - I work best before midday (from 0700 to 1200)

    "Actually I work best from 19.00 to 22.00 at home, then there are no interruptions and I can be efficient and concentrated."

Question 4 *1 - ok, 2 - unfortunate, 4 - unacceptable.*

    1 - OK (1)
    2 - OK (1)
    3 - OK (1)
    4 - unfortunate (2)

    "It's only a matter of planning, presence and awareness."

Question 5

    1 - 30 minutes
    2 - 30 minutes

    "For practical purposes."

    3 - 30 minutes after, 30 minutes before

    "Considering all entries are equally important then it would be ideal to have the same amount of time before and after."

Question 6

1 - private appointment

2 - office work

3 - meeting

4 - social event

5 - private appointment

6 - office work

7 - meeting

8 - private appointment

9 - travel (short)

10 - meeting

11 - private appointment

12 - office work

13 - office work

14 - office work

15 - social event

Question 7

Module 1:

grade:OK

Module 2:

grade:OK

Module 3:

grade: OK

- "ok placements, but had to reorganize the entries."

Module 4:

grade: OK

General observations

Plans the most important modules first, and also tries to gather the modules as close to each other as possible. He feels that this would create a better way to learn the topic rather than scattering the modules across the calendar. He does not feel that the lunch is important - as long as it is possible to get some food.
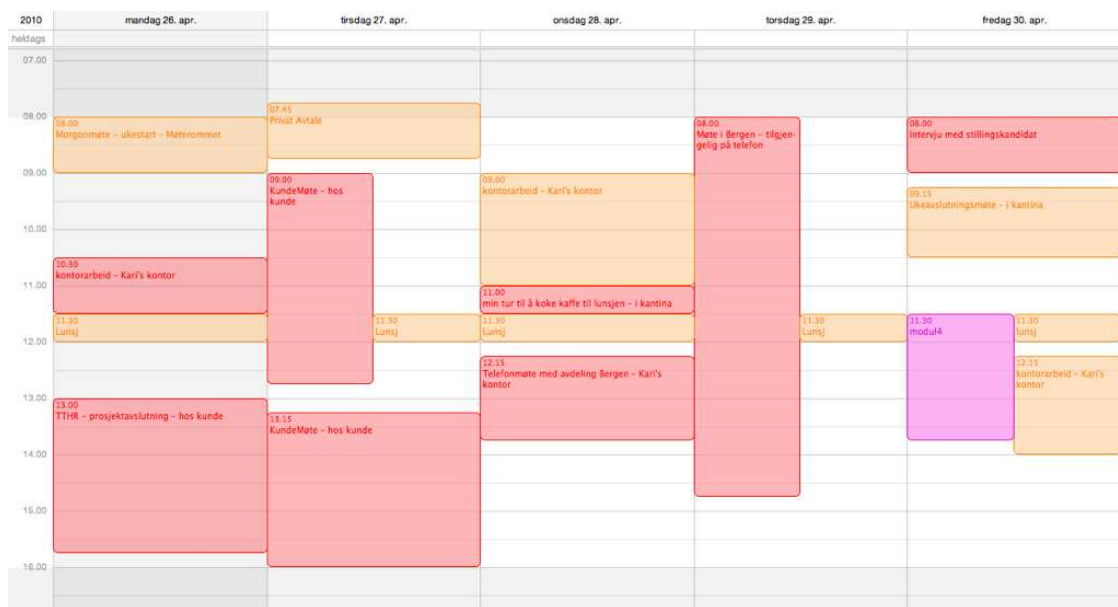
Figure 33: Screenshot of week1 - p3

Figure 34: Screenshot of week2 - p3

D.3.4   Subject Four

- Man, 41 years, High school teacher, calendar usage: about 20-30 entries a week.

Question 1
> Best day: Thursday
> Ok/good days: Tuesday, Wednesday
> Worst day: Friday
> Bad days: Monday,

Question 2
> Worst time: 08.30

> "Directly after I arrive at work."

> Ok times: 10.00 and 14.00

Question 3
> S2 - I work best after midday (from 1200 to 1600)

> "After 1500, this is when my pupils have left school, and things have calmed down."

Question 4 *1 - ok, 2 - unfortunate, 4 - unacceptable.*
> 1 - OK (1)
> 2 - OK (1)
> 3 - unfortunate (2)
> 4 - OK(1)

> "Directly after lunch i'm tired and 'unfocused'."

Question 5
> 1 - 30 minutes
> 2 - 30 minutes

> "To prepare."

> 3 - 10 minutes after, 30 minutes before

Question 6
    1 - private appointment
    2 - office work
    3 - meeting
    4 - social event
    5 - private appointment
    6 - office work
    7 - meeting
    8 - private appointment
    9 - travel (short)
    10 - meeting
    11 - private appointment
    12 - private appointment
    13 - office work
    14 - office work
    15 - social event

Question 7
Module 1:
grade:OK

Module 2:
grade:OK

Module 3:
grade: OK
- " had to reorganize the entries."
Module 4:
grade: unfortunate

    General observations
He states that, this type of calendar is quite different from the one he normally is used to. Since he is a teacher, it is seldom possible to rearrange the entries, due to the fixed schedule. However, he rearranges entries for the third module, and gives the latter module "unfortunate" because it is such a long time between module 4 and 3, and this he sees as a disadvantage.
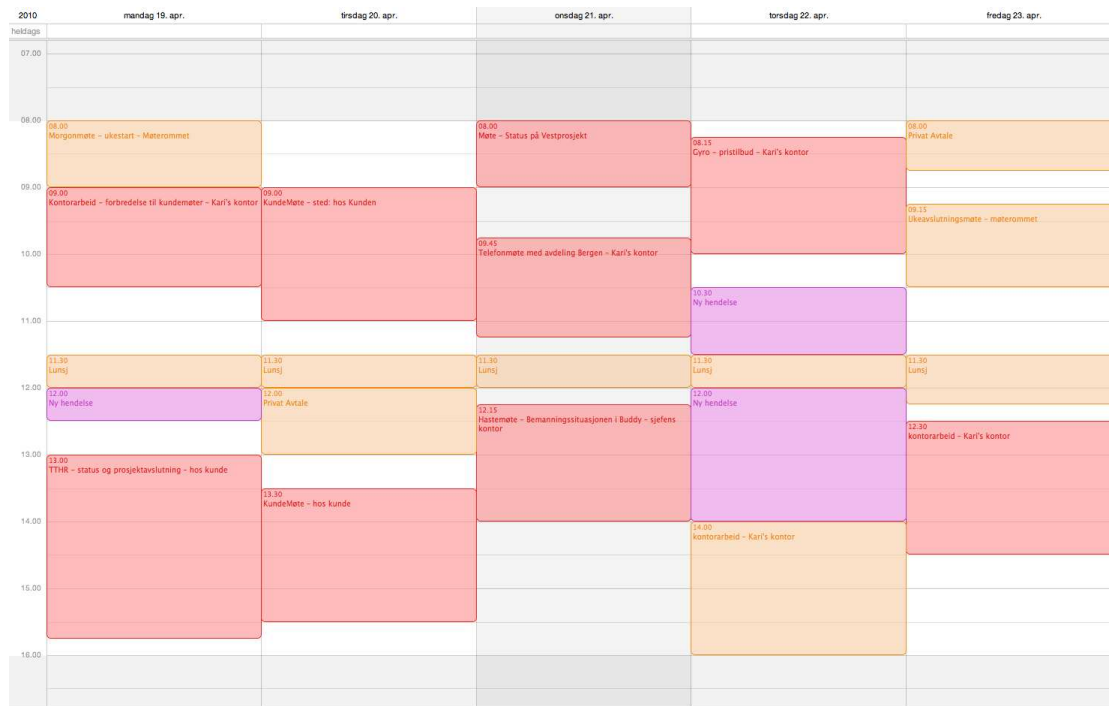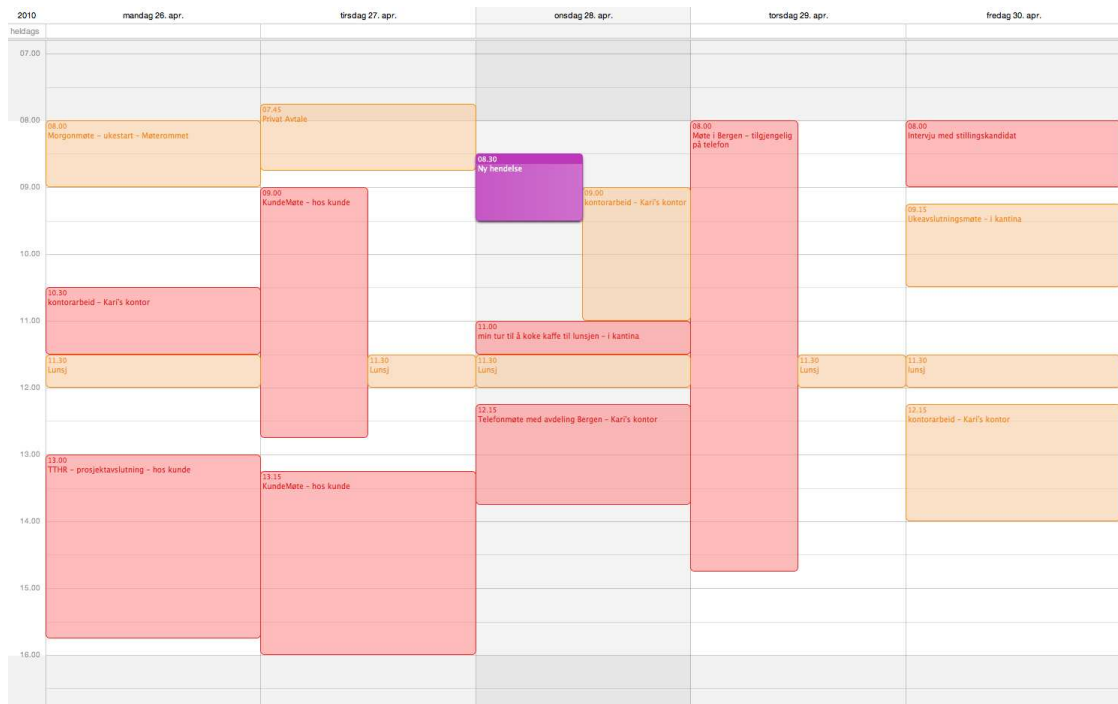
Figure 35: Screenshot of week1 - p4

Figure 36: Screenshot of week2 - p4

D.3.5 Subject Five

- Woman, 29 years, High school teacher, calendar usage: about 15-25 entries a week.

"This participant, also use a paper 'organizer', together with her digital calendar"

Question 1

Best day: Tuesday

Ok/good days: Monday, Wednesday, Thursday

Worst day: Friday

"Friday for me last from 0800 to 1400 - a short day. This makes me unfocused and in a 'close-to-weekend-mood', i'm not productive at all."

Question 2

Worst time: 15.00

"Worst times after lunch."

Ok times: 09.00 and 14.00

Question 3

S1 - I work best before midday (from 0700 to 1200)

Question 4 *1 - ok, 2 - unfortunate, 4 - unacceptable.*

1 - unfortunate (2)

2 - OK (1)
3 - OK (1)
4 - unfortunate (2)

Question 5
1 - 30 minutes
2 - 30 minutes
3 - 10 minutes after, 30 minutes before

"Hard to give a definite answer, i always depends on the situation, the more time the better..."

Question 6
   1 - travel (short)
   2 - office work
   3 - meeting
   4 - social event
   5 - private appointment
   6 - office work
   7 - meeting
   8 - meeting
   9 - travel (short)
   10 - meeting
   11 - private appointment
   12 - office work
   13 - office work
   14 - office work
   15 - travel (long)

Question 7
Module 1:
grade:OK

Module 2:
grade:OK

Module 3:
grade: OK

Module 4:
grade: OK

   General observations
Spends much time to read and understand the calendar. Carefully consider the best time to place the modules according to perform the best possible way.
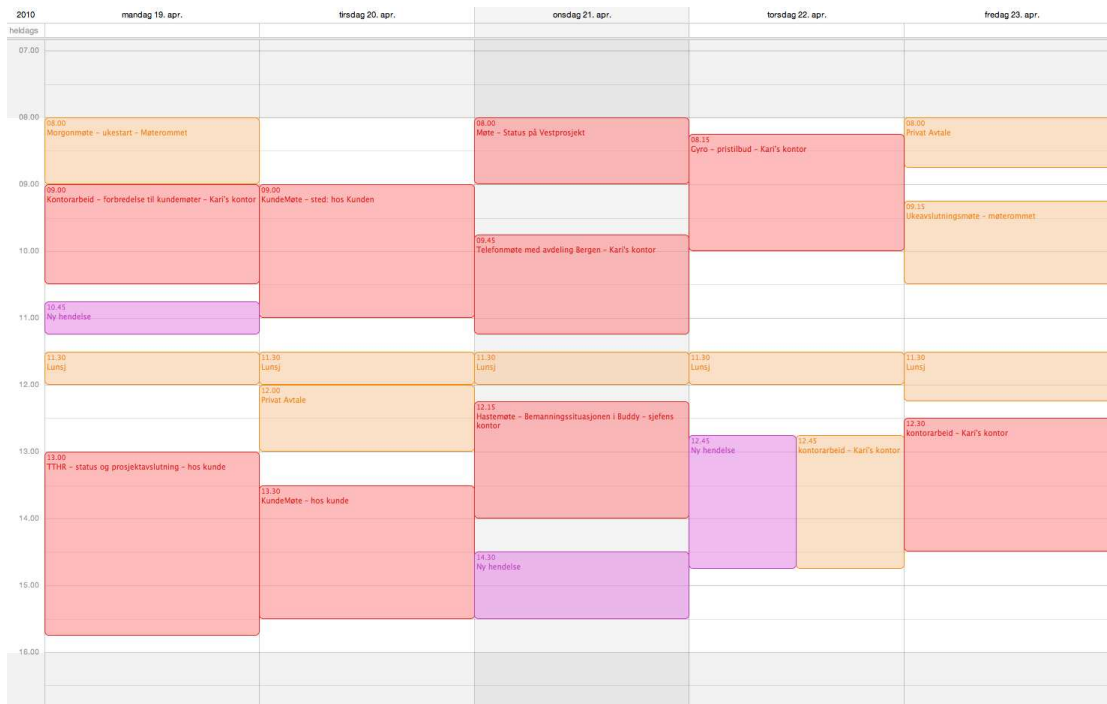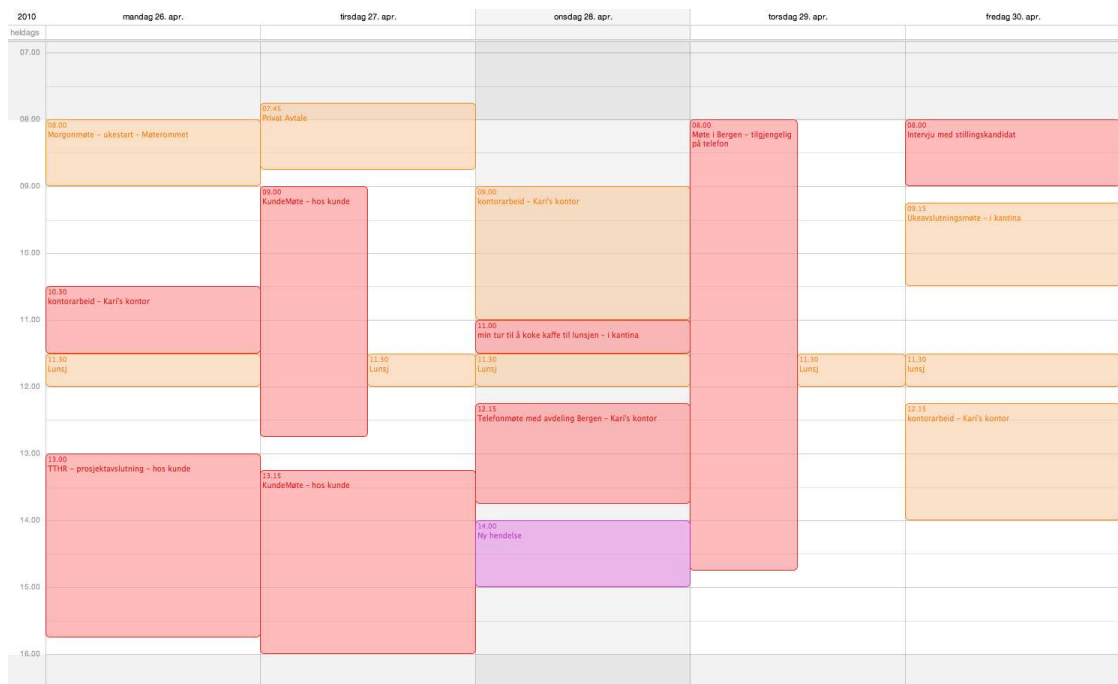
Figure 37: Screenshot of week1 - p5

Figure 38: Screenshot of week2 - p5

E   Files

The following files are part of the of the documentation:

- Survey: results (*.pdf*) with diagrams
- Survey: results (*.sav*)
- Survey: analysis output (*.doc*)
- Prototype: source code (*.php*)

Files are available at:
http://master.guleinteraktiv.com/appendix