# MASTER THESIS

TITLE "Investigating the Use of Self-Addressed Reminders"


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# ABSTRACT

Digital devices are great examples of how technology daily can help externalize our memory. Instead of always having to remember information, we can easy look it up on our computers or smartphones, so we do not have to remember it anymore. This thesis studies how people create, manage, and act upon digital reminders created on digital devices using the method approach of contextual inquiry. Results show that the participants prefer to use their smartphone to both create and manage reminders, while computers often are used when the reminder requires a larger screen. The participants use different channels to create reminders depending on the reminder's intentions and device. Reminders created at a computer is often with *self-addressed email* (21,4%), and *desktops* (21,4%), while we found that reminders on smartphones most often are created with the *note-taking apps* (16,2%), *calendar* (16,2%), and *screenshots* (16,2%). Reminders are typically organized chronological, which the devices often do for the user, while people also organize reminders by label or folder. Moreover, we investigated cues in digital reminders, and our findings show that people in most cases check the channel to find reminders they have to act upon, while the cue action often are event-based prospective memory. Last, we investigated the context of both creating and acting upon digital reminders, and results show that the context created and acted upon varies from both the used channel and the reminders intentions.

**Keywords**: Reminders, contextual inquiry, PIM, personal information management, content analysis, prospective memory

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# 1. INTRODUCTION

Smartphones and computers are great examples of how technology daily can help externalize our memory. Instead of always having to remember information, we can easy look it up on our computers or smartphones, so we do not have to remember it anymore. An example of information our smartphones and computers allow us to externalize are reminders to perform some kind of action. This is also known as prospective memory. People use a variety of channels to record and send themselves these reminders, such as self-addressed calendars, photos, emails, text messages to yourself, screenshots, notes, open browser tabs, and voice recordings. When doing reminders on a smartphone or computer, different kinds of apps and methods can be used depending on if you e.g. want to remember to call the doctor for an appointment or a scarf you want for your birthday.

Some studies have already showed how smartphones are used for personal information management (PIM) (Zhang & Liu, 2015), Jensen, A. E., Jægerfelt, C. M., Francis, S., Larsen, B., & Bogers, T., 2017). These studies investigate more generally what kind of PIM is managed on handheld devices, which contain both different kinds of information, reminders etc. Zhang and Liu (2015) studied how Chinese college students use their smartphones for PIM. Their study showed that PIM behavior on smartphones are different from computers and desktop computers, and also concluded that the support for mobile PIM is still lacking. In 2017, Jensen, Jægerfelt, Francis, Larsen and Bogers (2017) investigated different ways that people manage their personal information on handheld devices. Their research showed among others, that the main information types managed on smartphones were email, photos, screenshots notes, and applications.

There is a difference between a reminder and something to remember, and it is important to know the difference for this study. Having to remember something could e.g. be remembering a password for your Spotify account. When you want to remind yourself of something it could e.g. be when you have to call your doctor, so you create a reminder in your calendar to pop up, so you see the reminder and then act upon it.

We found a gap in academic literature regarding the study of reminders from a PIM or information behavior perspective, while other researchers had not focused on this specific field. Therefore, this thesis will contribute to closing a gap and provide useful information and insight in how people manage, create and use reminders on digital devices with a PIM perspective. To investigate this topic, following problem statement has been made.

## 1.1 Problem statement

PS: How do people create, manage, and act upon digital reminders on their digital devices?

To answer our problem statement, the following research questions will be examined.

### 1.1.1 Research questions

We pose seven research question, which we will examine in order to answer our problem statement.

Many people use their smartphone and/or laptop to create reminders to themselves, but you can use several channels to create a reminder, and it can depend of the reminders purpose. We try to understand what preferences people have for channels in terms of devices with the following research question:

RQ 1: Which digital channels & devices do people use to create reminders?

After understanding what preferences people have for channels, it is important to understand which cues people use in their reminders. Cues could be anything from a subject line in emails, notification messages, alarm sound etc. To investigate the cues, RQ 2 was made:

RQ 2: Which cues do people use in their digital reminders?

When creating reminders, it can be necessary to organize it in a special way to ensure the participants remember the reminder. To investigate how people organize reminders in different channels, RQ 3 was made:

RQ 3: How do people organize their digital reminders?

There can be different intended actions when creating a digital reminder. The reminders intended action can be anything from something to buy, do, visit, cook etc. With RQ 4, we investigate what the intended actions of the reminders are.

RQ 4: What are the intentions of digital reminders?

It is interesting to investigate, how cues of digital reminders are activated. This can vary from scheduled reminders to event based. To understand how the cues are activated, RQ 5 was made:

RQ 5: How are cues of digital reminders activated?

It is both relevant to investigate in which context do people create, e.g. at work, home, stores etc. but also, in which contexts should the intended action take place. With RQ 6 and RQ 7, we try to understand the contexts of the created reminders and in which context they intended to act upon it:

RQ 6: In which contexts are digital reminders created?

RQ 7: In which contexts should the intended action take place?

## 1.2 Research scope

This thesis aims to explore how people create, manage, and act upon digital reminders on their digital devices. The digital devices include smartphones, computers, and tablets. Although some people might use analog reminders, such as, paper notes, the thesis will limit itself to only investigating the use of digital reminders.

### 1.2.1 Definitions

In the following subsection, we list the definitions of abbreviations we use throughout the report

- *Channels* refers to the specific places the participants can create reminders digital, e.g. calendar, browser tabs, photos etc.
- Individual participants from the CI sessions are assigned a number between one and seven, and they will consistently through the report be referred to as, e.g. *P1*.

## 1.4 Outline

Figure 1 illustrate the structure of this thesis, which start with the introduction where we propose our problem statement and research questions. Moreover, the introduction contains the projects research scope with term definitions. In the second chapter, the literature review will be covered. This include a systematic review and relevant literature within PIM and prospective memory. The third section covers the used methodology, which include both data collection methods and analysis methods. In the fourth section, the results of the conducted data will be presented and analyzed. Section five covers both the discussion and conclusion, where the research questions will be discussed related to the conducted data and analysis. Last, you will find a reference list in section six.

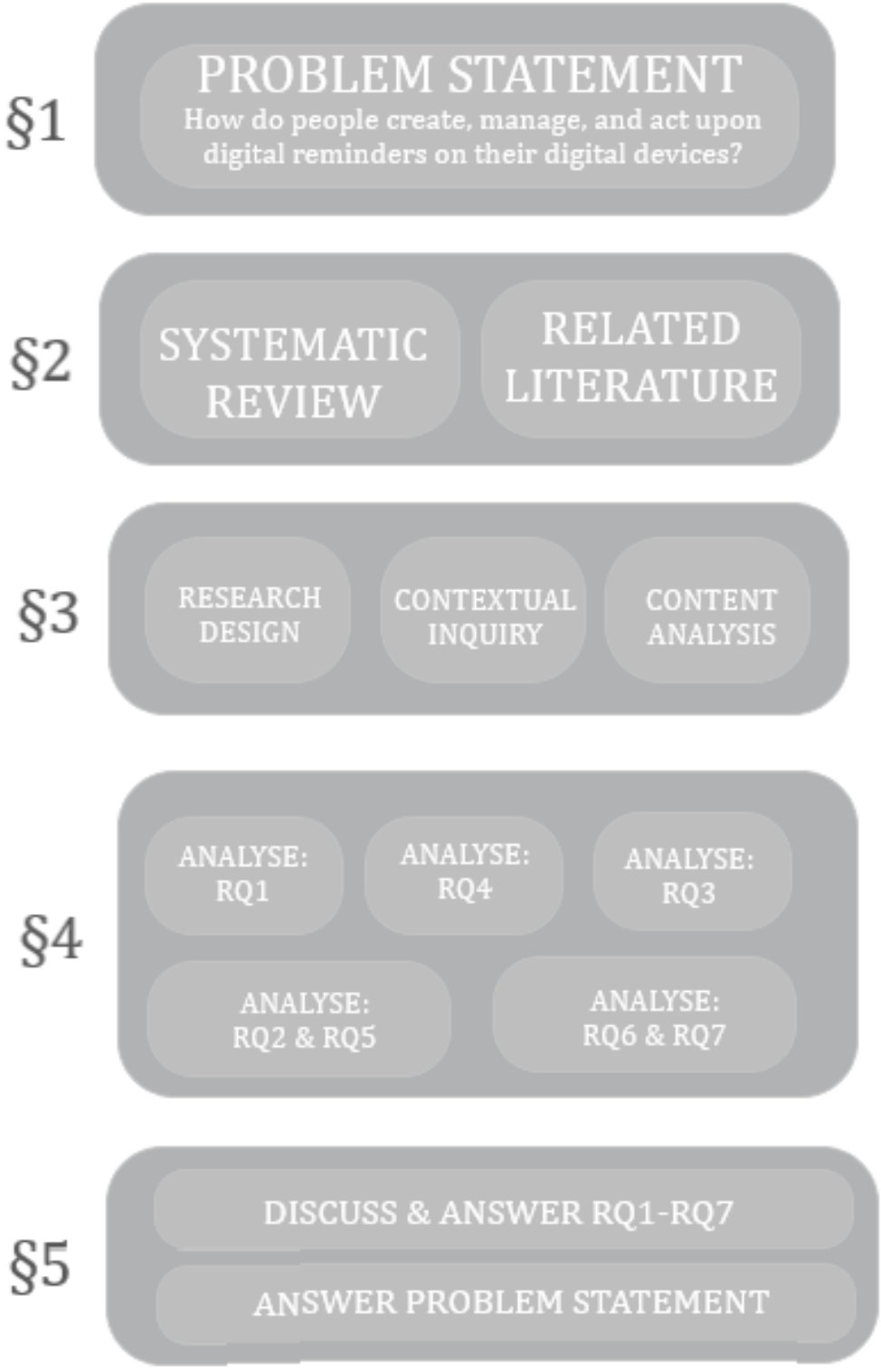



Figure 1: Thesis outline

# 2. LITERATURE REVIEW

This chapter presents the traditional review and related literature regarding managing and remembering personal information. To navigate in what Rowley and Slack (2004) call "the messy nature of knowledge", a systematic review was first conducted to find relevant literature to the topic. Afterward, a comprehensive walkthrough of related literature is performed.

## 2.1 Systematic Review

To conduct a systematic review, relevant literature was searched for, gathered, and reviewed with the aim of identifying knowledge gaps in prior work within the field. This approach will guide the present research to take on a focus which can make further contributions to the field. With this approach, we will focus on not investigating a topic that has already been covered (Webster & Watson, 2002).

Section 2.1.1 covers how the phase of searching and gathering literature was conducted, while section 2.2 until section 2.5 will elaborate related literature regarding prospective memory, PIM, and how to use digital devices with a PIM perspective.

### 2.1.1 Searching

The search for relevant literature was approached with the help of building block strategy (Cronin, Ryan, and Coughlan, 2008), where the information needed is broken up into facets, which each contain a set of keywords (Cronin, Ryan, and Coughlan, 2008).

We identified reminders and their roles as personal information as the main area of interest with also three content-specific facets: (1) the *focus* of the literature, (2) the *context*, and (3) the *device* (Appendix A). Within the facet *focus*, terms as acquisition, organizing, retrieval and task are used. The facet *context* focuses on where personal information is found, which e.g. could be education, office and workplace. Last, the facet *device* covers all the possible devices people can use for managing personal information.

These keywords were subsequently combined as search terms by using the *Boolean operators* "OR" and "AND" (Schlosser, 2006). We used the digital library of Aalborg University (AUB) to find related work and information. Moreover, databases as EBSCOhost, IEEE Xplore, ProQuest, ScienceDirect, and Scopus were used. To limit over search, we only included full-text literature and peer-reviewed.

After finding relevant literature by using building block strategy and Boolean operators, literature was also found through, and the use of pearl-growing where we looked at reference lists in relevant literature. By looking at reference lists, finding more relevant literature related to the topic was possible.

## 2.2 Prospective memory

To understand how people interact with reminders on their digital devices, and why they make reminders, it is important to understand how prospective memory works. According to Cohen (2017), prospective memory involves an intention to perform a future action being established in memory. It is also referred to as "remembering to recall" or "remembering to remember" (Cohen, 2017). It is the ability to perform delayed intentions such as remembering to buy a present, buy milk at the grocery store, send a message to a friend or remember an important meeting at work.

McDaniel and Einstein (2007) divide prospective memory into three types: *time-based, event-based and activity-based.* According to Brewer at el. (2011), activity-based is the most understudied type of intention. Time-based prospective memory involves remembering to perform an action at a specific point in time, while event-based prospective memory involves remembering to perform a certain action when a specific circumstance occurs. Activity-based prospective tasks require that the intention is retrieved and executed upon completing another task. An example of activity-based prospective memory could be when having an intention of doing grocery shopping after a long meeting.

Scullin et. al (2015) describe three stages of prospective memory, which are: (1) *encoding,* the initial learning of information; *(*2) *storage*, maintaining information over time; and (3) *retrieval*, the ability to access information when needed. Ellis (1996) also states a fourth phase, which is *evaluation the outcome*, while Pink and Dodson (2013) add a fifth stage *negative prospective memory*, which they define as *"remembering not to perform an action when encountering a particular cue".* McDaniel and Einstein (2007) emphasize that it is also important to consider the nature of intentions because prospective memory refers to remembering intentions. According to McDaniel et. al (2007), the most important feature of intentions is their relation to the activities and actions that people perform in everyday lives. Furthermore, they elaborate two types of intentions: *prior intentions* and *intentions-in-action*. Prior intentions are defined as an intention which is formed prior to action, while intentions-in-action is not associated with a prior intention e.g. a spontaneous action such as picking up an umbrella on the way out (2007). This thesis will use prior intentions, because we investigate what kind of reminders the participants create with prior intentions.

When investing studies regarding prospective memory and intentions, we find three main lines of thinking about intentions. Smith (2003) presents the *Preparational Attentional and Memory* (PAM) model and suggest that the processes to recognize an opportunity to accomplish the intention consume conscious resources. This involves changing the attention from current ongoing activities in order to find the appropriate time to execute the future intention (Cohen & Hicks, 2017). Einstein and McDaniel (1996) presented the *spontaneous retrieval theory*, which assumes that participants do not monitor the environment for target event but instead remembering occurs when the existence of the target event initiates successful retrieval processes. During planning, people form a strong association between the intended action and the target cue, and the cue is fully processed at retrieval. This also means that if a reminder cue is not recognized by people, the spontaneous retrieval fails. According to McDaniel et al. (2013), spontaneous retrieval appears to be more used when the time between execution and intention formation is longer. McDaniel and Einstein (2000) combines these two and assumes that whether one relies on spontaneous retrieval process or a monitoring depends on the characteristics of the prospective memory task. Instead, it depends on a variety of factors, such as, the prospective memory task compared with the importance of the ongoing task. Moreover, it depends on the context, as it does not make sense to monitor the environment for cues when the context means that people cannot execute the intention. Arriving in the right contexts can engage these monitoring processes, which also is the reason why we are interested in which context reminders are both created and acted upon.

Kliegel and Jäger (2006) investigated event-based prospective memory in five age groups of preschoolers. The study wanted to investigate whether prospective memory develop among preschoolers, and moreover, in which age the first signs of prospective memory shows. They applied a laboratory-controlled prospective memory procedure, and the data showed especially in the age of 3 and 6 years of age prospective memory performance improves. Moreover, the study showed that there was a difference in prospective memory performance among preschoolers. While Kliegel and Jäger (2006) investigated prospective memory among preschoolers, McDaniel and Einstein (1990) investigated whether prospective memory is especially difficult for the elderly. The study were divided in two experiments, young and old participants were given a prospective memory test, where they were asked to perform an action when a target event occurred, and three tests of retrospective memory, which is short-term memory, free recall, and recognition (McDaniel & Einstein, 1990). Both experiments showed no age deficits in prospective memory.

Kliegel, Martin, McDaniel and Einstein (2001) investigated together the importance of prospective memory tasks. The study is the perceived importance of carrying out an intention which is formed

during encoding and its influence on prospective remembering (Kliegel, Martin, McDaniel and Einstein, 2001). To investigate prospective memory tasks, they conducted two experiments where they compared two typical prospective memory tasks which required different amounts of strategic attentional resources. In the first experiment, they investigated a time-based prospective memory task, while the second experiment investigated an event-based task. Experiment 1 showed an importance effect in time-based prospective memory concerning the accuracy of prospective memory performance, and when participants were told that the prospective memory task was way more important than the cover tasked, they produced more than twice as many correct target responses compared to the participants who received the opposite instruction (Kliegel, Martin, McDaniel and Einstein, 2001). In Experiment 2, the cue in the event-based tasks for correct prospective memory performance was explicit and within the cover task. Results showed, that importance influences the time-based events, while there was were no effect was showed in the event-based task. Mullet et al. (2013) also investigated memory versus aging with the purpose of investigate whether normal aging "*..spares or compromises cue-driven spontaneous retrieval processes that support prospective remembering*" (2013). Older and young adults had to participant in three different experiments where they had to perform different memory tasks. One of the tasks were a lexical-decision task where the participants had to press '*Q*' when the word '*Money*' appeared. Mullet et al. (2013) found that older and young adults showed significant slowing when the task regarding prospective-memory cues.

When we have to remember something in the future, we have the possibility to create and leave both analog and digital reminders. But sometimes the reminder fails, and we forget the activity. This scenario is investigated by Guynn, McDaniel and Einstein (1998), where they through four experiments investigated the effect of reminders on prospective memory. The results demonstrated that reminders that referred only to the target events did not improve prospective memory over that in a control condition with no reminders, while reminders referred only to the intended action improved prospective memory over that in a control condition. When the reminders both referred to the target events and the intended activity, the prospective memory was also improved over that in a control condition (Gyunn, McDaniel and Einstein, 1998). With these results, they note some implications for the practical issues of what types of reminders are reminders that are effective in 'real-world' prospective remembering. Gyunn, McDaniel and Einstein (1998) suggest that an effective reminder must specify both the intended activity and the target events of the prospective memory task.

Cues can also be a way of remembering something, and Manning and Edwards (1995) investigated how external cues support memory for the consent of a to-be-performed action. In their paper, they cited Meacham and Columbo (1980), describing how an external cue act in two sequential

stages; *rehearsal* and *retrieval*. The results of evaluating the efficacy of external cues showed, that having the cues visible throughout both stages provided the best effect, while only having the cue visible during the retrieval stage, e.g. a reminder at the time where it should be acted upon, was nearly as effective (Manning & Edwards, 1995).

### Summary

We adopt how McDaniel and Einstein (2007) divide perspective memory into two categories; time-based and action based. Moreover, Scullin et. al's (2015) three stages of prospective memory, will also be used in this thesis by investigating the how the cues of the participant's reminders and the cue action. When examining how people remember reminders and what kind of cues they create, we divide the participants' reminders into whether it is a time-based or action-based reminder, and how they handle reminders in specific channels and devices. Moreover, we use the concepts in our RQs, so we are using the theoretical framework to guide our exploration of reminders as personal information.

## 2.3 Personal Information Management (PIM)

In 2004, Boardman defined information to be "*..data which carries some meaning for one or more people*" (p. 14), while personal information was described as "*.. information owned by an individual, and under their direct control.*" (p. 15). This means that the user is in control over which information to keep, change, and delete. According to Barreau (1995), personal information is acquired in various formats and can include different types of information, which e.g. could be photos and documents.

Many researchers have tried to define personal information, and not all researchers have the same definition of PIM. Whittaker (2011) emphasizes different properties regarding how information is oriented and the information's possession of uniqueness. According to Whittaker (2011), information orientation distinguishes between *action-oriented* information types and *informative* information types. Action-oriented refers to that information requiring an action, which e.g. could be answering an email, while informative information does not require any action (Whittaker, 2011). This difference between action-oriented items and informative items is important in order to understand how users handle information

Personal information management (PIM) is the organization, storage, and retrieval of information by an individual for his/her own use. PIM places special emphasis on the maintenance and organization of personal information collections. Therefore, information items, such as electronic

documents, email messages, paper documents, web references, handwritten notes, etc. are stored for later use and repeated re-use (Jones, 2008).

Previous research includes many aspects and perspectives on PIM, but a lack of consensus seems to exist regarding how PIM is defined. In 1988, Lansdale defined PIM as "*..... the methods and procedures by which we handle, categorize, and retrieve information on a day-to-day basis*" (Lansdale, 1988, p. 55). Lansdale (1988) does not define anything about acquiring information but is instead concerned about how to handle the information most conveniently once it is acquired. Later, Broadman (2004) embodied acquisition in his definition of PIM, as he defined as: "*Personal Information Management describes the acquisition, organization, and retrieval of information by an individual computer user.*" (p. 1).

Jones (2007) defines PIM as "*.. both the practice and the study of the activities a person performs in order to acquire or create, store, organize, maintain, retrieve, use and distribute the information needed to meet life's many goals … and to fulfill life's many roles and responsibilities*", while Barreau (1995) was more specifically concerned with PIM systems in a work context and he argued that "*.. personal information management system is an information system developed by or created for an individual for personal use in a work environment.*" (p. 327).

Besides PIM, we are also introduced to the two concepts; *PSI* and *PICs*. PSI includes various tools and other objects which affect the flow of information from, to, and through PSI. This could e.g. be folders containing notes, Dropbox folder, Google Drive folder etc. When looking at PSI, *personal information collections* (PICs) have to control both the information which goes in and how it is organized. This kind of information could e.g. be a smartphone's email inbox, calendar, photos or notes in the note-taking app (Jones, 2008). To summaries, each individual has a single PSI, which consists of multiple PICs, and all of it is handled by PIM.

### 2.3.1 Stages of PIM

Barreau (1995) elaborated that a PIM system contain five phases, and this section covers the phases. Figure 2 below shows an overview of PIM activities and stages, which according to Jones (2010) contains of: *acquisition*, *organization*, *maintenance*, *retrieval*, and *output.*

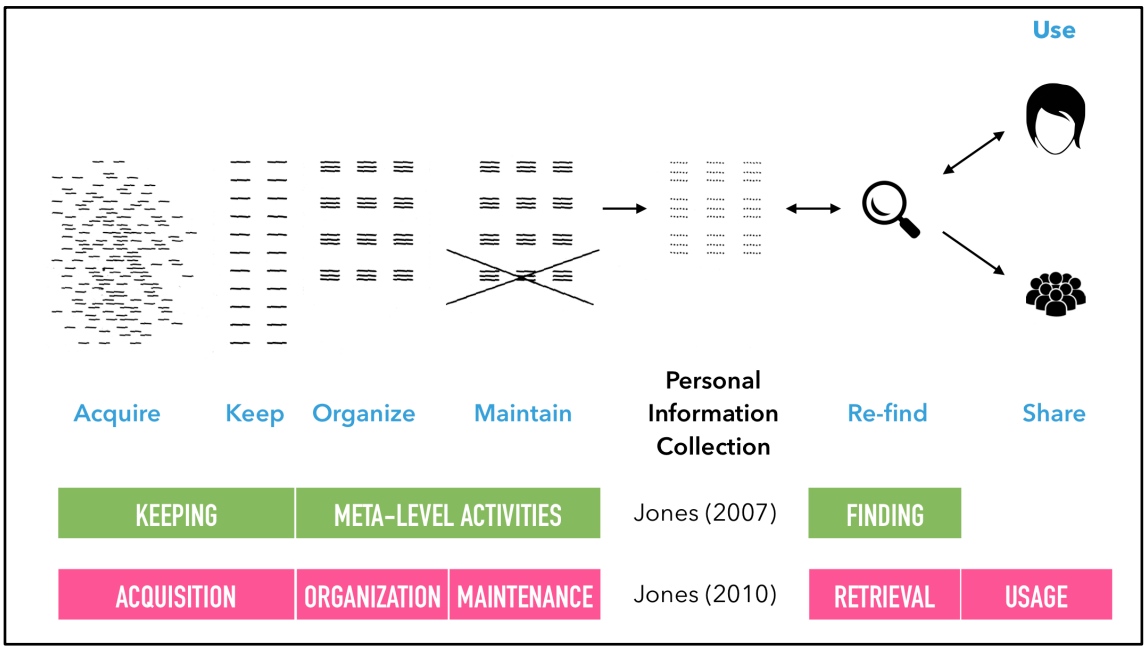



Figure 2: PIM activities and stages. Adapted from Jones (2007, 2008)

From our review, Barreau (1995) and Jones' (2010) definitions appear commonly known and cited within the field. They both have a clear framework, which has been found beneficial to keep a clean focus in this thesis. Therefore, we adopted the following phases: (1) acquisition, (2) organization, (3) maintenance, and (4) retrieval as both Barreau (1995) and Jones (2010) proposed. This also means that we have chosen to leave out the fifth phase regarding *output* (Barreau, 1995) since current PIM tools automatically output information, as Boardman (2004) argued. The following subsections will elaborate the four stages, we will use in the thesis.

### *Acquisition*

Acquisition is the way people keep information, which covers *"... acquire, represent, organize, store, and remember the location of, information sources and channels in the personal information collection*." (Bruce, 2005). When people have to acquire information, they can do it in many different ways. Information can be digital documents, emails, browser tabs, photos and screenshots, note-taking apps, text messages etc. Besides finding information, acquisition covers how people keep and storage information,

### *Organization*

Organizing information can be done in different ways, and the 'correct' way of structuring and organizing information vary from person to person. According to Morville and Rosenfeld (2002), people organize to understand, control and explain, and their classification systems reflect political and social objectives and perspectives. People have differences perspectives when

organizing information, and it can sometimes be difficult to find information at people's own devices.

Morville and Rosenfeld (2002) divide organization systems in two; *organization schemes* and *organization structures*. Organization schemes can be an exact organization scheme, which is objective, where people organize information alphabetical, chronological, or geographical. Morville and Rosenfeld (2002) also define an ambiguous organization scheme, which are subjective, and are more difficult to design, maintain and use. Examples of an ambiguous organizational scheme is:

- **Topical organization scheme**: One of the most useful and challenging approaches is to organize information by topic or subject
- **Task-oriented schemes**: A way of organizing content and applications into a collection of functions, processes, or tasks.
- **Audience-specific scheme**: Uses in cases where there are two or more clearly definable audiences for a service or product.
- **Metaphor-driven scheme**: Often used to help the user understand the new by relating it to something familiar.
- **Hybrid scheme**: When mixing elements of multiple schemes

The user can organize information in many ways, and we want to investigate how people organize reminders created at their digital devices.

### *Maintenance*

When people have acquired and organized information, the information is maintained in order to improve the retrieval process later and also to avoid an overload of information. Some PIM tools can automatically maintain information items such as deleting information after a certain time, but otherwise the maintenance is left to the user (Jones, 2010). A problem can occur, when people do not have to delete information because of the large memory digital devices have. Therefore, it is not necessary for the user to delete and clean their devices for old and irrelevant information.

When maintaining digital information, the user can (1) delete items, (2) changing the organization structure, (3) updating outdated or incorrect information, (4) renaming folders and items, (5) moving information items, and (6) backing up information (Barreau, 1995). Maintenance is where the user update, re-organize and/or delete acquired information, which they have to be able to re-find again. In this thesis, we focus on what make the participants keep or delete digital reminders.

### *Retrieval*

In this stage, the user re-finds saved information within the system, and refers to process of finding previously addressed information for re-use. When the user has to re-find acquired information, the earlier choices made by the user are important for a successful retrieval. Thus, when the user did poor organization choices, such as 'over organization' or lack of organization often causes difficulty in the retrieval process and can cause complication with both recall and recognition. Song and Ling (2011) describes that recall and recognition are a related, memory-based process for information retrieval. Recall refers accurately locate an unique item, which provides the user with direct access to the required information, which e.g. could be by searching for a specific name of a document. Recognition is when the user browses or navigate through information in order to locate an unique item (Song and Ling, 2011). Recall is the fastest approach to retrieval, but it is also considered as the most difficult approach because the user needs to remember specific details about the information, which can make it more time consuming for the user. Recognition is an easier way of retrieve information, but it is slower to execute, which often causes the user to balance the two processes to maintain reasonable utility (Lansdale, 1989).

## 2.4 Using digital devices with a PIM perspective

Studies of using PIM phases on digital devices are still rare, and most PIM related studies focus on PIM on computers or desks. As mentioned earlier, Zhang and Liu (2015) studied how Chinese college students use their smartphones for PIM. The study concluded that there was a difference between computers and smartphones. For the smartphone users, sending self-addressed emails and messages as well as, taking screenshots were a very popular information acquisition strategy (Zhang & Liu, 2015) Besides Zhang and Liu's study (2015), Capra (2009) did an interesting study about users' practices in managing personal information and transferring information among electronic devices and computers. Through the study, Capra could conclude that the participants used bookmarks, emails, and writing down notes as primary methods to save information found on the internet. Almost all the respondents used bookmarks, while more than half of the respondents sent self-addressed emails.

In 2017, Jensen, Jægerfelt, Francis, Larsen and Bogers studied different ways of using PIM on handheld devices. More specifically, they wanted to find out what kind of information is managed on handheld devices and, what challenges people experience when managing personal information on their private handheld devices. The study used Jones' PIM phases to analyze the collected data with five participants in their contextual inquiry sessions. All five participants had a smartphone, while only two participants also got a tablet. Based on their study, they could conclude that the main information types managed on smartphones were email, photos,

screenshots notes, and applications (Jensen, A. E., Jægerfelt, C. M., Francis, S., Larsen, B., & Bogers, T., 2017). Moreover, they could conclude that the action-oriented use of these information types often focused on setting up reminders of things to do or by through screenshots and photos, while important emails and notes also were managed frequently on smartphones. Their study also showed that screenshots typically is served as reminders of a future intended action, while maps and the calendar were also used to set reminders, which e.g. were when a participant had to remember to renew a travel card (Jensen, A. E., Jægerfelt, C. M., Francis, S., Larsen, B., & Bogers, T., 2017). According to Jensen, Jægerfelt, Francis, Larsen and Bogers' study (2017), they also found browser tabs as a channel, which the participants used to create reminders for e.g. things to buy.

While Jensen, Jægerfelt, Francis, Larsen and Boger (2017) only investigated the use of handheld devices, Oulasvirta and Sumari (2007) did a study at a IT company where they investigated how workers from the company migrated work across devices, which in this study were smartphones, desktop, PCs and laptops. Their study showed that the workers from the IT company frequently migrate work across devices, and often switch devices, sometimes at ".. *intervals of less than five minutes"* (Oulasvirta and Sumari, 2007 p.3). The participants in the study indicated that choosing devices is intimately intertwined with the employee's knowledge, personal preferences, and skills related to work. Moreover, the employees used laptops for larger and more complicated tasks, while smartphones were used to execute minor tasks such as checking the weather and locate specific information. The study also showed, that the participants sometimes had to use different devices because of a single device did not had the data or function needed, which e.g. could be phones for phone calls and laptops for connecting to a projector (Oulasvirta and Sumari, 2007 p. 4). By using different devices for different purposes, Oulasvirta and Sumari (2007) observed two strategies in their data, which were 1) ensuring access to relevant data, and 2) ensuring that the correct devices are carried and easily accessible (Oulasvirta and Sumari, 2007 p. 5). The participants wanted to make sure they had access to all relevant data, and had the correct devices carried with them.

Many PIM studies investigate how people organize their information on a laptop. This could be studies about how people organize information with their email, calendar etc., and how they re-find documents and other kinds of information (Malone, 1983). One of the first to study PIM was Malone (1983), who studied PIM as manifested in physical desk organization. Malone concluded that desks are organized both to serve as a reminder of things the respondents must do and also to enable retrieval of desired information.

A study done by Czerwinski et al. (2003) investigated the benefits of using larger display surfaces compared to traditional single-monitor displays. The researcher found that desktop users often

were more productive and satisfied when they used a screen size suitable for a specific task and content. Moreover, the users were significantly faster working on a larger display, and the user's satisfaction measures were better for the larger display (Czerwinski et al., 2003). Both the study done by Oulasvirta and Sumari (2007) and Czerwinski et al. (2003) state that the users are not as satisfied and productive when using a small screen.

Leino et al.'s study from 2010 compares analog to-do lists on paper versus on a smartphone. Based on their two studies, reminders on smartphones are going to be more common than paper-based reminders. The electronic reminders allow the user to use active reminders such as reminders in the calendar and phone alarms. Moreover, Leino et al. (2010) conclude, the more the respondents used electronic to-dos, the more likely they were to use mobile phones in PIM. Based on the interviews gathered in the study, a gender difference appeared. More males used electronic reminders 'all the time' or 'occasionally' compared to the female respondents. Leino et.al (2010) described that the gender difference might mirror the general trend of males often adopting new gadgets and technologies first.

Bota et al. (2017) investigated the use of self-addressed email, and why people send themselves emails. Their study showed, sending self-addressed email a part of regular behavior for a substantial percentage of the users asked, and moreover, that reminders and to-dos were the most popular type of information contained in such emails. Even though the study showed that to-dos and reminders were most common, self-addressed emails had a broad spectrum of intentions.

### Summary

As Zhang and Liu (2015) findings showed, there is a difference of what kind of device people use for managing information. Oulasvirta and Sumari (2007) study emphasizes that users e.g. chose devices based on the information size and how complicated a task was. We seek to investigate how people chose digital devices and what kind of information they manage on different devices. Moreover, we find it interesting to investigate in which context the users use specific devices. Using digital devices for managing personal information also relates to creating reminders. We want to investigate what kind of reminders people create in digital devices, in which context they made the reminder and in which context they act upon the reminder. Moreover, we find it interesting to investigate if there is a pattern between the type of reminders created on specific devices.

## 2.5 PIM across devices

There can be different reasons for people to manage personal information across devices. Screen size, backing up, and transferring are just some of the ways of managing personal information on digital devices.

Through a study by Sedghi et al. (2015), they identified three categories of tools to store information: 1) PCs, tablets and smartphones, 2) memory storage, e.g. external hard disks, and 3) services using a "cloud" such as Google Drive, Dropbox and email storage. Moreover, they found out that when information is stored in multiple locations or on multiple devices on the same device, maintaining and retrieving information is considered more challenging. Zhang and Liu's (2915) study regarding Chinese college students using smartphones for PIM support Sedghi et al. 's (2015) category about using desktops or cloud services for backing up. Among other findings, Zhang and Liu (2015) concluded that the users backed up to desktops or cloud services. Moreover, Zhang and Liu (2015) and Oulasvirta and Sumari (2007) both found out that users' backup important information such as text messages, work documents, and contact lists to other devices in case one of their device's crashes, replaces or is lost.

When using different devices, it can also be important to transfer information from device to device (Buttfield-Addison, 2012). Oulasvirta and Sumari (2007) concluded that the smartphone's limited storage capacity developed more connections between the smartphone and the desktop, because users transferred information to the desktop to avoid that the data got lost. Later in 2009, Capra (2009) investigated how information is transferred among devices and concluded that USB drivers, self-addressed emails and network storage were the three main methods used by the study's participants. Moreover, Capra (2009) concluded that the choice of method could be influenced by the size of the file.

Researchers seem to agree that retrieval problems can occur when managing information across devices (Sedgi et. al, 2015, Oulasvirta & Sumari, 2017). Today, users have several alternatives to keep information, and often the same information may be kept on several devices to "be sure" that they can find the information again (Jones, 2004). But the opportunity to manage information across devices can increase the risk of misfiling, misplacing or forgetting about information (Jones, 2004). The retrieval process can also be way longer than if only one device was used because people may have to look into several devices to find the right information, or also the need to maintain and organize a large amount of information across several devices.

# 3. METHODOLOGY

This section describes the methods applied for collecting and analyzing the data used in order to answer our problem statement and research questions. We will describe our choice of methods and the preparations and procedures followed in order to gather useful data of high validity and reliability. The research design and population for the data collection will be described as first.

## 3.1 Research design

The fact that how people manage and create reminders on digital devices is relatively unexplored, this thesis is non-experimental but instead conducted within an exploratory research design. In addressing our RQs, we aim to explore how digital reminders are created and managed with a PIM perspective (Jones, 2007). Moreover, we focus on presenting a thorough literature review. The research is structured by conducting a qualitative method; *contextual inquiry sessions*, followed by a *content analysis* of the conducted data from seven *contextual inquiry sessions.* Due the lack of studies regarding reminders with a PIM perspective, we need to find evidence of our participants reminder behavior through a qualitative research. The conducted data must be validated, so we can be reasonably confident that our findings represent the user base we examined. This will help us keep our findings understandable and straightforward, and then leave more advanced statistical analysis for future research (Mulder & Yaar, 2006).

## 3.2 Population

The population of this research is the smartphone, tablet and laptop users worldwide who use their digital devices to create and manage digital reminders. To understand what kind of digital device people prefer to use in different situations, an overview of the use of smartphones, tablets and laptops worldwide is important.

According to studies done by Statista, the number of smartphone users worldwide passes 3 billion and is forecast to grow by several hundred million in the next few years (eMarketer, 2016b). Looking at the computer market, almost half of private households worldwide in 2018 were estimated to have a computer at home. In recent years the global PC unit sales have declined. According to Statista (2020), the growing popularity and usages of smartphones makes owning a PC as an extra device redundant for many people. Looking at digital devices, tablets are also a device many people own. In 2014, around 840 million people worldwide used a tablet at least once per month (eMarketer, 2016c).

## 3.3 Data collection methods

### 3.3.1 Contextual inquiry

The contextual inquiry method is a qualitative method and aims to understand and provide information about how the participants perform certain tasks (Raven et al., 1996, Holtzblatt & Jones, 1993). Contextual inquiry is a variant of field study that combines elements of hermeneutics, anthropology, user research, sociology and participatory design, and it is used to promote an understanding of a current work practices in context (Holtzblatt & Jones, 1993) We used contextual inquiry to figure out the participants' behavior when creating reminders on their digital devices.

Holtzblatt and Jones (1993) make a distinction between *work-of-the-work* and *work-of-the-tool*. Work-of-the-work is the way people talk, think about, and structure their work, while work-of-the-tool refers to the way people interact with the computer system (Holtzblatt & Jones, 1993). Both are connected with each other, and when one of them is poorly supported or violated, the system fails to be usable. So, by placing ourselves in the context of the participants' environment and context, we avoid summary data and abstractions in favor of concrete examples (Raven et al., 1996).

According to Raven et al. (1996), contextual inquiry is based on three principles;

1. *Environment & context*: The data must be gathered in the participant's own context or environment

2. *Partnership*: The inquiry is a partnership between the researcher and the participant where behavior and issues are explored together

3. *Focus*: The data collection is based on an exploratory approach and a defined focus

Even though, according to Raven et al. (1996), it is important to collect the data in the participant's own context and environment. Due COVID-19, the participant and the researcher have been in separate rooms and the CI sessions have been done with Skype. The participants have still been in their own context and environment, but it has not been possible for the researcher to be physically in the same room. The second principle concerns the *partnership* between the researcher and participant. The partnership is considered equal, and the researcher does not have an agenda or prepared questions (Raven et al., 1996; Holtzblatt & Jones, 1993). We chose not to follow Raven et al.'s (1996) idea of *partnership* because we found it important to observe and evaluate specific topics regarding the problem statement and research questions. This leads to the

last principle, *focus*, where the focus must lead the conversation and observation, which can be a specific perspective or concern. In this CI protocol, the focus was aligned with our research questions.

Raven et al. (1996) describe various implementations of contextual inquiry, which are:

1. *Work-based interview*: A traditional CI method which is used when participants allow the researcher to observe and interview them while engaging in an activity.

2. *Post-observation inquiry*: Used when work can't be interrupted e.g. observing employees at a help desk.

3. *Artifact walkthrough*: It is the most common approach to study user information and is used when the activity takes place over time and, when a process take place over a period and involves several people.

We will use *artifact walkthrough* in our contextual inquiry sessions because we want to investigate how people over time manage self-addressed reminders.

### *Pilot test*

We performed a pilot test of the contextual inquiry with the purpose of fine-tuning our protocol and testing the timeframe. Moreover, we wanted to test whether the asked questions would give us the right insight into the participants' behavior. During the pilot test, we became aware of the importance of the protocols structure and asking the right questions at the right time.

Before the pilot test, some of the first questions in the CI protocol were *"How many hours do you use on your devices",* and also *"Which apps do you often use for creating reminders".* The pilot test showed, it was first relevant to ask these kinds of questions in the end of the session. Therefore, it was removed to the last part of the CI session. In the artifact walkthrough, the participant was asked if *"..show and tell us about you creating reminders on your digital devices"*. After explaining the different kinds of reminders in each channel, the CI protocol was designed after each channel, and the participant had again to go through the different reminders. The pilot test showed that it would be better to ask the questions in extension of what the participant talked about in the beginning of the artifact walkthrough. Therefore, the questions regarding the participant's behavior for the reminders were moved up to the general talk about the reminders in each channel. Last, the CI protocol has eight scenarios for the participant, where the participant got a scenario and had to show and explain how he would create a reminder. With the pilot test, we got aware of a new, important scenario where the outcome could vary from participant to participant.

Therefore, we added a ninth scenario regarding *"how the participants remind themselves of birthdays"*.

Based on the pilot test, we estimated that the contextual inquiry sessions would take around 1 hour, which we informed the participants about in an information letter (Appendix B).

## *Procedure*

Due COVID-19, all the CI sessions had to be done online because people could not meet face-to-face in fear of getting sick. Therefore, the CI sessions were done differently than usual using Skype. The participant and one researcher were connected on Skype, where the sessions were screen recorded. The researcher facilitated the conversion following the protocol, while also taking notes in a separate sheet. The procedure for the CI sessions was as follows: 1) Introduction, 2) Artefact walkthrough, 3) Scenarios, and 4) Wrap up.

The CI sessions were conducted in Danish, which were decided to avoid a language barrier because all the participants are Danes. If the sessions were conducted in English, the participants might leave out information because it could be difficult to explain in English.

### *Introduction*

A first stage in the contextual inquiry sessions, we started with an introduction of the researcher and the purpose of the session. Moreover, we informed and gave the participants the consent form (Appendix C). In the introduction, it was important to explain for the participant, how we as researchers defined a reminder. This was explained, so the participant did not give irrelevant information and only focused on reminders. After explaining the definition of a reminder and the purpose of the study, the artifact walkthrough could begin.

### *Artifact walkthrough*

As mentioned earlier, Raven et al. (1996) describe various implementations of contextual inquiry, and we have chosen *artifact walkthrough*, which is a preferred approach for studying user information (Raven et al., 1996). In practice, we started the artifact walkthrough by asking the participants to show and tell about how they create reminders on their digital devices. The participant can choose for themselves which device and channel they would start with. When the participant shows an example of a reminder, the researcher will ask more specific question regarding the reminder which e.g. could be *"When did you create the reminder?", "What have you called the reminder?,* and questions about the reminders context, both created and acted upon.

Meanwhile the participants explain and show how they create reminders, the researcher can ask questions regarding the reminders, if the participants do not mention it themselves. The questions are created to ensure the researcher gets enough data related to the seven research questions.

Moreover, the participants get asked to take screenshots of the reminders they show as an example.

The CI protocol contains all the different channels, and if the participants do not mention a channel by themselves, the researcher will ask about specific channels. This will ensure that the participants talk about every kind of reminder, they do, even though they might have forgotten about it.

***Scenarios***

Besides the artifact walkthrough, we have also created eight scenarios which we want the participants to perform. The scenarios are different kinds of information that the participant has to save as a reminder. The participant tells and show the researcher how they normally will save the specific reminder. The scenarios cover all the channels, and it is therefore interesting if there is a difference between how the participants save and create reminders based on the eight different scenarios. An example of scenarios is;

- You must call your doctor in three days; how do you remind yourself?
- You have found a t-shirt on the internet and want to remember it, because you want to buy it later. How do you save it?

The participant chose a device and channel and then explains how they would create the reminder on their digital device.

***Wrap up***

In the last part of the contextual inquiry sessions, the researcher summarizes and asks clarifying questions to make sure that we examined what was intended. Moreover, the researcher asks specific questions about the participants' weekly use of their digital devices and if they can walk through their most used apps on their smartphone the last week.

***Sample***

In total, seven contextual inquiry sessions were conducted. We interviewed two males and five females in the age of 23-47 years old.

| | Gender | Age | Occupation | Smartphone | OS | Computer |
|---|---|---|---|---|---|---|
| **P1** | Female | 26 | Student | Samsung S10 | Android 2.0 | Lenovo |
| **P2** | Female | 47 | Translator | iPhone XR | iSO 13.4 | Asus |
| **P3** | Female | 27 | Student | Huawei P20 Pro | 10.0.0.196 | MacBook |
| **P4** | Female | 37 | Project Manager | iPhone 8 | iSO 13.2.3 | Acer |
| **P5** | Female | 24 | Student | Samsung s10 | Android 10 | HP |
| **P6** | Male | 23 | Office trainee | Huawei P20 Pro | Android 9.1.0 | PC |
| **P7** | Male | 31 | Unemployed | Huawei P20 Pro | Android 9.1.0 | PC |

Table 1: Participants demographics

***Reliability and Validity***

To ensure reliability in our contextual inquiry sessions, we perform each phase of the study as clear and consistently as possible, to ensure that other researchers might replicate our methods, as well as, to ensure that the concepts are consistent (Bryman, 2012). *External reliability* refers to the criterion of replication of a research, which was not possible to meet by conducting the contextual inquiry sessions, since it is not possible to replicate because the semi-structured form allowed for questions to emerge from the interaction between the participant and interviewer. When looking at *internal reliability*, which refers to consistency, it was negatively affected by the fact that it was only one researcher who conducted the contextual inquiry sessions. However, when creating codes for the analysis of the qualitative data, it was created in collaboration with another researcher to reach intercoder agreement and void *single-observer idiosyncrasy* (Bordens & Abbott, 2011).

*External validity* refers to whether "*..results can be extended (generalized) beyond the limited research setting and sample*" (Borden & Abbott, 2011), and it was never the intention to be met by this thesis because its qualitative nature and the small sample size. Participants for this thesis were all found within the researcher's network which further decreases the ability to generalize to the entire population (Bordens & Abbott, 2011). Looking at *internal validity*, which refers to the ability of our research design to adequately test our hypothesis (Bordens & Abbott, 2011), was influenced by more factors. When conducting the CI sessions, we decided to conduct it in the

participants' native language so we could ensure that none of the participants would leave out information because of a discomfort. An additional factor, which could have influenced the internal validity negatively is social desirability (Bryman, 2012), if the participants did not answer truthfully but in accordance to what they perceive as socially desirable. We tried to avoid social desirability by letting the participants show clear examples of how they create and manage reminders on their digital devices.

## 3.4 Analysis methods

To analyze the collected CI sessions, content analysis was used as an analysis method. In the following section, the methods of content analysis will be presented.

### 3.4.1 Content analysis

Content analysis is an approach to analyze documents and texts which seeks to quantify content in terms of predetermined categories and in a replicable and systematic manner (Lazar et al., 2010). Content analysis is used to understand the main concepts expressed in qualitative data, and by developing a coding scheme, the researchers can summarize findings which can be reused in different contexts (Bryman, 2016). Content analysis has two qualities: being systematic and objectivity. The quality of being systematic means that the application of the rules is done in a consistent manner, so the researchers cannot be biased. The objectivity ensures transparency on the procedure for assigning the raw material to categories (Bryman, 2016). These two qualities, anyone could employ the rules and end up with the same results.

An important tool in content analysis is coding. A code is a word or a short phrase, that represents a given concept, which is related to the research objectives (Lazar et al., 2010). Two types of coding can be used, *priori coding* or *open coding*. Prior coding is used with applying pre-existing/theoretical frameworks to analyze the documents, while open coding, also known as emerge coding, aims to develop codes describing, classifying or naming or the phenomenon under consideration (Lazar et al., 2010).

Below, Table 2 shows a description of the coding scheme. The coding scheme is divided into three levels, and Table 2 gives a short definition of each code and example of quotes.

| Level 1 category | Level 2 category | Level 3 category | Short definition | Example quote(s) |
|---|---|---|---|---|
| **Intention** | Inspiration | | Reminders with the intention of getting inspired | *“inspiration on how to create storage for my children's room"* |
| | Contact | | Participants have the intention to contact someone. | *".. to call my doctor"* |
| | Schedule event | | Reminders with the intention of remember events | *"I have to remember my grandma's birthday party"* |
| | Purchase | | Reminders created with the intention to purchase something | *".. if I want to buy something" or "..I saved this browser tab so I could remember to buy it later"* |
| | Complete task | | Reminders created with the intention to complete a task | *"I create reminders, so I remember to complete tasks at work."* |
| | Collect | | Reminders created with the intention to collect information | *".. information about a meeting I have to attend"* |
| **Activity** | Beauty & personal care | | When the reminder activity is regarding; Makeup | *"I kept this photo, so I get reminded of which mascara I have to buy"* |
| | Commuting | | When the participants create reminders to remember to leave in time | *"I make phone alarms so I know when to leave, so I will get from A to B in time"* |
| | Education | | When the reminder is regarding activities at the education | *"I saved this screenshot of some results I did at my university"* |
| | Fashion | | When the reminder is about fashion, e.g. clothes | |
| | Food preparation | | When the reminder is about prepare food, both meal plans, cooking time etc. | *"I make meal plans" or "I set an alarm when I cook so I know when it is done"* |

| | | | | |
|---|---|---|---|---|
| | Health & household | | When the reminder is related to health and household | *"I have a phone alarm reminding me to take a daily pill."* |
| | Home & kitchen | | When the reminder is regarding home and kitchen | *"I have created reminders with inspiration of how to decorate our children's room"* |
| | Personal administration | | When the reminder is related to personal administration, e.g. pay a bill | *"I took a screenshot of a bill so I could remember to pay it"* |
| | Rest & relaxation | | When the reminder must remind the participants to get up in the morning | *"I have a phone alarm Monday to Friday, so I get out of bed every morning"* |
| | Social engagements | | Reminders regarding social engagements with friends and family | *"I write in my calendar, when I have to meet with friends and family"* |
| | Job application | | When the participant must remember to apply for a job | *"I keep browser tabs open with jobs I want to apply later"* |
| | Vacation | | Reminders regarding vacation, e.g. flight tickets | *"I took a screenshot of information from Ryanair because our flight is cancelled"* |
| | Work | | Reminders regarding activities at work | *"I have a document with notes only for work"* |
| **Organization** | Organization structure | Folder | When the participants create folders to organize reminders | *"I have created folders in my photo app"* |
| | | List | When the participants organize reminders in lists | *"My to do list is just one, large list"* |
| | Organization scheme | Color | When the participants use colors to organize reminders | *"Some of my notes are organized by color"* |
| | | Label | When the participants organize reminders by giving it a label | *"I give my reminders in my calendar labels, so I know what I have to do"* |
| | | Chronological | Reminders are organized in chronological order. | *"It just organizes it buy time, so the latest created is in the top"* |

| | | | | |
|---|---|---|---|---|
| **Cue** | Alarm sound | | Setting an alarm sound to play when the reminder should be acted upon | *"I use the alarm sound, so I hear, when I have to do something"* |
| | Unread | | Leaving a reminder unread or marking it as unread again | *"I leave it unread, so I remember to act upon it when I have time"* |
| | Check channel | | Active checking of a channel by the participant for reminders | *"I just check the channel and see, if I have any reminders"* |
| | Push notification | | Passive push notification of the reminder on the participant's screen | *"The reminder just pop up on my screen, and then I see what I have to remember"* |
| **Cue Action** | Time-based | Recurring | When it is a reminder that is recurring, e.g. remember to do the same work task every week | *"My child go to the same sport every week"* |
| | | Single use | When the reminder is single use, e.g. calling the doctor | *"I have to go to the hairdresser"* |
| | Event-based | | When the participant remembers a reminder because of an event | *"When I am at the supermarket, I know I have created a shopping list"* |
| **Context created** | Work | | Reminders created at work | |
| | Home | | Participant create reminders at home | |
| | Other | | Participant create reminders out, e.g. shops, out with friends/family | |
| | Transport | | Participant create reminders in transit, e.g. in the bus, car, metro | |
| **Context acted** | Work | | Participant act on reminders at work | |
| | Home | | Participant act on reminders at home | |

| | | | | |
|---|---|---|---|---|
| | Other | | Participant act on reminders out, e.g. shops, out with friends/family | |
| | Transport | | Participant act on reminders in transport, e.g. in the bus, car, metro | |

Table 2: Coding scheme description

Level 1 is divided into seven codes, which is; *Intention*, *Activity, Organization, Cue, Cue action, Context created,* and *Context acted*. This is followed by several "Level 2 category"-codes. Each code has been giving a short definition followed by an example of a quote from the conducted CI sessions. The coding book is used to describe the coding scheme (Appendix E), where we coded all data from the seven CI sessions. The results from the conducted data will be presented in the following chapter.

# 4. RESULTS AND ANALYSIS

The following chapter presents and eliminates the results of the conducted content analysis on the data collected through seven contextual inquiry sessions. By presenting and analyzing the findings, we will answer the problem statement: *How do people create, manage, and act upon digital reminders on their digital devices?*

The chapter is divided into 5 main sections which are covering the seven research questions:

- §4.1 Devices and Channels: Covers RQ1
- §4.2 Intentions: Covers RQ4
- §4.3 Cues in digital reminders: Covers RQ2 and RQ5
- §4.4 Organizing digital reminders: Covers RQ3
- §4.5 Context created and acted upon: Covers RQ6 and RQ7

## 4.1 Devices and Channels

In this section, results regarding RQ1 will be analyzed.

RQ 1: Which digital channels & devices do people use to create reminders?

The results of RQ1 will be presented in a subsection for each device. In each section, the device and which channels the participants used to create reminders will be analyzed.

When looking at which devices the seven participants used most for creating digital reminders, tablets could be quickly executed. None of the seven participants used tablets for creating reminders, and therefore, the device will not be focused on in the analysis. To get an overview of which devices the participants used for different channels, Figure 3 below was created:

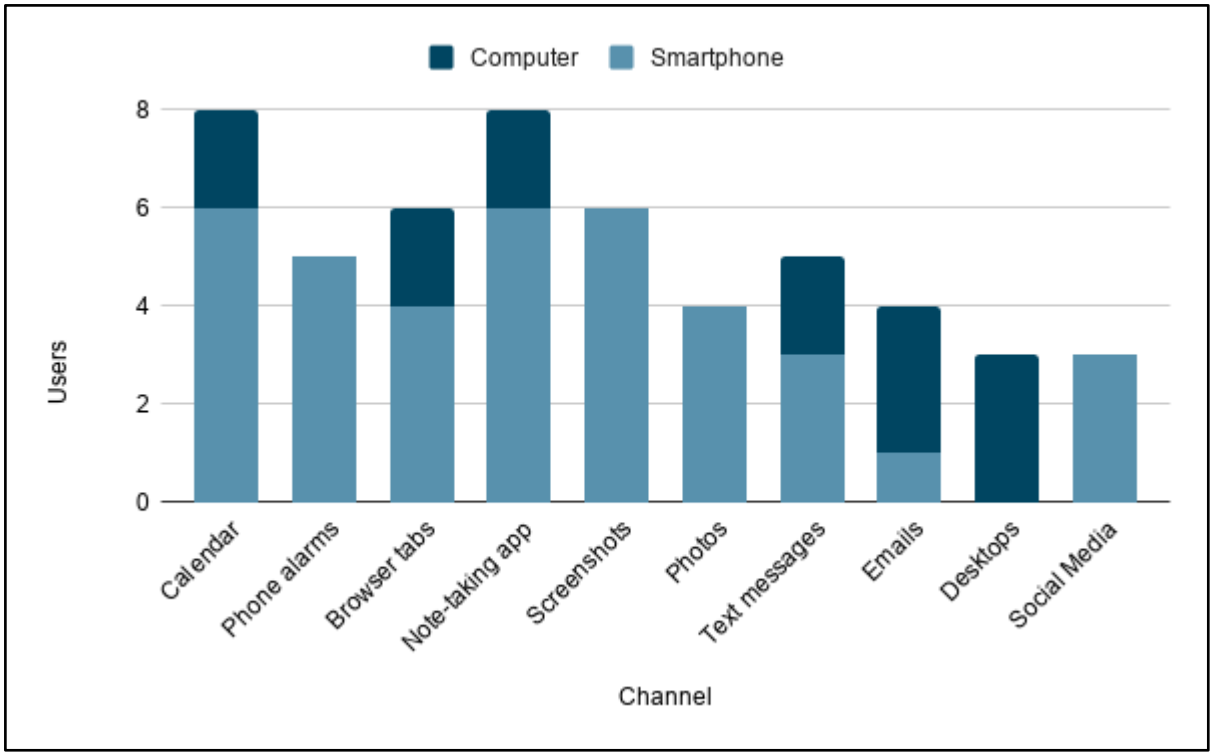



Figure 3: Overview of how what device the seven participants use to create reminders in each channel

Aa Figure 3 shows, the participants use several different channels when creating reminders on their smartphone, while they use fever channels when using a computer. Looking at the calendar, six of the participants use their smartphone, while two participants use computer. A device do not exclude another, and therefore, a participant can use both smartphone and computer in the same channel.

In the following two sections; §4.1.1 Computer and channels and §4.1.2 Smartphone and channels, the main channels used with the two devices will be analyzed. Specific information regarding how the participants use cues, organize, the intended actions and context both created and acted upon, will be analyzed afterward.

### 4.1.1 Computer and channels

Five of the participants used their computer to create digital reminders. Participant P6 and P7 both have a desktops PC, while the other participants have a laptop.

It was especially by using desktops and sending self-addressed messages the participants used their computers to create and manage digital reminders. P3 used her desktop to remind herself of what to study for next class "*.. documents that I use while on a course are on the desk or texts to read for the next lesson*" and they will "*.. be on my desktops until they are acted upon*" (Appendix I).

Another reason for using computers for digital reminders, is the size of the screen. A computer offers the user to have a bigger screen which can make it easier to read information instead of on a smartphone screen. As the study done Czerwinski et al. (2003) showed, desktop users were more satisfied when using a screen size suitable for the specific task and content, which the CI sessions confirmed. P4 often chose to use her computer instead of her smartphone, when she wants a better look at specific items, e.g. when shopping online. P4 prefer a larger screen, when she really has to focus or has to look at something she wants to by "*When I was going to buy new garden furniture I used the computer because it was better to look at a larger screen"* (Appendix J). P1 also use this feature a lot by sending self-addressed messages with screenshots, photos or other kind of reminders, she wants to see on a bigger screen "*.. I send screenshots to myself so I have bigger screen to see it and send information to myself so I can see it on a larger screen*" (Appendix G) In this case, the computer is not used to create the reminder but instead to act on it. We will in §4.5 Context created and acted upon cover how the participants act on their reminders. P2 also use her computer to manage her reminders; *"I am using my laptop when I need to sit longer or have a larger screen*". Again, the larger screen is important for the participant, because it gives her a better workspace and it is easier to read needed information.

Besides chosen a computer over smartphones because of a larger screen, P4 only use a laptop when creating work related reminders (Appendix J). As a project manager in finances, it is important for P4 to create reminders regarding work tasks, meetings and reserve time for demanding work tasks, and she chose to "*.. divide privacy and work-related reminders. Work-related tasks are only on my work computer*" (Appendix J). It is two specific channels P4 uses to create and manage reminders on her computer, Outlook and Calendar, "*.. in Outlook I can make a list of my tasks, and then select when I have to do the task. I use the calendar to block time, so I know when to do a specific or important task*" (Appendix J).

When focusing on what kind of channels the participants in the CI sessions used to create reminders with their computers, it is clear that some of the channels are often more used than others. Figure 4 below illustrates, which channels the participants use most to create reminders on their computer.

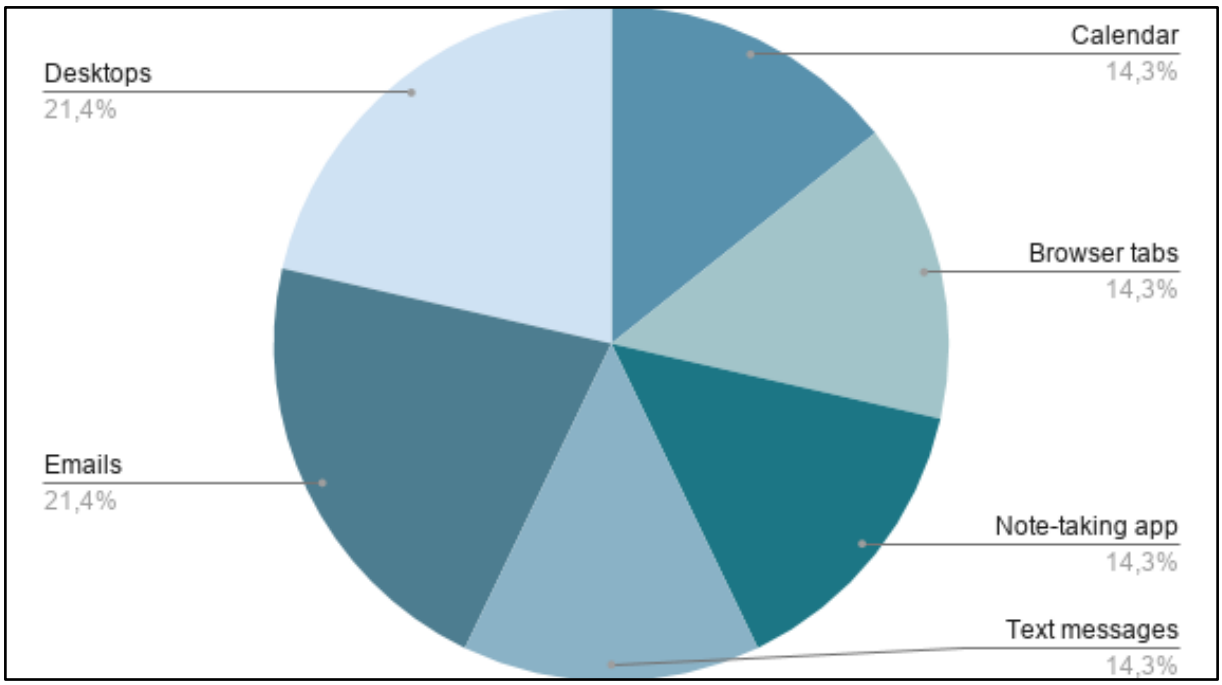



Figure 4: Channels used by participants on a computer

The CI sessions showed, the most common channels for creating reminders with a computer, both desktops and laptops, is *Email* (21,4%), and *Desktops* (21,4%) while using *Browser tabs*, *Calendar*, *Note-taking app,* and *Self-addressed messages* is used 14,3% of the time to create digital reminders. P6 use his work laptop a lot to create work related reminders. The email program and calendar are most used by P6, who create "*-- reminders regarding meetings at work and smaller assignments at work in my calendar and send myself 'not-finished' emails and CC myself to important emails*" (Appendix L). P6 only use his email program to create reminders at work, while his calendar is divided into private and work. Moreover, it is only P6's work related reminders in his calendar, which are created at a computer. All of P6's private reminders are created and managed in his calendar at his smartphone. Both P4 and P6 use the email program on their work laptop to create to do lists of their work tasks which they can check off, when the task is done. Outlook also has a calendar function, which both P4 and P6 use a lot. P4 "*.. uses calendar to block time so I know when to do a specific or important task*" (Appendix J).

Both P6 and P7 use a note-taking app on their computer to create and manage reminders. P6 create work related notes on his work computer in a Word document with "*.. general notes and emails notes when people have sent something that might be useful then I save them in a note*" (Appendix L), while P7 use the note-taking app on his computer to e.g. "*.. save information regarding a job interview I got in next week. Then I save both the date and time in the note and save it on my desktop*" (Appendix M). The difference between P6 and P7 is, P6 only create work related notes on his computer, while P7 use his private desktop computer to create personal related

notes. P7 combine the use of two channels, *desktop* and *note-taking app*, because he first creates a note with information he needs to remember, and then he places it at his desktop to remind himself to act on the note (Appendix M). This is a way of managing the reminder twice, thus the desktop channel can in this case be argued as a way of organizing reminders. In 14,3% of the time, browsers are used to create reminders on a computer (Figure 4.2). P7 often use browser tabs to create reminders, when he is sitting at his desktop PC. Because of P7s job situation, most of the reminders are related to job searching, and P7 "*.. keeps relevant jobs I find open, so I remember to apply later or the next day.*" (Appendix M). When P6 also own a desktop PC at home, and when he finds something relevant e.g. shopping, articles etc. he use his browser tabs to remind him to look at it later. P6 explains: "*I often just browse on my computer, when I am home, and when I find something, I want to look at later, I keep my tab open, so I remember to look at it later.*" (Appendix L).

Through the CI sessions, the participants also had to do nine scenarios, where they should tell how they would create a specific reminder. Four of the seven participants would use their computer to create some of the scenario's reminders. The nine scenarios were:

| **Scenarios** |
|---|
| 1. You must call your doctor in three days. How do you remember it? |
| 2. You have found a t-shirt on the internet you will buy later. How do you remember it? |
| 3. You are out shopping and find a hat, you want to remember, so you can add it on your birthday wish list. How do you remember it? |
| 4. You have found a job on Jobindex as you want to apply in the next day. How do you remember the job? |
| 5. Du received a text message saying you can pick up your package. How do you remember to get your package? |
| 6. You must bring cake for work and have found a recipe on the internet. How do you save the recipe? |
| 7. Tomorrow you must go to the supermarket to buy ingredients for the cake. How do you remember all the ingredients? |
| 8. You received an email about information regarding a meeting. How do you save and remember the information? |
| 9. How do you remember friends and family's birthdays? |

Table 3: Scenarios questions from the CI sessions

To create the scenarios as reminders, some of the participants chose a computer as device for creating scenario 2, 4, 6, and, 8.

In scenario 2, all four participants, who chose to use a computer, would use their browser tab to remember the t-shirt. P6 add, that he also "*.. sometimes will also add it in the basket at the website, because then they will send me an email saying, that I have something I have not bought yet.*" (Appendix L). Then P6 both keep the browser tab open, but still create another kind of reminder, because he then receives an email with a reminder. Three of the participants would use a computer to create scenario 4 reminder but they use different channels to create the reminder. P5 would ".. *keep the browser tab open and also create a phone alarm, so I got reminded later to apply for the job.*", while P6 preferred to *".. create a self-addressed text message on Facebook, and send the job posting to myself."* (Appendix K & L).

During the CI session, P6 were asked whether he sometimes create self-addressed text messages to remind himself of something. According to him, he never writes himself text messages, and therefore did not use the channel. But when the CI session came to the scenarios, P6 twice mentioned *self-addressed text messages* as a channel to remember a scenario (Appendix L). Thus, the scenario also showed, that the participants sometimes do not recall using a specific channel, but when they must create and manage a specific reminder, they might use the channel anyway.

P5 and P6 would also in some case use a computer to create scenario 6. With this reminder, they both agree of what kind of channel to use to create the reminder. Both would create a self-addressed text message, where they would send them self the recipe for the cake. Moreover, P6 would also keep the browser tab open ".. *if I stay on my computer*" (Appendix K). However, they both argue, that the choice of device depends on the context they are in. In §4.5 Context created and acted upon: Covers RQ6 and RQ7, the context for the scenarios will be analyzed. In scenario 8, it is only P6 how would prefer to use a computer to create the reminder. He argues that "*I will probably use my work laptop, and when I receive an email about a meeting, I will both save the reminder in my email program and in my work calendar."* (Appendix L).

### 4.1.2 Smartphone and channels

Six out of seven participants use their smartphone to create digital reminders. P2 explains "*I always have my smartphone with me"* (Appendix H), which is her reason for creating reminders on her smartphone because she always carries it around with her. It is easy to access reminders on smartphones, because the participants carry it around all the time. The easy and fast access to a smartphone is also a reason for P4 to not use computer as much as her smartphone to create and manage reminders. For P4, it is both the easy access and what the smartphone offers her to do,

that determinate why she use smartphone more often *".. you can just as well use a smartphone instead of a computer, because it is always near you and you can do the same on a smartphone as the computer."* Now a day, a smartphone offers the user almost same opportunities as a computer, and according to our CI sessions, this is a reason for the participants to choose their smartphone over their computer.

Sometimes, smartphones and computers allow to sync which could make it easier for the participants to use both smartphone and laptop. But P2 won't ".. *sync my smartphone with my computer because I have a lot of private stuff and reminders on my smartphone, which I do not want to have on my computer because other people will then have access to it"* (Appendix H). The CI sessions also show, that the operating system can determine whether people choose to sync their smartphone and computer. P3 do not sync her smartphone with her computer but that is not because of privacy but instead of the ability to sync the two devices. P2 have a Huawei P20 Pro smartphone with Android system and a MacBook Pro with an iOS system. This makes it difficult for P2 to sync, which she did when she had an iPhone. This is her reason for almost only using her smartphone for creating and manage reminders ".. *most use my smartphone - especially after I got Huawei because it does not play with my MacBook. When I had the iPhone, it synced with my MacBoo*k" (Appendix H).

When focusing on what kind of channels the participants in the CI sessions used to create reminders with their smartphone, some of the channels are often more used than others. Figure 5 below illustrates, which channels the participants use most to create reminders on their smartphone.

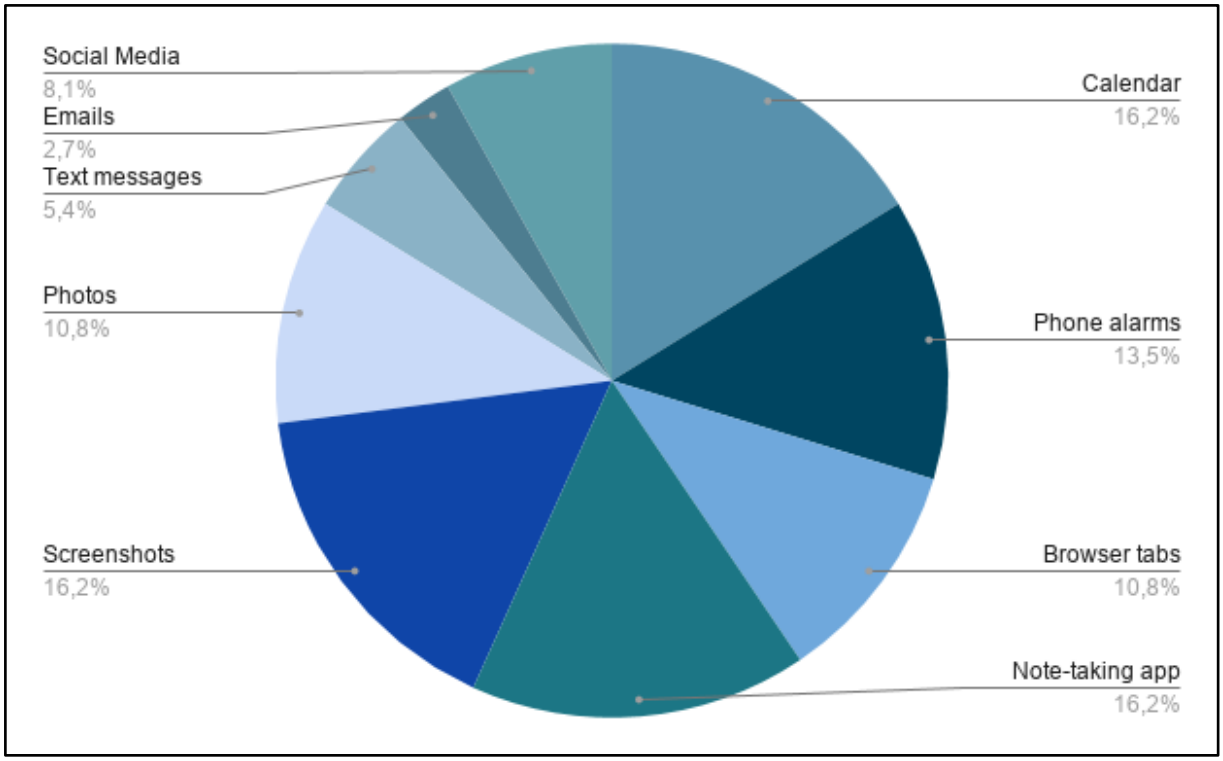



Figure 5: Channels used by participants on a smartphone

The CI sessions showed, the most common channel for creating reminders with a smartphone are *note-taking apps* (16,2%), *calendar* (16,2%), and *screenshots* (16,2%), while using *phone alarms* (13,5%) is the second most used channel. The note-taking app and calendar were both used at smartphone and computers, and the total use of these two channels are higher, if both smartphone and computer use are combined.

The calendar is especially used by the participants to create reminders regarding weekly appointments, which both cover work-related, personal-related and study-related appointments. P2 explains: "*My calendar is both meetings at work, courses I take, appointments with friends and family. Primarily important things*" (Appendix H), while P5 also use her calendar to create reminders about tasks she has to "*.. so, I remember my reservation to the laundry room.*". Moreover, P5 also create reminders in her calendar with her working schedule, so she both remember to go to work and also remember how many hours she had work in a period (Appendix K). P1 has two calendars, one is the standard calendar application on her smartphone and the other one is a online version so "*.. if I lose my smartphone, I can download the online calendar again, which my standard calendar at my smartphone cannot*" (Appendix G). The two calendars got exactly the same reminders, and it could be argued whether P1 need two calendars, but she explains that she: "*.. don not like the design on my 'backup calendar' that saves it if I lose it, so I prefer to use my standard smartphone calendar*".

Six out of seven participants use their note-taking app to create reminders on their smartphone (Appendix E). The participants use the channel for many different purposes, which can vary from remembering a recipe to create a weekly to do list (Appendix E). Especially P3 use the note-taking app a lot when creating reminders. Image 1 and Image 2 show how P3 use her note-taking app on her smartphone to create different kind of reminders.

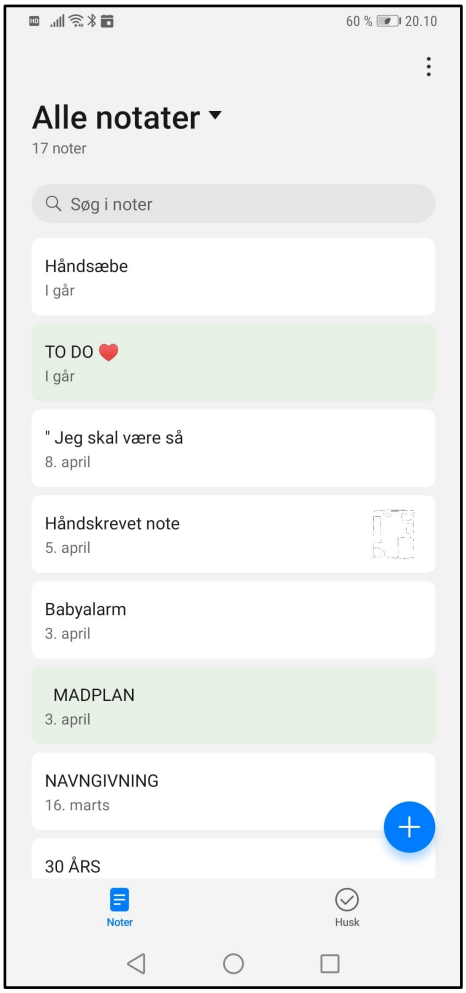



Image 1: P3's note-taking app


Image 2: P3's note-taking app

P3 has more than 16 notes in her note-taking app, and they vary from a general 'to do list' to 'what can I do with my 1-year old son'. The note-taking app is the "*-.. primary channel I use to make reminders*" for P3, who daily use her notes to remind herself of what to do the same day, week or month. We saw a difference of what kind of note-taking app the participants used. Most of the participants used the standard note-taking app on their smartphone, while P7 used the note-taking program "*Notepad*", which is a note-taking program on computers.

The channel *screenshots* (16,2%) is only used on smartphones, and six out of seven of the participants use this channel to create reminders. Four of the six participants use screenshots as

a channel for reminders, when they want to remember a recipe they found online (Appendix E), while P2 often take a screenshot, when she "*..browse at my smartphone and do not have time to finish it, then I take a screenshot to remember to look at it the next day.*" (Appendix H). The screenshot become a reminder for P2 to check what she did not manage to finish the day or evening before. P3 "*.. do not use screenshots for reminder so often*", but when she do it is often '*.. not so important reminders or something to act on quickly*" which e.g. could be a bill to pay in the upcoming week or events, she maybe would like to attend (Appendix I). *Photos* is also a channel; the participants only use to create reminders with their smartphones (Appendix E). Photos are used by four out of seven participants, and they often use photos for reminders when they are outside and quickly have to take a photo of something they have to remember. P6 use photos as a channel for reminders, when he is out shopping and have to "*.. remember specific clothes, make-up my girlfriend wants or something similar as I maybe want to buy later.*" (Appendix L). P1 often use both screenshots and photos to save and remember specific recipes she finds. A photo could e.g. "*.. be a recipe from a magazine"*, while screenshots more often are "*.. recipes I find online on the internet or social medias*" (Appendix G).

Five out of seven participants use their *phone alarm* (13,5%) to create reminders on their smartphone (Appendix E), which makes this channel one of the most used to create reminders on a smartphone. P1 often use her phone alarm in relation with her calendar, if it is "*.. something important I really have to remember on time.*" (Appendix G), while P2 and P6 also often use their phone alarm when they cook. When P6 is cooking and has to create a reminder in his phone alarm, so he remember the cooking time, he "*.. use Google Assistant so I just tell Google to create the reminder in my phone alarms for me. Then I know, if the meat should cook in 30 minutes, then Google Assistant will set the alarm to exactly 30 minutes.*" (Appendix L). Moreover, P6 also argue, that "*.. Google Assistant makes it easier and faster to create a reminder in the phone alarm, because I e.g., just can stand and stir in the sauce while I just tell Google Assistant to set an alarm for me.*". (Appendix L). It is only when creating reminders in the phone alarm, P6 use Google Assistant to help him create a reminder.

Browser tabs (10,8%) is also often used by some of the participants to create reminders. P3 is one of the participants, who use browser tabs as reminder, and she: "*.. often use browser tabs when I am in transport. I have 3 quarters transport to work, so I often spend time browsing the web. If I do not reach it when I get off, I will leave it open so I can remember to act upon it later.*" (Appendix J). This can be anything from finish reading an interesting article to remember to check up on insurance and call the insurance company (Appendix J). P6 also use browser tabs on his smartphone to create reminders, and he explains: "*An example of how I use browser tabs could be,*

*when I order something and I receive the track and trace link, I open the link and keep it open, so I remember to follow my package."* (Appendix L).

When looking at the channel *Social media (8,1%)*, three of the participants use the channel to create and manage reminders. The participants mention both Facebook and Instagram as social medias they use to create and manage reminders. The reminders can vary form fitness inspiration to products the participants want to buy later. Reminders created in social medias are only by using smartphones. None of the participants use their computer to create and manage reminders on social medias. P2 argue: "*I just sit with my phone, and when something come up on my screen, it is easy just to save it for later use*" (Appendix H), while P4's many hours weekly in transport also *"makes it easy for me to create a reminder, which I have to look at, when I have time*" (Appendix J). P5 also use the social medias a lot and often find posts she wants to remember, but instead of using the social media's function of saving the post, she takes a screenshot of the post (Appendix K). Last, self-*addressed email* (2,7%) and *self-addressed text message* 5,4%) is used differently when it is created and handled on a smartphone. The participants tend to use the email program more on their computer than on their smartphone, while self-addressed text messages more often are used as reminders on smartphones (Appendix E)

When the participants must create the scenarios reminders in most cases, the participants chose to use their smartphone as device for creating the reminder. Based on the CI sessions, the choice of smartphones may be because of its easy access and "*.. always carry it around with me"* (Appendix H). The results of the scenarios with a smartphone perspective is showed below:

| Scenario | Number of participants who would use smartphone |
|---|---|
| 1. You must call your doctor in three days. How do you remember it? | 6 |
| 2. You have found a t-shirt on the internet you will buy later. How do you remember it? | 4 |
| 3. You are out shopping and find a hat, you want to remember, so you can add it on your birthday wish list. How do you remember it? | 7 |
| 4. You have found a job on Jobindex as you want to apply in the next day. How do you remember the job? | 5 |
| 5. Du received a text message saying you can pick up your package. How do you remember to get your package? | 7 |
| 6. You must bring cake for work and have found a recipe on the internet. How do you save the recipe? | 7 |
| 7. Tomorrow you must go to the supermarket to buy ingredients for the cake. How do you remember all the ingredients? | 7 |
| 8. You received an email about information regarding a meeting. How do you save and remember the information? | 5 |
| 9. How do you remember friends and family's birthdays? | 7 |

Table 4: How many of the participants use a smartphone to create reminders

As Table 4 shows, the participants often prefer to use their smartphone to create reminders. However, it is important to emphasize that in some of the scenarios, the participant answered both smartphone and computer, because it "*.. depends of the situation and where I am at the moment the reminder has to be created.*" (Appendix M) To illustrate what kind of channels the participants chose to use to create the nine scenarios, Figure 6 was made:

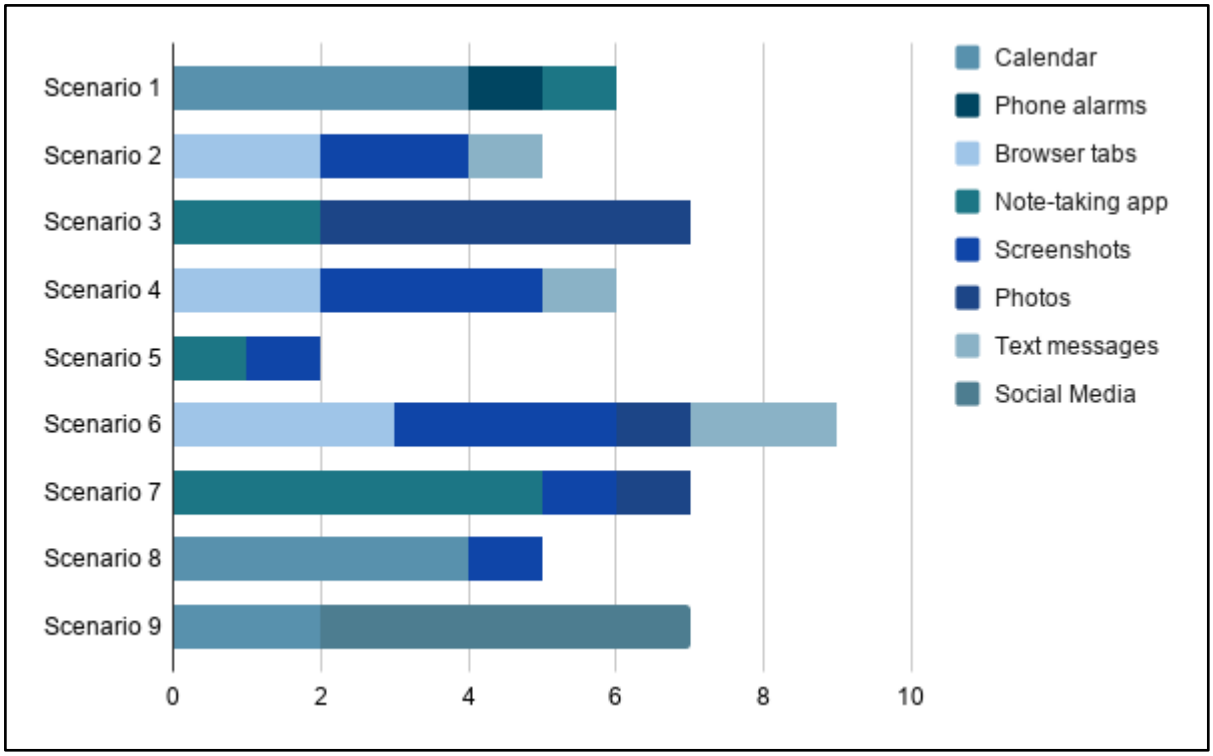



Figure 6: What kind of channels do the participants use to create scenario reminders with a smartphone

The choice of channel depends of the kind of reminder the participants were told to create. As Figure 6 shows, the participants often chose the same channels and it is only in Scenario 5, that four different channels have been selected. The most used channel is *Screenshot* which was picked 11 times by the seven participants. *Calendar* was the second most used channel with 10, while the *Note-taking app* was chosen 9 time by the participants. This is also the top three channels mentioned by the participants in the CI sessions (Appendix E). The participants general observation of how they create reminders on their smartphone is very similar to the way they would create the nine scenarios, which emphasize their own observation of their use of channels to create and manage digital reminders on a smartphone. None of the participants chose to use *Desktops* to create one of the scenario reminders, while both *email* and *phone alarm* only were used once each.

### 4.1.3 Summary

The participants from the CI sessions preferred to use their smartphone to create digital reminder, while they often used their computer to create reminders, if it was work-related or acquired a larger screen. None of the participants use a tablet or other devices such as smartwatch to create reminders. When creating reminders on a computer, both laptop and desktop, the participants used *desktops* and *email* most often. However, the computer was also selected in cases where it required or needed a larger screen. The smartphone was the most preferable device, and the three

most used channels to create reminders on a smartphone were; 1) Calendar, 2) Note-taking app, and 3) Screenshots.

The intended actions for all reminders in the different channels will be further analyzed in the next section, §4.2 Intentions.

## 4.2 Intentions

In this section, results regarding RQ4 will be analyzed.

> RQ 4: What are the intentions of digital reminders?

There can be different intentions when creating a digital reminder. The reminders intended action can be anything from something to buy, do, visit, cook etc. The participants had different intentions and to get an overview of the participants intentions and activities with their reminders in each channel, Figure 7 and Figure 8 were made:

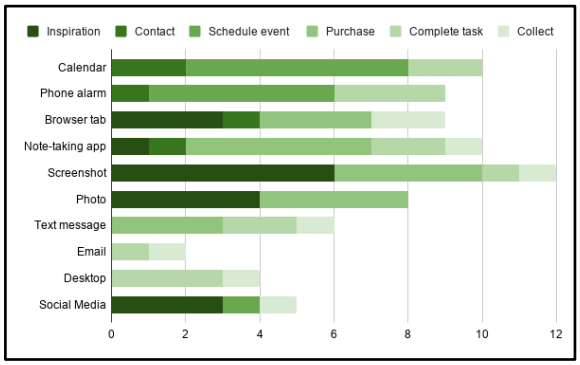



Figure 7: The intentions for each reminder

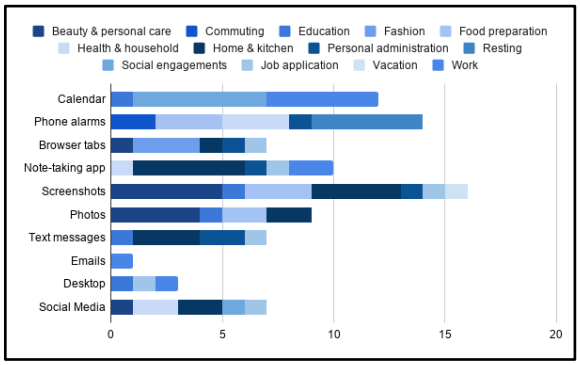



Figure 8: The activities for each reminder

Figure 7 is divided into the six intentions in our coding scheme (Appendix E), and the reminders intention vary a lot from channel to channel. When the intention is to *complete a task*, the participants use seven different channels, while both the intention of *collect* and *contact* only are used in four channels. Besides analyzing the intentions of the reminders, we also want to analyze the reminders activities. We have coded 13 different activities and as Figure 8 shows, it varies a lot from activity to activity what kind of channels the participants use to create reminders. Screenshots as reminders have seven different activities, while emails only serve one purpose.

In the following sections, the intentions and activities for reminders in each channel will be analyzed.

### 4.2.1 Calendar

The calendar is one of the most used channels to create digital reminders, and the participants both use the channel with their smartphone and computer (Appendix E). Six out of seven participants use their calendar to create and manage reminders. To get an overview of the intentions and activities for reminders in the calendar, Table 5 was made:

| | Inspiration | Contact | Schedule event | Purchase | Complete task | Collect |
|---|---|---|---|---|---|---|
| **Beauty & personal care** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Commuting** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Education** | 0 | 0 | 1 | 0 | 0 | 0 |
| **Fashion** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Food preparation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Health & household** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Home & kitchen** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Personal administration** | 0 | 2 | 0 | 0 | 0 | 0 |
| **Resting** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social engagements** | 0 | 0 | 6 | 0 | 0 | 0 |
| **Job application** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Vacation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Work** | 0 | 0 | 3 | 0 | 2 | 0 |

Table 5: Intentions versus Activities for reminders created in the calendar

Table 5 shows a heat map of the intentions versus the activities for reminders the participants created in their calendar. Most often, the intention with a reminder in the calendar is *schedule event* with the activity to remember social engagements. Two of the participants also use their calendar to *complete task* within work, while also two of the participants create reminders in the calendar with the intention of contact with the activity of personal administration, which e.g. could be *".. call the doctor"* (Appendix G).

P2 use her calendar to both create personal-related reminders regarding herself but also of what her family, boyfriend and child, must remember and work-related reminders. Image 3 and Image 4 show an example of what kind of reminders P2 can have in a day in her calendar.

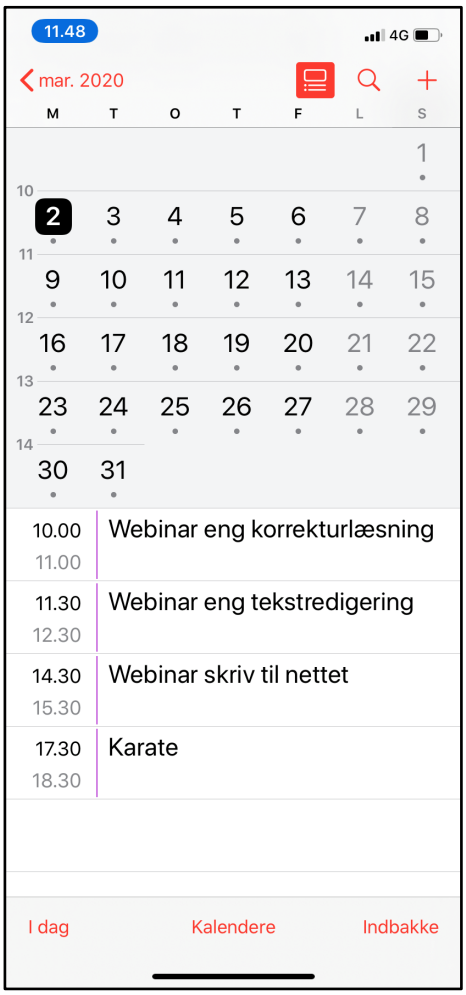



Image 3: Example of P2s calendar

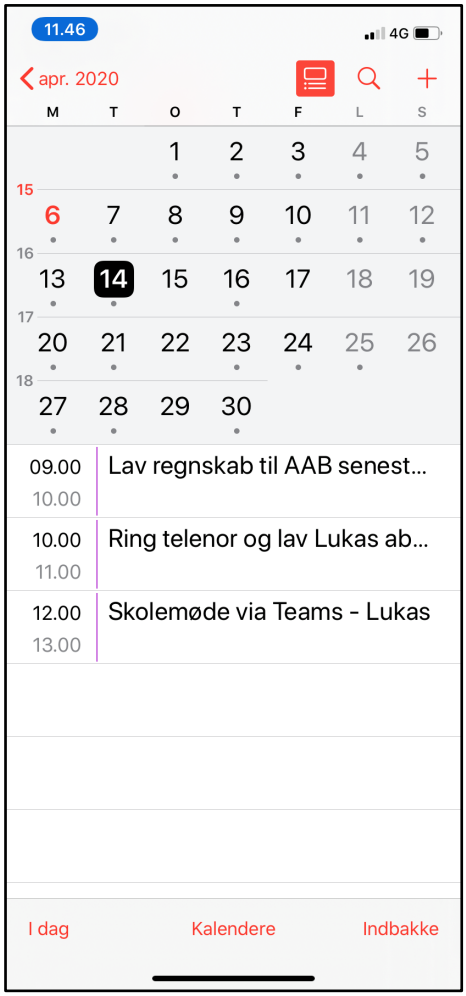



Image 4: Example of P2s calendar

Image 3 shows four reminders in one day for P2, who both must remember schedule events regarding some courses she shall attend and to remind her that her son must go to karate. P2 also created reminders with the intention to remember to do work-related tasks. The reminders in Image 4 are both work and schedule events, where she must remember to make accounting to the housing association AAB, call her telecommunications company, and last, have a meeting with her son's school. These examples also show, that P2 use her calendar to remember both schedule social events, meetings etc. for herself but also create reminders regarding her son.

As analyzed in section 4.1 Devices and Channels, P6 has two calendars which is one at his work computer and one at his smartphone. P6 divide his calendar into work-related and personal-related, to ".. *keep it separate.*" (Appendix L) While P6's personal calendar is on his smartphone, his work-related calendar is used every day at work where he keeps an overview of meetings, time he came and left the office etc., which is created to remind him daily.

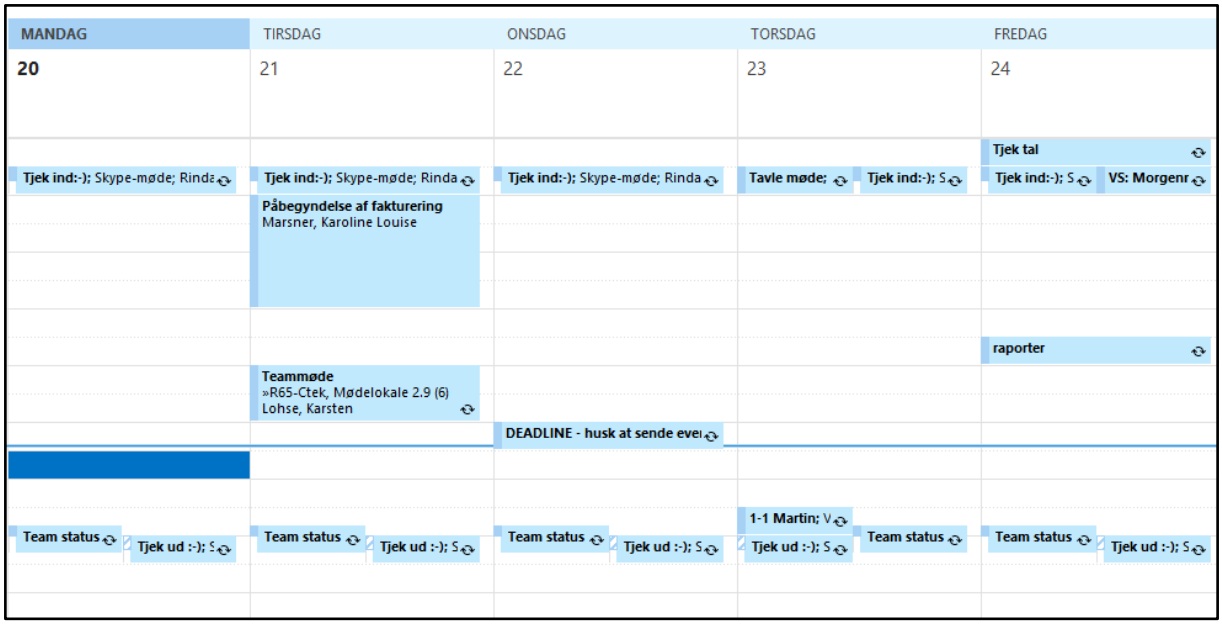



Image 5: Example of P5's work calendar at his work computer

If we divide P6's work-related calendar into another level, his reminders intentions action vary from *schedule event* to *complete task*. Due to COVID-19, the employees at P6's office say hi and goodbye the same time every day, which also is kept as a reminder for P6 in his calendar (Appendix L). Besides creating reminders regarding meetings, team status and check in and out, P6 also got a reminder of a deadline. The reminder in his calendar is created to ensure, he remember to do the task in time and send it to someone. Thus, all his reminders in his work calendar is work-related, the reminders serve different purposes for P6.

P5 is one of the participants, who also use her calendar to create reminders with the intentions of *complete task.* Besides creating reminders regarding her work schedule or social engagements with friends and family, she also types in her calendar, when she has something she has to do. Image 6 shows an example of a reminder with the purpose of something to do. P5 *".. has to book time to do my laundry, so I always create a reminder in my calendar, so I remember my time in the laundry room."*

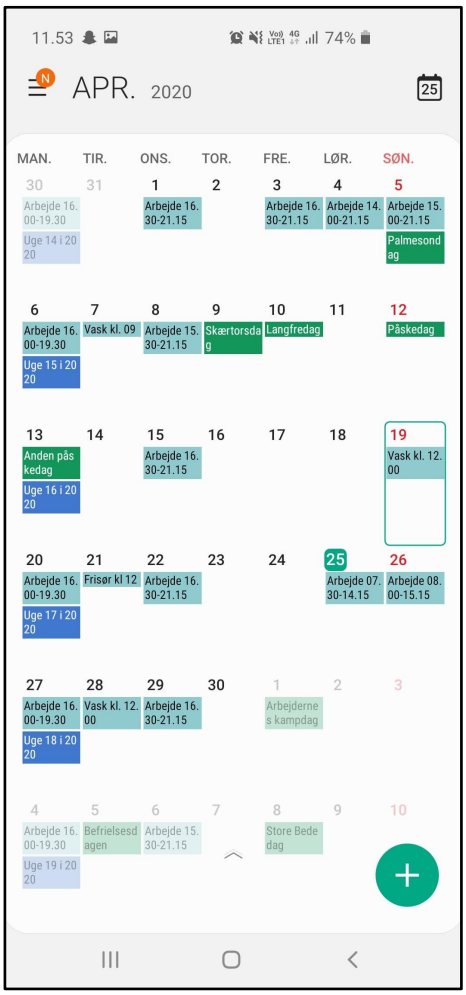



Image 6: Example of P5s calendar

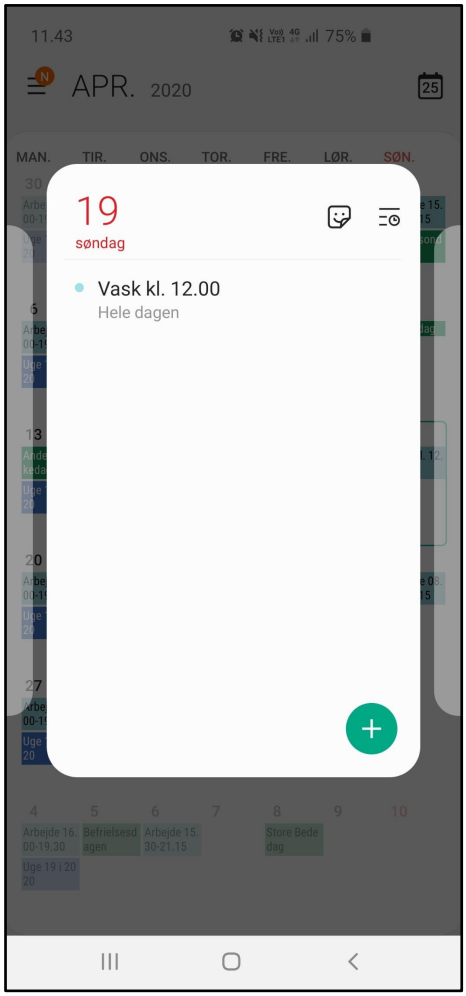



Image 7: Example of reminder in P5's calendar

Image 6 shows an overview of all P5's reminders for April, and as marked, P5 has a reminder on April 19th where she has booked the laundry room and has to do laundry. Image 7 shows what it looks like when P5 click on a specific date in her calendar. Then the reminders for the day pops up and, in this example, P5 only must remember to do her laundry. This reminder ensures, she will remember when she has booked the laundry room and makes sure she do not make any other appointments in the same period of time.

### *Scenarios*

The participants also had to do nine scenarios during the CI sessions, where they had to create nine different reminders while they explained how they normally would do it. Within Scenario 1, 8, and 9, some of the participants choose to use their calendar to create the reminder.

| Scenario | Intention | Participants choosing browser |
|---|---|---|
| 1. You must call your doctor in three days. How do you remember it? | Contact | 4 |
| 8. You received an email about information regarding a meeting. How do you save and remember the information? | Schedule event | 3 |
| 9. How do you remember friends and family's birthdays? | Schedule event | 3 |

Table 6: The intentions in scenario 1, 8 and 9 and how many participants using browser in the scenarios

Table 6 shows, how many of the participants chose their calendar to create scenario 1, 8 and/or 9. Scenario 8 and 9 deal with a schedule event, because the participants are asked how to remember a meeting or friends and family's birthdays.

When both the intentions of these three scenarios and the intentions of the participants general reminders in the calendar are analyzed, it shows the calendar is used with almost the same purpose. The participants most often prefer to use the calendar when they have to remember a schedule event.

### 4.2.2 Browser tabs

Browser tabs are used by four of the participants and is a channel that serves many different purposes. This channel is used both on smartphones and computers and serve seven different purposes. Table 7 below shows the intentions versus the activities for reminders created when using browser tabs.

| | Inspiration | Contact | Schedule event | Purchase | Complete task | Collect |
|---|---|---|---|---|---|---|
| **Beauty & personal care** | 2 | 0 | 0 | 1 | 0 | 0 |
| **Commuting** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Education** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Fashion** | 2 | 0 | 0 | 3 | 0 | 2 |
| **Food preparation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Health & household** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Home & kitchen** | 0 | 0 | 0 | 0 | 0 | 1 |
| **Personal administration** | 0 | 1 | 0 | 0 | 0 | 0 |
| **Resting** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social engagements** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Job application** | 1 | 0 | 0 | 0 | 0 | 0 |
| **Vacation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Work** | 0 | 0 | 0 | 0 | 0 | 0 |

Table 7: Intentions versus Activities for reminders created with browser tabs

Reminders created with browser tabs vary from *".. want to remember the recipe of this "easiest tomato soup"* (Appendix J) to *".. just keep my tab open so I remember to apply for this job later."* (Appendix M). Most of the participants use browser tabs to remind themselves of recipes and shopping inspiration.

As Image 8 shows below, P4 has both a recipe, *personal administration* in form of home insurance and shopping inspiration. P5 also use his browser tab to remind himself of articles, he wants to read later, tracking number of a package and reservation for his hairdresser.

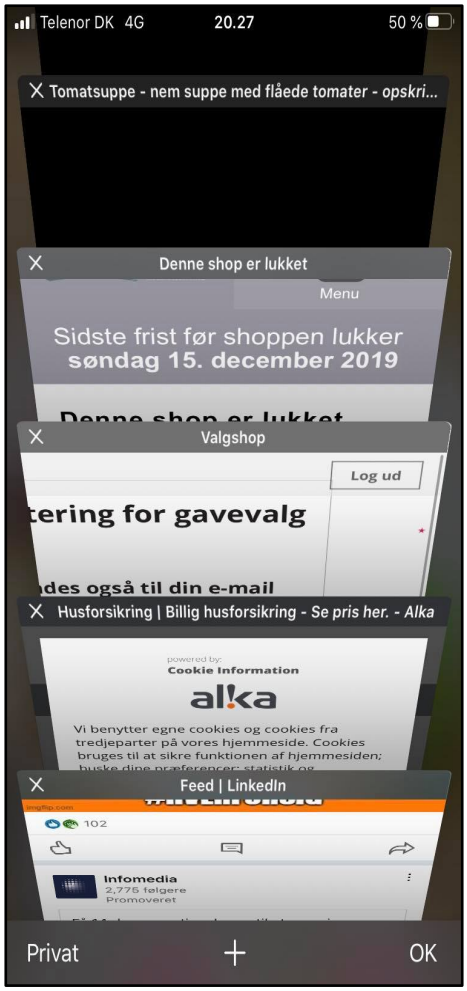



Image 8: Example of P4's browser tabs

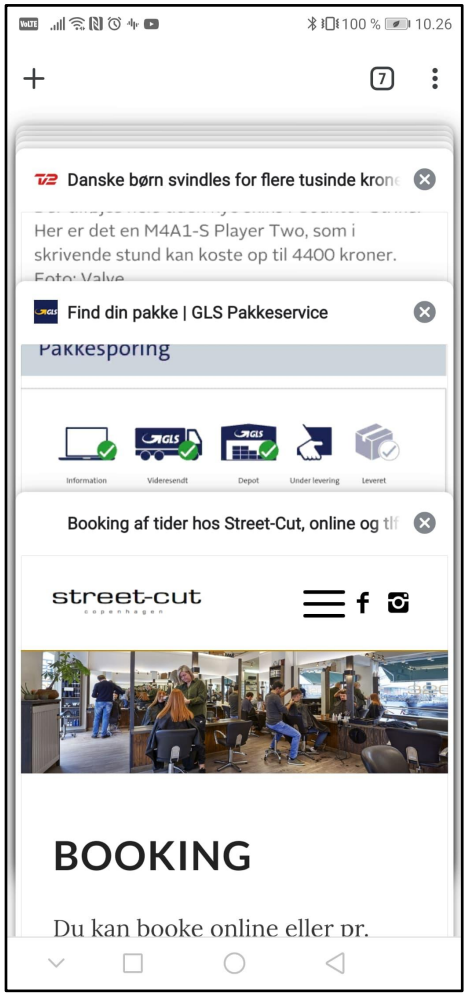



Image 9: Example of P6's browser tabs

P4 and P5 use their browser tabs on their smartphones a lot, because they must sit in transit every weekday. When they are finished with transport, they keep their browser tabs open, so they can remind themselves to act upon it later when they have time.

Not all of the seven participants use a smartphone to create and manage reminders with browser tabs. P7 has a desktop computer and while he is unemployed, he uses his computer a lot. Especially, when he has to ".. *look for jobs to apply, I use my desktop computer because it is more comfortable to sit many hours instead of with my smartphone*". To ensure that P7 remembers to apply for all the jobs he finds, he always keeps his browser tabs open, so he remembers to apply for the jobs later the same day or the day after. Image 10 below shows how P7 uses his browser tabs to create and manage reminders regarding job search and applying.

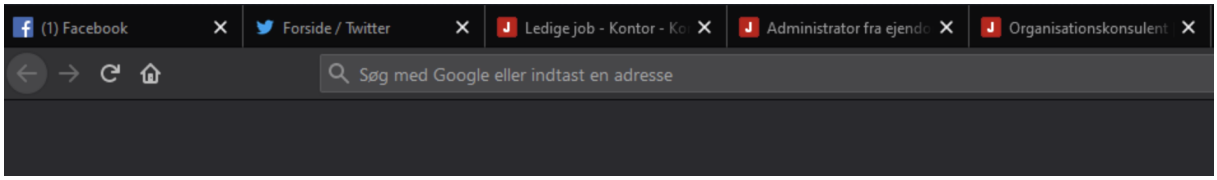



Image 10: Example of P7s browser tabs on his desktop computer

Image 10 shows three browser tabs with three different jobs, P7 wants to apply. These jobs will stay open in his browser until he has either applied the job or decided it was not a job for him (Appendix M). P7 is not the only one of the participants, who use a desktop computer to create reminders with browser tabs. P6 also owns a desktop computer and he uses it a lot, when the intended action of a reminder is ".. *shopping because it is easier to search on my desktop with a bigger screen*" (Appendix L) When P6 is searching for inspiration within clothes, make-up for his girlfriend etc., he keeps the browser tab open on his desktop computer and later either buy the product or close the browser tab.

***Scenarios***

As mentioned earlier, during the CI sessions the participants had to go through nine scenarios and explain, how they normally would create a reminder within each scenario. In scenario 2, 4 and 6 (Appendix D), some of the participants preferred to use browser tabs as the channel to create the reminder.

| Scenario | Intention | Participants choosing browser |
|---|---|---|
| 2. You have found a t-shirt on the internet you will buy later. How do you remember it? | Purchase | 4 |
| 4. You have found a job on Jobindex as you want to apply in the next day. How do you remember the job? | Collect | 4 |
| 6. You have to bring cake for work and have found a recipe on the internet. How do you save the recipe? | Inspiration | 3 |

Table 8: The intentions in scenario 2, 4 and 6 and how many participants using browser in the scenarios

As Table 8 shows, both in scenario 2 and 4, four participants choose to use their browser tabs to create a reminder. Scenario 2's intended action is *Purchase*, because the participants are asked how they will remember a specific t-shirt they will buy later. The intended action in Scenario 4 is to *Collect,* which four of the seven participants would prefer to remind themselves by their browser tab. Last, Scenario 6 deals with how to save and remind themselves of a cake recipe.

Therefore, Scenario 6's intention is *Inspiration*, which three of the participants would use browser tabs to remind themselves of. These intentions for the reminders are also what we see when analyzing the data from the CI sessions, where the participants showed and explained their general use of reminders created and managed with browser tabs. The participants both prefer using smartphones and computers when using browser tabs, and often the intended action when using browser tabs on smartphones are more recipe, personal-related information and general inspiration, while the intended actions when using browser tabs on a computer is more often about applying for a job, work-related information and to buy. It is often the possibility of a larger screen that makes the computer more preferable because "*..it is easier to see all details and manage the reminder on a larger screen*" (Appendix J).

### 4.2.3 Note-taking app

As covered in section 4.1 Devices & Channels, the note-taking app is one of the most preferred channels for creating digital reminders for the seven participants. Six out of seven participants use their note-taking app on their smartphone, while one participant use both smartphone and computer and one participant only use his computer to create reminders with his note-taking app. Table 9 below shows the intentions versus the activities for reminders created when using a note-taking application.

| | Inspiration | Contact | Schedule event | Purchase | Complete task | Collect |
|---|---|---|---|---|---|---|
| **Beauty & personal care** | 1 | 0 | 0 | 1 | 0 | 0 |
| **Commuting** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Education** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Fashion** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Food preparation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Health & household** | 0 | 0 | 0 | 0 | 1 | 0 |
| **Home & kitchen** | 3 | 0 | 0 | 5 | 0 | 0 |
| **Personal administration** | 0 | 1 | 0 | 0 | 0 | 0 |
| **Resting** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social engagements** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Job application** | 0 | 0 | 0 | 0 | 0 | 1 |
| **Vacation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Work** | 0 | 0 | 0 | 0 | 1 | 0 |

Table 9: Intentions versus Activities for reminders created with note-taking apps

When asked in the CI sessions, the participants found it difficult to explain the intended actions for reminders in the note-taking app. P2 explains: "*But it is very hard to answer what the intended actions are, because it really depends on what kind of reminder I create*" (Appendix H), which P3

emphasizes: ".. *well it is really different from note to note, because it is all kind of reminders I make in my note-taking app.*" (Appendix I). The variation of the activities is shown in Table 9.

The activity behind reminders in the note-taking app vary from *"I make a weekly meal plan so I know what we are going to eat"* (Appendix H) to "*I use my notes to write down my wishes for both birthday and Christmas"* (Appendix J). The most used intention is *Purchase* with five participants who use the note-taking app with the purpose of reminding themselves of what to buy. This can vary from ".. *a weekly list of what I have to buy for all my meals for a week"* (Appendix G) to *"when I just need to buy some groceries, it is easier to write it in my notes"* (Appendix K).

P3 uses the note-taking app a lot and creates several reminders with different topics depending on the intentions. Below, Image 11 and Image 12 gives an overview of what kind of reminders P3 keeps in her note-taking app.

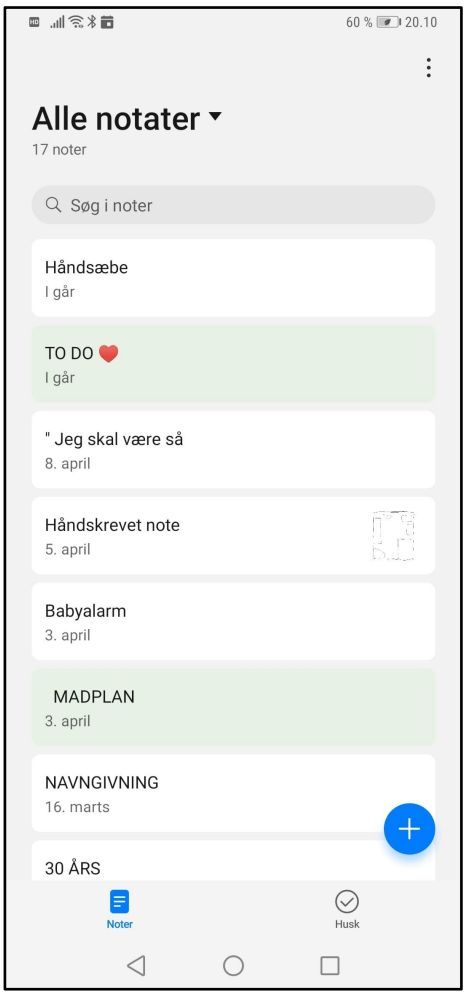



Image 11: Example of P3's notes


Image 12: Example of P3's notes

The notes in P3's note-taking app, the standard note-taking app on a Huawei smartphone, vary from *to do, meal plan, wishlist,* and *writers going on the bookshelf.* This is just a selection of the

many reminders P3 has created in her note-taking app. For P3, the note-taking app is the "*.. app I use the most. I put almost everything in my notes and check the app daily"* (Appendix I). The reminders also have different intentions and activities, and to get an understanding of the intended actions in P3's reminders, an example of her large "TO DO"-list is shown below:


Image 13: Example of P3's notes

P4 has a list of all the "to-do's" for April, which all have different intended actions. Even though everything on the list is something *to do*, every single reminder has its own intention and activity, and to get an overview of what kind of the intentions P3's reminders on her "TO DO" have, Table 10 was created:

| Intention | P3's 'To do'-list |
|---|---|
| Purchase | ● Buy present to grandma<br>● Go to Babysam with trolley<br>● Make booth at Børneloppen |
| Make book | ● Make book with pictures from allotment<br>● Make yearbook to Hugo |
| Personal administration | ● Send package for Nicolai<br>● Give Nadia the book back<br>● Get book back from Sandra<br>● Get freezer from apartment |
| Health | ● Find out about maternity<br>● Book doctor appointment<br>● Call Udbetaling Danmark |
| Child related | ● Write letter to Hugo about his first year<br>● Write up to private school |
| Study | ● Interview with Talle and Cille<br>● Write to Andreas about thesis |

Table 10: P3's intended actions in her "To Do"-list

As Table 10 shows, P3's reminders in her general 'TO-DO'-list serve many different intentions. Although, they all are related to something she has *to do*. The intended actions vary from buying a present to her grandma to make two different photo books. P3 explains: "*My reminders on my To-Do list are not something I need to do at a specific time or date. It is just something I need to do during the month, and if I do not remember to do so, I just move the reminder to next month's list of reminders.*" (Appendix I). P3's to do list is also an example of, she does not divide her reminders into the intentions but instead has one, long list of what to do the next month. Moreover, P3 emphasizes that she: ".. *always act upon the reminders but the reminder can in some cases be pushed and acted on later than expected.*".

Most of the participants use a note-taking app with the intention to purchase groceries (Appendix E). It is "*..easy just to use my notes to write down the grocery shopping list"* (Appendix G) and it also allows the participant to ".. *save old and useful grocery shopping lists for use more than once*" (Appendix H). P2 uses her note-taking app a lot for grocery shopping lists, where she writes down all the things she has to remember to buy. In relation to her grocery shopping list, she also reminds herself of what her and her family should have for dinner all week. Besides her large grocery

shopping list of everything to buy for every meal, she also constantly makes smaller grocery shopping list if she "*.. has forgot to buy something or suddenly need some other products*" (Appendix H).

P6 is one of the participants who use a note-taking app to remind himself of collected information regarded work. The work-related notes are created with his work computer and he use both a "*.. Word document to notes and then I have email notes, if someone sends me something useful, I have to remember and remind myself of.*" (Appendix L). P5 also uses her note-taking app to remind herself of work-related information, as she has a note with "*.. all the dates I would like to have extra shifts at work"* (Appendix K). This is two different ways of both creating and managing reminders with the same intention.

***Scenarios***

Several of the participants would also use their note-taking app to create some of the reminders in the nine scenarios from the CI sessions. In Scenario 1, 3, 5, and 7, participants chose to use their note-taking app to create the given reminder. Figure 9 below gives an overview of how many participants who chose to use the note-taking app in the four scenarios.

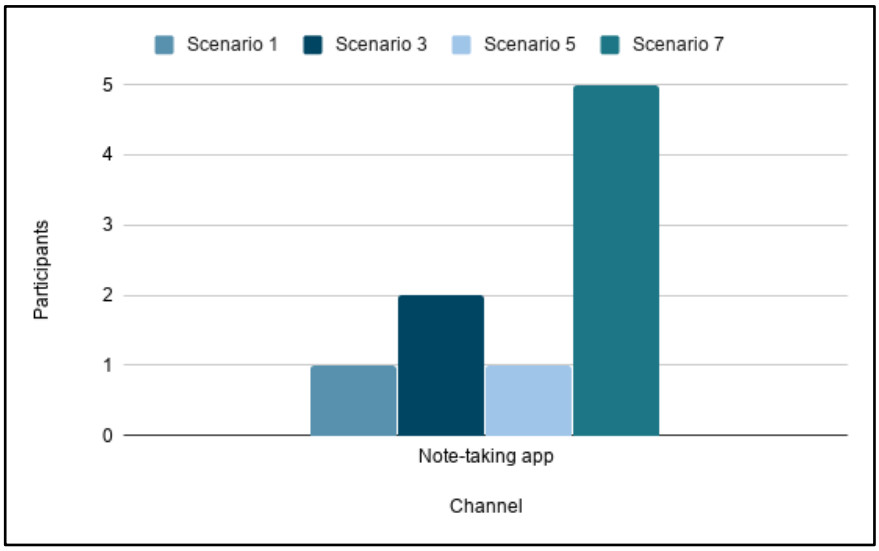



Figure 9: Number of participants who chose "Note-taking app" as a channel in the scenarios

It is especially Scenario 7, regarding remembering ingredients for a recipe, that the note-taking app was preferable among the participants. Five out of seven participants would use their note-taking app to remember all the ingredients, while the last two participants preferred to use either screenshots or photos. The one participants preferring the note-taking app in Scenario 1, calling the doctor in three days, and 5, remember to pick up a package, is P3, who earlier in the CI session explained that she "*.. most often use her note-taking app for reminders, because then everything is*

*at the same channel."*, which the scenarios also demonstrate. When looking at the analyzing of P3's "To do"-list, she already got her own reminder to send a package for her boyfriend. P3 and P4 are the two participants who chose the note-taking app in Scenario 3, out shopping and find a hat they want for birthday, and both would prefer the note-taking app and place information about the hat at their "Wish list".

### 4.2.4 Phone Alarm

Five out of seven participants use the phone alarm on their smartphone, and reminders in the phone alarm serve six different intentions. Table 11 below shows the intentions versus the activities for reminders created when using the phone alarm.

| | Inspiration | Contact | Schedule event | Purchase | Complete task | Collect |
|---|---|---|---|---|---|---|
| **Beauty & personal care** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Commuting** | 0 | 0 | 2 | 0 | 0 | 0 |
| **Education** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Fashion** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Food preparation** | 0 | 0 | 0 | 0 | 3 | 0 |
| **Health & household** | 0 | 0 | 0 | 0 | 3 | 0 |
| **Home & kitchen** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Personal administration** | 0 | 1 | 0 | 0 | 0 | 0 |
| **Resting** | 0 | 0 | 5 | 0 | 0 | 0 |
| **Social engagements** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Job application** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Vacation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Work** | 0 | 0 | 0 | 0 | 0 | 0 |

Table 11: Intentions versus Activities for reminders created with the phone alarm

The phone alarm is most used to remind the participants to get up in the morning and be ready for work. The two participants who did not use their phone alarm as alarm clock in the morning are either on maternity leave or unemployed. The phone alarm is also used to create reminders regarding to *commuting* in time to get from A to B, and P6 among others uses his phone alarm to "*.. remember when to leave so I can get from A to B in time*" (Appendix L). Three of the participants create reminders with their phone alarm with an activity of *Health and household*, because they have to remember to take medicine every day. P5 has created a daily reminder, which has the intentions to remind her of taking her birth control pill every day. All of the three participants who had the intention of remembering to take medicine is a birth control related pill, which is important to take at the same time every day for the best effect.

Two of the participants use the phone alarm to remind themselves of schedule events reminders. P5 often uses her phone alarm when she "*.. has to remember something the same day. That could*

*be if I have to call my school etc.*" (Appendix K). Also P1 uses her phone alarm to remember schedule events, because she often uses her phone alarm in "*.. relation to my calendar, so I both got the reminder in my calendar but also get an alarm when it is time to act upon my reminder*." (Appendix G) For P1, it is the combination of the calendar and phone alarm that makes the phone alarm relevant to her, because the alarm reminds her of the appointment in her calendar. This way of using the phone alarm, is the same way P1 uses the alarm with study-related appointments. It could e.g. be when she has to "*.. attend a meeting with her supervisor*" and it is important to her to be ready on time.

The phone alarm is also used when the activity of *Food preparation.* Two of the participants explained in the CI sessions, that they often use the phone alarm, when they have to remember cooking time for the food they make. As mentioned in section 4.1.2 Smartphone and channels, P6 uses the phone alarm when cooking in another way than P2. P6 explains: "*I use Google Assistant to set the alarm for me. Then I say e.g. "Set alarm for 30 minutes".*, when P6 afterward was asked why he did not set the alarm manual in the application, he said: "*I do not use the Alarm Timer because it is easier just to talk to Google Assistant. For example, I can just stand and stir in the sauce while I just tell Google Assistant to set an alarm for me"* (Appendix L).

When the participants had to go through the nine scenarios, it was only P1 and P5 who chose to use the phone alarm in some of the scenarios. P1 would use the phone alarm in Scenario 1 and 8, but in both scenarios, it would be in combination with her calendar (Appendix G). P1 does not choose to use the phone alarm in any of the scenarios without also using the calendar. P5 chose to use her phone alarm to create Scenario 1, 4, and 8. In Scenario 1, P5 would only use her phone alarm to remind herself of calling the doctor, while she in Scenario 4 chose to combine the phone alarm with browser tabs, where the intended action of the alarm would be to remember the opened browser tabs with a job to apply. Last, P5 would prefer to use her phone alarm to create Scenario 8, but only "*.. if it is a reminder I had to act upon the same day*" (Appendix K).

### 4.2.5 Screenshot and Photo

In this section, the results from the CI sessions regarding the intended actions for both screenshot and photo will be analyzed.

Six out of seven participants use screenshots as a channel for reminders, while four of the participants use photos as a channel for reminders. Even though screenshots and photos are almost the same function, the results of the CI sessions showed, there is a difference in the two channels' intended actions. To illustrate the intentions and activities in each channel, Figure 10 and Figure 11 were made:

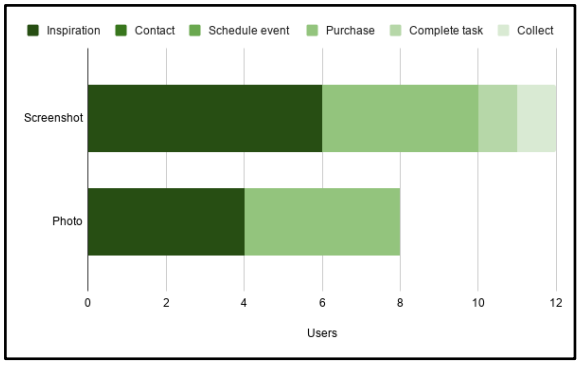



Figure 10: The intentions for screenshots & photos

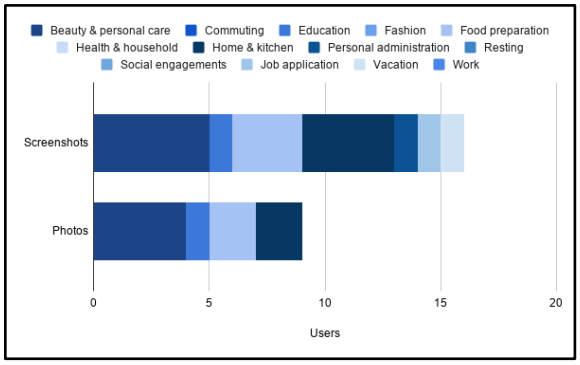



Figure 11: The activities for screenshots & photos

As Figure 10 shows, screenshots and photos are not as often used with the same intention. The participants use screenshots with four different intentions, while photos serve two different intentions. The two channels have many of the same intentions and activities, but we still find some differences between the two channels.

Creating reminders with the intention to remember some kind of *inspiration* are the most used intention in both screenshots and photos. The participants often find inspiration and recipes when browsing on their smartphone or computer, and when they find something interesting, they often take a screenshot or photo of the given recipe so they can have it for later use. Photos also often have the intended action of something *to buy*. P4 explains that it is: "*.. easy to take a photo when I am out shopping and find something, I want to remind myself of to buy later.*", and it is both within clothing, make-up, grocery etc. that the participants create reminders with photos or screenshots. When only looking at the intended actions of reminders created with photos, it is almost always with the intentions to either to buy or inspiration. Often the inspiration ends up with a buy later. Screenshots are also used with the intended action of buying. P5 shows us an example of a screenshot with "*.. some make-up I found on a website that I want to remember to buy*" (Appendix K), while P3 has kept a screenshot of a "*.. a baby wrap I want to remember to buy, when I can visit the seller after all this COVID-19*" (Appendix J).

P1 both uses screenshots and photos, when she creates reminders, but it is often with different intended actions. Below, two examples of how P1 uses both screenshots and photos as reminders are showed:

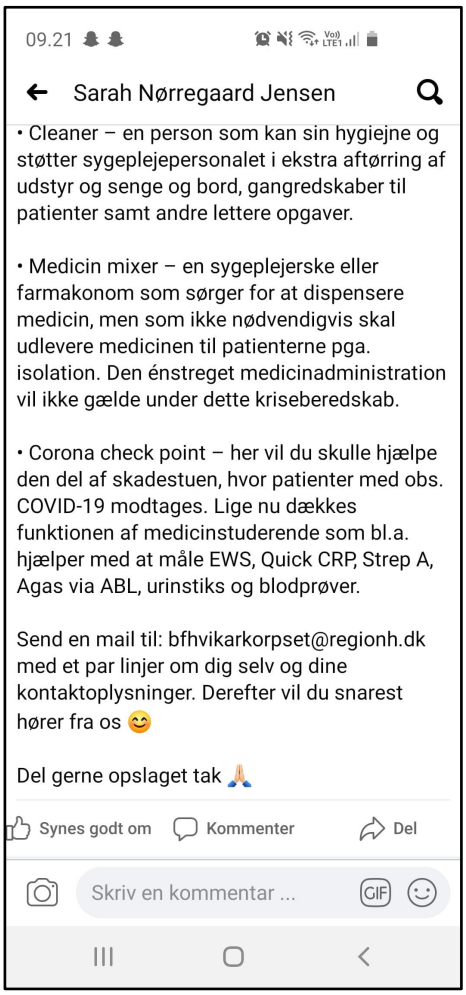



Image 14: Example of P1's screenshot

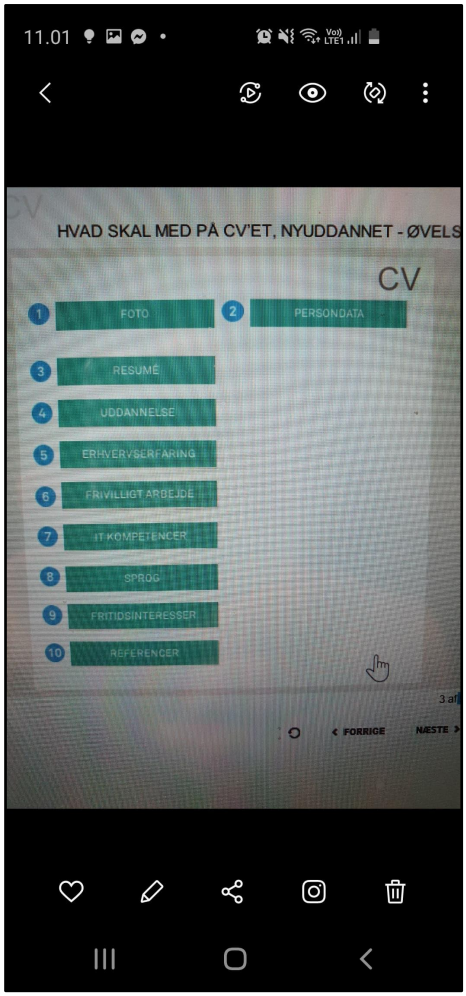



Image 15: Example of P1's photo

Image 14 is a screenshot taken by P1 of a job she may want to apply for. She "*.. found the job when browsing at Facebook and took a screenshot so I could remind myself to apply for the job later.*" (Appendix G). The intended action of the P1's screenshot is to apply *job*, because she chose to save it to remind herself to apply later. At Image 15, P1 took a photo of her laptop screen, because she wanted to "*.. remind myself of what is important to have on my CV, when I have to apply for a job after graduating"* (Appendix G). P1 created the photo reminder regarding 'CV Guide' because she wanted to remember what to write in her new CV.

P2 has a 10-year-old son, and she often uses screenshots to remind herself to act upon information from her son's school. P2 explains: "*.I e.g. take a screenshot of AULA (red. Danish learning platform) with information about his homework or important links he has to use.*". P3 also uses screenshots with the intended action of remembering personal-related information, which she gave an example of: *"I took a screenshot of a bill I received in E-Boks, and took the screenshot so I could remind myself of paying the bill in time."* (Appendix I). P4 also creates reminders with screenshots with the intended action to remind herself of personal-related information. P4 shows us during

the CI session an example of a screenshot with personal-related information. During COVID-19, her travel with Ryanair is canceled, so she ".. *took a screenshot of the application form to Ryanair, I have to fill out to get my money back"* (Appendix J).

Screenshots are also used to remind the participants of inspiration they have found interesting. P6 explains: "*I have taken this screenshot of a necklace, I would remember because it is the inspiration for a special designed necklace for my nephew, I want a jewelry designer to make for me*" (Appendix L). In addition, P3 also creates reminders with the intended action to get inspired. She showed us a screenshot of ".. *inspiration for better closet storage in my children's rooms, because we need more storage in our small room for our, soon, two kids"* (Appendix I). Another kind of a reminder with the intended action is inspiration, is P5's screenshot of a ".. *Instagram profile of a cocktail business that me and my boyfriend maybe could use for our wedding or maybe get inspiration of the drinks they sell"* (Appendix K). Thus, the intended action to get inspired is very wide and serves many kinds of inspiration.

***Scenarios***

Table 12 below shows an overview of how many participants chose to either use screenshots or photos to create the reminders from the scenario-sessions. Screenshots were the most popular channel to use compared to photos when looking at the scenarios.

| Scenario | Intended action | Participants choosing screenshot | Participants choosing photo |
|---|---|---|---|
| 2. You have found a t-shirt on the internet you will buy later. How do you remember it? | Purchase | 2 | - |
| 3. You are out shopping and find a hat, you want to remember, so you can add it on your birthday wish list. How do you remember it? | Purchase | - | 5 |
| 4. You have found a job on Jobindex as you want to apply in the next day. How do you remember the job? | Collect | 3 | - |
| 5. You received a text message saying you can pick up your package. How do you remember to get your package? | Complete task | 1 | - |
| 6. You must bring cake for work and have found a recipe on the internet. How do you save the recipe? | Inspiration | 3 | 1 |

| | | | |
|---|---|---|---|
| 7. Tomorrow you must go to the supermarket to buy ingredients for the cake. How do you remember all the ingredients? | Purchase | 1 | 1 |
| 8. You received an email about information regarding a meeting. How do you save and remember the information? | Schedule event | 1 | - |

Table 12: The intended actions in scenario 2-8 and how many participants using screenshot and photo in the scenarios

Scenario 2 and 3 both covers the intention of *purchase* a product, but we see a difference in which channel they use to create the reminder. When they find something to buy on the internet, they prefer to take a screenshot compared to photos, while when they are out in a store and find something to buy later, five of the participants preferred to take a photo. When looking at scenario 6, four participants out of seven chose to use either screenshots or photos, which was a reminder with the intention to get inspiration. As Table 12 shows, reminders created with screenshots and photos can serve many different intentions, which in the scenario-sessions were five different intentions.

### 4.2.6 Self-addressed text messages & Self-addressed emails

When looking at self-addressed text messages and self-addressed emails, the results of the CI session show that these channels are not that popular among the participants. Self-addressed text messages are used by four of the participants, while only one of the participants use self-addressed email. As only one user of self-addressed email, the intended action does not vary much. However, self-addressed text messages have different intended actions, but still in most of the same categories. To get an overview of the intentions and activities for both reminders at self-addressed text messages and emails, Figure 12 and Figure 13 were made:

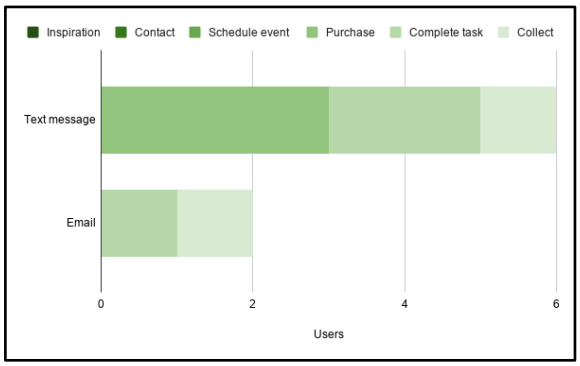



Figure 12: The intentions for text message and email

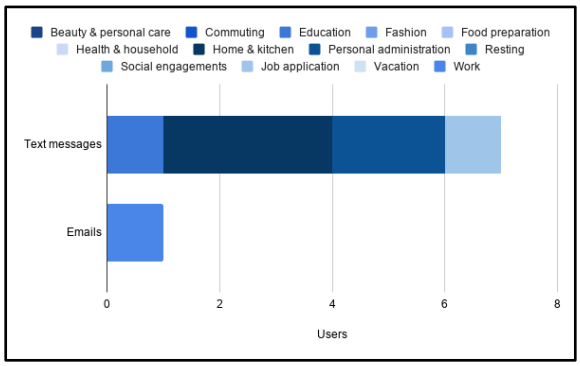



Figure 13: The activities for text message and email

Only P6 sends self-addressed emails, and it is always with the intention of remembering to *complete a task*. P5 uses self-addressed emails in two different ways, and he explains: "*I send myself unfinished emails, so I remember to finish it and send it. Moreover, I also send myself very important emails where I put myself CC, so I can remember the information from the email.*" (Appendix L). In both cases, it is only work-related information, P6 mails himself. We found some similarities between our findings and Bota et al. (2017), who argued that the typically information in self-addressed emails is reminders or to-dos, which we also detected. P6 send himself emails to remind himself of e.g. finish an email but also create small to-dos of what kind of tasks he has to complete at work.

P3 uses a messages thread with her boyfriend, where they often send self-addressed text messages, they both have to remember and/or act upon. This is most related to personal-related information, which often deals with information regarding their family. The self-addressed messages are often also with the intention of remembering *purchase.* P3 explains: "*I often send a self-addressed message with a small list of groceries, we (red. me and my boyfriend) need to buy. The message is often to myself, but often I send it in our conversation, so I see the message when we write together.*" (Appendix I). P6 also sends himself text messages, and he explains that it could be "*.. a recipe I find on the computer. Then I sent it to myself, so I also got it on my smartphone.".* P1 is also one of the participants, who send self-addressed text messages. This is most with the intended action of remembering some information. Moreover, P1 explains: "*I often send myself text messages, because I want to see the specific information on my computer, because it has a larger screen*". P1 shows us an example of a study-related picture she has sent herself, so she had the opportunity to open it on her computer, when she really had to use it for study (Appendix G).

***Scenarios***

Even though many of the participants do not use self-addressed text messages and emails, some of them chose to create some of the scenarios by sending themselves a text message, while none of participants chose to create a self-addressed email.

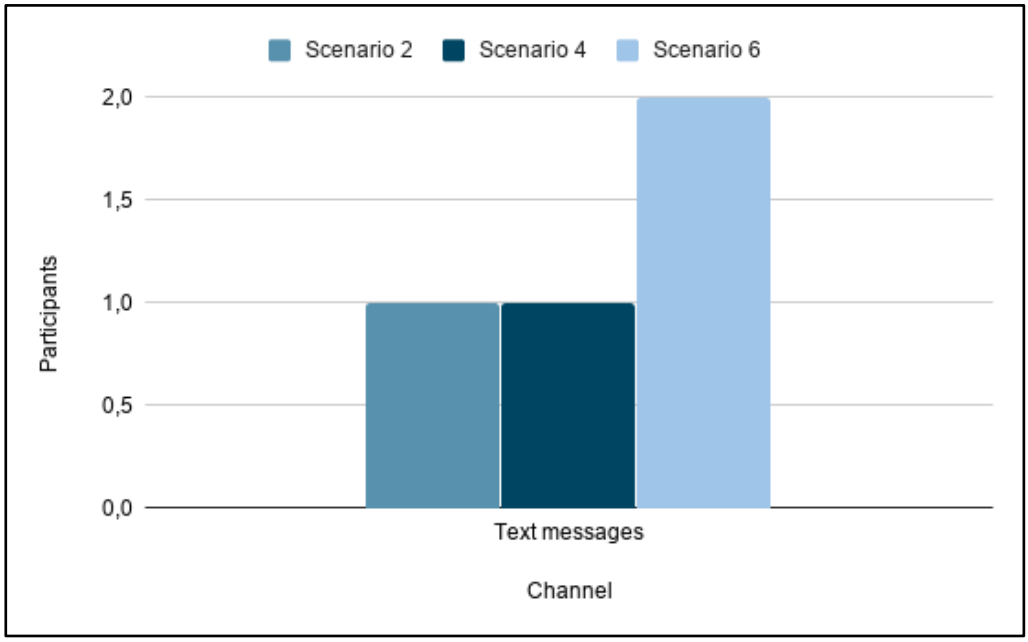



Figure 14: How many of the participants used self-addressed text messages to create scenario-reminders

The results of our scenario questions show that the participants' general use and observation of how they create digital reminders match their answer in the scenario part of the CI sessions. The interesting part is, the participants would use self-addressed text messages with three different intended actions. Scenario 2 has the intended action of something to buy, which P7 would use self-addressed messages for, because he would send the link of the t-shirt to himself to remember to buy it. The intended action in Scenario 4 is to apply for a job, and P5 explains: "*If I find the job at my computer, when I will send the link to myself, so I remember the specific job post*" (Appendix L). Last, two of the seven participants chose to use self-addressed messages to create Scenario 6, which is a scenario with the intended action of remembering a recipe. Both P5 and P6 would send themselves a text message, but as in Scenario 4, the participants would create a self-addressed text message, because they ".. *assume I found the recipe at their computer*" (Appendix K) because if they found it on their smartphone they would ".. *probably just keep the tab open or take a screenshot*" (Appendix K).

### 4.2.7 Desktops

Three out of seven participants use their desktop to create digital reminders, and to illustrate the intention versus the activities for reminders created at the desktop, Table 13 was made:

| | Inspiration | Contact | Schedule event | Purchase | Complete task | Collect |
|---|---|---|---|---|---|---|
| **Beauty & personal care** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Commuting** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Education** | 0 | 0 | 0 | 0 | 1 | 0 |
| **Fashion** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Food preparation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Health & household** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Home & kitchen** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Personal administration** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Resting** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social engagements** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Job application** | 0 | 0 | 0 | 0 | 1 | 1 |
| **Vacation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Work** | 0 | 0 | 0 | 0 | 1 | 0 |

Table 13: Intentions versus Activities for reminders created at the desktop

As Table 13 shows, the three participants use the desktop with two different intentions. P2 is the one, who uses her desktop to remind herself of the work-related tasks she has to complete. As P2 explains: "*Things I am doing right now at work which both could be summaries for earlier meetings or a work task I have to do"* (Appendix H). P7 is the one participant, who only uses his desktop to remind himself to both *collect* and *complete task*. When the CI session with P7 takes place, he has a freshly made reminder on his desktop, which is specific information about a job interview he has to attend. The note contained information about ".. *time, date and the person I am going to be interviewed by"* (Appendix M).

P3 is the one participant, who uses her desktop with the intention of remembering an activity for *education*. Image 16 below shows how P3 uses her desktop to manage reminders.

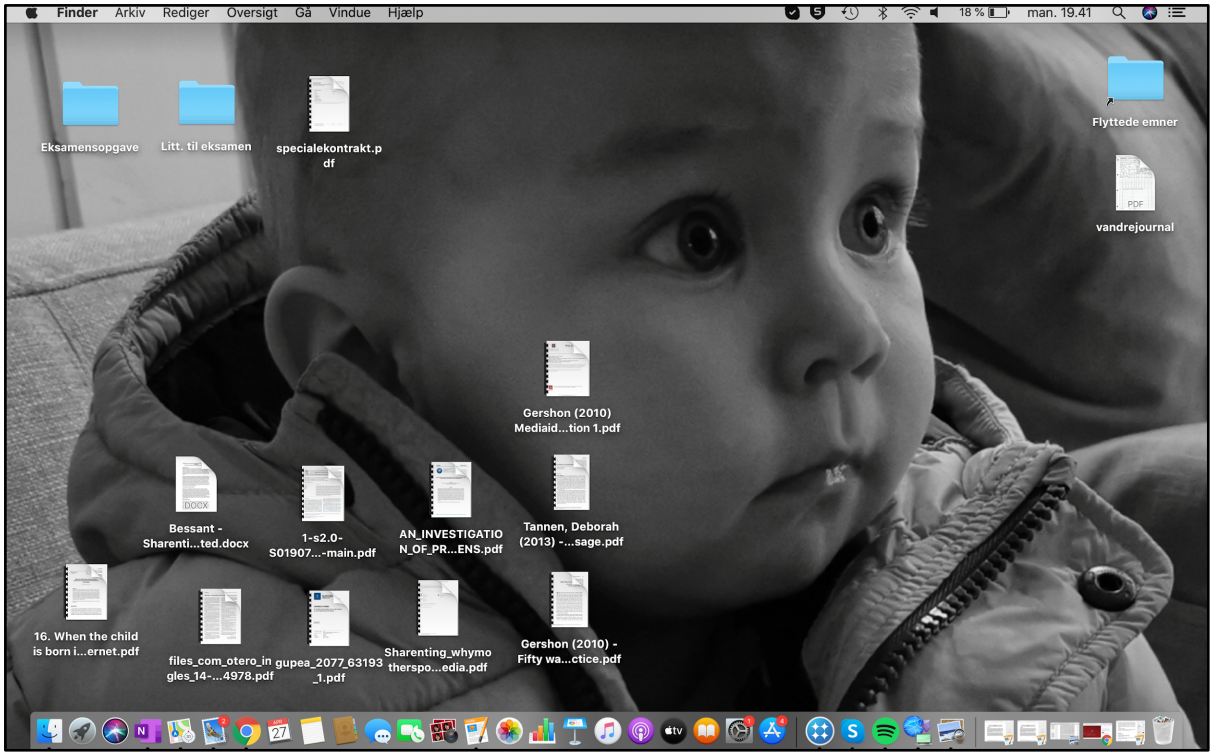



Image 16: Example of P3's desktop

As Image 16 shows, P3 has saved some documents on her laptop and placed them on her desktop. The documents are always only related to her study, and this is the only kind of reminder she uses her desktop to. P3 explains: "*The documents that I use while on a course are on the desk."* Moreover, P3 also keeps ".. *texts I have to read for the next lesson, so I remember to read them in time*." (Appendix J).

### 4.2.8 Social Media

The last channel is Social Media, and three of the participants use social media to create and manage reminders. According to the three participants, they use both Facebook, Instagram and LinkedIn. To get an overview of the intentions and activities when using social medias for reminders, Table 14 was made:

| | Inspiration | Contact | Schedule event | Purchase | Complete task | Collect |
|---|---|---|---|---|---|---|
| **Beauty & personal care** | 1 | 0 | 0 | 0 | 0 | 0 |
| **Commuting** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Education** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Fashion** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Food preparation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Health & household** | 2 | 0 | 0 | 0 | 0 | 0 |
| **Home & kitchen** | 2 | 0 | 0 | 0 | 0 | 0 |
| **Personal administration** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Resting** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Social engagements** | 1 | 0 | 1 | 0 | 0 | 0 |
| **Job application** | 0 | 0 | 0 | 0 | 0 | 1 |
| **Vacation** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Work** | 0 | 0 | 0 | 0 | 0 | 0 |

Table 14: Intentions versus Activities for reminders created at social media

As Table 14 shows, reminders created on social media often have the intention to remember some kind of *inspiration*. Instagram gives the user the opportunity to save posts from other users, and this is a function all the three participants use. P1 saves a lot of recipes on Instagram, so she can both "*.. get inspiration for my meal plan and remind myself of a specific recipe, as I can cook.*" (Appendix G). P4 also uses Instagram to create and manage reminders, which most often are with the intended action of inspiration. Image 17 and Image 18 below show two examples of what P1 and P4 want to remind themselves of with reminders at Instagram.

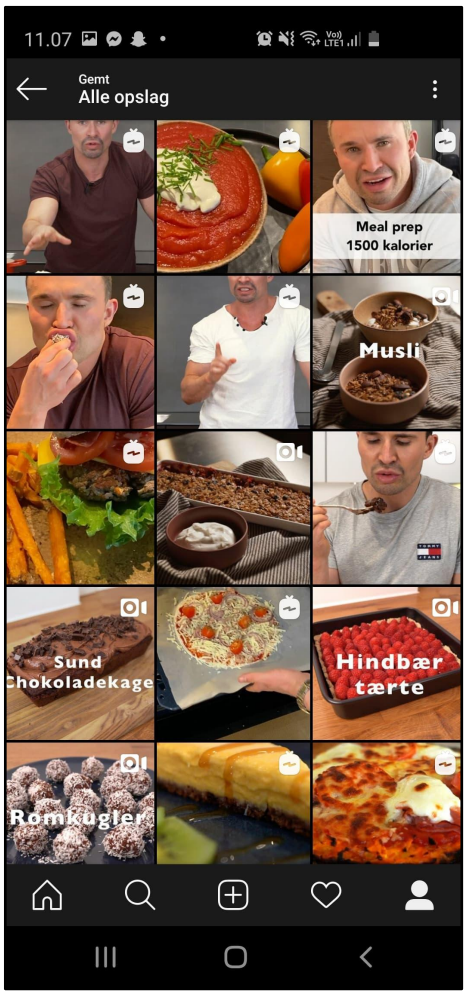



Image 17: Example of P1's Social Media

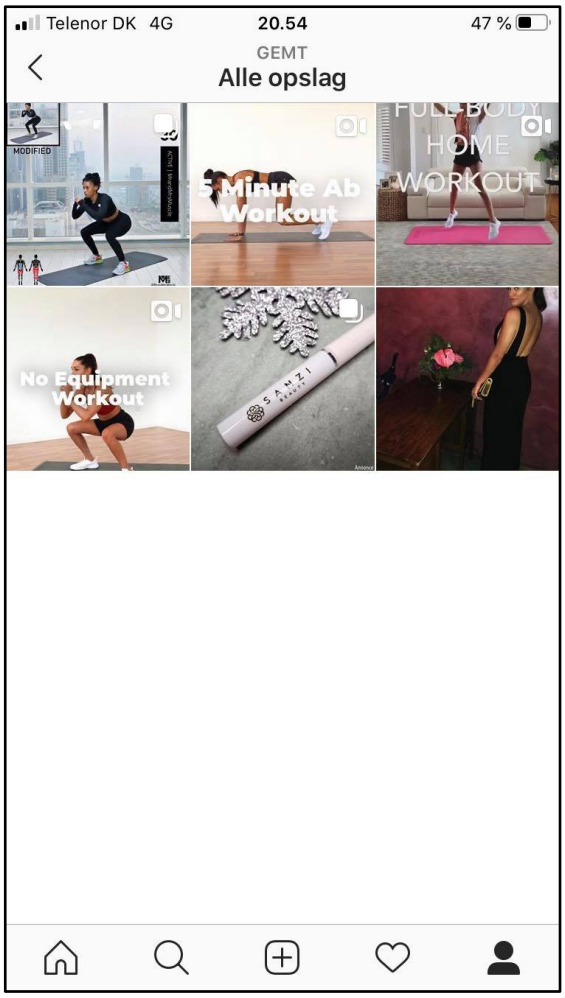



Image 18: Example of P4's Social Media

Image 17 shows some of the reminders created of P1 at Instagram, and all the 15 reminders are created with the intended action of remembering a recipe. Instagram became a *".. digital cookbook"* for P1 (Appendix G). At Image 18, P4 has created six reminders at Instagram, and four of the reminders are with the intended action of getting fitness inspiration. The last two reminders are shopping inspiration that P4 has saved so she reminds herself of ".. *that I maybe could buy the product, if I need it and have the time"* (Appendix J).

P3 is the participant, who uses social media the most when it comes to create and manage reminders at social media. P3 also uses Instagram to create reminders, and this is most often with the intended action to get inspired. P3 has several reminders created at Instagram, and to get an understanding of what kind of reminders she creates, Image 19 and Image 20 illustrate it below:

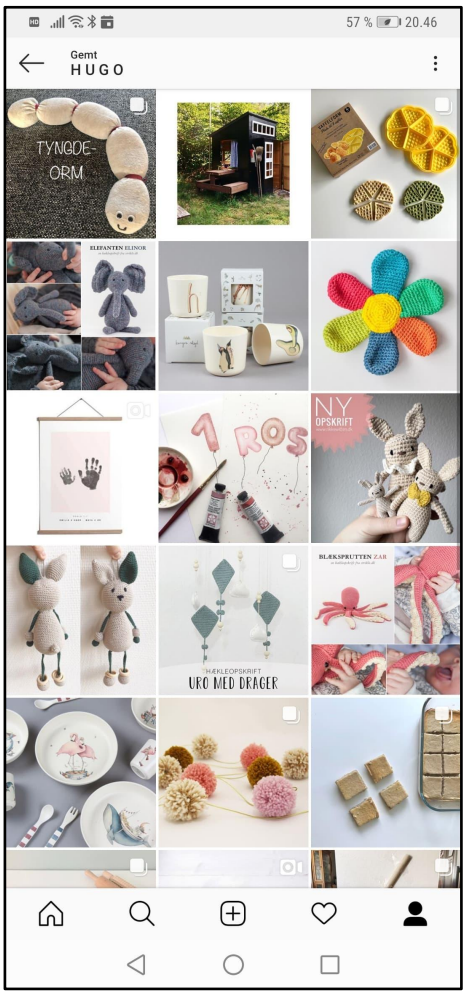



Image 19: Example of P3's Social Media

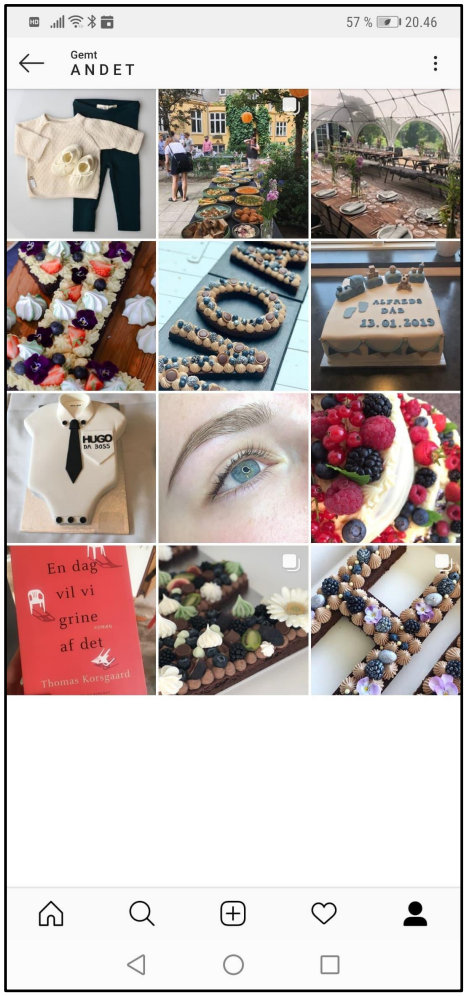



Image 20: Example of P3's Social Media

At Image 1, P3 has created reminders regarding inspiration for what to do with her one-year old son or inspiration related to her son. P3 explains: "*I am very creative and do a lot of stuff with my son, so I always save other users' posts regarding stuff I can do with my son"* (Appendix J). Image 20 illustrates 12 other reminders with the intended action of being inspired. The reminders at Image 20 are especially different kinds of cakes, which P3 created "*.. when I was looking for inspiration for my son's naming celebration."* (Appendix J).

The participants also use Facebook, which only remembers personal-related appointments, such as, when ".. *getting invited to an event on Facebook"* (Appendix P1), or when family and friends have birthdays. Especially remembering birthdays is the most used intended action. When the participants had to do the Scenario reminders, five out of seven participants would use Facebook as a social media to remind them of family members or friends' birthdays. P1 also use the social media, LinkedIn, to create reminders with the intention of *collect*, when she e.g. "*.. seeing an interesting job post on LinkedIn, I use the 'Save' function at LinkedIn and save the job post, so I can apply later.*" (Appendix G).

### 4.2.9 Summary

We detect a variation in both the intentions and activities depending on the channel. Our findings show, some channels serve up to five different intentions while channels like *self-addressed email* and *desktop* only have two different intentions. When we look at the reminder's activities, we also detect a variation from each channel. Reminders created with *screenshots* serve seven different activities, while *self-addressed email* only has one activity. The activities vary from remembering to *buy groceries* to *finish an email*.

## 4.3 Cues in digital reminders

In this section, results regarding RQ2 and RQ5 will be analyzed.

RQ2: Which cues do people use in their digital reminders?

RQ5: How are cues of digital reminders activated?

It is important to understand what kind of cues the participants use in their reminders. Cues can be anything from a subject line in emails, notification messages, alarm sound etc. Furthermore, the results of how cues are activated will be analyzed.

Based on the results from the CI sessions, these four different cues were coded: (1) Alarm sound, (2) Unread, (3) Check channel and, 4), Push notification To get an understanding of what kind of cues the participants used when creating digital reminders, Figure 15 was made:

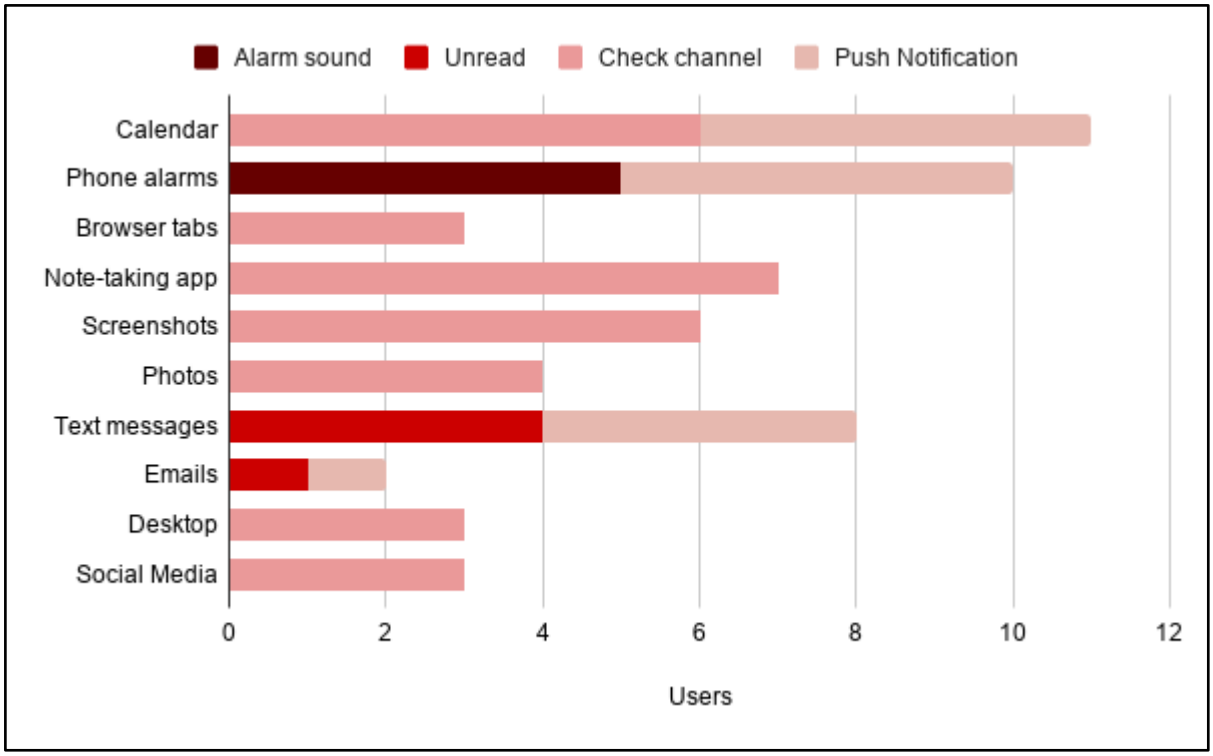



Figure 15: Overview of what cues the participants use in each channel

As Figure 15 shows, most of the participants only check the channel to remember a specific reminder (Appendix E). The calendar, phone alarms, text messages and emails are the channels, the participants use most different cues to remember their reminders. As Manning and Edwards (1995) describes, the best way of remembering a reminder is to both having the cues visible throughout both stages, *rehearsal* and *retrieval*, which the participants do not often do. Some of the participants combine the use of their calendar and phone alarms, when they have to remember a reminder. P1 describes that she "*.. both create a reminder in my calendar and in my phone alarms when it is important to act upon on a specific time."* (Appendix G). P1 continues and says: "*.. my calendar does not make a sound when making a notification for a reminder, so I combine it with my phone alarms to get the alarm sound.*" (Appendix G). The calendar application only gives the participant the opportunity to create a silent notification, which makes the phone alarm useful to get an alarm sound. When P4 must remember a meeting, complete a task etc. at work, she uses her notification system in her calendar, which gives her a "*..push notification 15 minutes before, 10 minutes before, and 5 min minutes before the reminder is set to. If I do not make them at 'agreed time', they pop up the next day with red and show that I did not make it*" (Appendix J). The push notifications are P4's cue to remember to complete tasks at work or attend meetings.

Common for both browser tabs, note-taking apps, screenshots, photos, desktop, and social media are, the participants do not use a special cue to remember reminders in the channel. Instead, the participants explained in the CI sessions, that they "*.. just check the channel*" (Appendix I). But how

often the participants check the channel vary a lot from participant to participant, and it depends on what kind of reminders the participants create. The participants were asked, how often they browse through the different channels, so we could get an overview of how often they check reminders in each channel.

| | Daily | 1-3 times a week | 2-3 times a month | Once a month | Never |
|---|---|---|---|---|---|
| **Calendar** | 3 | 2 | 1 | 0 | 0 |
| **Phone alarms** | 1 | 1 | 1 | 0 | 2 |
| **Browser tabs** | 1 | 1 | 1 | 1 | 0 |
| **Note-taking app** | 1 | 4 | 1 | | 0 |
| **Screenshots** | 1 | 1 | 3 | 1 | 0 |
| **Photos** | 0 | 1 | 2 | 1 | 0 |
| **Text messages** | 0 | 0 | 1 | 0 | 1 |
| **Emails** | 2 | 0 | 0 | 0 | 0 |
| **Desktop** | 0 | 2 | 0 | 1 | 0 |
| **Social Media** | 1 | 0 | 0 | 2 | 0 |

Table 15: How often the participants browse through each channel

We have coded the participants answers of how often they browse through each channel into five categories, to get a better overview. As Table 15 shows, three of the participants check their calendar daily, where P1 "*.. checks it around three times a day"* (Appendix G). P4 do not check her calendar every day, but instead she explains: "*I often check my calendar in the weekend to see what my plans for the upcoming week are.*" (Appendix J). P3 is the participant, who only check her calendar "*..once in a while"*, which she thinks is around 2-3 times a month (Appendix I). When looking at the phone alarm, the participants do not that often check the channel. The participants most often use the phone alarm with the intention to get up in the morning, and therefore it is not as relevant to check the channel every day. The participant who uses self-addressed emails as a channel, check the channel every day. P6 explains: "*I check my email daily, so I can see if I have received something important from work*" (Appendix L).

Even though the participants check their social medias every day, they do not check the created reminders in the channel. Only P3 daily check her social media with the intention to browse through her reminders. However, both P1 and P4 only check their reminders on social media once a month. It also results in P1 always "*.. forget that I have created a reminder"* (Appendix G). The note-taking applications are the second most checked channel, where P3 check the note-taking application *".. every day"*, while four of the participants check their notes 1-3 times a week. P6, who create work-related reminders, only check his reminders in the note-taking app 2-3 times a month. Both screenshots and photos are channels, the participants do not check as often as other channels. Most of the participants check their screenshots and photos 2-3 times a month.

When analyzing the reminders' cues, it is also important to analyze the cue action. According to McDaniel and Einstein (2007), prospective memory can be divided into three types: *event-based, time-based* and *activity-based*. Based on the analyze of the data from the CI sessions, we only use event-based prospective memory and time-based prospective memory. Furthermore, time-based memory has been divided into *recurring* and *single use*. To get an overview of the cue action, Figure 16 was made:

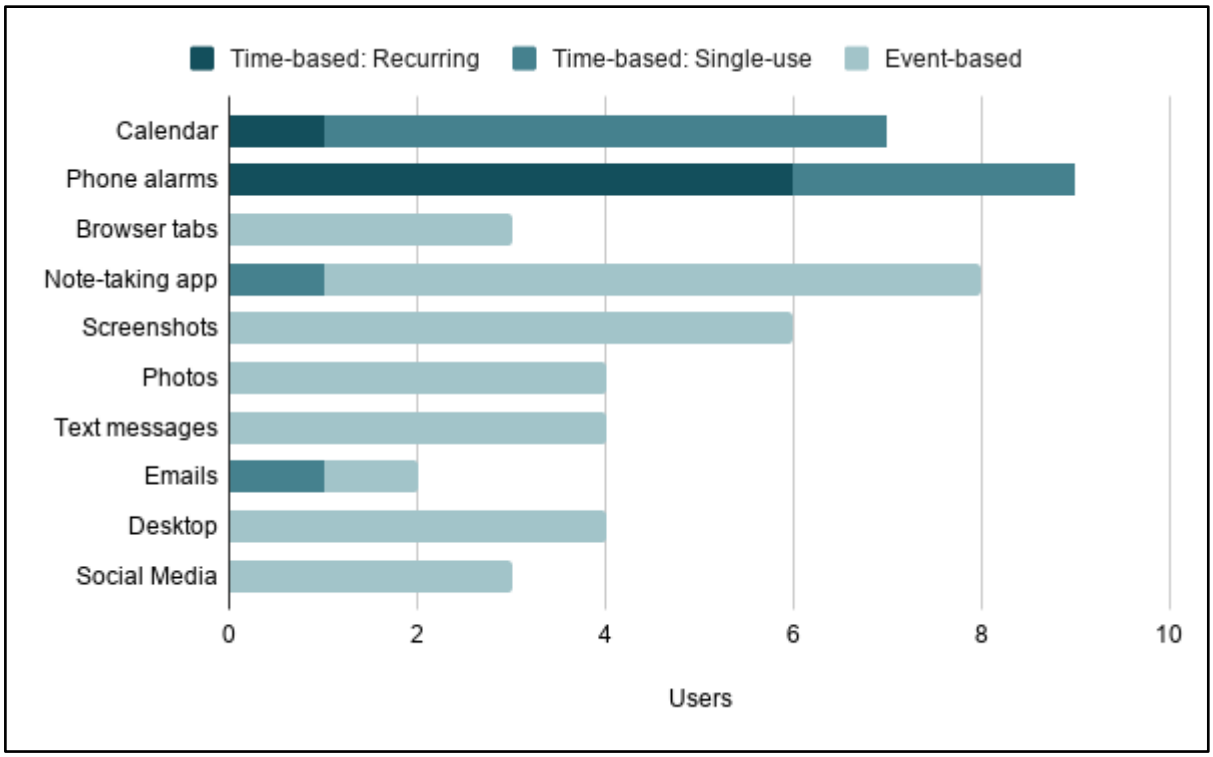



Figure 16: Overview of the participants use of cue actions in each channel

In eight out of 10 channels, the cue actions are most often *event-based*, which mean the participants remember to perform certain actions when specific circumstances occur. When looking at the note-taking app, most of the participants use the channel to create grocery shopping lists. The participants remember their reminder when "*..standing in the supermarket and then know I have a grocery shopping list in my notes"* (Appendix G).

The calendar is time-based and the participants both have recurring and single-use reminders. P2 showed us reminders in her calendar, which had a time-based recurring cue action, because she had created a weekly reminder to remember "*.. my son's weekly karate class*" (Appendix H). Six of the participants create reminders with time-based: single-use cue action, which often is social engagements. The social engagements are single use, because it is a reminder of one specific event that only occur at one specific date and time. The participants do most often have reminders that are time-based: recurring phone alarms. The time-based recurring reminder is the participants

daily alarm clock that reminds the participants to get up in the morning and go to work. The phone alarms, which are time-based: single use, is e.g. "*When I cook, I set an alarm so I remember when my food is finish"* (Appendix L) or "*I set an alarm to remember when my son has to read his 20 minutes a day, so I know when time is up"* (Appendix H). These kinds of reminders are single use, because it is not a reminder the participant re-use.

We detect a connection between the cues and cue actions, when the cue is *check channel*, the cue action is most often *event based*. When the cue action is event-based, the participant do not need to get a push notification, alarm sound or leave the reminder unread, because they will remember the reminder ' by themselves', because the reminder will occur in their memory when they are in a specific situation or event.

## 4.4 Organizing digital reminders

When creating reminders, it can be necessary to organize it in a special way to ensure the participants remember the reminder. To investigate how people organize reminders in different channels, RQ 3 was made:

RQ 3: How do people organize their digital reminders?

How to organize and structure information is very individual, and there is not a 'correct' way of doing it. We have through the CI sessions tried to understand, how the participants organize reminders in each channel. To get an overview of the organizing of reminders, a heat map in Table 16 was made:

| | Organization structure | | Organization scheme | | |
|---|---|---|---|---|---|
| | Folder | List | Chronological | Color | Label |
| Calendar | 0 | 0 | 6 | 1 | 6 |
| Phone alarm | 0 | 0 | 6 | 0 | 0 |
| Browser tab | 0 | 0 | 3 | 0 | 0 |
| Note-taking app | 1 | 5 | 5 | 1 | 6 |
| Screenshot | 4 | 0 | 6 | 0 | 1 |
| Photo | 4 | 0 | 4 | 0 | 0 |
| Text message | 0 | 0 | 4 | 0 | 0 |
| Email | 1 | 0 | 1 | 0 | 0 |
| Desktop | 1 | 0 | 0 | 0 | 3 |
| Social Media | 1 | 0 | 3 | 0 | 0 |

Table 16: Heat map of how the participants organize reminders in each channel

We are aware of multiple other ways of organizing information, but these five ways were the one we detected in our data. The reminders could e.g. have an organization structure by alphabetical

or geographical, while it e.g. could have a task-oriented or topical scheme in the organization scheme (Morville & Rosenfeld, 2002) Instead, we chose only to use *Folder* and *List* within organization structure, and *Chronological, Color,* and *Label* within organization scheme. As Table 16 shows, almost all the reminders are chronological organized, and the reason for the large use of chronological organization is that the smartphone most often organize information chronological, thus the date and time the reminder was created. Therefore, it is not a way of organizing reminders, which the participants do by themselves, but instead a function in the channel. Even though many of the reminders are chronological organized, the participants also use other kinds of organization structure and scheme to organize created reminders.

Six out of six participants' reminders created in the calendar have a label. The label is created, so the participants know what the reminder is about. Below, two examples of how P1 and P6 create labels when they create reminders in their calendar.

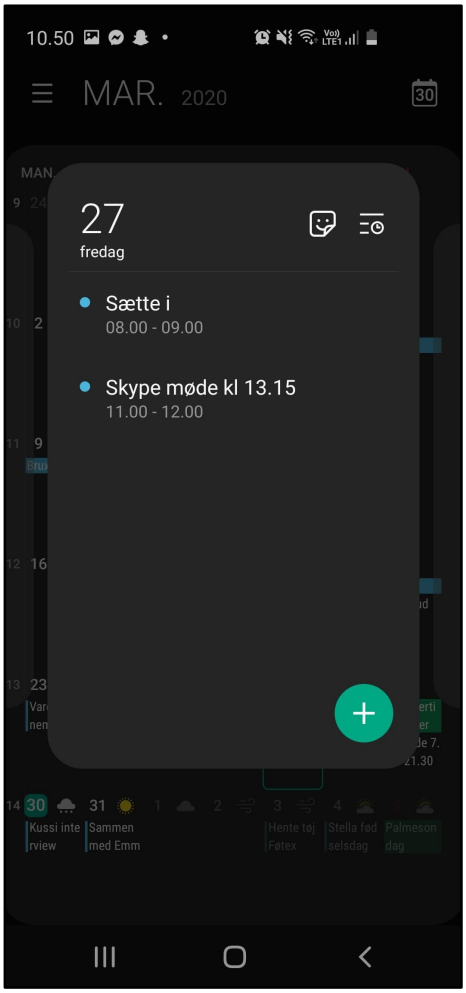



Image 21: Example of P1's label in calendar

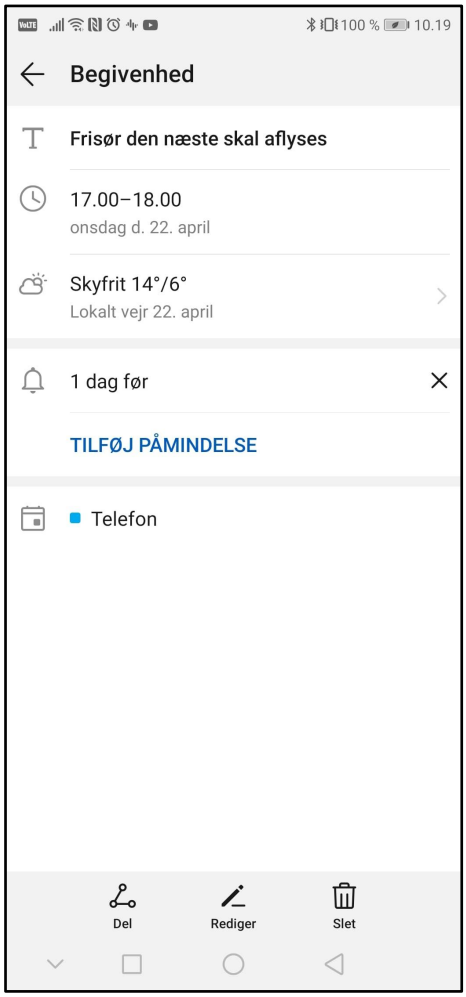
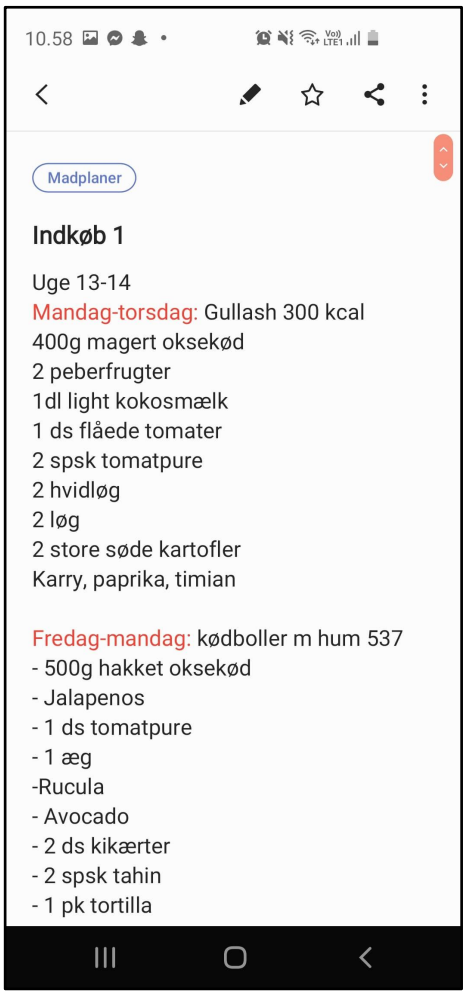



Image 22: Example of P6's label in calendar

Image 21 shows two of P1's reminders, where she uses the label in two different ways. The top reminder says: "*Put in"*, which is very short and not descriptive, while the button reminder has a more detailed label saying, "*Skype meeting at 13:15"*. This reminder both have a specific label for what P1 has to do and also the time. But if we look closely at the reminder, P1 has created the reminder between 11:00-12:00, while the label says 13:15. Thus, the reminder can create confusing because it says two different times. At Image 22, P6 shows an example of one of his reminders in his calendar. This reminder is 'two in one' and says, "*Hairdresser remember to cancel next appointment"*. The label makes the reminder into two different reminders, because P6 both has to remember an appointment at his hairdresser and also cancel another appointment, he does not need anymore. Beside the label, P6 also placed the reminder in the time period he has to be at his hairdresser, which makes the reminder organized both chronological and by a label.

The note-taking application is the only channel, which is organized by both all the organization structure and organization scheme. Five of the participants organize reminders chronological, because their smartphone automatically organizes the notes by when they were last created or edited. Only P7 does not organize reminders created with a note-taking app chronological, because he uses the note-taking application on his desktop computer and save the reminder on his desktop. Five of the participants organize reminders in the note-taking app by lists, but the participants do not make the same kind of grocery shopping lists. Below, Image 23 and Image 24 show to different ways to do grocery shopping lists:



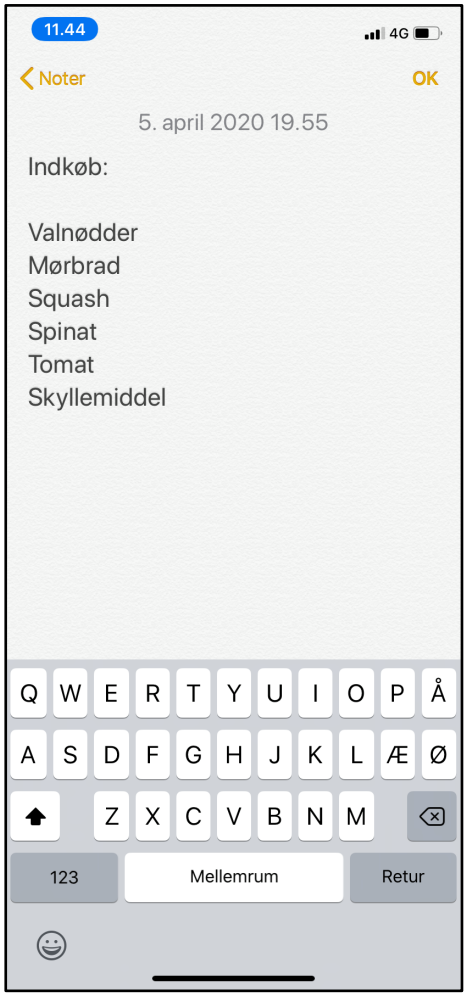




Image 23: Example of P1's grocery shopping list  Image 24: Example of P2's grocery shopping list

Image 23 is an example of how P1 reminds herself of what to buy when she is doing grocery shopping. She writes very specific what she must buy for each week and uses bullet points to structure her list. Moreover, P1's grocery shopping list is very specific with number of how many pieces to buy of each grocery. On the other hand, P2 created a way simpler grocery list in her note-taking app. P2's list does not contain bullet points or specific number of how much to buy.

P6 is the only participant, who organize some of his note-taking reminders in folders. P6 explains "*I have a folder on my work computer called 'Notes', where I place all my notes"* (Appendix L). P2 is the participant, who also organizes reminders in her note-taking app by colors, and she explains: *"I organize by color after 'personal' and 'spare time. For instance, 'spare time' covers my reminders regarding 'Things to do with Hugo', while a 'personal' note is e.g. 'Wish List'"* (Appendix I).

Screenshots and photos are organized by folders and chronological. The participants' smartphones create folders called 'Photos", 'Screenshots' etc., but P2 and P4 do also create folders by themselves to organize photos and screenshots as reminders. P4 explains: "*I have created*

*different folders. For instance, I have a folder called 'Apartment', where all photos of our apartment before we moved in are organized"* (Appendix J). Moreover, P4 also created a folder called 'Recipes' where she organizes all her photos and screenshots regarding a recipe. When we investigate the 'Recipes' folder, P4 organize all photos and screenshots chronological where the oldest reminder is from April 2014 and the latest attend is at October 2017 (Appendix J).

When looking at self-addressed emails, P6 is the only participant who creates reminders this way. As analyzed in section 4.2.6, P6 sends himself emails when he is at work and only creates work-related reminders. To ensure an easy and smooth process when re-finding his reminders, he organizes his reminders in self-created folders. P6 has created several folders to save reminders. Image 25 and Image 26 below show how P6 organize his email.

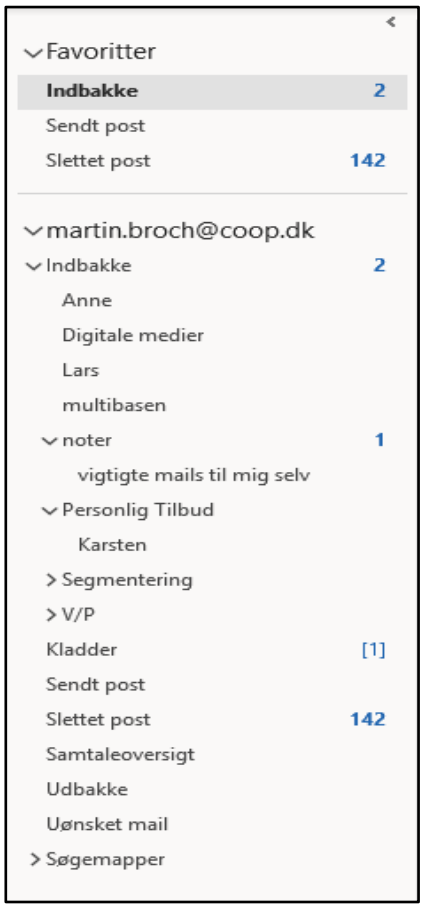



Image 25: Example of P6's folders in his email

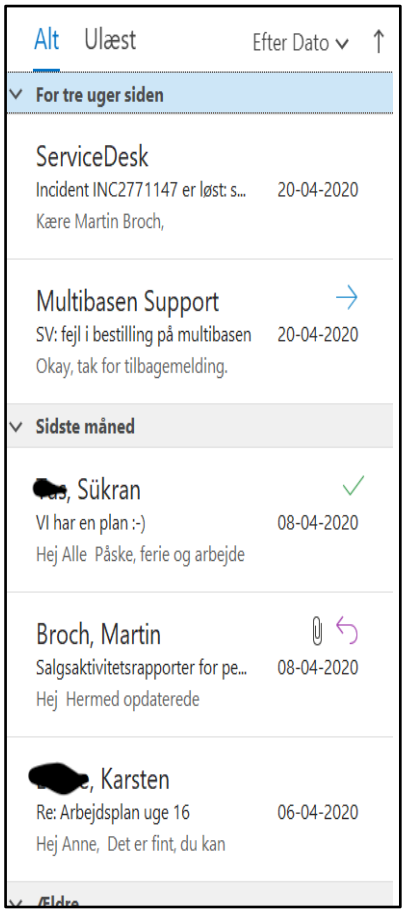



Image 26: Example of P6's how emails are organized

As Image 25 shows, P6 has created a folder called 'Notes', which contain another folder called 'Important mails to me'. Moreover, P6 has created several different folders depending on the department he is in. When he receives important information, he put himself CC and afterward organizes the email in the correct 'department folder' as the reminder belongs to. Image 26 illustrates how the reminders in the folder *'Notes'* is organized. P6 does not organize the emails

by himself but has chosen to use the chronological function and thereby organize reminders in each folder chronological. Thus, the organization structure in P6's email is the folders, while the organization scheme is when the emails are organized chronological.

P3 creates reminders with both her desktop and social media. Common for both desktop and social media are that P3 uses the organization structure, *folder.* P3 organizes her study-related files and reminders in folders, while documents she must remember to act upon within a short period of time are directly on her desktop. These reminders got a label, which e.g. is the name of the literature, and '*Thesis contract*'. P6 explains: "*When I have to remember to read literature to next class, I organize the literature on my desktop. When I have read it and we have reviewed it in class, I move it into the folder."* (Appendix I). The way of organizing reminders on P3's desktop is very clear, where she uses the organization scheme when it is a 'on going' reminder and the organization structure, folders, when she has acted upon the reminder. Looking at P3's social media, Instagram, she also organizes her reminders in folders. The folders are divided into: All posts, *Hugo* (P3's child), *Home*, *children's room, Other,* and *Crea*.

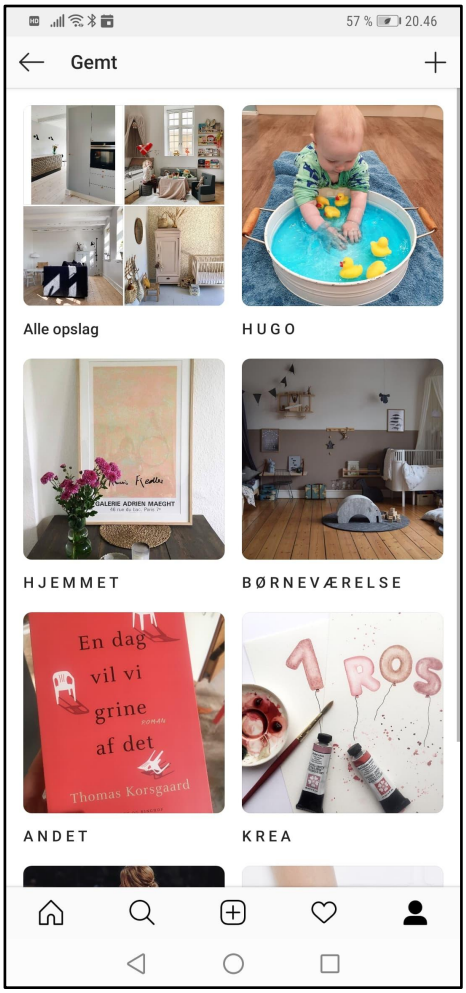



Image 27: Example of P3's Social Media

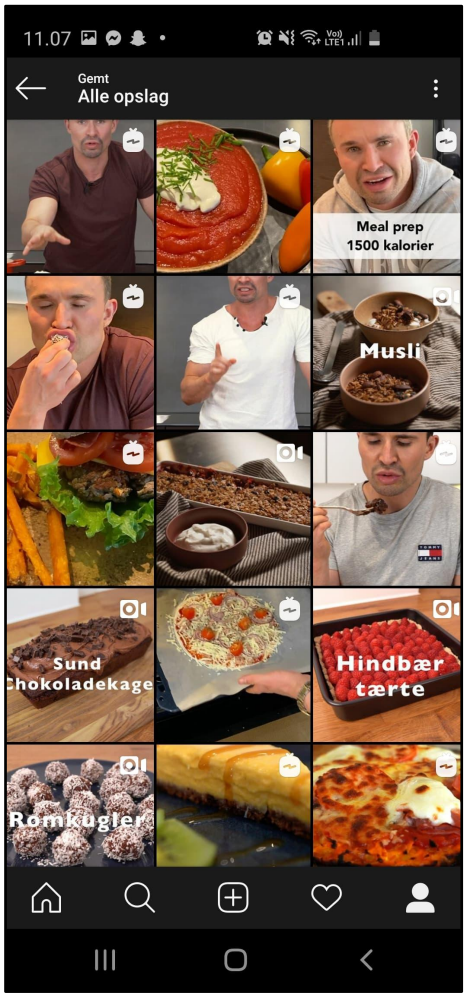



Image 28: Example of P1's Social Media

P1 does not organizes her reminders in Instagram with an organization structure, but only with an organization scheme, which is chronological organization. P1 has saved all reminders in her Instagram in one large folder called '*All posts',* which is automatically created by Instagram. Thus, the organization structure is not chosen by P1, while the organization scheme neither is chosen by P1, because Instagram automatically organizes the saved post chronological. P1 explains the active choice of not to organize reminders in Instagram is because ".. *I most often only create reminders regarding recipes or fitness inspiration, so I do not need to organize it in specific folders"* (Appendix G).

We can conclude the automatically structure scheme, which smartphones and computers offers the user means that the participants do not have to organize reminders themselves because the device automatically organize the information chronological and sometimes also in folders created by the system.

## 4.5 Context created and acted upon

It is both relevant to investigate in which context do people create, e.g. at work, home, stores etc. but also, in which contexts should the intended action take place. With RQ 6 and RQ 7, we try to understand the contexts of the created reminders and in which context they intended to act upon it:

RQ 6: In which contexts are digital reminders created?

RQ 7: In which contexts should the intended action take place?

We will in this section analyze what the context created, and context acted upon are in each channel for the seven participants.

During the CI sessions, the participants were asked "*In which context do you create reminders in this channel"* and "*Where are you when you act upon reminders in this channel?"*. It was difficult for the participants to tell the exact context. Thus, the participants explained in percent the context and where they act upon the reminders. Based on the results from the CI sessions, we chose to code four contexts: (1) *Work*, (2) *Home*, (3) *Other*, and (4) *Transport*. *Other* covers when the participants are outside, which e.g. can be with friends and family, out shopping, going for a walk etc.

### 4.5.1 Calendar

Six out of seven participants use the calendar to create reminders. To get an overview of the context, Figure 17 and Figure 18 were made:

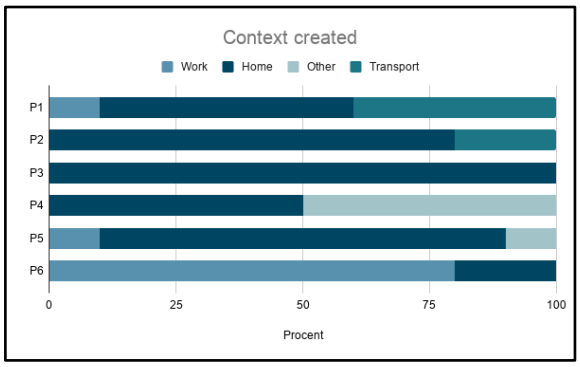



Figure 17: Context created in the calendar

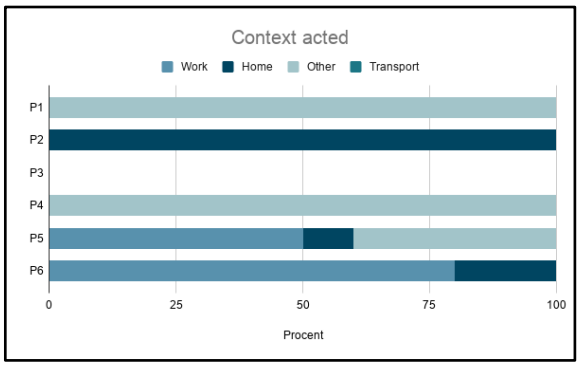



Figure 18: Context acted in the calendar

When reminders are created in the calendar, the context is most often *Home*. All the participants create reminders at home, and four of the participants are most of the time at home when creating reminders in the calendar, while P4 is 50% at home and P6 is 25% at home when creating reminders in the calendar. P2 explains: "*I believe that I am home in 70% of the time when I create reminders in my calendar. When I am home, I have the time to sit down and plan the coming days or weeks*." (Appendix H). P5 estimates, she creates reminders in her calendar at home in 80% of the time. The remaining 20% is split by *work* and *other*. P1 and P2 also create reminders when they are in transport, because the participants have time to just sit with their smartphone and get an overview and create reminders. P2 explains: "*When we drive to our cottage, I like to use some of the time to create reminders in my calendar."* (Appendix H). P1 estimates that she in 40% of the time creates reminders in her calendar when she is in transport.

P1, P5 and P6 create reminders in the calendar when they are at work. Both P1 and P5 estimate that they are in a work context 10% of the time, while P6 believes he is at work 80% of the time when using the calendar to create reminders. Only P4 and P5 think they create reminders in the context of *other*. As mentioned earlier, *other* covers when the participants are outside with friends/family, out shopping etc. P4 estimates that she in 50% of the times are in another place than home, work or transport, when she uses her calendar for reminders. She explains: "*I often create reminders in my calendar when I am outside and plan something with friends and family. Then I immediately write the social engagements into* "*When I visited my grandma, she told me to save the date for her birthday before we received the invitation. When sitting at her dining table, I immediately wrote her birthday party into my calendar."* (Appendix J).

When looking at the context acted upon the reminders created in the calendar, we can conclude that the context created is different from the context acted. While the context created most often was at *home*, the context acted is most often *Other*. P1 created reminders both at home, work and in transport, but she only acted in the context of *other.* P1 explains: "*My reminders in my calendar are always something I have to do when I am out. This is for instance seeing my friends, which I do outside.*" (Appendix G). P4 does also always act on her reminders in the context of *Other.* As P1, P4 is also "*.. often outside, e.g. going to my grandma's birthday party."* (Appendix J). In 40% of the time, P5 acts upon her reminders in the calendar in the context of *Other*, and as P1 and P4 explained, P5 also acts upon her reminders in the calendar when she is outside, which e.g. could be "*.. when I have an appointment at my hairdresser."* (Appendix K). While P5 most often created reminders at *home*, she estimates that she in 50% of the time acted upon the reminders at *work*. P5 explains: "*I often create reminders with my work schedule, so I create the reminder at home, but the reminder is acted upon at work."* (Appendix K). Only P6 estimates to create reminders in the calendar with the same context created and acted, as he estimates to use 80% at *work* and 20% at *home* when both creating and acting upon the reminders.

P2 believes, she only acts upon reminders in the calendar at *home*. It can be discussed, whether she also is in another context when she acts upon the reminders, because she earlier in the CI sessions gave examples of reminders regarding her son's karate lessons (Appendix H). P5 only estimates to act upon reminders at *home* in 10% of the time. P5 explains: "*It can for instance be my reminders about my laundry room booking. This is a reminder I act upon at home, because I do my laundry at home.*" (Appendix K). P3 could not give us an estimate of the context she acts upon reminders in her calendar. She finds it "*.. to difficult to answer because it really varies from reminder to reminder.*" (Appendix I).

### 4.5.2 Phone alarm

Six out of seven participants use their phone alarm to create reminders. To get an overview of the context, Figure 19 and Figure 20 were made:

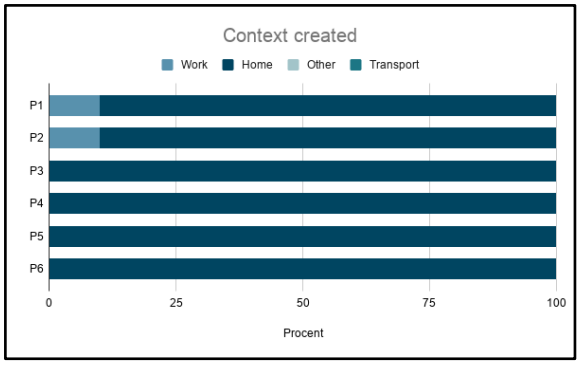



Figure 19: Context created with the phone alarm

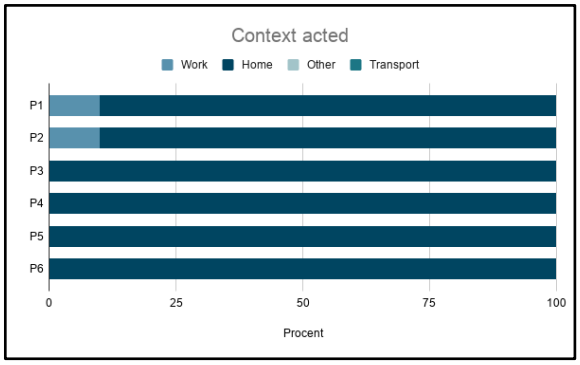



Figure 20: Context acted with the phone alarm

*Home* as context is very dominating, when the participants use the phone alarm to create reminders. Only P1 and P2 estimate they use the phone alarm in a *work* context when both creating and acting upon the reminder. P1 explains: "*I sometimes use the phone alarm at work because I easy forget the time at work, so the phone alarm helps me to e.g. do something in 10 minutes.*" (Appendix G). P2 works from home and has to remember to attend different kinds of meetings from home, and she sometimes set "*.. the phone alarm so I remember that I have to make another task or attend a meeting in e.g. 30 minutes.*" (Appendix H). The remaining four participants who also use the phone alarm to create reminders, only use the channel in a *home* context when they both create and act upon the reminder. P5 uses the phone alarm to e.g. "*.. remember to leave in time so I can get from A to B.*" (Appendix K), while P6 uses the phone alarm to for instance ".. *set an alarm when preparing food so I know when the dinner is ready.*" (Appendix L).

### 4.5.3 Browser tabs

Four out of seven participants use browser tabs to create reminders. To get an overview of the context, Figure 21 and Figure 22 were made:

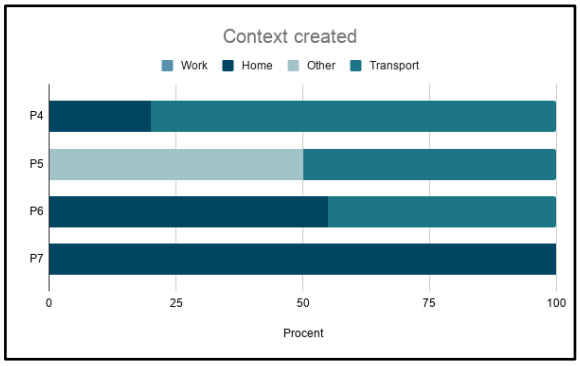



Figure 21: Context created with browser tabs

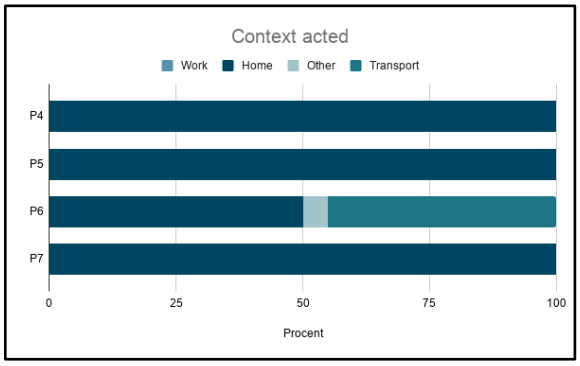



Figure 22: Context acted with browser tabs

As Figure 21 and Figure 22 shows, the context varies from created to acted, and none of the participants have estimated the same context created, while three of the four participants act

upon browser reminders in the same context. P4 creates most of her reminders with browser tabs when she is in transport, "*I have 45 minutes transport to work each way, so I often spend time browsing the web. If I am not finish when I get off, I'll leave it open so I can remember to look at it later"* (Appendix J). When P4 says "*.. look at it later"*, she will act upon the reminders in the browser "*.. at home when I after a long day relax on the couch, I can finish what I did not achieved in the bus*." (Appendix J) P5 estimates she creates reminders with browser tabs 50% in context of *other* and 50% in context of *transport*. To P5, reminders with browser tabs are created when she is out, both out with friends etc. or when she has time to "*..just browse on my smartphone while sitting in transport."* P5 gives the example: "*It could be, if I am out and I think of a movie I would like to see. Then I Google it and leave the tab open, so I remember to watch it when I have time."* (Appendix K). This also leads to P5's context acted upon the reminders, as P5 estimates, she acts upon reminders created with browser tabs at *home*.

P6 estimates to create browser tabs reminders 45% in a *transport* context and the other 55% in a *home* context. He explains: "*I most often browse when I am at home, but also when I have time in transport to and from work."*. P6 further gives an example of the contexts w he creates and acts upon browser tabs reminders: *"I can find a recipe in the bus, and then act upon it in the supermarket because I have to buy the groceries from the recipe"* (Appendix L). P6's example is created in *transport*, but is acted upon in a context of *other*, because he acts upon it in the supermarket. P6 is also the only participant, who acts upon reminders in a *transport* context, and he explains: "*Yesterday I found an article on my way to work, but I did not have the time to read it, so I kept the tab open, so I remembered to read the article on my way home"* (Appendix L). P7 is the only participant, who both creates and acts on browser tabs reminders in a *home* context. As analyzed earlier, P7 only uses his desktop computer to create reminders with browser tabs, which also is the reason why he only can creates and acts upon the reminders at home, because he cannot take the computer with him.

### 4.5.4 Note-taking apps

All of the participants use a note-taking app to create reminders. To get an overview of the context, Figure 23 and Figure 24 were made:

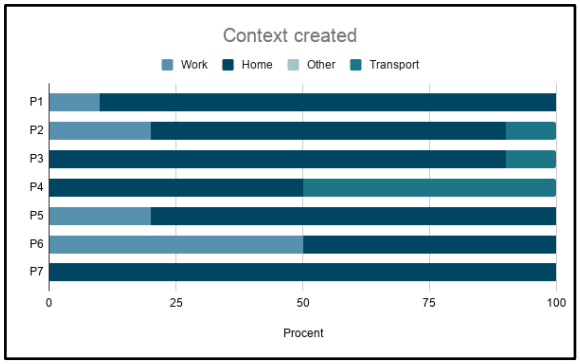



Figure 23: Context created in the note-taking app

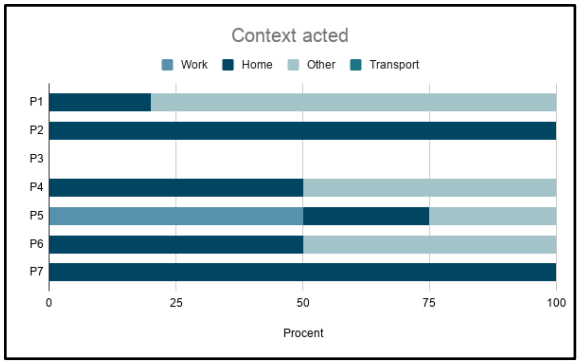



Figure 24: Context acted in the note-taking app

The context created vary from *work*, *home* or *transport*, and none of the participants have estimated the same context. The context acted covers *home, other* and *transport* which is different from the context created. P1 estimates to create reminders in the note-taking app 10% at *work* and 90% at *home*, but when P1 is asked in which context she acts upon the reminders, it is only 20% in a *home* context and 80% in an *other* context. P1 explains: "Most often, *I use my notes to create meal plan and grocery shopping lists, so I create it at home, and then act upon it in the supermarket"* (Appendix G). P3 uses the note-taking app to create many kinds of reminders, and she estimates to be at *home* 90% of the time and 10% of the time in a *transport* context. But when P3 is asked, in which context she most often acted upon the reminders in her note-taking app, she explains: "*It is very different what kind of reminders I have in my notes. For instance, it can say 'pick up a package' or 'grocery shopping', which I do outside from home,, while another reminder can be 'vacuum cleaner' or 'call the doctor', which I have to do from home*", and therefore, P3 would not give an estimate on the acted context, which is showed Figure 24 with missing data from P3. P5 is the only participant, who acts in a *work* context, which she estimates to do in 50% of the time. P5 explains: "*I have a note to remind myself of all the dates I would like to have extra shifts at work"*, which she creates at *home*, but act upon at *work.* P7 uses the note-taking program 'Notepad' on his desktop computer, which makes the context both created and acted at *home*.

Common for the participants, they often create reminders in the note-taking app at *home* or in *transport*, while they act upon it at *home* or *other*, which covers supermarket, out shopping, seeing friends etc.

### 4.5.5 Screenshots

Six out of seven participants use screenshots to create reminders. To get an overview of the context, Figure 25 and Figure 26 were made:

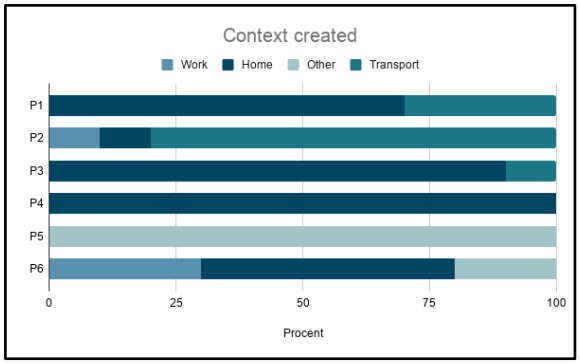



Figure 25: Context created with screenshots

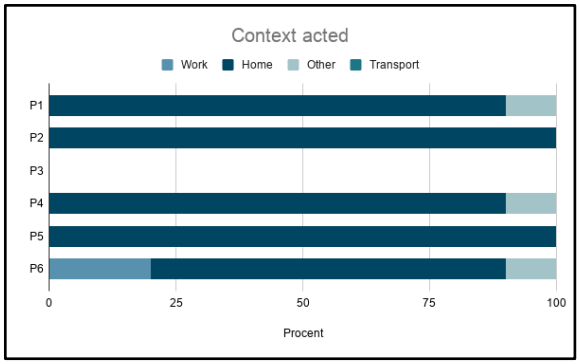



Figure 26: Context acted with screenshots

The six participants who use screenshots as reminders create it in different contexts. All four created contexts are used by the six participants, and the context the reminders are created varies from participant to participant, as none of the participants have estimated the same created contexts. P2 uses screenshots in both a *work* (10%), *home* (10%) and *transport* (80%) context, and with an estimate of 80% in *transport*, P2 prefers to "*.. take a screenshot when I am in my car and find something I have to remember to act upon later*" and P2 further estimates that she acts upon the screenshots at *home* (Appendix H). P5 estimates to create screenshots reminders in an *other* context 100% of the time, which covers when P5 is out shopping, with friends etc. But when P5 must act upon the screenshots, she estimates that she acts upon the reminders 100% of the time at *home*. P4 estimates that she only create reminders with screenshots at *home*, but when she has to act upon the reminders, she estimates to be in an *other* context 20% of the time, P4 explains: "*I can take a screenshot at home of something I want to buy, and then I go out to the store and buy it*" (Appendix J) P6 creates reminders within three different contexts, which are *work* (30%), *home* (50%) and *other* (20%), but when he act upon the reminders the contexts percentages is different. P6 estimates that he acts upon reminders at *work* (20%), *home* (80%) and *other* (10%), which is a difference from the context created. This also shows that P6 e.g. creates reminders at work, but act upon it when he gets home.

Common for the participants, they most often act upon screenshots reminders at *home*, while the context created varies from the participant to participant.

### 4.5.6 Photos

Four out of seven participants use photos to create reminders. To get an overview of the context, Figure 27 and Figure 28 were made:

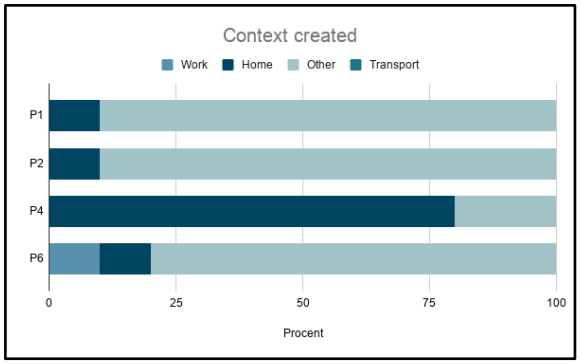



Figure 27: Context created with photos

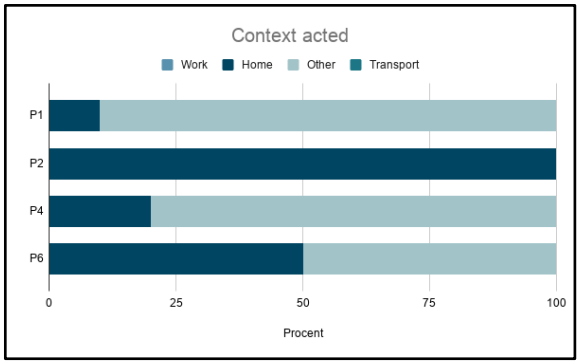



Figure 28: Context acted with photos

P1, P2, and P4 create reminders with photos in both a *home* and *other* context, while P6 also creates reminders at *work*. Both P1 and P2 estimate, they create reminders 10% of the time at *home*, and 90% within *other*. P1 explains: "*When I am out shopping, at my study, or somewhere else and I see something I have to remember, I take a picture of it."* (Appendix G). The difference between P1 and P2 is the context they act upon reminders created with photos. P1 estimate that she, as the context created, acts upon the reminders 10% at *home*, and 90% at *other*, while P2 only acts upon the reminders with a *home* context. P4 believes, she in 80% of the time creates reminders with photos, while she only in 20% of the time creates reminders in the context of *other*. P4 explained during the CI sessions that she most often uses photos to remember "*.. recipes and grocery shopping"* (Appendix J), and therefore, P4 takes a picture at home and then go out an acts upon the reminders, which also explains how P4 estimates the context acted, where she believe she acts 20% of the time in a *home* context, and 80% of the time in an *other* context. P6 was the only participant, who also uses photos to create reminders in a *work* (10%) context, but looking at the context acted upon, P6 do not act upon reminders at *work* "*..if I create reminders at work, it is with personal intentions, which e.g. could be if I find something I want to buy."* (Appendix L) P6 creates, like P1 and P2, most often reminders with photos when he is outside, shopping etc., which he both acts upon in a *home* (50%) and *other* (50%) context.

### 4.5.7 Self-addressed text messages

Four out of seven participants use self-addressed text messages to create reminders. To get an overview of the context, Figure 29 and Figure 30 were made:

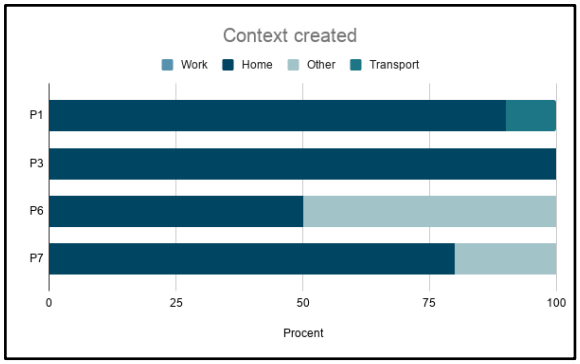



Figure 29: Context created with self-addressed text messages

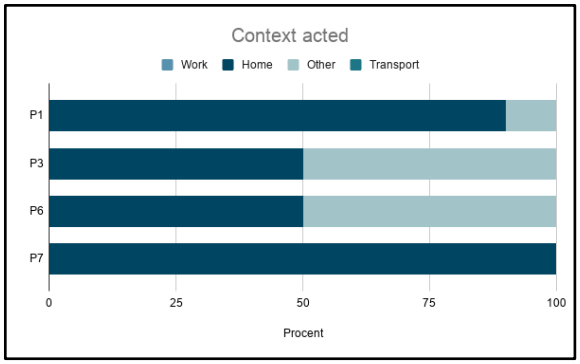



Figure 30: Context acted with self-addressed text messages

When using self-addressed text messages as a channel to create reminders, the participants do almost create and act upon the reminders in the same context. In most cases, the participants create self-addressed text messages in a *work* context, which P1, P2, and, P7 do 80% or more of the time. Only P6 estimates the use of self-addressed text messages to be created in 50% of the time in an *other* context. When looking into the context acted, the participants estimate of the context vary a bit. In 90% of the time, P1 acts upon the reminders with a *home* context, and only 10% of the time with an *other* context. As described earlier, P1 send self-addressed text messages to save information between two devices. Often she "*.. send a message to myself from my phone, as I can open on my laptop, so I can use the larger screen to see the information."* (Appendix G). P3 and P4 both estimates, they act upon the self-addressed text messages with a *home* (50%) context and an *other* (50%) context. Last, P7 estimates the context of acted upon the reminders to be 100% at *home*, "*I send myself messages with e.g. jobs to apply, clothes I want to buy etc., and this is reminders I always act upon at home on my desktop computer with my large screen."* (Appendix M).

### 4.5.8 Self-addressed emails

Only one participant uses self-addressed emails to create reminders. To get an overview of the context, Figure 31 and Figure 32 were made:

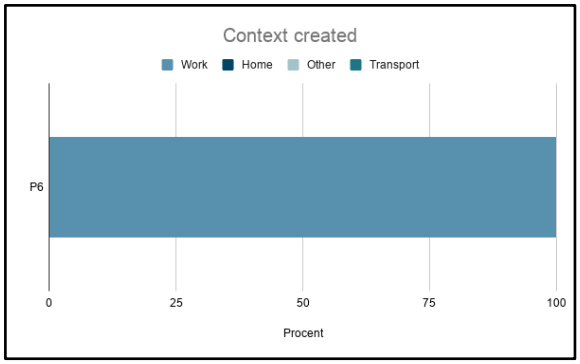



Figure 31: Context created with self-addressed email

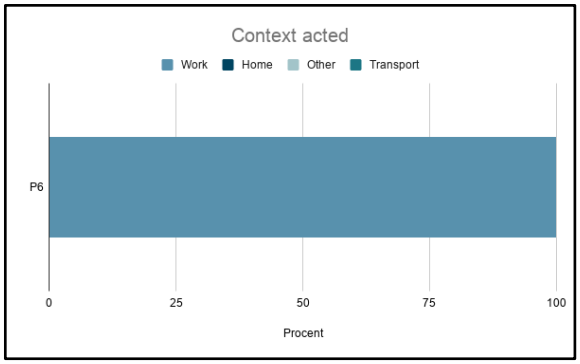



Figure 32: Context acted with self-addressed email

It is only P6, who creates self-addressed emails, which he only uses in a *work* context. As described earlier, P6 send himself emails if "*I am not finish with a mail, I send it to myself to remind myself to finish it and send it.*" (Appendix L). Therefore, P6 only creates and acts upon reminders created with self-addressed emails in a *work* context.

### 4.5.9 Desktop

Three out of seven participants use the desktop to create reminders. To get an overview of the context, Figure 33 and Figure 34 were made:

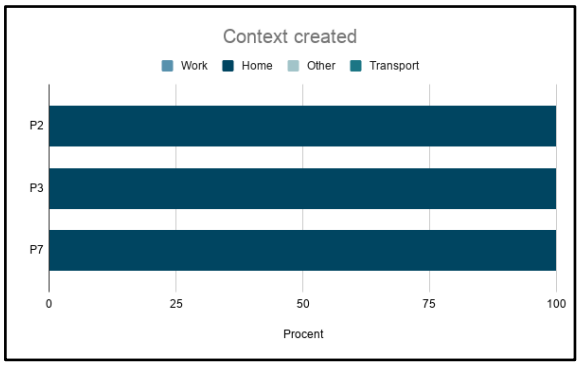



Figure 33: Context created at the desktop

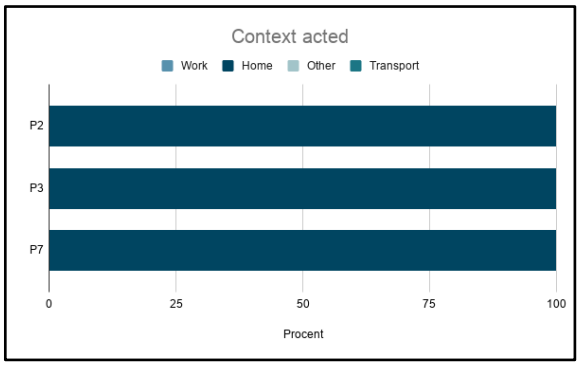



Figure 34: Context acted at the desktop

There is no difference to see when looking at Figure 33 and Figure 34, since all of the participants estimate they both create and act upon reminders at their desktop in a *home* context. P2 estimates the context to be 100% at *home* both when created and acted upon. However, P2 explained during the CI sessions that she works from home, and P2's estimate can therefore be a bit false, because

she might not calculate when she creates a work-related reminder when sitting at home. P3 creates study-related reminders with the literature she has to prepare before class, but even though it is related to her education, she "*..always create the reminders on my desktop when I am home and have the time to get the overview of what to prepare for next class.*" (Appendix I). Moreover, P3 also acts upon the reminders at *home*, where she "*..prepare and read the literature.*". P7 does also estimates that he both creates and acts upon reminders on his desktop when he is in a *home* context. When P7 uses his desktop at his desktop computer, it is not possible for him to be anywhere else than home.

### 4.5.10 Social media

Three out of seven participants use social media to create reminders. To get an overview of the context, Figure 35 and Figure 36 were made:

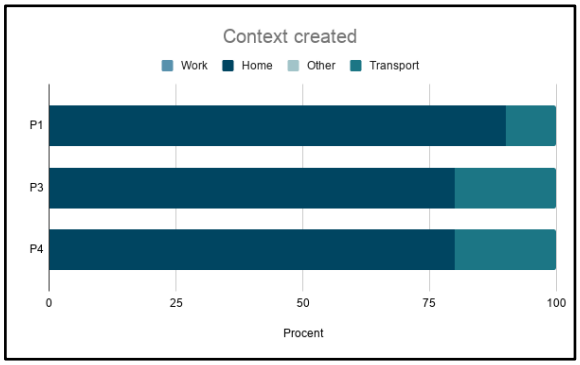



Figure 35: Context created at the social media

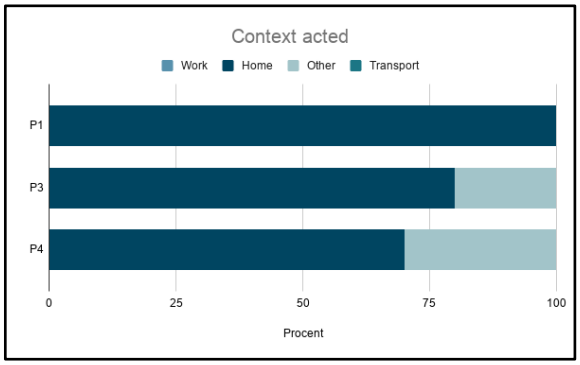



Figure 36: Context acted at the social media

The three participants using social media to create reminders agree on the context they create the reminders. All three participants estimate, they create reminders at social media in either a *home* context or *transport* context. According to P3: "*.. social media is just something I browse through when I have time either at home or when I have to kill time in transport*" (Appendix I) Often, the participants do not search for reminders, but only create reminders when they stumble upon something. Looking at the context acted upon the reminders at social media, P1 does only acts upon the reminders in a *home* context. As described in section 4.2.8 Social Media, P1 only saves recipes to get inspiration, and these reminders is something she always acts upon at home, where she can prepare groceries and cook. Both P3 and P4 act upon the reminders in both a *home* context and *other* context. P3 creates many kinds of reminders at Instagram, such as, things to do with her son, decoration etc. Therefore, she both acts upon reminders at home, e.g. when she finds a post about something creative to do, or when she acts upon a reminder regarding decorating a room, she is in an *other* context, because she has to go to the store to buy furniture. As analyzed in section 4.2.8 Social Media, P4 creates reminders with workout inspiration and shopping inspiration.

Therefore, P4 estimates the context of acting upon the reminders to be 70% at *home*, and 30% to be *other*. When P4 acts upon the workout inspiration, it is when she workouts at home, but if she wants to act upon the shopping inspiration, she will go to the store and buy the item (Appendix J).

# 5. DISCUSSION AND CONCLUSION

This thesis examined how people manage and create reminders on digital devices, and in the following chapter, the seven research questions, which guided the research, will be answered by discussing the main findings and limitations that altogether answers the problem statement.

**RQ 1: Which digital channels & devices do people use to create reminders?**

We wanted to investigate, which digital channels and devices people use to create reminders, and after analyzing the seven CI sessions, we could exclude tablets as a device, since none of the participants used tablets to create or manage digital reminders. The participants most often preferred to use their smartphones to both create and manage reminders, while they in some cases used a computer. As analyzed, the use of a computer was most often in relation to work-related reminders or the opportunity to use a larger screen. Moreover, the results from our CI sessions showed, the participants preferred to use their smartphones because they always have it with them, and it is easy to access. Due the data collection was only with seven participants through CI sessions, it is not possible to conclude anything about why tablets were not used to create and/or manage reminders. Moreover, it possible to generalize the findings because it would require more participants.

We analyzed the relation between device and channels, and a difference between the choice of channels depended on the device. When the participants used their computer to create reminders, they used *desktop* (21,4%) and *email* (21,4%) most often, while *calendar* (14,3%), *browser tabs* (14,3%), *note-taking app* (14,3%), and, *text messages* (14,3%) were the second most used channels. It can be discussed whether the use of the *desktop* both is a channel and a way of organizing reminders. Results from the CI sessions showed that participants create reminders with their desktop but also use the desktop to organize reminders, such as, remembering to read a document. To get a clear answer, it would have been advantageous to get the participants to more explicit elaborate the use of their desktop. When looking at the channels used on smartphones when creating reminders, the participants used nine different channels with both *note-taking apps* (16,2%), *calendar* (16,2%), and *screenshots* (16,2%) being the most preferable channels. The note-taking app and calendar were both used at smartphone and computers, and the total use of these two channels are higher, if both smartphone and computer use are combined. For future work, we would prefer a larger sample size so we can detect whether people use other kinds of devices, like tablet, smartwatch etc.

**RQ 2: Which cues do people use in their digital reminders?**

**&**

**RQ 5: How are cues of digital reminders activated?**

A qualitative analysis of which cues the participants used in their reminders showed, most of the participants *check the channel*, and then get reminded by seeing the reminder in the channel. Therefore, we asked the participants how often they browse through the channels, and the results showed a variation, as it depended on the importance of the reminder. When looking at the cues, it was also important to analyze the cue action. Through studies by McDaniel and Einstein (2007), we analyzed the cue action by looking at whether the reminders cue was *event-based, time-based* or *activity-based*. The results showed a clear use of *event-based* cue action, which the participants used in eight out of teen channels, while we did not detect any use of *activity-based* prospective memory. However, the participants used two different kinds of *time-based* prospective memory, which were *recurring* and *single use.* Both reminders created in the calendar and by phone alarms, the cues were activated *time-based* with both *recurring* and *single-use* reminders. Our analysis showed that only one participant used the calendar to create reminders which were *time-based: recurring*, and it can be discussed whether the result is misleading. Our analysis is based on the examples showed and described during the CI sessions, and thus more participants could create reminders which were recurring. Therefore, it makes it more difficult to draw clear conclusions because we only received a small amount of data from each participant. To analyze the reminders cues and how the cues are activated, it would have been preferable to analyze all reminders created within a time period so a better understanding of the cues could have been made.

Earlier studies have investigated whether age has an impact on the prospective memory, and as described earlier, Mullet et al. (2013) found that young and older adults showed significant slowing when the task was about prospective memory cues. Age difference is an important and relevant topic to analyze and discuss when investigating reminders and what cues people use when creating reminders. This thesis only had data from seven participants in the age 23-47 years old, which did not make it possible to generalize the results. Based on the data giving by P2, 47 years old female, we could not detect any main differences between how she uses cues and how cues are activated compared to e.g. P6, 23 years old male. For future work, it would be interesting to investigate if aging has an impact on how people use cues and how cues are activated when creating reminders. Thus, the study could have several participants in each age-group, e.g. 20-30, 30-40, 40-50 etc. Then it would be possible to detect, if aging affects reminders cues.

### RQ 3: How do people organize their digital reminders?

We investigated how digital reminders were organized, and through a heat map we could conclude a main use of a *chronological* organization scheme. Only reminders created with the *desktop* were not organized *chronological*, but instead by *label* or/and *folder*. Moreover, the analysis showed how the devices helped participants organize reminders. The devices organized the reminders *chronological*, e.g. when the participants create a note, the latest created or edited note will occur at the top. Besides organizing it *chronological*, the devices do also create folders, which we detected in both *photos* and *screenshot*. Some of the participants did also create folders in their photo application themselves, but their device created e.g. a *screenshot* folder, which the participants used. Thus, the organization of the reminders are not always on purpose but instead because the device organizes information for the user.

It can be discussed whether P3 organized her reminders at Instagram by *topical organization scheme*. This means, P3 organized her reminders by topic or subject. As analyzed in section 4.4 Organizing digital reminders, P3 divides her reminders into folders: *Hugo* (P3's child), *Home*, *children's room, Other,* and *Crea*. The folders contain different kind of reminders, which P3 has organized by the reminders topic, e.g. *children's room*. By looking at P3's reminders at Instagram, we could discuss whether the reminders are organized by:

| Organization scheme | Organization structure |
|---|---|
| ● Chronological | ● Folders<br>● Topical |

Table 17: Overview of how P3 organize reminders at Instagram

When coding the data, we did not detect a need of *topical organization structure*, resulting in us as researchers not looking at *topical* as a way of organization structure. If we had more time, it would have been preferable to adjust the coding scheme and analyze how topical organization structure can be used to organize reminders.

### RQ 4: What are the intentions of digital reminders?

The analysis of the participants intentions of digital reminders were coded into six different intentions and 13 different activities (Appendix E), and the results showed a difference from each channel used. Moreover, we tried to understand if there was a connection between the intention and activity, and through heat maps for each channel, we could detect some similarities between the participants intentions and activities. Our findings showed the intentions and activities are different depending on the used channel, and if we look at the intentions versus activities for the

calendar, we detected three different intentions; *contact, schedule event* and *complete task*, while we also detected three different activities; *education, social engagements* and *work*. The intentions and activities for social media are very different from a channel like the calendar. When analyzing the intentions and activities when using social media as a channel, we detected following intentions; *inspiration, schedule event* and *collect*, and following six activities; *beauty and personal care, health & household, home & kitchen, social engagements* and *job application*. The results show a difference of both intentions and activities in each channel, as the participants use the channels with different purposes.

The findings cannot be generalized due to the small sample size, and the conclusion can only be drawn on the basis of the sample. With a larger sample size, it would be possible to generalize the intentions and activities and draw a clearer conclusion.

**RQ 6: In which contexts are digital reminders created?**

**&**

**RQ 7: In which contexts should the intended action take place?**

We wanted to investigate the context reminders were both created and acted upon, but due COVID-19, the participants tried to answer with a perspective of how they normal act and in which context they normally create and act upon reminders. The results were analyzed in subsections for each channel, where the context created were compared with the context acted. When coding the data from the seven CI sessions, we decided to code a context called *Other*. This code covers when the participants are out with friends, shopping, going for a walk etc. We discussed whether to create several codes regarding "Other" but with a small sample size, we decided to merge the codes into one "Other"-code, so it would be better to compare and analyze the data from the seven participants.

Our findings showed a difference between the context created and context acted in the channels; calendar, *screenshots*, *note-taking app*, and *browser tabs*. When looking at e.g. the calendar, the findings showed that most of the participants create reminders at home, while they most often act upon the reminders at *work* or *other*. As analyzed in section 4.5 Context created and acted upon, the calendar is often used to social engagements, which the participants act upon when they are out, while they often create the reminders when they are at home and have some time to create reminders. Our findings also showed that some of the channels do not have a large difference between the context created and acted. When the participants use; *phone alarm, photos, self-addressed text messages, self-addressed emails, desktop* and *social media,* the context both created and acted upon are very similar. If the thesis had a large sample size, we would probably have detected more variation from context created to context acted. Moreover, a larger sample size

could also result in a coding scheme with more codes regarding the context. With more codes, we would have the opportunity to detect several other contexts and thereby get a more varied picture of the context created and acted upon digital reminders.

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