

## Design for everyday life reflection

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Design for  
Everyday Life Reflection

Ine Mols

# **Design for Everyday Life Reflection**

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# **Design for Everyday Life Reflection**

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de Technische Universiteit Eindhoven, op gezag van de rector magnificus prof.dr.ir. F.P.T. Baaijens, voor een commissie aangewezen door het College voor Promoties, in het openbaar te verdedigen op dinsdag 26 november 2019 om 16:00 uur

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## Certificate of original authorship

I, Ine Mols, declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Software at the University of Technology Sydney and the Department of Industrial Design at the Eindhoven University of Technology.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of the requirements for a degree at any other academic institution except as fully acknowledged within the text. This thesis is the result of a Collaborative Doctoral Research Degree program with Eindhoven University of Technology.

This research is supported by the Australian Government Research Training Program and the Netherlands Organization for Scientific Research (NWO), awarded to Elise van den Hoven (STW VIDI grant number 016.128.303).

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Date: March 25th 2019

# Abstract

In everyday life, most people reflect frequently. It is a way of thinking to process experiences, to come up with potential solutions to problems and to gain a better understanding. But reflection can be challenging, as it requires time, effort and attention. We identify an opportunity for interaction design to support everyday life reflection by creating new reflective habits.

In this thesis, we explore this opportunity by adopting a research-through-design approach. We discuss the notion of everyday life reflection through a review of related literature, a probes study and a questionnaire. Following, we present three design driven studies, exploring how such reflection might be supported through interactive media systems. We conclude that such systems can adopt different strategies and can take different roles. By evaluating interactive systems in the homes of people, we found that integrating new reflective habits in everyday life relies on triggers and opportunity. Reflection occurs not just through the review of media, but in the moment of creation as well. Our findings contribute to the understanding of everyday life reflection as an open process and flexible habit. Secondly, we contribute to the area of design for reflection, through a number of considerations and design examples.

*Please note a longer summary is available at the end of this thesis.*



*We do not think of our future as experiences,  
we think of our future as anticipated memories.*

- Daniel Kahneman

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# 1

## Introduction

# 1.1 Introduction

For one person, it might be walking the dog. For another, it is chatting with their partner while doing the dishes. For you, it might be staring out the train window over a cup of coffee. Everyone has moments of reflection in everyday life. We think about our experiences, thoughts, and feelings. We connect past experiences, present events, and future possibilities. These moments are important, as such reflections help us to make choices, manage stress and form a view of who we are. Consequently, reflection can have a positive effect on personal wellbeing. But reflection can also be challenging, it requires taking a critical stance towards thoughts and feelings, which takes time and effort. We therefore aim to support reflection through the designs explored in this thesis.

As the situations in the introduction illustrate, many people frequently reflect in everyday life, in many everyday moments. Reflection plays a role throughout people's lives, at least from the moment a view on personal life is developed in adolescence (Habermas & Bluck, 2000). Life can be seen as a series of alternating periods of change and (relative) stability (Staudinger, 2001). Reflection is an important mechanism to deal with such change, including the feelings of uncertainty, stress, and choices. Reflection allows standing 'still', to overlook the present situation and consider it more elaborately. As such, it requires time and effort. The following two examples illustrate such everyday life reflection, both expressed in a form of 'self-talk'.

*"I'm not feeling it today. I haven't been productive at all. Well, that's not true – the morning was pretty good, but in the afternoon, I got distracted. Why can't I stay focussed? My heart rate is slightly up – I might have had too much coffee. This is a bad habit. Should really try to do something about it."*

*"So excited about looking for a house to buy together. But, where should we start. Our apartment is not bad, but I really want to move to a 'real' house, somewhere we can live for years, even start a family. I want to stay in the city, but still, a quiet place with lots of green would be good. As a child, I always really enjoyed that we could just go down the street and play outside."*



In these segments of self-talk, we see some of the aspects that define everyday life reflection. The first illustrates that it can be small moments frequently occurring in everyday life, and the second shows that reflection can also concern more substantial consideration about life decisions, occurring less frequently. The second example also shows references to memories that influence current and future decisions, an indication of how reflection and remembering are closely related. Finally, the examples show some of the themes that might be included in everyday life reflection such as work, housing or habits. Together, these aspects of varying depth of reflection, the impact on life, the diverse topics and different temporal perspectives, show the breadth of everyday life reflection.

Although self-talk is just one of the forms of everyday life reflection (others include for example writing or talking), we could argue it is the most common one. At the same time, many of the natural moments for reflection through self-talk are increasingly being filled with external stimuli and distraction (Wayne, 2016; Flaxington, 2016). Rather than staring out the train window considering what made the day good or bad, we grab our phones and check our mail. Instead of waiting for a friend to return to the restaurant table, wandering about the conversation, we quickly check social media. Grabbing one's phone in all such situations can even be seen as using phones as 'pacifiers' to reduce stress and avoid negative emotions (Diefenbach & Borrmann, 2019). People can easily be distracted and having a phone full of distraction within arm's reach makes finding moments for contemplative thinking even more difficult (Wayne, 2016; Carr, 2011). Without such moments of reflection, life can become a rut, as people keep doing as they are doing, without deliberate thought. Additionally, it can result in stress building up or dissatisfaction with certain life aspects. We consider living more self-conscious and being reflective to be virtues worth striving for. Thus, we identify a challenge to create deliberate moments of reflection in and on everyday life.

Deliberate moments of reflection can be supported in numerous ways, including through technology for reflection. In this thesis, we are specifically interested in exploring interactive media for this purpose, taking a design-research approach by creating novel concepts to explore this area. As the examples show, media can be a distraction, be it social media or mass media. At the same time, personal media hold great potential to be dedicated support for reflection. Media can capture an event and enable us to express our personal perspective on such events. Additionally, creating media of present experiences allows reviewing these experiences later for additional reflection. When media are created by people themselves, it does not prescribe an external perspective, but allows supporting reflection in an open way. We have therefore chosen to design for reflection by designing for personal media creation.

In conclusion, this thesis addresses the challenge to support people to casually reflect. Specifically, we aim to support reflection within the context of everyday life and by using media interaction. Below, we explore these three themes that define the scope of our research.

## 1.2 Everyday life

When people are asked to describe everyday life, some focus primarily on mundane aspects, considered as not worthwhile or boring (e.g. commuting, doing the dishes or even sleeping). Others might focus on simple things that bring happiness: an early cup of coffee or a walk outside. Without giving a judgment on either positive or negative qualities, everyday life is often associated with descriptions such as routine, natural or normal. Most people will agree that a large part of their lives (in time) consists of such ordinary experiences or 'everyday life' activities. Sociologist Schaffer (2000) estimates that over 60% of our time is spent in such everyday activities or even 'drudgery' – which could still be seen as a modest estimation. Despite its omnipresence and widespread use, it can be challenging to express what exactly encompasses everyday life. As Felski (1999) put it *"everyday life is the most self-evident, yet the most puzzling of ideas"* (p.15). In some cases, everyday life is scoped through a negative definition as the absence of special occasions, battle or celebration. More often, its use and definition remain implicit.

In this thesis, we explicitly frame 'everyday life' as our area of focus. On the one hand, one might say that design for everyday life is evident. In essence, many of the products that are designed and manufactured are primarily used in 'everyday life'. On the other hand, similar to the position described above, these everyday aspects are rarely described as the specific focus of design. Within HCI, the shift to the everyday has been described as one of the key aspects of 'third wave HCI', based on the spread of technology from the workspace to our homes, everyday lives and culture (Bødker, 2006). Interaction design is increasingly focussed on interaction within the domestic context (e.g. Gaver et al., 2006), the creation of daily habits (e.g. Thieme et al., 2012) and everyday 'intersections' with designs (Odom & Wakkary, 2015). Design supports various aspects of everyday life, ranging from sleep, to leisure time, from commuting to entertainment, and from family life to romance. However, a focus on the everyday nature of these aspects is rarely made explicit.

A number of scholars in the area of sociology have also struggled with the notion of everyday life as a specific topic of interest. Some were frustrated by the lack of attention for the everyday, criticizing that the field overemphasized both exceptional groups of interest, and looking for exceptional examples within these groups (Brekhus, 2000). For a few

years, a dedicated journal was published: *"The Journal of Mundane Behavior"* (appeared between 2000 and 2004). The journal focussed specifically on "celebrating the majesty of the obvious" and on the everyday interactions of everyday people. Even this journal struggled with how to define the mundane. Defining it as a contrast to 'sacred' by focusing on its 'earthly' qualities did not suffice, as the editors write that *"the everyday, the earthly, the worldly represents a part of what is sacred about our live"* (Schaffer, 2000). As such, part of the efforts of this journal were directed at studying what processes are involved in making certain things 'mundane' and others 'extraordinary'.

For us, the writing of Felski (1999) has best provided a grasp of what everyday life is. Based on readings of a number of 20th-century philosophers, Felski (1999) proposes a definition based on three key facets: *repetition*, *a sense of home* and the experience of *habit*. The first shows that everyday life is primarily determined by a temporal aspect. It does not refer to the unique, but rather to experiences that happen "day after day". These repetitions are often embedded in longer cycles such as having a daily habit of drinking morning coffee on the balcony or doing grocery shopping on Saturdays. Secondly, regarding space, everyday life is characterized by a sense of home. The home (as a central place of living) is iconic for many everyday life aspects, but this notion also stands for a more symbolic position. A sense of home is not bound to a house but includes spaces that provide familiarity, protection, and warmth. Finally, in terms of experience, everyday life is defined by the experience of habit. In the view of Felski, habit refers not simply to an action, but to an attitude. Habits are carried out in a semi-automatic or involuntary manner. However, this should not be seen in a negative light, as many habits are comfortable, easy, and bring happiness. These three aspects have helped us in directing our understanding of everyday life.

## 1.3 Reflection

The connection between everyday life and reflection can seem counter-intuitive. Part of the definition of everyday life, as discussed above, is how it is done without deliberate consideration, but with a sense of habit. Kahneman (2011) describes this mode as our 'System 1' mode of thinking. This mode, which he also describes as 'thinking fast', operates quickly and automatically. Many of our actions are guided by such thought, which happens with little or no effort and no sense of voluntary control. However, people (in contrast to other animals) also have the ability to engage in 'System 2' or 'slow thinking'. This type of thinking refers to mental activities that require effort and that are more deliberately directed. Such effortful thought is involved in challenges such as solving equations but also in making decisions or reconsidering previous behaviours. It is this system that is involved in

reflecting. Fundamentally, reflection can be defined as the ability to assess circumstances critically. In his pivotal work 'How we think', Dewey (1933) describes what constitutes thought. He specifies further that for thinking to become reflective, it needs to demonstrate several characteristics. The most crucial characteristic making thoughts reflective is that a certain belief is examined and the ground or basis for that belief is deliberately sought and examined. Dewey illustrates these characteristics with a very mundane example of walking outside, noticing a change in temperature in the air and looking to the sky to check if rain might be coming. This example illustrates these characteristics: the belief that it might rain is examined by looking for evidence to support it. Yet usually, when talking about reflection, people refer to some more complex cognitive process. In everyday life, it might be more associated with contemplation, the deliberate act of analysing why things happen or why we feel the way we feel. Reflection often requires taking a step back from current actions and exploring our thoughts in a broader context. We are interested in these more deliberate levels of reflection, as they can provide many benefits for personal wellbeing.

Reflection can be beneficial for personal wellbeing, both in direct and indirect ways. Reflection has been considered important for adaptation and self-development (Dewey, 1933) and is a positive indicator of Personal Growth, one of the levels of psychological wellbeing (Harrington & Loffredo, 2010). Most technology-mediated reflection is oriented towards actions, rarely using measures of wellbeing. As one of the few examples, Isaacs et al. (2013) found that technology-mediated reflection has a positive effect on wellbeing as measured by several self-reported wellbeing scales as well as a scale for psychological wellbeing. Reflection also has a positive effect on wellbeing more indirectly by providing self-insight or by supporting action. Self-insight is a positive indicator of all six dimensions of psychological- as well as subjective wellbeing (Harrington & Loffredo, 2010). Psychological wellbeing is herein measured by combining six constructs: Self-Acceptance, Positive Relations With Others, Autonomy, Environmental Mastery, Purpose in Life, and Personal Growth (Ryff, 1989). Rather than 'only' insight, the foreseen benefit in much work on personal reflection support is action. Supporting reflection can help with reflection in two phases: Discovery (discovering patterns, causes and setting goals) and Maintenance (maintaining behaviour to achieve goals) (Li, Dey & Forlizzi, 2011). Such actions are often oriented towards health, using reflection as a way to promote healthy behaviour change (e.g. Anderson et al., 2007) as well as promoting greater awareness and learning to self-manage chronic conditions such as diabetes (Mamykina et al., 2008).

Other positive characteristics associated with reflection are 'openness to new experiences' (Trapnell and Campbell, 1999), 'creative fluency and originality' (Verhaeghen, Joormann & Khan, 2005), and 'being effective at school and job-seeking' (Pennebaker & Chung,

2011). Based on such an overview, one could conclude that any situation or person would benefit from more reflection: from health to learning, from performance to mental well-being. However, there are risks involved as well. Reconsidering (past) experiences might not always be beneficial. Reflection can be viewed within a broader perspective on 'repetitive thought', which can be seen as the "process of thinking attentively, repetitively or frequently about one's self and one's world," (Segerstrom et al., 2003, p. 909). In an extensive review, Watkins (2008) found both constructive and unconstructive effects of such repetitive thought. For example, 'depressive rumination', 'worrying' and 'habitual negative self-thinking' were found to have negative consequences. On the other hand, 'problem-solving', 'processing' and 'cognitive/emotional thought' had predominantly positive consequences. In most processes of repetitive thought the consequences are either positive or negative, but at other times repetitive thought may simultaneously have both constructive and unconstructive outcomes, for example, posttraumatic growth can occur alongside increased distress (Tedeschi & Calhoun, 2004). In Watkins' review (2008), reflection is described as one of the classes of repetitive thought, for which he found both positive and unknown consequences in the literature. He describes three factors to account for the differential consequences of repetitive thought: the valence of thought content, the intrapersonal and situational context of the individual and the construal level (abstract or concrete) of the repetitive thought.

Some of these studies take a more negative stance towards reflection, with definitions closer to what we would consider rumination: this form of self-consciousness is neurotically dispositional (Trapnell & Campbell, 1999) and associated with aspects such as involuntary thought, dwelling on the past and thinking about embarrassing or disappointing moments. Trapnell and Campbell (1999) use these aspects of rumination to contrast it to reflection, which is an intrinsically motivated exploration of the novel, unique or alternative self-perceptions. This term is associated with terms such as self-analysis, introspection and a fascination for one's attitudes and feelings. Differentiating clearly between reflection and rumination thus makes it clearer why we consider reflection to be worth striving for. Reflection, as a constructive process of consideration, supports self-consciousness, having positive effects on personal wellbeing.

## 1.4 Media Interaction

Our mind does not function as an isolated entity, instead it is influenced by many external factors. When people reflect, the process is influenced by things they see, read or hear. This influence can be both intentional (such as reading philosophy books to reflect) or more opportune (such as being spontaneously triggered by a newspaper article).

The relation between the mind and external factors has extensively been studied in the domain of extended cognition (Clark & Chalmers, 1998; Sutton et al., 2010). This area of research explores specifically how the way people remember is influenced, for example by studying the influence of partners in social remembering (Harris, et al., 2014) or the impact of television on cultural memory (Lorenzo-Dus, 2015). On a more personal level, different types of media also influence what is remembered. Rather than describing memory and media as two separate entities Van Dijck (2004) proposes considering mediated memories: *“memories recorded by and (re-)collected through media technologies”* (Van Dijck, 2005, p. 312). The mediation does not refer only to the object but includes the practices of interacting with them as well. Often when considering the influence of media, we look at the modern forms of digital media and their influence on remembering. However, the mediation of memory can be viewed from a historical perspective to date back all the way to Plato. He argued that the invention of writing and script initiated a “degeneration of pure memory” (Van Dijck, 2007). Using external carriers of information, whether ancient script or modern digital media, thus influences what and how is remembered. This in turn strongly influences how people reflect on the past, by scoping what is remembered and providing a certain perspective on these experiences (for example, capturing merely positive sides of a past holiday (personal level) or framing a national event in a certain way (cultural level). Mind and media are not only intertwined when media is retrieved, but also when media is created: what we intend to remember and how we reflect on present experiences influences what media is created and how it is interacted with over time (e.g. stored, printed, deleted).

In addition to social or cultural studies, the field of interaction design also shows an interest in the interplay between media and memory. Some approaches within interaction design have seen modern technological means to capture everything as a way to create an ‘extension’ or ‘replacement’ of human memory (memory prosthesis, Lamming et al., 1994). Others have argued that the relationship is more complex, in line with the notion of mediation discussed above. The notion of cuing (Van den Hoven & Eggen, 2014, more extensively discussed in Chapter 2) describes how media can be seen as external triggers bringing memories to mind. Within HCI the mediation of reflection has been explored under different terms such “reflective design” (Sengers et al., 2005) and “technology mediated reflection” (Isaacs et al., 2013). One study, for example, found that mediation influences the

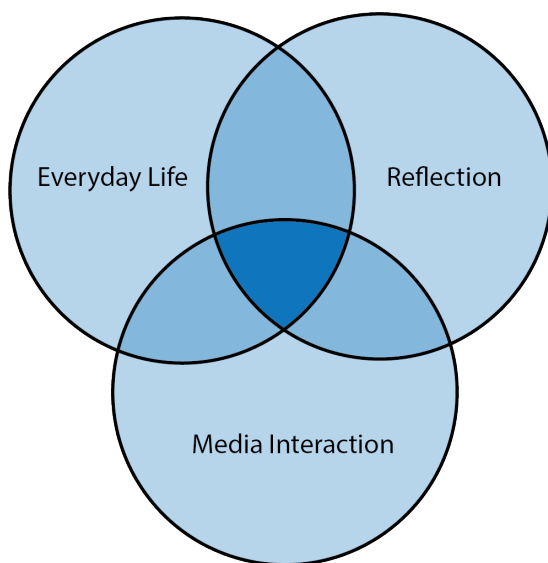
positivity in reflection and the use of analytical language (Hollis et al., 2017). Within HCI, media generally refers to external carriers of information, either digital or analogue, such as photos, videos, objects, text or music. We focus specifically on personal media, rather than public media such as television broadcasts. Media can be created both by people explicitly and intentionally (taking pictures, writing diary entries) as well as by systems (collecting data, automatically capturing video). In some cases, media is created as a ‘side effect’ of system use. For example, conversation logs in message-applications can be considered media, although they are not intentionally created by people to capture an experience.

The notion of ‘mediation’ describes the interplay between media and mind on an abstract level, regarding how the existence of both concepts influences each other. But interaction with media also concerns the more concrete manipulation of media: how it is made, stored, opened and used. In general, people perform a wide variety of actions with their media, photos for example are not just created or viewed, but also managed, triaged, edited, organised and shared (Broekhuijsen, Van den Hoven & Markopoulos, 2017). These actions all serve some purpose, the most dominant purposes as found by Broekhuijsen, Van den Hoven & Markopoulos (2017) can be defined as a social purpose (storytelling, shared reminiscing), an individual purpose (browsing for enjoyment, for creation, but also for identity formation) and a utilitarian purpose (optimising organisation of hobby, searching for specific information). Reflection can be seen as one of the individual purposes for which people interact with media. The stage-based model of personal informatics describes different phases of how people interact with media: preparation, collection, integration and reflection, together aiming at action (Li, Dey & Forlizzi, 2010). Others explored applications for reflection in which media was created, reviewed and potentially responded to (Isaacs et al., 2013, Cheng et al., 2011). Reflection is often stimulated by focussing on interactions that retrieve or review media and data. One of the dominantly used mechanism is comparison, either over time (e.g. Epstein et al., 2016) or to others (Valkanova et al., 2013).

The abstract notion of how the mind and media ‘interact’ is important for our understanding but when we talk about media interaction, we primarily refer to forms of direct interaction, such as creating, viewing, listening or reading. We use the term ‘media interaction systems’ to refer to the design of products (be it physical or digital) that enable interacting with media. Examples of media interaction systems include: a camera app on a phone, a voice-recorder or a tangible photo display.

## 1.5 Research Opportunity & Aim

As the sections above illustrate, the work in this thesis is characterised by three themes: everyday life, reflection, and media interaction. Each of these topics is studied extensively in different areas, but we specifically identify a research opportunity at the intersection of these themes (Figure 1.1). To support reflection at this intersection with everyday life and media interaction, we aim to design interactive systems and as such the research opportunity can also be seen as a design opportunity. Our approach to design research is more extensively discussed in section 1.6 Approach. To motivate our research scope, we discuss how we differentiate from existing work by looking at each of the intersections of two of our themes.



*Figure 1.1. We identify a research opportunity at the intersection of three themes.*

In the sections below, there will be multiple references to other areas concerned with supporting reflection, most dominantly reflection as studied within the area of education and professional development and the area of personal informatics. These two areas have inspired our work as we build upon theories from both areas. But we distinguish our direction from these areas by the specific combination of the three themes.



## Reflection & everyday life

The overlap between the topics of reflection and everyday life can be split into two areas, which both characterize our research: reflection *in* and *on* everyday life.

### *Reflection in everyday life*

As mentioned in the introduction (Section 1.1), we observe a decrease in the ‘natural moments’ of reflection. Moments in which the mind wonders and people can reflect on current, past and future events are increasingly filled with distraction. On average millennials (people born between 1980 and 2000) spend almost four hours each day using mobile internet applications (Diefenbach & Borrmann, 2019). This is often split into many small moments of interaction, because smartphones provide such strong distractive signals. The behaviour has been described under terms such as ‘addiction to technology’ (e.g. Carr, 2011), ‘addiction to speed’ (Brown, 2014) or even ‘addiction to distraction’ (Pang, 2013). Because people are so ‘distractible’ using moments of ‘down-time’ for reflection has become increasingly difficult (Carr, 2011). Diefenbach & Borrmann similarly found that smartphones are often used during alone time, such as when waiting or commuting. Time that can otherwise be spent with introspection, is instead filled with new information. This type of usage was found to show a negative association to self-insight (Diefenbach & Borrmann, 2019). Others have argued that it seems to be in current society’s culture to focus on others, rather than focus on the role of the self in a situation, thus reducing our ability to self-reflect. (Flaxington, 2016). With all these developments, we see supporting reflection in everyday life as a timely challenge. Design for reflection can create new reflective habits as part of everyday life routines. In these habits, reflection is not part of an orchestrated process or done because one is instructed to do so (e.g. a coach or teacher). Instead, we look for reflection that is self-motivated. Much work on creating new habits is done within the domain of persuasive technology (Fogg, 2009). However, the notion of persuasion can make it seem like the design or the designer are persuading people into performing a behaviour they prefer not to. We frame our design for reflective habits as design for empowerment: it empowers and supports people to adopt habits they want to adopt.

Reflection in everyday life also means by anybody, rather than a specific group of for example students or practitioners. In line with Schön’s (1986) notion of the reflective practitioner, reflective approaches in education have especially been studied focusing on teachers (e.g., Hatton & Smith, 1995), nurses (e.g., Ruth-Sahd, 2003) and designers (e.g. Mendels, Frens & Overbeeke, 2011). With reflection in everyday life, such a specific target group is not pre-determined. Although we will explore in Chapter 5 if a specific (demographic) target group can be identified, we approach design for everyday reflection with a broad potential

population. This target group is bound by being of adult age with well-functioning cognitive abilities (e.g., no memory impairment).

### *Reflection **on** everyday life*

In reflection research, the scope of everyday life provides a unique perspective. Most reflection research is topic specific: studying for example the performance of practitioners, learning of students, or behaviour for healthy living. With reflection on everyday life, we broaden the scope, which differentiates from most research on supporting reflection in three ways: topic, aim, and levels involved. Many systems to support reflections focus on a specific topic: e.g. movement pattern (Consolvo et al., 2006), energy consumption (Valkanova et al., 2013) or classroom performance (McNicol et al., 2014). Although some people in the area of personal informatics track a diverse set of data and look for correlations or causalities between them (Li, Dey & Forlizzi, 2010), it is rarely the focus of systems. The topic of reflection on everyday life is also broad by including past, present and future experiences. In addition to a specific topic, systems in personal informatics often support a specific aim: to change behaviour. Both this area and the quantified-self movement focus on (quantitatively) tracking aspects of one's life (food intake, movement, expenses, books read, etc.). Neither tracking nor reflecting on what is tracked, is the goal in itself, instead, such efforts are often aimed at action and change (Li, Dey & Forlizzi, 2010). With reflection on everyday life, we look for a variety of aims, including behaviour change, but also personal insight and self-growth. These additional aims connect to the final aspect discussed here, the different levels involved in reflection. Often, reflection is focussed on the action or behaviour level (Li, Dey & Forlizzi, 2010). Korthagen & Kessels (1999) developed the 'ALACT' model, focussed around such actions (Action, Looking Back, Awareness, Creating alternatives, Trial) with questions such as 'what did I do?' and 'what could be alternatives?'. In a later publication, Korthagen & Vasalos (2005) provide an additional model, arguing for the value of deeper reflection within their (educational) context ('core reflection'), connecting such action to a deeper notion of self, including competencies and identity. In reflection on everyday life we are similarly interested in these different levels of actions, competencies, values and personal identity.

## **Everyday life & media interaction**

In the home, one of the iconic places of everyday life, people surround themselves with objects and media that relate to their past lives. Such a 'landscape of autobiographical objects' (Petrelli, Whittaker & Brockmeier, 2008, p. 10) serves several purposes, such as being a conversation-starter, providing comfort and evoking emotions (Petrelli, Whittaker & Brockmeier, 2008). Similarly, digital photos have been found to serve both individual and social purposes (Lux, Kogler & Fabro, 2010, Broekhuijsen, van den Hoven & Markopou-

los, 2017). However, digital media are much less frequently seen in the home (Petrelli, Whittaker & Brockmeier, 2008) or mentioned as valuable memory items (Zijlema, Van den Hoven & Eggen, 2017). This is despite the fact that digital media, and especially photos, are created in vast quantities. With the advent of digital photography, the creation of photos has become 'cheap', both in effort and money (Niforatos, Langheinrich & Bexheti, 2014). Storage of virtually unlimited creation of high-quality photos is possible at all times using smart-phones. As a result, many people create large quantities of media that are often badly managed (Bergman et al., 2009; Broekhuijsen, 2018), but instead are stored in bulk on hard-drives or in cloud storage, being 'hidden away'. Several design research projects have explored the challenge of bringing these media into the context of everyday life. For example, by making the photos visible within the home on interactive displays (see e.g., Phototype by Van Gennip, 2018, Meerkat & Tuba by Helmes et al., 2011). These systems use (tangible) interaction as a way to give the media more presence within an everyday context. Others have studied the integration into specific everyday routines, such as having dinner together (4Photos by Bhömer et al., 2010) or family storytelling (Cueb by Golsteijn & Van den Hoven, 2013). The advantage of bringing media into the everyday context and routine is that people can benefit more from the potential value of such media. Inspired by these designs, we believe the reflective potential of media can similarly be fostered.

In conclusion, at the intersection of everyday life and media interaction, we see the opportunity to integrate digital media use better in everyday life through its context and interactions.

## **Reflection & media interaction**

Different types of technology can support reflection. Here, we present media interaction in a contrast to data-supported reflection. Domains such as personal informatics and the quantified-self explore the use of quantitative data to support reflection. The practice of collecting personal data can be described as an iterative process of preparation, collection, integration, and reflection, ultimately aimed at action (Li, Dey & Forlizzi, 2010). Most commonly, this data is (in part) automatically collected by systems. In turn, these systems present the data through visualisations, suggestions or overviews. Reflecting by looking at this data is useful as it shows things that cannot be directly perceived (e.g. steps taken in a day) and can show long-term trends or patterns. Despite these advantages, we believe data supported reflection has several limitations. First, it often focuses the reflection on a (single) specific dimension, which does not suit the diversity of everyday life reflection. Secondly, it often sees systems as having a certain 'authority' (Sengers & Gaver, 2006). At the risk of trusting more on a system, rather than becoming truly self-conscious. We, therefore, prefer to support reflection using human-generated media because it is open and personal.

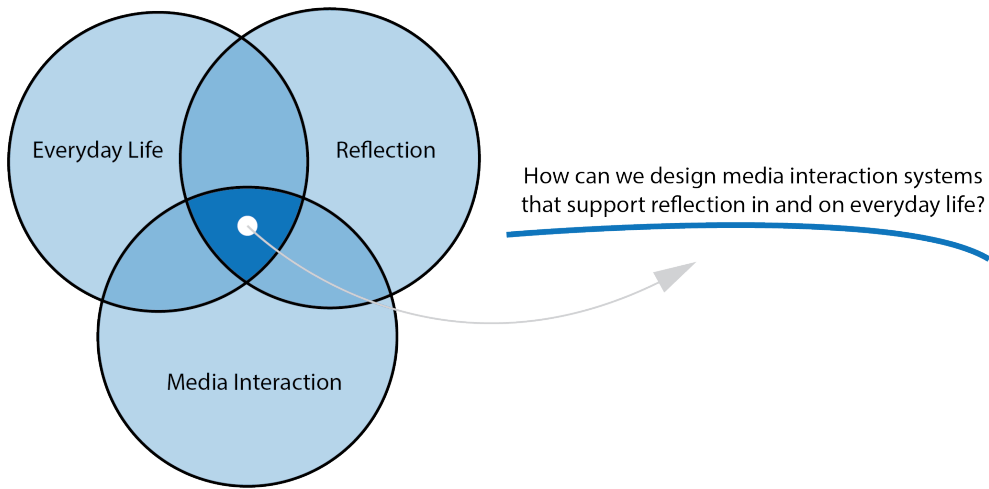
In an educational context, reflection is often supported by written material such as portfolios (Orland-Barak, 2007) and journals (Kember, 2010). Such written accounts are also seen in the personal domain, in the form of diaries and personal journals. In recent years, there seems to be a rising trend of specific journals aimed at reflection, sometimes based on the notion of gratefulness from positive psychology. In such ‘gratitude journals’ people are prompted to note several things each day that they are grateful for. Such positive thinking interventions have a good potential of increasing wellbeing and reducing depressive symptoms (Hollis et al., 2017). In other journals, more directive and diverse prompts are used, such as ‘five-year journals’ in which a certain question is posed each day with room to give an answer on the same date over a five-year period. Using prompts was also seen as a way to make the use of photos more reflective, for example by adding experience tags (Landry, 2009). Others have explored the reflective use of photos as part of diary-like apps (Isaacs et al., 2013) or by reviewing (automatically created) Sensecam photos in a reflective way (Lindley et al., 2011). These studies have in common that they primarily study the moment the photos are being viewed. The area of written media additionally often looks at the moment media is created, as reflection is supported both by writing (creation) and reading (retrieval). We take a similar approach to any type of media use, exploring how reflection is supported both through creation and retrieval.

In conclusion, at the intersection of reflection and media interaction, we see an opportunity for open and personal support. We have no predefined focus on a specific type of media, but explore multiple modalities. We explore how reflection can be stimulated during both media creation and retrieval.

## **Research aim**

Based on the intersection described above, we identify a research opportunity by focussing on everyday life reflection through media creation (see Figure 1.2). As the intersections above illustrate, combining these topics creates a unique area to explore, providing an addition to the existing work on reflection. We will discuss this scope elaborately through our theoretical grounding in Chapter 2. Here, the scope is summarized in our primary research aim. As we are interested in supporting reflection through the design of media interaction systems, this aim is formulated as a design challenge:

*How can we design media interaction systems that support reflection in and on everyday life?*



*Figure 1.2. The research challenge as identified at the intersection of three themes.*

The design challenge is explored through a research-through-design process, elaborately discussed in Section 1.6. In addition to the design challenge, this process is guided by three research-questions, one from each of the circles above:

1. Which everyday life experiences become meaningful, and which are valuable for reflection? (Everyday life)
2. What are people's practices, values, and desires concerning everyday life reflection? (Reflection)
3. How do system-supported media creation and media use influence reflection? (Media Interaction)

These sub-questions can best be addressed by combining the findings from the various studies in this thesis. Therefore, these questions and the overarching research aim will mainly be discussed at the end of this thesis.

## 1.6 Approach

In the previous section, we formulated our primary research aim as a design challenge. We address this challenge by doing design research, a term that refers to a wide variety of practices that include a combination of design activities and research. Different scholars have used different terms to differentiate between approaches. Often used are the classifications as introduced by Fallman (2003) into design-oriented research and research-oriented design and as introduced by Frayling (1993): research into design, research for design and research through design. With research-into-design he refers to research that studies the practice of design. The second type, research-for-design, uses a variety of methods to inform design practice. Some (e.g. Golsteijn et al., 2014) have argued that this is very similar to Fallman's research-oriented design. Finally, research-through-design, refers to research that uses design action as a tool or method. This term has been widely used and re-defined by multiple academics, and is increasingly described as an approach often taken within HCI (e.g. Gaver, 2012, Zimmerman, Forlizzi & Evenson, 2007).

In our work, we adopt such a research-through-design (RtD) approach, using a variety of design actions. The aim is to gather (design) knowledge, rather than create a finalized design product. For us, a primary characteristic of RtD is that it studies the world as it could be, rather than only observing its current state. In other words, RtD is about research into the future, a view shared across many of RtD's definitions (Zimmerman, Stolterman & Forlizzi, 2010). Zimmerman, Stolterman & Forlizzi highlight that most definitions share a few more characteristics that shape the scope of RtD: it uses some variation of user-centred design (involving users before, during and after design) (Gaver, 2012) and is often exploratory. In such exploratory domains, design becomes problem setting as much as problem solving (Fallman, 2003) or in other words the design- and solution space evolve simultaneously. Despite these shared characteristics, RtD has been criticised for being more of an attitude rather than a systematic method of inquiry, because of a lack of protocols, descriptions and guidelines (Zimmerman, Stolterman & Forlizzi, 2010). Other, such as Gaver (2012) argue that a route towards more strict processes should be approached with care and that divergence in tools, methods and processes is not necessarily bad.

For our research challenge, we consider RtD as the preferred approach for several reasons. First, for its generative perspective and future-orientation, allowing to study needs, values, and potential future experiences. Secondly, RtD allows possible solutions to be evaluated in a real-life context, in which theories can also be confronted with real-life 'messiness'. Finally, RtD allows learning about the topic by doing, leading to discussions, new insights and ideas (Van den Hoven et al., 2007).

Although the overall approach can be characterized as Research-through-Design, some of our specific studies are inspired more by Research-for-Design methodologies, such as a questionnaire. As suggested by Golsteijn et al. (2014), research-for-design and research-through design are not exclusive practices but can be powerful if used together effectively and reflectively. In our approach, methods from both perspectives are used iteratively (see Section 1.7 and Figure 1.3 for more details). However, because of the emphasis that we put on the design and evaluation of design artefacts in the construction of knowledge, our process as a whole can be characterized as RtD.

## **Design for open-ended reflection**

We approach our design challenge with a specific perspective: to design with an open approach. We create designs that leave part of its use open to interpretation (Sengers & Gaver, 2006). This allows for users to appropriate how they interact with systems.

This approach with openness is very suitable for our focus on everyday life. As Sengers & Gaver (2006) observed, traditional perspectives in which a single interpretation of use is “the right one” do no longer suffice when computing shifts to other domains. In everyday life, HCI becomes “*broader more personal, more idiosyncratic and therefore less appropriate for designer control*” (Sengers & Gaver, 2006, p. 99). Allowing for multiple interpretations of a system to exist in parallel is then helpful to create meaningful designs. It allows systems to be used in different ways by different people (even niches) without trying to optimize it for one of those areas. As we consider everyday life reflection a broad type of reflection, we similarly aim to design systems that can be used by a variety of people for a variety of ways of reflecting.

By describing this direction as “design for open-ended reflection” we draw a parallel to design for open-ended play (Valk, Bekker & Eggen, 2015). This area is concerned with designing interactive systems that stimulate (children) to create different forms of play, without rules being prescribed (Valk, Bekker & Eggen 2015). Similarly, we design conditions and system interactions from which reflection can emerge, but do not define the steps (or rules) to be taken in this reflection. This framing highlights the degree of open-endedness. Sengers & Gaver (2016) describe different levels of openness to interpretation: at the lowest level of interpretation, users interpret a system’s interface and actions they can perform (“what does this button do”). The middle levels of interpretation relate to unpacking how the system relates to their everyday life (for example “what activities is it appropriate for” or “what role can it play in my life”). The highest level of interpretation relates to the broader context and cultural meaning of a system (“what does it mean about me, my society, my culture”). In our approach to design for open-ended reflection we especially see opportunities for being open to interpretation on the mid-level. As one of the strategies by Sengers & Gaver (2016)

highlights, the open-endedness is bound in a certain way, allowing for a “space of interpretation around a topic”. Open-ended design for reflection is primarily bound by its aim: to reflect. Its openness is seen in some aspects of ‘meaning making’ of the object through use (Redström, 2008). Redström poses that designing a ‘thing’ inherently also means designing its use. But part of the ‘use’ can also remain open allowing users to explore their personal meaning through use. We do not want our designs to prescribe a very specific use (how to reflect) but give a general direction (to reflect). In our designs, this is seen in leaving the ‘steps’ of reflection open to the user, as the complexity of reflection in everyday life cannot be reduced to different stages (Ekebergh, 2007).

## **Characteristics of a Research-through-Design process**

The research-through-design approach has several implications for the process of research. Such a process does not focus on linear iteration but uses a variety of studies and activities to reach a better understanding. The methods used in this thesis are primarily qualitative. As part of a holistic design approach, the focus is on subjective measures and self-reported experiences. Such methods are suitable as the research focuses on individual values and individual differences. The rich, qualitative insights are most suitable to inform holistic design decisions. More traditional methods, such as interviews and questionnaires are combined with more creative and generative methods, such as cultural probes, design interventions, and prototype deployments. Prototypes take a central role in research through design, which we will discuss more elaborately below. In the following paragraphs, we will elaborate on three aspects of this process: the use of theories as background, the involvement of people and the use of design concepts.

### *Building on theory*

RtD does not start from a vacuum but is often informed by theories from different fields (Van den Hoven et al., 2007). The design work in this thesis is informed by a number of theories, more elaborately discussed in Chapter 2. Most of these theories focus on autobiographical memory and reflection, coming from psychology, philosophy and educational sciences. Specifically, the work is strongly grounded in the model of the self-memory-system (Conway & Pleydell-Pearce, 2000) and on the functions of autobiographical memory (Bluck, 2010, Williams et al., 2008). For our understanding of reflection, we build mainly on the theories of Dewey (1933) and Staudinger (2001). In addition to psychology and philosophy, remembering and reflecting are also dealt with in cultural, behavioural (Shipp et al 2009), and even business studies (Holak & Havlena, 1998).



### *Involving people*

The involvement of ‘users’ is at the core of various design approaches, often split into user-centred design (user as subject) or participatory design (user as partner) (Sanders & Stappers, 2008). As mentioned above, our research-through-design process adopts aspects of user-centred design. These studies thus involve participants, resulting in some ethical considerations on two main aspects: by gathering information and by having an impact on lives. Gathering information results in several potential privacy risks, both by interviewing (and recording) and by collecting media. In all the studies within this thesis, the collected information was minimized and focussed data collection was used to answer our questions. Additionally, most studies rely on self-report or interviews, allowing people to filter and express what they want. In the case of concept evaluations that use or create media, additional measures are taken to reduce any invasion of privacy. In all cases, only selective access to media was given, after explicit consent and only to the primary researcher. Secondly, design research is based on intervention, not only on observing current practice. These interventions have an impact on the participants and their lives. In our case, prompting to recall past experiences and stimulating to reflect is not without potentially negative effects. Several measures are taken to reduce these risks. First of all, the research is generally focused on everyday-life thoughts, not on negative or traumatic thoughts. Secondly, the research mainly uses open questions and prompts, giving the freedom to focus on aspects people want to (re)consider. Providing these measures, the ethical implications of our studies are minimal and UTS Human Research and Ethics Committee has approved all studies in this process.

### *Creating design concepts & prototypes*

In our RtD process, design concepts and prototypes take a significant role. With concepts, we refer to the more general design descriptions or, as Stolterman & Wiberg (2010) describe it: “a concept design is an exploration of new ideas and constitutes a new composition from the perspective of the researcher with the intent to address and challenge existing theoretical concepts and frameworks.” [p. 104]. Concepts can manifest themselves in many ways such as drawings, scenarios or prototypes. In a design research process, a prototype can serve different purposes: providing focus for a discussion, testing a hypothesis, confronting theories, confronting the world and changing the world (Stappers, 2013). For us, prototypes are especially important for their ability to test hypotheses and confront the world. A prototype is not a complete concept, rather a prototype is a placeholder for something else (Wensveen & Matthews, 2015). A prototype allows people to experience (specific aspects of) a concept, and should not be judged for its actuality or present state but for its potential. In other words, “not judging it only by what it is, but also by what it might become” (Wensveen & Matthews, 2015). As Houde and Hill (1997) explain it, a prototype serves a

certain role; something is prototyped, be it the role, implementation or look and feel of a concept. In their definition, a prototype is any representation for a design idea regardless of the medium (e.g. physical, video prototype or description). In this thesis, when we refer to prototypes, we refer to physical items with some aspect of interactivity that have been made to make a concept experiential. Both concepts and prototypes can be used to *express* as well as *gather* knowledge (see below). Questions or prompts are often used to stimulate participants to think broader than the prototype and reflect on the concept and conceptual contributions. However, within design-research, there has been critique that design just seems to ‘happen’ and prototypes come into existence without attention for the process (Fallman, 2003) and some researchers seem to hold a ‘romantic view’ of design with a ‘genius designer’ (Zimmerman, Stolterman & Forlizzi, 2010). Such a lack of attention for the role the act of designing makes in the construction of knowledge limits the potential contribution of design-research. As a solution, some have argued to provide more detailed documentation of the design process (Zimmerman, Stolterman & Forlizzi) or to combine concepts and rationale in ‘annotated portfolios’ (Gaver, 2012).

## **Outcomes from Research-through-Design**

Research-through-Design can be seen as an open and reflective practice, even one in which ‘problem and solution space evolve simultaneously’ (Fallman, 2003). With such framing, what can be considered a successful outcome, as traditional scientific measures might not apply (Gaver, 2012)? The knowledge contributions from research-through-design are primarily generative: they are concerned with what might be rather than with what currently is (Gaver, 2012). The success of a design-research process is defined by the knowledge it gathers and by the extent to which this knowledge can inform future design. RtD has been criticized for not putting the creation of knowledge as an intended outcome (Zimmerman, Stolterman & Forlizzi, 2010), but for us it is a central component of the approach. Our outcomes are primarily focussed on intermediate-level knowledge, a type of outcome in design-research that is ‘more abstracted than particular instances, without aspiring to be at the scope of generalized theories’ (Höök, & Löwgren, 2012, p.23:1). Within this level, we focus on contributions that are generative rather than evaluative. Examples of generative knowledge forms include patterns, guidelines, annotated portfolios, tools or strong concepts (Höök, & Löwgren, 2012). We adhere to Stolterman’s (2008) view that “designers can be prepared-for-action but not guided-in-action by detailed prescriptive procedures” (p 61). Our outcomes are therefore presented as a set of design considerations (Chapter 8) to be taken into account when designing, rather than detailed procedures or guidelines.

As explained in the previous section, prototypes and concepts play an important role in the construction of this knowledge. A variety of HCI- and design researchers have put different

emphasis on design artefacts as an outcome, for example describing them as 'ultimate particular' (Stolterman, 2008) or as 'theory nexus' (Carroll & Kellogg, 1989). They put forward how artefacts can be seen as "[in] itself is a type of implicit, theoretical contribution." (Zimmerman, Stolterman, Forlizzi, 2010). For us, artefacts are most important during the process, rather than as end-result, in line with Fallman's (2003) description that "the resulting artefact is considered more a means than an end". In our research-through-design process, the evaluation of concepts through deployments 'in-the-wild' (Rogers & Marshall, 2017) plays an important role. Even with our emphasis on a certain level of open-endedness, success factors of design artefacts need to be specified for them to be evaluated. As our open-endedness is constraint by a focus on everyday life reflection, the characteristics of this scope are discussed in more detail in Section 2.3 and used as a way to review our design interventions (Section 9.2).

On a more abstract level, the success of the research is discussed in Chapter 9, by answering research questions (and highlighting where these were not answered) and by discussing the research aim (Section 9.3). We will come back to the limitations of this approach in Section 9.4.

## 1.7 Outline of this Thesis

The iterative and reflective process of our design-research consists of multiple studies and explorations that contribute to our aims and questions. To provide a clear overview, we have created a visual representation of this thesis (Figure 1.3, p.22). As can be seen, the process shifts between studies with a stronger focus on research-for-design and research-through-design (see also previous section). Although any chapter is influenced by all previous chapters, the visual shows several specific insights that influenced a future study specifically.

Following this introduction, we explore the thesis' topic from a theoretical perspective. In **Chapter 2**, we present our scope of everyday life reflection by **reviewing literature** from diverse fields on remembering and reflecting. Although either of these processes can be considered without reference to the other there is great overlap as well: in functions, processes and advantages. In this chapter, we explain our choice for the term everyday life reflection over reflective remembering. This choice puts the focus more on the content and context (everyday life) allowing for more variety in temporal perspectives taken (including past as well as present and future). Additionally, we discuss how media can be used in these processes and how a diverse range of projects from HCI and design has aimed to support both remembering and reflecting. The concepts are reviewed to bring forward common aspects of design that can inspire our future design explorations in this thesis.

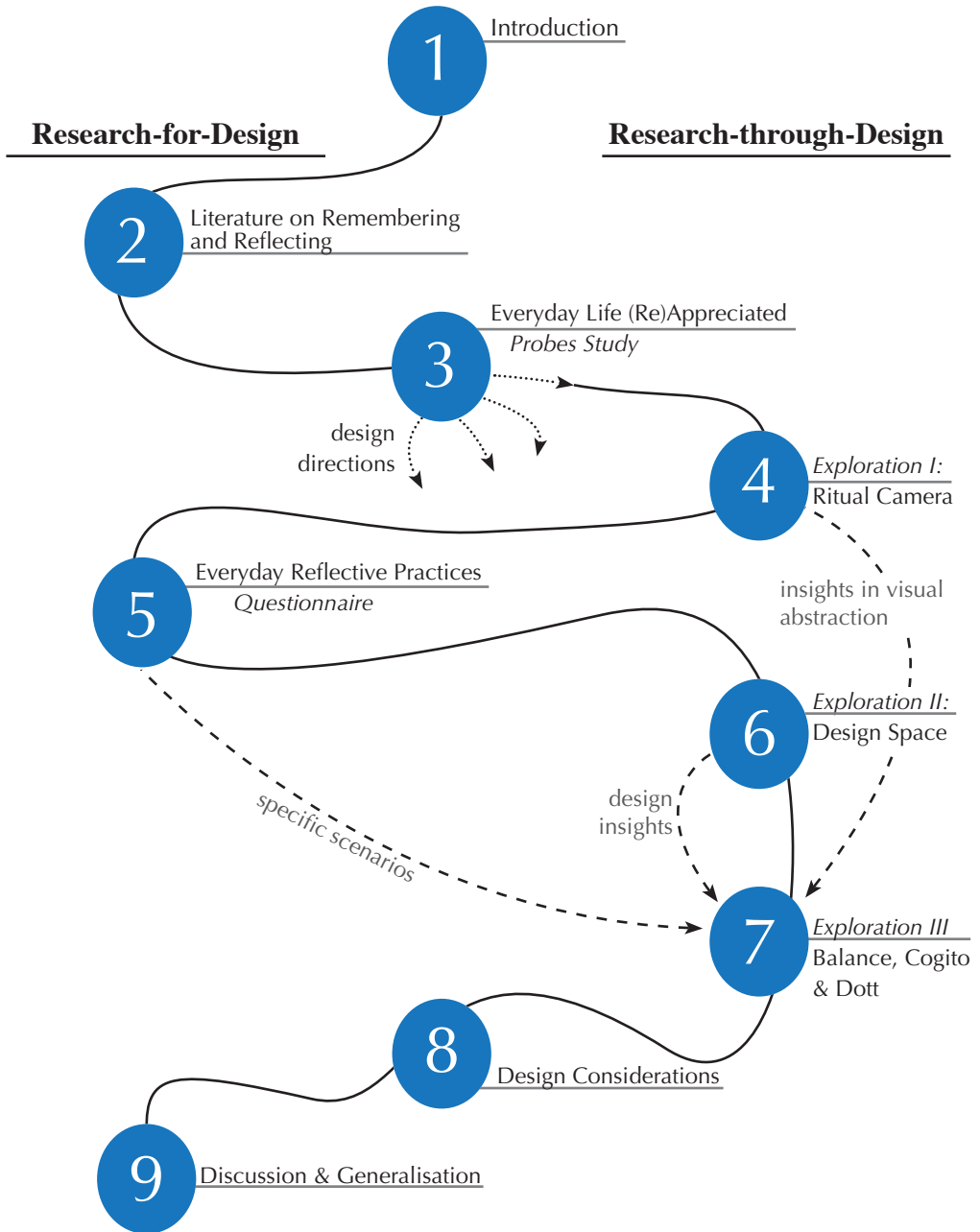


Figure 1.3 Visual representation of the outline of this thesis. The main line represents the storyline going through all the chapters. Dotted lines indicate specific potential design directions. Dashed lines indicate specific contributions between chapters (apart from all chapters being informed by the previous work).

This theoretical review gave detailed insight in the process of reflection, but also highlighted the need for more research on the intersection of our themes. The following chapters therefore take such a broader perspective, exploring the values associated with everyday life (Chapter 3), the intersection of media creation and everyday life (Chapter 4) and the intersection of reflection in everyday life (Chapter 5). These studies provided additional insights about our scope, before focussing specifically on combining all three themes into exploring design for everyday life reflection (Chapter 6 and 7).

Everyday life is rarely made explicit as a focus in research and it often remains abstract what value it provides. In **Chapter 3**, we therefore explore from an empirical perspective how everyday life experiences are perceived and described. Although all our three central themes are involved, the study focusses most on the concept of everyday life, to explore what it constitutes and how it is valued. Specifically, we present a **probes study** on mundane experiences. This method was chosen as it can help people to consider and express things they often do not think about explicitly, which applies very well to everyday life experiences. By combining probes with in-depth interviews, we explore how such experiences are valued, both from the present and the past. The study is aimed at answering research questions such as: What constitutes everyday life for people? Why are some everyday experiences considered valuable? And how do people appreciate present experiences? We see that past everyday experiences are appreciated for a wide variety of reasons, but such appreciation often only evolves later, for example during periods of transition. We also found that capturing current everyday experiences in a meaningful way was challenging. The study brings forward four directions for design: creating mementos in retrospect, repurposing mementos, selecting experiences in the present and creating media for repeated events.

In **Chapter 4**, we continued with one of these directions in our first **design exploration**, focussed on capturing repeated experiences. As repetition is such a core element of everyday life, we wanted to explore how such experiences could be represented in media. We choose to use abstract visual media that combines multiple single instances to resemble the way our mind combines the memories of multiple single experiences. We designed Ritual Camera as a means to create such abstract visuals. Whereas the previous chapter was primarily focussed on past everyday life experience, this chapter focussed on the capturing the present. The chapter explore the intersection of the themes media creation and everyday life, with a strong focus on novel media types. We explore nine different visual styles with several households. Central questions include: how are different representations valued? And how are media valued differently when distinguishing between remembering and reflecting? Findings show that the visuals are appreciated differently for different purposes. Some of the visuals were very surprising for people and/or gave them new insight.

These moments of reflection further strengthen our belief that media can be used for more reflective purposes. Our findings show how the media can help people to reflect on everyday life but tell us little about how people normally reflect in everyday life. The following two chapters explore opportunities for reflection in everyday life in two ways; through an empirical study on current practices and through a design exploration on potential future practices

To inform how to design for reflection, we wanted to know more about current practices of reflection in everyday life, without the involvement of extra probes or concepts. We therefore conducted an **online questionnaire**, described in **Chapter 5**. Because design explorations often involve a low number of participants with rich in-depth results, we wanted to complement this with a broader exploration with a higher number of participants. Our research questions concerned the timing of reflection, the physical context, the used tools and social context. In short, we explain these characteristics as describing the 'practices' of reflection. The study thus focusses on providing insight into the context and circumstances around reflection rather than the content of reflection. These circumstances are explored with a combination of quantitative and qualitative measures. Findings show that most people reflect frequently, but not as a fixed habit or routine. The experienced need for reflection varies between different periods and depends on experiences as well as context. Many people indicated reflecting alone as well as with others. The questionnaire also brought forward a number of specific scenarios that describe the context in which people frequently reflect, used as an inspiration to our third design exploration.

In parallel to the empirical exploration of current practices, we explore the design space for reflection in a broad conceptual way. **Chapter 6** presents our **second design exploration**, focussing on such a broader exploration of the possibilities to support everyday life reflection. First, we describe three strategies for reflection as often found in literature. The previous chapter was aimed at finding out how people normally reflected, to which this overview adds how reflection is supported in a variety of academic disciplines. We choose to explore the design space broadly through a number of brainstorming sessions and discussions. The overview of the created concepts reveals the different roles systems can take by triggering, supporting or capturing reflections. The combination of strategies and roles is used as a way to describe a design space. Providing more specific vocabulary on how systems can specifically relate to reflection. Additionally, the design space highlights several important considerations for design for reflection such as a holistic approach, open-ended design and balanced initiative.

These notions are further explored in **Chapter 7**, in our **third design exploration**, for which three concepts are selected from the design space to be explored further. We developed

these concepts in more detail based on the scenarios from our questionnaire study. All three concepts for reflection use media interaction, each focussing on a different media type. With Balance, we explored personal voice messages as a form of auditory media. With Cogito, we explored textual media by combining mobile messages with a tangible interactive object. Finally, with Dott, we explored visual media for reflection. The concepts are evaluated in an in-depth evaluation with six participants, each using all three different concepts in turn. Questions include both how these designs could be used in everyday life as well as how they impacted reflecting on everyday life. Therefore, an in-the-wild evaluation lasting several weeks allowed participants to experience the concepts and gain experience in reflecting with them. We choose for each participant to experience all three concepts to allow for comparison, not just by us, but by actively involving the participants in discussing the differences between the concepts. The study provides more insight in how reflection can be integrated into everyday life habits as well as how the characteristics of reflection are influenced by the designs.

In the final part of the thesis, we aim to generalise the findings from the studies in this thesis to contribute to the field of interaction design for reflection. In **Chapter 8**, we combine the findings from the studies into **seven considerations** for everyday-life reflection. These considerations summarise our most important lessons for design concerning the scope of everyday life reflection, the integration into everyday life and the influence of media interaction. It is a way to synthesise across the findings of the different individual studies presented in chapters three to seven and connects these findings to the literature. Considerations have been chosen as a way of presenting ‘intermediate level design knowledge’ (Höök, & Löwgren, 2012) that is more abstract than individual instances yet not as abstract as a theory. This knowledge is generative (Gaver, 2012), with a primary aim to inform designers and researchers who focus on everyday life reflection and to inspire others to include more ‘everyday’ aspects in their (design for) reflection.

Finally, we conclude the thesis with a more elaborate **discussion** of our work in **Chapter 9**. We come back to the design challenge and questions as introduced in this chapter. Secondly, we consider our findings in relation to the theoretical scope of everyday life reflection, as presented in chapter two. This scope is shaped by the intersection of three themes, as presented in this introduction: everyday life, reflection and media interaction. We present how our findings can be generalised to each of these broader areas of study. Additionally, we discuss our experience within our research-through-design approach on a methodological level. We present potential directions for future research and end the thesis with some concluding remarks regarding the experience of everyday life.

## **1.8 Conclusion**

This thesis is concerned with reflection that occurs in and on everyday life. In this chapter, we have introduced this scope by providing examples of such everyday life reflection. We argue for the importance of supporting this through design because moments for everyday life reflection seem to be decreasing. Everyday life reflection has the potential to increase personal wellbeing by supporting making choices, having a sense of identity and changing behaviour. We have thus argued it to be worthwhile to explore how systems can support such everyday life reflection. Specifically, we highlight our aim to do this through media interaction, for the potential of supporting reflection in creating and retrieving, by providing a different perspective on events. This aim is positioned on the intersection of three related research topics: Everyday Life, Reflection and Media Interaction. We have argued that focussing on the intersection of all three themes creates a novel research opportunity. This chapter lays the foundation for the work presented in the remainder of this thesis.







# 2

## Literature on Remembering and Reflecting

**Abstract** This thesis focuses on systems that support reflection in everyday life. To be able to assess the value of these systems a detailed description of reflection is needed. Based on literature on both remembering and reflecting, we present our perspective on how these processes are intertwined. We discuss a number of theories that scope everyday life reflection, including its function, level, temporal dimension, process and the role of cuing. Following, we discuss how mediation and, more specifically, processes of media creation and retrieval can support reflection. The chapter is concluded with an overview of related designs.

## 2.1 Introduction

Reflection can be described from many different perspectives and remembering is a similarly broad term that can encompass a wide variety of processes. Because of these diverse definitions and approaches, the relation between reflecting and remembering can be viewed in different ways. As we will discuss below, perspectives on remembering include those from cognitive psychology and neuropsychology, but also from social sciences and philosophy. Reflection is primarily studied within education, psychology, philosophy, and design. In some of these fields, we see that reflection is being studied without explicit reference to remembering theories, or the other way around, when remembering is studied without attention for its reflective characteristics. Other researchers, especially within cognitive psychology and philosophy have emphasised the strong connection between remembering and reflecting. We adhere to this view, which we will elaborate on in this chapter.

Remembering can be defined in a simplified way as *bringing to mind or thinking of again*.<sup>1</sup> It refers to a number of activities such as recalling facts, considering intentions and bringing up personal past experiences. The latter meaning is especially prevalent when remembering is used in combination with the term ‘memories’ which often refers to recalling past personal experiences in an anecdotal manner. Everybody knows those moments at a birthday party when people exchange stories that start like “that one time on holiday...” or “when I was a kid I once went to...”. However, from an academic perspective, the scope of both remembering and memory is more than the voluntary recall of specific anecdotal memories. The fact that people have memory is what enables a far broader range of processes. For example, having the ability to remember allows us to form a sense of identity. Only because you can remember what kind of things you have done before, you can construct a notion of what kind of person you are. The development of such a notion of identity does not even require the constant or active recollection of such memories in story-like ways. In other words, autobiographical memory does not only refer to the deliberate recall, but also to the concept of being able to recall past experiences. This definition is further broadened from its everyday use by a temporal dimension. Often, when we talk about memories or remembering, we refer to events that are years, months or weeks ago. However, memory is also involved when recalling what you did this morning or only minutes ago.

Reflecting, as a verb, might be less used in everyday language, compared to remembering, although people engage in both processes frequently. Many different definitions of reflection exist, but in essence it can be described as *the thoughtful consideration of some subject, idea or purpose*.<sup>2</sup> Reflection in everyday life for example occurs when you are driving home from work, recalling a meeting of that day and considering how to address

the matter in the future. Similar to remembering, reflecting can take many different forms, ranging from more light-hearted to very serious considerations of one's life path. The core notion of reflection is the aim to change something, whether this is thoughts, emotions, presuppositions or future actions.

In research, different relations between remembering and reflecting have been discussed. The model by Staudinger (2001), for example, is based on a strong connection between reflection and autobiographical memory (AM), arguing that reflection consists of remembering plus further analysis, as such considering remembering *part of reflecting*. In contrast, Sellen & Whittaker (2010) propose reflection as a specific *type of remembering*. In this thesis, we do not adhere strictly to one of these views as we do not make a hierarchical distinction between the two processes. In our opinion, both processes show an overlap, rather than one belonging to the other. We choose this perspective for three main reasons. First of all, from an academic point of view, theories from both fields show clear connections: they serve similar functions, change over the course of a lifetime and have different levels of detail. Section 2.3 further discusses these characteristics. These theoretical similarities make it more worthwhile to look at the overlapping areas, rather than making a hierarchical distinction. Secondly, on a more everyday experience level, it is difficult and not necessary to make a hierarchical distinction. In everyday life experience, people mix modes of thinking, and in any such moment, both remembering and reflecting can play a role. Finally, we view both concepts as mental processes, not as an activity, which allows both processes to be intertwined. From our perspective, people can be engaged in specific activities (such as talking or walking) that can support these processes, but we do not consider remembering or reflecting an *activity* in itself.

In the following sections, we will first look at the broader range of research areas concerned with remembering and reflecting, which will help define the specific process we are studying: everyday life reflection. We end Section 2.2 by introducing and defining this term, arguing why it is more appropriate for our aims than using reflective remembering. Following, we will discuss relevant theories on the characteristics of this process that inform our design work. One of these characteristics is the process of cuing: triggering memories with (external) information. In Section 2.4, we will explore how media can serve as such external cues, to support everyday life reflection. Finally, we give an overview of related design research that shares some of our aims in Section 2.5.

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<sup>1</sup> <https://www.merriam-webster.com/dictionary/remembering> Last accessed March 2019.

<sup>2</sup> <https://www.merriam-webster.com/dictionary/reflection> Last accessed March 2019.

## 2.2 Related Research Areas

Both remembering and reflecting are studied in a range of fields, from which we select the approaches most suitable to inform our designs. To make this perspective more explicit, we briefly illustrate the broader related fields.

### Remembering in different fields

As was described above, remembering is a broad term. The use of remembering in an academic context is broader than its everyday definition mentioned above. The Oxford dictionary broadens this definition by highlighting that it is not just the “bringing to mind” of things but also includes “*to be able to bring to one's mind an awareness of (someone or something from) the past*”<sup>3</sup>. The related term 'memory' refers to both “*the faculty by which the mind stores and remembers information*” and “*something remembered from the past*”<sup>4</sup>. Human memory concerns many aspects including facts, knowledge and personal experience and can thus be studied on different levels. First of all, a difference can be made between explicit memory and memory, where explicit memory refers to intention or conscious recollection of experiences and implicit in contrast refers to unintentional retrieval of previously acquired information (Schacter, 1987). Implicit memory is often involved in processes of ‘fast thinking’ (Kahneman, 2011) when actions are guided by thoughts that happen with little or no effort. Experiences that are not available to conscious or voluntary recall nevertheless influence cognition and behaviour in everyday life (Schacter, 1987).

A second distinction that can be made is whether memory is studied on an individual, social or cultural level. These studies, for example, focus on how a particular nation remembers a part of its history or how a generation experiences nostalgia. Cultural memory includes both the collective and the individual as shaped by culture (Van Dijck, 2005). Some studies combine this approach with a focus on external memory support, exploring people’s experience at memorials (Dekel, 2009) or refugees’ experience of revisiting places where they have lived (Marshall, 2016). Other fields focus more on the individual’s memory, studied in neuropsychology, cognitive psychology, and philosophy, often with a special focus on memory dysfunction (e.g. memory-loss, amnesia). Phenomena of memory dysfunction are studied both in an attempt to be resolved (cured or supported) and because studying dysfunction improves the understanding of normal remembering as well. Based on the increased understanding of normal remembering, different types of memory have been described, with distinctions being made in different ways (see e.g. Renoult et al., 2015).

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<sup>3</sup> <https://en.oxforddictionaries.com/definition/remember> Last accessed March 2019.

<sup>4</sup> <https://en.oxforddictionaries.com/definition/memory> Last accessed March 2019.

For example, the distinction between semantic and episodic memory is often referred to as ‘knowing’ versus ‘remembering’ (Tulving, 1985). Within this thesis, the scope of remembering and memory is that of autobiographical memory (AM): the memories for the events of one’s life (Conway and Rubin, 1993). Although the episodic and semantic memory can be distinguished on some theoretical level, they are not stored entirely separately in the mind but are instead intertwined within the Self-Memory-System (Conway & Loveday, 2015). This system contains many different types of knowledge, both autobiographical (that which one has experienced oneself) as well as cultural and societal knowledge (Conway & Loveday, 2015). Within this system, memories are not seen as being stored, but as patterns of temporal activation. During these moments memories are temporarily constructed within the mind (Conway & Loveday, 2015). Although being aware of memories only happens occasionally, it is argued that the Self-Memory System is always partially active, even during sleep (Conway & Loveday 2015). These aspects of the self-memory system, as well as its levels (discussed in Section 2.3), have been the central theory for our understanding of human memory to inform design.

### *Remembering in HCI*

Design for remembering is of increasing interest within HCI. Different scholars have referred to similar attempts in different ways, including ‘Designing for Personal Memories’ (Van den Hoven, Sas & Whittaker, 2012), ‘Design for Remembering’ (Elsden, Kirk & Durrant, 2015) and ‘Designing for Remembering Experiences’ (Van den Hoven, 2014). All refer to the creation or appropriation of artefacts for supporting human memory or remembering. Some systems have the premise of ‘being’ memory or serving as ‘memory prosthesis’ (Lamming et al., 1994). Some areas, such as lifelogging, aim at storing large quantities of data to support ‘total recall’ (Sellen & Whittaker, 2010). Lifelogging is based on passive capture: automated creation and archiving of media in daily life. However, research shows that the objects people value are often the result of a deliberate and personal selection process (Petrelli, Whittaker & Brockmeier, 2008), a value lifelogging does not provide. Several people have therefore argued for a more deliberate design approach for memory support systems.

Such an approach can be based on autobiographical memory theory (Van den Hoven & Eggen, 2008) or be supported by a more specific focus on a certain type of remembering (Sellen & Whittaker, 2010). This approach also recognises that technologies cannot contain the memories, but can only serve as cues (Van den Hoven & Eggen, 2014, see also Section 2.3). In other words, rather than capturing large parts of people’s lives to ‘an external memory’ several researchers have argued that designers of interactive systems should focus on “*designing effective retrieval cues*” (Sellen & Whittaker, 2010, p.6; see also Van den Hoven & Eggen, 2008). This perspective, of creating and retrieving media as explicit

cues, provides a more reciprocal relationship between human memory and media-technologies. Media are created (and used, retrieved or appropriated) because of specific memory processes and in turn, memory construction is influenced by the involved media. A number of examples of design for remembering will be further discussed in Section 2.6.

## **Reflecting in different fields**

Similar to remembering, reflection is studied within various areas, including education, philosophy, psychology, and design. The topic attracts much attention, from both theoretical and applied perspectives, of which many refer back to Dewey (1933). In his pioneering work “How we think” (Dewey, 1933), he distinguishes four types of thought: the first considering chance or idle thinking, the second imaginative thought and thirdly belief. These three types are set apart from the fourth type, reflective thought, which can be started from either of the first three. Reflective thought is described as: “*active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends*” (Dewey, 1933 p.6). However, Dewey also recognises that the four modes blend, which makes reflection more challenging to distinguish. His definition of reflection is characterised by the combination of belief and support. Reflection implies that something is believed not just on its own account, but through something else as proof or evidence. Dewey’s work has formed a theoretical basis for studies of reflection, especially in an educational context. It has inspired most contemporary models of reflection, for example in experiential learning (Kolb, 1983) and professional education (Schön, 1983).

Later work, whether directly inspired by Dewey or not, has often adopted different definitions from the one cited above. Baumer et al. (2014) explicitly provide an inclusive definition of reflection as “*reviewing a series of previous experiences, [...] putting them together in such a way as to come to a better understanding or to gain some sort of insight*” (p. 94). Boyd & Fales (1983) similarly emphasise that reflection concerns both the examining or exploring of an issue and that it “*creates and clarifies meaning in terms of self and which results in a changed conceptual perspective*” (Boyd & Fales, 1983, as quoted by Kember, 2010, p.22). The aspect of a changed conceptual perspective seems to require more critical reflection, which Mezirow defined as “*reassessing our own orientation to perceiving, knowing, believing, feeling and acting*” (Mezirow, 1990, p. 23).

Mezirow further distinguishes non-reflective action from *reflective action*, the second involving a (short) pause to reassess what one is doing. This distinction closely relates to Schön’s (1983) work on reflection-*in*-action, which he, in turn, distinguishes from reflection-*on*-action. These two terms have been frequently used in areas of educational reflection and reflective design. Reflection-*on*-action refers to retrospectively considering an experience, its



ground, and potential implications. In contrast, reflection-in-action occurs while an action is being performed and can still be adapted. A mode of performing that is often considered to be preferred for practitioners. In education both modes are often combined, when reflection is supported both during an activity and afterwards. Mezirow (1990), adheres more to the view of reflection-on-action and argues that critical reflection, requires “*ex-post facto consideration of previous learning*”. In our view of reflection, we focus primarily on such reflection-on-action, occurring outside of the considered experience.

It is important to notice that these authors, Schön, Mezirow, and Kember, have all written within the context of education or professional development, which is different from our focus on personal context and personal development. The topics within education are often more specific and pre-determined. In a sense, the experiences that are reflected upon (e.g. lessons or course activities) are often ‘staged’ to be ‘ideal learning experiences’ (Slovak, Frauenberger & Fitzpatrick, 2017). Instead, with concepts such as Life Reflection (Staudinger, 2001) it is more emphasised that any (life) experience or event can be the topic of reflection. Therefore, although we build upon the definitions from the educational context, the emphasis in our work is slightly different.

#### *Reflection in HCI*

Reflection is of growing interest within HCI, and has been explored under different names including ‘design for reflection’ (Landry, 2009, Sas & Dix, 2009, Sas & Dix, 2011), ‘technology supported reflection’ (Morris, date unknown), ‘reflective informatics’ (Baumer, 2015, Saksono & Parker, 2017) or ‘reflective design’ (Sengers et al., 2005). An important distinction to be made between these fields is whether the reflection is done by designers as part of the design process or by the users, on or through a system. Baumer (2015) distinguishes three different areas of design for reflection in which reflection by the user plays a role: personal informatics, slow technology, and reflective design. Personal informatics is the area of study focused on individuals recording and analysing personal data. However, the research within the field is diverse regarding why and how this is done (Ohlin, Olsson & Davidsson, 2015). For many researchers, reflection on the collected data plays an important role, as seen for example by the central position it takes in Li et al.’s model of personal informatics (2010). Despite such emphasis, it often remains unclear exactly *how* reflection is supported. It often seems to be assumed that merely showing “well-framed and presented data” is sufficient (Baumer, 2015). The second area, as identified by Baumer, is concerned with Slow Technology. This term was introduced by Hallnäs & Redström (2001) as an alternative to the focus on efficiency and productivity in interaction design. One of the aspects is the stimulation of reflection by the user (Odom et al., 2012) but this reflection is more often oriented towards the system, technology or interaction. The third area, Reflective Design,

puts reflection central, including multiple forms of reflection by both designer and user (Sengers et al., 2005). The majority of the core principles described by Senger et al. (2005) refer to the designer taking a more reflective stance or to engage in reflection with the users. Two of the principles focus more on reflection amongst users, highlighting that technology can (and should) support reflection on its own and that reflection should be integrated into activities (conform reflection-in-action). Again, both forms of reflection amongst users are primarily oriented towards the system, rather than other aspects of everyday life.

Although we acknowledge the importance of reflection as part of the design process, we focus on systems that support reflection in users. Such systems can be further specified by looking at the foreseen benefit of reflection including learning in an educational or professional context, gaining self-knowledge and stimulating behaviour change. In Section 2.5 we discuss a selection of examples that share some of our aims in supporting reflection through design.

## **Blurring boundaries**

Reflection, especially in the context of design research is often ill-defined (Baumer, 2015, Fleck & Fitzpatrick, 2010). Some argue that this unclarity makes it difficult to argue for the importance of supporting reflection. For example, Draper (1999) states *"This unclarity means among other things that perhaps we all do it anyway [...]. After all, "reflection" just means "thinking", and I'm sure we all agree that thinking is helpful to learning"*. In a similar strand, it can be argued that all thinking is concerned with the 'remembering self'. In Kahneman & Riis' (2001) model of 'the two selves', the human mind is divided in an *experiencing self* and a *remembering self*. The experiencing self is involved in the present moment, which has been argued to last only three seconds. Most such moments are fleeting, and we only keep our memories of them. As such, the only perspective we can adopt to think about our lives and experiences is that of the remembering self. With these views, *all* our thought-processes could be considered as being both remembering and reflecting (or at least all those that can be considered 'slow thinking' [Kahneman, 2011]).

Distinguishing reflection from other cognitive processes is further complicated when respecting the constructive perspective on remembering. In everyday life, people often describe their memories as being stored in the minds and simply retrieved. Such spatial analogies (in which memories exist in a 'space' and can be sought) have existed since Plato and have always been influenced by developments of the time (e.g. analogies including a wax tablet, rooms in a house, a library or a computer program) (Roediger, 1980). With the advancement of psychology, these views developed into the *reconstructive view* (in which each retrieval is a reconstruction and hence can be slightly different), which was later developed into a *constructive view* of memory. With this view, a memory is not seen as being a

stored item within the mind, but rather something that is constructed based on fragments in the self-memory system (Conway, 2005). Such constructions are not stable over time but can be different every time they are cued. In turn, retrieval has an impact on how fragments in the self-memory system are stored. A constructive approach makes the distinction between remembering and reflection less evident, as any recollection can be seen as a reinterpretation, influenced by current self-images and goals (Conway & Loveday, 2015). If that is true, what distinguishes remembering from reflection as a process of interpretation and sense-making? For us, the most important difference lies in the awareness of the process: reflection constitutes a process in which people are aware of the interpretation whereas this happens unconsciously in remembering.

In our view, both areas are concerned with reflection and those focussed on remembering, in part, refer to the same thought processes, but from a different perspective. In processes of critically thinking about past, present and future experiences, characteristics of both remembering and reflecting can be seen. It is not always possible, nor needed to distinguish one from the other. Therefore, we define our focus as *everyday life reflection*, in which views from both perspectives are integrated. We believe that, through specifying the purpose of and levels within reflection (as will be explained below), our scope of everyday life reflection can be distinguished from other forms of (non-reflective) thinking.

### **Everyday life reflection: scope**

Based on the overlapping field between remembering and reflecting, we initially defined our scope as Reflective Remembering. However, we consider this to overemphasise the role of the past, because we are also interested in considering present and future experiences (more elaborately discussed in Section 2.3). We, therefore, choose to emphasise the context of reflection, as we focus on reflection in and on everyday life, rather than reflection in the more dominantly studied settings of work or learning. We, therefore, use the term everyday life reflection, rather than reflective remembering, even though memory plays an important role in the process of reflection. We define this term based on Staudinger's model of life reflection (Staudinger, 2001) and Mezirow's (1999) term critical reflection as:

*“Considering and analysing past, present and future experiences in order to (re-)assess our thoughts, beliefs, feelings, and actions regarding one’s everyday life.”*

Below, we will briefly unpack this definition by explaining the different elements within it.

- ***considering and analysing***: Based on the model presented by Staudinger (2001), we include both considering and analysing in our definition. Reflection requires more than bringing to mind of past, present or future experiences but instead includes some aspects of analysing, such as grouping, explaining, combining or abstracting.
- ***past, present and future***: We differentiate explicitly from Staudinger's definition of "remembering plus analysing" by including past, present and future experiences. Remembering the past and imagining the future are even highly similar (Schacter & Addis, 2007, see also Section 2.3)
- ***reassessing thoughts, beliefs, feelings, and actions***: We adopt aspects of Mezirow's definition of critical reflection, but broaden the scope slightly to concern reassessing thoughts, beliefs, feelings or actions rather than strictly presuppositions.
- ***regarding our everyday life***: Finally, we use this phrase to emphasise the context and potential topics of reflection. The topics to be reflected upon relate to one's everyday life, which can be distinguished from reflection on topics outside of one's personal life such as global development or scientific knowledge (although explicit connections between personal life and such aspects could be made). Secondly, 'everyday life' emphasises the broadness of topics that can be included, rather than the restricted or focussed reflections within educational contexts.

Together, these elements provide a broad definition, which still encompasses many different forms of reflection, but that helps to differentiate our scope from other types of thinking. Memory plays an important role in this process of reflection, even though it is broader than only reflective remembering. When using 'reflection' within this thesis, we refer to everyday life reflection, as described here. In the following sections, we will discuss several theories that help specify further what we mean with everyday life reflection. The specific 'everyday' aspects of reflection, such as timing, location, and persons, are further explored through an empirical study discussed in Chapter 5.

## 2.3 Characteristics of Everyday Life Reflection

Here we discuss different characteristics that are relevant to inform design, and to assess the success of design for reflection.

### Memory functions

Reflection is strongly related to several of the basic functions of Autobiographical Memory (AM). It has been theorised (Bluck & Alea [2002]) that AM serves three broad functions: self, directive and social. Bluck et al. (2005) further refined these functions, based on an empirical study of why people remember both mundane and significant events over long periods of time.

The *self-function*, as found in the study by Bluck et al. (2005) focusses on self-continuity. This includes aspects of self-image, both concerning the present self as well as how one has become who one is. These aspects of memory have also been described as the formation and maintenance of a biographical identity (McAdams2001) coherent self-concept (Cohen 1998) or self-image (Conway, 2005). In turn, the current self-identity also influences what memories are being recalled (Wilson & Ross, 2010). Such aspects of self and identity always play a role in remembering and can be considered more explicitly in processes of reflection. Korthagen & Vasalos (2005) express that (in their scope of professional development) reflection will often evolve from “outer to inner”, starting from contact with “the environment” which gives the opportunity to reflect on more inner levels, such as competencies, beliefs, and identity.

The *directive function* concerns using memory to solve present problems and to direct present and future behaviour (Bluck et al., 2005). Their findings broaden the initial definition of this function to also include meaning making about one’s life trajectory, for example concerning turning points that redirect one’s life path or originating events for chosen life directions. Similarly, the goal of many interventions in the domain of personal informatics is to ‘act’ rather than to stop at reflecting (Li et al., 2010). This line of reasoning suggests that showing users data about themselves will lead them to do something, presumably something different from and better than what they are already doing (Li et al., 2010). Again, as with identity, the relation between goals and memory is reciprocal. In the Self-Memory-System both the conceptual self and personal goals play an important role in what is being remembered (Conway & Loveday, 2015). Reflection is essential both for the setting of goals as well as the monitoring of progress towards these goals, again showing how remembering and reflecting are closely intertwined. The directive function however goes beyond goal setting and can be more broadly conceptualised as being a function of memory that guides

any future action. Both traumatic events and everyday life experience are seen as having such a directive function (Pillemer, 2003). For example, when memories provide a positive motivation for future endeavours, when lessons are encapsulated in vivid memories or when memories guide choices and actions (Pillemer, 2003).

Finally, Bluck et al. (2005) describe the *social function* of memory, including both developing relationships and nurturing relationships. The first includes learning about another's life to form new relationships. The second concerns maintaining empathy and social bond in existing relationships. In our view, the connection between the social function of memory and reflection is least evident. These processes of using memory to build and maintain relationships often happen without deliberate consideration. People exchange stories and bond over them without deliberately reflecting and deciding "I will tell this story because it shows that we have traits in common". Even without telling about memories, they play an important role in relationships (e.g. remembering a shared past). Of course, there are also cases when people deliberately reflect on the relationships they have, how they were shaped or how they want to proceed with them, but that is rarer.

In addition to these three initial functions of autobiographical memory, a fourth function was proposed focussing on emotion in memory, the *adaptive or mood-regulating function* (Pasupathi & Carstensen, 2003, Williams et al., 2008). This function includes elements such as bitterness revival, boredom reduction or lifting moods. Effects of emotional contents of people's thoughts were also seen in a study on future thinking (D'Argembeau, Renaud & Van der Linden, 2011), which can be seen as reflective thought, oriented towards the future. D'Argembeau et al. found that future thoughts were more frequently positive of nature, rather than negative. These positive thoughts were also more specific and associated more with visual images. Such a positive position towards the future can motivate goal pursuit and can provide advantages for mental health.

Within our scope of everyday life reflection, all these functions play a role. Reflection can contribute to the appreciation of everyday life, which involves the mood regulation function. Everyday life is shaped by the social bonds that people build and have, thus reflecting on these bonds is part of it as well. Finally, reflecting on aspects of everyday life can provide insight in one's identity as well as support a broad range of choices and actions (directive function). In our work, we see primarily the potential to support these latter two functions, reflecting on personal identity and supporting directing everyday life choices. We believe these to be important in life and suitable for open-ended support.

## Levels of depth and detail

Autobiographical memories can be described with different levels of detail, together forming the 'Self-Memory System' (Conway, 2005) see figure 2.1 (p. 42). According to Conway & Pleydell-Pearce's (2000) initial model, a single memory often includes Event Specific Knowledge. Such memories have more recently been considered as Episodic Memories (Conway & Loveday, 2015). These episodic memories are closest to what in everyday life is often just referred to as 'memories': story-like (anecdotal) recollections of past events, which can often be recalled visually as well. These episodic memories are embedded in General Events and are on a higher-level part of a certain Life Time Period. General Events can be grouped according to repeated events (e.g. weekly dinners with the family) or more thematically (e.g. memories related to basketball). General Event memories can also include memories of a short, specific period, either mundane or more extraordinary, such as "that cold and icy winter" or "last years holiday to Spain". Life Time Periods are temporal clusters of longer duration such as "when I was in high school" or "while living in the city". On a further abstracted level, memories are integrated into a life story or concept of self.

Again, we see clear connections between the areas concerned with reflection and those focussed on remembering. These abstract aspects of self-concept and identity are also seen in some models that describe levels of reflection. Korthagen & Vasalos (2005), for example, developed a model to explore what is (or should be) reflected upon. This model describes different levels that influence how a person (practitioner, teacher in this case) performs. These levels include (from outer to inner) environment, behaviour, competencies, beliefs, identity, and mission. Reflections that include the two deepest levels are considered *core reflection*. Korthagen & Vasalos (2005) describe that beliefs can be deeply rooted in these deeper levels and might need to be re-evaluated to allow for change on the levels of competencies and behaviour. This view is similar to Mezirow's (1990) view on critical reflection. However, an important distinction is that core reflection seems to turn inwards, whereas 'critical reflection' relates to external factors such as political and social context (Hatton & Smith, 1995). In our view, reaching such a deeper or more critical level of reflection requires recalling memories on multiple levels. Reflection based upon recalling a single episodic memory will often not reach these levels of criticality. This is more seen through for example thematic connections or causal relations, more seen on the level of General Events.

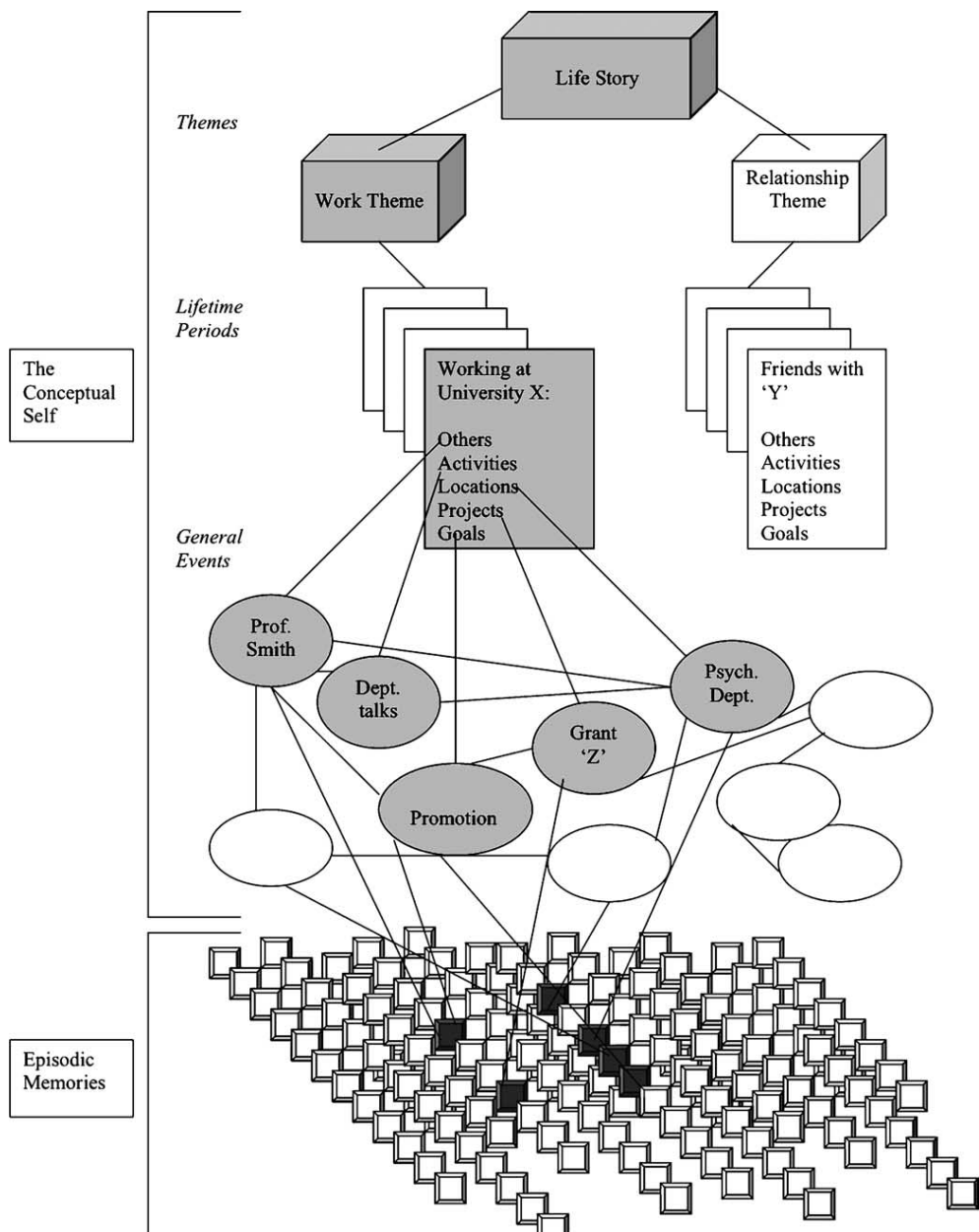


Figure 2.1 Visualisation of knowledge structures in the Self-Memory System (Conway, 2005)<sup>5</sup>

<sup>5</sup> Reprinted from: Journal of Memory and Language (53), M.A. Conway, Memory and the Self, 594-628, Copyright (2005), with permission from Elsevier



We agree with the views of both Mezirow (1990) and Korthagen & Vasalos (2005) that critical reflection is vital for personal development. With our design, we therefore aim to support personal and different levels of reflection. We want to encourage people to reflect on deeper levels rather than mere pragmatic action-oriented reflection (e.g. focussed on action planning), but instead look at making connections to beliefs or identity. We, therefore, expect the higher-level memories such as General Events and Life Time Periods to be relevant.

## **Remembering the past and imagining the future**

Reflection is not only focused on the past but on present and future events as well. In the human mind, remembering the past and imagining the future are closely related. One of the (hypothesised) reasons for the constructive process of remembering is that an important function of episodic memory is allowing individuals to imagine or anticipate future events (Schacter & Addis, 2007). Because of the intrinsic relation between remembering and imagining they can even be considered to be part of the same 'remembering imagining system' (Conway & Loveday, 2015). Individuals will include the past, present, and future in their reflections in different degrees. This might depend on the topic of reflection but also on an individual's temporal focus, the degree to which an individual divides attention to past, present, and future (Shipp et al., 2009). A related concept that will be worthwhile to consider when analysing reflection is temporal depth. This notion relates to a conceptual horizon of whether an individual is inclined to consider the close or distant past and future (Bluedorn, 2002). Together, these concepts show how closely related past, present, and future are in the memory system as well as in reflections. With our scope of everyday life reflection, we refer to reflection that can include different time perspectives and horizons, but that always contains some connection to the present. Such a link to the present allows for actionable conclusions and current change.

## **Reflection and life transitions**

On the highest level of abstraction, one's memories can be integrated into a Life Story (Bluck & Habermas, 2001). The life story should not be seen as a fixed story constructed near the end of one's life but rather as a continuous view on the past, present, and future of one's life that changes throughout the lifespan. People's life stories show that people of different ages value the past differently (Bluck & Habermas, 2001). Besides Life Time Periods, Life Stories include important milestones (McAdams, 2001). Many of these milestones are part of the Life Script: events that are part of the normative expectations within a given culture to the patterns of individual life courses (Berntsen & Rubin, 2002). Milestones such as graduating from college, getting married or having children are often approached with

great anticipation. These milestones are often a beacon of transitional periods, which have been found to be periods of higher engagement with reflection (Staudinger 2001). People reflect both in anticipation of or preparation for a transition, but also shortly after to re-establish a “new normal” (Staudinger, 2001). In general, life can be considered as “a path of alternating periods of stable stages and transitional periods” (Levinson, 1978 / 1986 as quoted by Staudinger, 2001).

Staudinger’s (2001) notion of life reflection is a quite intense and severe form of reflection. It is not our everyday mode of processing, at least not in its full-fledged form (Staudinger, 2001). Triggers, such as the new, the unexpected, the hindrance of life plans and routines or the recognition of life patterns seem to be necessary. Only at such moments, are events evaluated within the broader context of a life story. With our scope of everyday life reflection, we similarly focus on more holistic reflection, making connections across several themes, domains or across time. It does not necessarily concern one’s entire life story, but can have a smaller scope in both time and topic (Staudinger, 2001). For us, connections across time periods or to different domains form the core element of Life Reflection. These connections distinguish Life Reflection from more topical reflection as is for example often seen in education (e.g. descriptive reflections in student portfolio’s [Orland-Barack, 2005]) or behaviour change (e.g. short- and long-term reflection on movement patterns (Li, Dey & Forlizzi, 2010)). Such reflection is instrumental to a specific goal or behaviour and is topic specific. It often remains on one of the lower levels of reflection and does not include criticality towards the self or society. Instead, we adopt some of the aspects of Life Reflection, by focusing on such connections and criticality. In the context of this thesis, the element of connecting multiple experiences across time, domain or to the self is characterising and helps to specify our scope of everyday life reflection further.

## **Reflection as a step-by-step process**

In research on both remembering and reflecting, researchers have attempted to describe its process. However, the goal in both areas seems to be mostly different. In psychology, describing the process of remembering is more focussed on understanding what happens and a large part of this process happens unconsciously. In studies of reflection however, the processes are more deliberate and are described with the intention to serve as instruction on how to reflect.

In remembering, important distinctions in the process are made between voluntary and involuntary remembering (Berntsen, 2009). The latter refers to a process in which personal autobiographical memories come to mind without any preceding retrieval attempts (Berntsen et al., 2013). In other words, things are remembered 'spontaneously' although

this is often initiated by an external cue. With voluntary remembering, people try to remember something, often through a process of cue elaboration, also referred to as generative retrieval (Conway, 2005). In more elaborate processes of reflection, both voluntary and involuntary remembering can occur.

As mentioned above, Staudinger (2001) presents life reflections within a psychological view on autobiographical memory as *"remembering plus further analysis"* [p. 150]. This process is further described by dividing the analysis into multiple layers. On the first layer, analysis is divided into evaluation or explanation of the remembered experience. On a second layer, the model describes the underlying processes that can provide more grip on the processes involved in reflection: abstraction, comparison, categorisation, etc. Others have used different models that include steps of looking back and looking ahead such as the ALACT-model (Action, Looking Back, Awareness, Creating alternatives, Trial - Korthagen & Kessels, 1999). Similar steps are described in Gibb's reflective cycle (1988) or Johns' (1999) model of structured reflection. Such process-models can provide direction on how to support or design for reflection. However, they might also hold a limitation, which is emphasised by Ekebergh (2007), concluding that the complexity of reflection can never be reduced to different stages. We adhere to his view that reflection closely relates to an attitude and should be supported in an *open, flexible and sensitive way*. As stated in Chapter 1, we support reflection through open-ended design.

## **External memory cuing**

As mentioned above, both voluntary and involuntary remembering often starts from a trigger or cue. A memory is triggered, perhaps by a word in a conversation, the expression on a friend's face, a childhood toy found in the attic or a smell. These signals that trigger us to remembering something are considered cues. Within the constructive approach to remembering cuing is described by Conway and Loveday (2015) as the process in which *"the effect of a cue or set of cues is to form a stable pattern of activation within AM knowledge structures and it is that pattern of activation that is, temporarily, a memory"* (p.575). A distinction can be made between internal and external cues, in which external refers to external from the mind (not thoughts triggering memories). External memory cues can be defined as *"a piece of information that has a physical or tangible embodiment but has an internal effect: triggering a memory"* (van den Hoven & Eggen, 2014, p.3). Sometimes it seems clear what has triggered a memory and in other cases, it seems impossible to pinpoint. But often it is a combination of many factors such as context and state of mind. Overall, the cuing process is a very complex process (Van den Hoven & Eggen, 2014) especially outside of lab conditions when dealing with real-life memories in real-life situations with all kinds of influencing factors. However, in many activities that relate to remembering, such as

browsing a photo album, we can point out what external media have to some extent cued the memory. In similar ways, external media are often used as a trigger to reflect. This can happen in multiple ways, for example when media triggers a memory, which is engaged with in a reflective way (considered reflective remembering, Sellen & Whittaker, 2010). Such interaction is in line with Staudinger 's model of reflection (2001) as "remembering plus analysing". But a trigger can also evoke reflection without memory being involved for example by providing a completely novel perspective or information. Any media or data can also be interpreted as something that 'must have happened' without specific recollection of such an event, and this can still spark reflection. Within certain areas, such as personal informatics, it is even assumed that presenting (well selected and framed data) will 'always' trigger reflection (Baumer et al., 2014, Saksono & Parker, 2017). However, as with remembering, this is a complex and sometimes unpredictable process, and mere presentation might not be enough. In addition to cuing, media can have another function in relation to reflecting, when media are created during reflection or with aspects of reflective expression, which we will elaborate upon in Section 2.4.

In short, we are interested in processes of everyday life reflection, in which media play a role that is either presented by a system or deliberately created through the use of a system.

## **Everyday life reflection characteristics**

The characteristics discussed in this section help to further specify our scope of everyday life reflection. We aim to design for reflection that is:

- **Supporting self- and directive functions:** We are especially interested in reflecting on broader areas, with the potential to connect multiple aspects. As such, we aim to support insight into the self as well as directive choices about (everyday) life.
- **On a personal and somewhat critical level:** With our design, we aim to support personal and somewhat critical reflection. We want to encourage people to reflect on deeper levels rather than mere pragmatic action-oriented reflection (e.g. focused on action planning), but instead look at making connections to beliefs or identity.
- **Connected to the present:** Reflections might be focused on the (distant) past or future, but we are specifically interested in reflection with a connection to present experiences and actions.
- **Across the lifespan:** Everyday life reflection can regard any aspect of personal life but we are especially interested in connections to everyday life experiences, the mundane or 'normal' experiences that occur across the lifespan and not merely in exceptional or transitional periods.
- **Flexible Process:** In our view, everyday life reflection cannot be separated into deliberate steps, but needs to be supported in an open and flexible way.

- **Involves an external cue:** In designing for everyday life reflection we focus on reflection that involves external media, which is either presented by a system (as cue) or deliberately created through the use of a system.

These characteristics can later be used to evaluate our design explorations, discussing where the systems have been successful in achieving these aims. Such an evaluation contributes to the construction of knowledge regarding designing for these characteristics.

## 2.4 Everyday Life Reflection & Media

Media are one of the external factors that influence the way people think and remember. This holds true for a variety of concepts including mass-media (television, newspaper etc.), social media (online platforms such as Facebook or Twitter) or personal media (photos, diaries). In this thesis, when referring to media, we primarily consider personal digital media. Here we elaborate on the (envisioned) role of media in processes of everyday life reflection.

### Personal media

Although all types of media can cue remembering or reflecting, we are specifically interested in personal digital media: one's (personal) possession, with personal meaning. Such media can be created by a person, but can also be bought, collected, gifted or otherwise received. Personal digital media includes a variety of media types such as photos, text, mail, files, documents, and music collections. Personal media has the potential to support reflection because these files often have personal meaning and we can design for specific ways of interacting with them. People have various interactions with their personal digital media such as collecting, editing, managing, browsing, sharing or printing (Broekhuijsen, Van den Hoven & Markopoulos, 2017). In our work, we focus on two primary interactions: creation and retrieval.

#### *Media creation*

Although media that is used for future reflection can evolve or be collected in multiple ways, we focus on intentional (deliberate) media *creation*. Deliberate media creation is frequently observed and studied within the domain of photography, as photos is one of the primary types of media used for remembering. In the moment of creation, effects can include disconnecting from the experience (also referred to as the attentional-disengagement hypothesis [Soares et al., 2017]) or, in contrast, engaging more with it (Mols et al., 2015). We believe such a deliberate creation process has the potential to support reflection in the moment. In our view on intentional media creation two processes are involved:

capturing and expressing. The everyday usage of both terms often depends on the type of media: a tourist captures a skyline when snapping a quick photo or a person expresses his thoughts in a diary. In our view, for any media type, both processes are often involved, but to different degrees. We see *capturing* as a process which is largely objective, focusing on representing a part of the (external) environment in media. In contrast, we define *expressing* as a subjective process, in which a part of the internal experience is represented in media. The balance between both these aspects thus depends largely on the degree of which aspects of life are personally interpreted by someone in the act of creating media.

The second process is important for the media creation to be reflective, but both can be combined in a single creation in different ways. For example: ‘point and shoot’ snapshots of buildings are mainly capturing the environment, the external (representing facts such as “I am here”, “This building looks like this”). On the other end of the spectrum: a written part from a diary might only focus on internal experience: describing how one feels and the thoughts related, without much capture of external events (what event has happened, where one is). But can also apply to more creative and deliberate instances of photography, for example capturing a ray of sunshine because it represents the positive feelings of the day. Other media creations that include both are for example annotated photos, these provide an interpretation (e.g. “had such a great time”). We aim to design media creation in which both are involved because we consider this to best support reflection in the present in combination with creating valuable media for future retrieval.

### *Media retrieval*

Concepts for reflection often focus on retrieving (or viewing) media, especially within the domain of personal informatics where (a part of) the media is created (or measured) by a system. Reviewing media can pull the attention to specific events or behaviour and can provide a new perspective that is otherwise not possible to perceive (e.g. the number of steps a person takes a day can be easily provided by a system but is difficult to observe directly). It is even a premise of many systems within personal informatics that presenting (well-selected and framed) data is enough to support reflection (Baumer et al., 2014, Slovak, Frauenberger & Fitzpatrick, 2017). In our view, reviewing media can trigger reflection in three main ways. Firstly, items can cue memories, recalling past experiences that are used as the basis for reflection. In general, encountering a memory related item can lead to both voluntary and involuntary remembering. In a study on involuntary cuing, van Gennip et al. (2016) found that the cued memories related to event-specific knowledge in 45% of entries, with an additional 40% cueing general events, and 15% lifetime periods. Such memories, in turn, can be elaborated upon, resulting in reflection. For example, a diary entry might be read and the recalled experience analysed in a reflective way. Such reflective processes can

be cued even if those items have not been created or collected for that purpose. Rather than this indirect path towards reflection, objects can also cue a 'memory evoked think or feel response' - as found by Zijlema et al. (2017). Such responses consist of a thought, feeling or reflection in the present, which is based on the memory connected to the object, although the memory can remain abstract or not deliberately recalled. For example, looking at a collage of holiday pictures and concluding to want to go on holidays more often, without specific memories being recalled. Finally, media can cue reflection without referring to previous memories or experiences. For example, when looking at media by others, that triggers thoughts or feelings. Similarly, we can also consider prompts such as questions or provocative quotes that trigger reflections. Additional types of triggers are further explored in the design space in Chapter 6.

## **Commonly studied media modalities**

As mentioned above, the scope of personal digital media can refer to a wide range of media types. It has been found that people cherish such diversity. When creating collections for future remembering they deliberately include a diverse set of media covering photos, things, craftwork, ephemera, essays, publications and (to in fewer cases) videos (Petrelli, Van den Hoven and Whittaker, 2009). Although a number of these objects is physical, we focus primarily on digital media, especially for the opportunities this provides for interaction. We will discuss some of the most dominantly studied modalities here.

Media used to support reflection often takes the form of written accounts. Diaries (sometimes referred to as journals) are ancient forms of mediated reflection that include “a record of events, transactions, or observations kept daily or at frequent intervals” (Merriam Webster). By some, diaries are even seen as the ‘purest form of reflection’ (Travers, 2011). They can take different forms, ranging from small notes to elaborate daily stories, potentially written in a dialogic manner (“dear diary”). Beyond private use, diaries have been used and suggested as interventions in a variety of contexts such as recovering from critical illness (Ewens, Hendricks & Sundin, 2015; Aitken et al., 2013), for post-traumatic disorders (Kvavilashvili, 2014) and within educational context (with online journals (Dement & O’Connell, 2011) and portfolios (Orland-Barack, 2005). In some cases, these written media are shared with others for online review, or discussed in face-to-face conversations. One of the advantages of elaborate written accounts is that they can be easily retrieved for e.g. assessment by others or future personal use.

In research on design for remembering, the use of *photos* is most frequently studied (for an elaborate overview, see Van Gennip, 2018), to no surprise as photos are created in vast quantities especially since the rise of digital photography. This media type easily sparks

the imagination as our memories often take the form of visual images as well (Conway & Loveday, 2015). Motivations for creating photos can be divided into either social or individual purpose with either affective or functional goals (Lux, Kogler & del Fabro, 2010). Landry (2009) explored reflection in photo-based communication by using tags about the experience. For this, the photo software asked questions such as “What emotions does looking at this picture evoke?” and “Is there a theme you could use to describe this picture?”. Such questions trigger the user to reflect on the broader meaning of the picture.

We consider *quantified data* a media category in itself because it is quite dominant in areas for reflection such as personal informatics. However, the quantified information might be manifested in a visual way (such as graphs) or textual way (such as a stated conclusion or comparison “You have taken 9000 steps today”). A characteristic of this category is also that the user is more indirectly involved in the ‘creation’ of such media as the quantitative information is often collected through systems and sensors. Although as found in the stage-based model described by Li, Dey & Forlizzi (2010), some personal direct engagement is often involved (depending on the chosen subject or scope of tracking).

The *audio* modality includes a number of different types of audio, such as music, voice recordings or soundscapes. Many people have a selection of songs with strong memories associated to them and even from a general body of popular music, many songs can evoke autobiographical memories (Janata, Tomic & Rakowski, 2007) both on a general and specific (anecdotal) level. Other sounds can similarly represent vivid memories, as was for example found in the recording of mundane sounds within the home. These soundscapes that involved, for example, playing children, sounds of pets or playing piano were considered 'sonic gems' on retrieval for their unexpected value (Oleksik & Brown, 2008). In more everyday use, voice recordings are most well known as practical memos to the self but can be used for more reflective purposes as well. Rather than looking at audio separately, the modality is often studied in combination with other media such as objects (Memory Box, Frohlich & Murphy, 2000) or photos (Audiophotography, Frohlich & Talynn, 1999).

*Social media* often includes the modalities mentioned above, combining videos, photos, and text. However, social media has several characteristics that these modalities do not have in themselves. Primarily, of course, this relates to the social aspect, the virtual space in which experiences and memories are shared. Several applications and platforms have

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<sup>6</sup> <https://timehop.com> Last accessed March 2019.

<sup>7</sup> <https://newsroom.fb.com/news/2015/03/introducing-on-this-day-a-new-way-to-look-back-at-photos-and-memories-on-facebook/> Last accessed March 2019.



been experimenting with ways to stimulate remembering and reflecting, such as the app TimeHop<sup>6</sup> and Facebook's function 'On this day'<sup>7</sup> that both present users' media back to themselves after a certain timeframe.

In conclusion, we focus primarily on personal digital media. Reflection with such media can occur both during retrieval and creation. In creating media, the combination of capturing (external aspects) and expressing (internal aspects) varies in different media types. In designing for everyday life reflection, we are interested in at least some of both because we believe this to be most valuable for reflection. We are interested in exploring the reflective potential of different modalities.

## 2.5 Related Design Concepts

From a designer's perspective, the influence on media-supported reflection is quite indirect: we do not design the reflection itself. One could consider staging experiences to be reflected upon and guiding the full process of reflection as coming as close as possible to "designing the reflection". We often do not even design the involved media directly (in contrast to, for example, the memorial object developed by Moncur et al. (2015) for reflection and remembering). Instead, we design tools for media interaction that aim to support reflection. This is also why we frame our area as design for reflection, similar to approaches on designing for the user experience. The effort is focussed on designing media technologies or tools for media creation and retrieval.

Related media technologies have been developed in the areas of both 'design for remembering' and 'design for reflection'. Both areas are of increasing interest within HCI, for overviews see e.g. Van den Hoven et al., (2012) on remembering and Baumer et al. (2014) or Fleck & Fitzpatrick (2010) on design for reflection. Within these areas, only a few concepts have a scope and purpose that is similar to ours. Most concepts support mediated remembering, but without a focus on reflection, often focussing on reminiscing or social remembering. Other concepts focus specifically on reflection but without the everyday context we aim for. The collection of concepts presented here illustrates relevant media-interactions and design aspects that have inspired our work. A more specific overview of what different strategies to support reflection are adopted in interactive systems is given in Chapter 6.

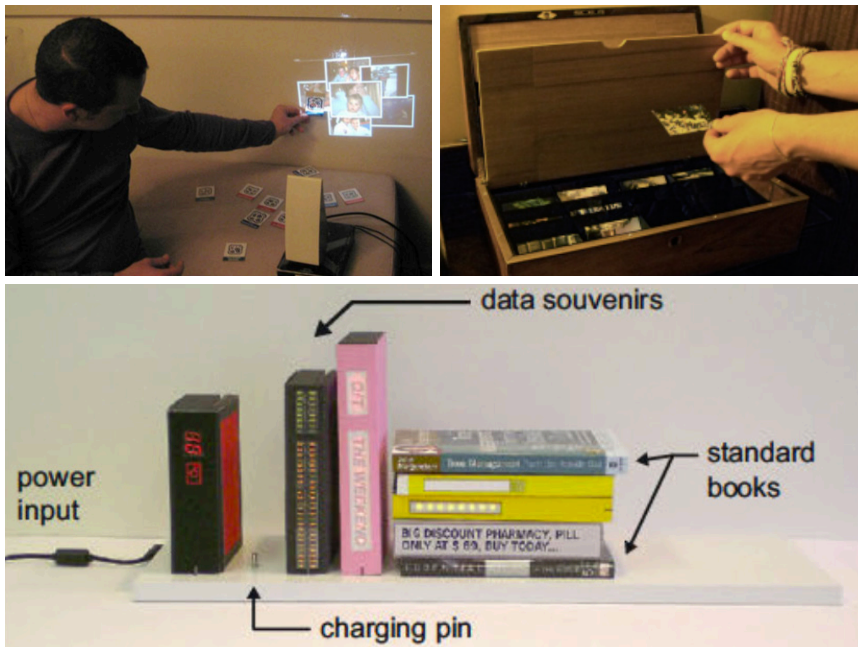


Figure 2.2 Example of media systems that give digital data a presence in the home.

Top left: Pearl (Jansen, Van den Hoven & Frohlich, 2011).

Top Right: Photobox (Odom et al., 2012).

Bottom: DataSouvenirs (Aippersbach, Hooker & Woodruff, 2011).

## Presence in the home

One of the disadvantages of digital media is that it often remains hidden and therefore unused (Van den Hoven, 2014). Several researchers have explored how to give digital media an explicit presence in the room. For example, the interactive home display of Pearl (Jansen, Van den Hoven & Frohlich, 2011) and photo-based dinner-centrepiece 4Photos (ten Bhömer et al., 2010) give digital photos a presence in the home and focus on social remembering. Other concepts address aims more similar to our own, stimulating re-appreciation and reflection, examples include Photobox (Odom et al., 2012) and Data Souvenirs (Aippersbach, Hooker & Woodruff, 2011). Photobox prints small physical photos from a digital collection, which are presented inside a wooden box, providing elements of uncertainty and surprise. Both the device itself and the media are given a presence in the room. Data Souvenirs brings data to the physical form in book-like objects. The data is specific and uncovers some aspect which is usually not seen, but it also stimulates reflection by putting this information into a different context. These examples show that physicalizing digital media not only brings more attention to them but also changes their context. Such a change of context can stimulate reflecting on the value of the media and of the experiences they represent.

## Alternative selection

Traditionally, media creation is selective. Especially in times of analogue photography, creating media for remembering was a deliberate decision. With the advance of digital photography and cheap storage, creation became less selective. In 2017, an estimated number of 1.2 trillion photos have been taken, of which more than 85% with mobile phones<sup>8</sup>. Even larger quantities can be created with systems that are non-selective, capturing photos automatically, such as the wearable camera Sensecam (Hodges et al., 2006). Such a camera either takes photos on a fixed interval or based on changing sensor values. Systems such as Sensecam have been promoted as a way to achieve 'total capture' or to serve as 'a memory prosthesis'. The domestic stationary camera Other Brother (Helmes, Hummels & Sellen, 2009) similarly uses changes in sensor values (such as light or sound) to determine what to capture. However, it is more selective: its aim is not to create a 'total capture' but rather to capture specific elements that are most likely to be interesting. Both systems seem to be built on the premise that people might not be well able to select, up front, what is interesting to capture. Other (commercial) designs have explored ways of deciding what to capture just after it has happened, such as Perfect Memory<sup>9</sup> (video) and Kapture<sup>10</sup> (audio). The premise of these systems is that you do not know if something funny or exciting will happen up front. For this reason, both use a running recording from which the last 30 seconds are stored with the press of a button.

Many of these systems focus on creating media for remembering, for which quantity might be a virtue. Others have explored reduction of media as a way to stimulate reflection, for example proposing to go back to the charm of 24 photos on a Kodak roll (Niforatos, Langheinrich & Bexheti, 2014). A provocative design by Schmitt<sup>11</sup> disables the camera on locations that are too often captured, such as touristic landmarks. The design provokes reflection on the quantity of media that is created and stimulates finding a unique perspective. These examples of alternative selection show two aspects that are interesting to explore further. First, a balance between capturing as much as possible (to support future retrieval) and reducing the quantity (to make media more meaningful). Secondly, the concepts illustrate varying degrees of user and system control over what is captured.

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<sup>8</sup> Data Source: InfoTrends Worldwide Consumer Photos Captured and Stored, 2013 – 2017.

<sup>9</sup> Perfect Memory wearable camera: [www.getperfectmemory.com](http://www.getperfectmemory.com) - Last accessed March 2019.

<sup>10</sup> Kapture wrist recorder: <https://www.kickstarter.com/projects/1483824574/kapture-the-audio-recording-wristband> - Last accessed March 2019.

<sup>11</sup> <https://philippschmitt.com/projects/camera-restricta> Last accessed March 2019.

## Creative creation

Several designs have supported creative creation, stimulating people to look at what they capture and how this is represented. We have seen this aspect especially in research concepts for alternative photo applications on smartphones. The concept Behind the Camera (Güldenpfennig, Reitberger & Fitzpatrick, 2012; see Figure 2.3), for example, explores how dual-sided camera can be used to take two pictures simultaneously (a feature which is now also commercially available through apps such as DualShot<sup>12</sup>). The evaluation of Behind the Camera showed that the feature was not only used to capture more, but also in more creative ways to represent an experience, such as capturing an ear and a music-speaker, or the sun and a shadow it casts. The concept PhotoMirror (Markopoulos et al., 2005) similarly used a two-way camera, focussing instead on creating videos of both the object of interest and the face of the person holding the camera. The design was aimed to capture “trivial daily events and rituals reflecting the commotion and activities of home inhabitants” (Markopoulos et al., 2005, p.1), an aim closely related to our own focus on everyday life.



Figure 2.3 Examples of media created with novel concepts that emphasize creativity.  
Top: Set of images created with ‘Behind The Camera’ showing a causal relation (Güldenpfennig, Reitberger & Fitzpatrick, 2012).  
Bottom: Two images created with Context Photography, influenced by sound and movement. (Håkansson, 2006).

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<sup>12</sup> Dualshot application: <http://www.dualshotapp.com> - Last accessed March 2019.

<sup>13</sup> Picture Your Moment application: <https://picyourmoment.nl> - Last accessed March 2019.

Rather than by using multiple camera's, Context Photography (Håkansson et al., 2006; See Figure 2.3) stimulates creative creation by using alternative sensors to create abstract photos. The images are morphed based on contextual factors such as sound and movement, which was found to affect the way people perceive their surroundings. Such effects on different senses are also seen in the design of Media Objects. With this design, Gldenpfennig, Reitberger & Fitpatrick (2012b) explore how photos can be combined with different modalities to create rich Media Objects. The application allows adding multiple aspects such as notes, locations, feelings, pictures and videos to a Mobile Object. With these combinations, it explores how experiences can be captured in richer ways. In their evaluation, the mere possibility of adding other types of media made people reflect on what form was most suitable to represent their experience.

These examples of creative creation show that the interplay between media and experience can be reciprocal. Depending on what people experience, they choose and create different types of media. In turn, the possibility to create certain media directs how an experience is perceived (Mols et al., 2015). Together, these examples show that media creation will influence the perception of experiences, and such can influence the reflections as well.

## **Triggers of creation**

Some designs have explored explicit triggers that stimulate users to create something. These triggers focus on the timing of creation or on the content (or both). Several apps that are designed for remembering or reflecting use explicit notifications from the smartphone. The application GoSlow (Cheng et al., 2011), designed to create moments of reflection and solitude, uses a fixed moment each day, which is determined by the user before use. The Echoes application (Isaacs et al., 2013) takes a different approach by using random timing throughout the day to send push notifications, stimulating both creation and review. The application Picture Your Moment<sup>13</sup> focusses specifically on this random timing, sending notifications that stimulate to take a photo at that moment, stimulating to capture more diverse aspects of everyday life. The triggers in GoSlow do not only influence the timing but provide some suggestion for the content of a reflection as well. The system suggests a theme (for example 'deep breathing' to consider that day). Such content suggestions are also seen in specific types of journals (both analogue and digital). Gratitude Journals (e.g. Emmons & McCullough, 2003) for example, provide a specific scope for all the entries: listing several aspects of a day that one is grateful for. Triggers are useful to remind people to reflect frequently but can be annoying when they are too dominant. We are interested in exploring further how triggers can be used in a way that is supportive of reflection, without being too restrictive (both in timing and content).

## Re-interpretation

The above-mentioned application Echoes (Isaacs et al., 2013) presents the media that people have created back to them at specific intervals. This is accompanied by a possibility to enter a response, both in text and as a rating on an emotional scale. In an evaluation of the concept, it was found that these moments of reflection also lead to re-interpretation, for example leading to less extreme emotional ratings. In general, reviewing media on later moments can stimulate to re-interpret both the media and the experience to which they refer. However, structured studies of these more longitudinal effects are rare, especially within the area of design research. In an evaluation with Sensecam images, Lindley et al., (2011) explored how the media was re-interpreted 18 months after capture. They found that participants had greater interest in images depicting mundane experiences retrospectively. Additionally, these images were found interesting because they could uncover incremental change. Several of the participants even saw the opportunity for explicit reflection on aspects of their everyday life that often remain unnoticed but were cause for concern. In general, although challenging to study, it is interesting to consider how the value of specific media might change over longer time intervals.

## 2.6 Conclusion

In this chapter, we have reviewed the related literature from research areas on both remembering and reflecting. We see overlap in the type of meta-cognitive processes that these areas study and in the characteristics they define to describe these processes. We introduce the term *everyday life reflection* to scope our research we define as: *considering and analysing past, present and future experiences in order to (re-)assess our thoughts, beliefs, feelings, and actions regarding one's everyday life.*

Although we are interested in the overlap between remembering and reflecting, we use this term to emphasise the context rather than any specific temporal dimension. We consider the overlap on a more abstract level as both fields describe similar characteristics that help to further define our scope. These characteristics introduce a number of theories and models that are used throughout this thesis. In short, we aim to design for reflection that:

- Supports the self- and directive functions
- Focuses on a personal and somewhat critical level
- Is connected to the present, and
- Occurs across the lifespan.

Specifically, we address this type of reflection in a way that it is supported through an *open and flexible process* and by focusing on the use of *personal digital media*. We have discussed how different interactions with such media can support everyday life reflection, especially on moments of creation and retrieval.

Finally, we concluded the chapter with an overview of related design work. Again, examples are given from both remembering and reflecting. The work inspires us to consider designing for integration into everyday life through *presence* and *triggering*. In terms of creating media, the work inspires to look at selection and creativity to direct the reflections in the moment. Finally, when retrieving media, different time intervals provide different opportunities for *re-interpretation*. These inspirational design aspects that will be recurring in our three design explorations (Chapter 4, 6 and 7).

Based on:

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# 3

## Everyday Life (Re)Appreciated

**Abstract** People go about large parts of their everyday life in an automated mode, normality and habit is what defines everyday life. At the same time, they also appreciate specific aspects of everyday life, but little is known about these values. This chapter describes a probes study exploring how everyday life experiences are valued, both from the past and in the present. The findings confirm that seemingly mundane experiences, concerning a variety of topics, can become valuable. More specifically, the memory of an experience was considered valuable if it: was regularly repeated, had social value, continued in the present, influenced life, was exemplary of character or showed a contrast. However, the moment memories become valuable is difficult to recognise. The study provides support for our focus on everyday life experiences as a valuable subject to reflect upon. Secondly, it shows that reflection is needed to appreciate everyday memories, because the value is often not evident in the moment. The chapter concludes with a discussion of the implications of these findings for designing systems for creating media of everyday life.

## 3.1 Introduction

As described in the previous chapter, remembering and reflecting are closely related. We focus on these processes within the scope of everyday life. The value of everyday life experiences changes over time, what initially seems mundane, can be valued in retrospect. Zhang et al. (2014) found that people underestimate how much they enjoy recalling mundane past experiences and actually enjoy reading about these experiences more so than about an extraordinary experience. We believe reflecting on everyday life experiences has value, both when considering past as well as present experiences. However, the question remains which experiences are most valuable. For most people, it might be easier to see the value in everyday life experiences of the past. Therefore, in this chapter, we focus primarily on exploring what memories of past everyday life experiences are considered valuable. In addition, we compare this to how people view their current daily experiences.

We first summarise our theoretical scope of everyday life and the mundane, informed by perspectives from autobiographical memory and philosophy. We then describe our probes study, exploring people's perception of valuable everyday experience. Participants received a set of probes to capture present everyday life and to explore what mundane experiences they value as memories. In a personal interview, we further explored why these experiences are valuable, how this value evolved over time and if media played a role in remembering them. The chapter ends with a discussion of our aims and contributions. The primary goal of this study was to get a better understanding of what kind of experiences become valuable memories. Secondly, understanding the transition from mundane into meaningful can inform how mediated reflection could support recognising values in everyday life. Finally, this study is in essence a form of guided reflection, which also contributes to our understanding of reflection on everyday life.

### Levels in remembering

As explained in Chapter 2, the concepts of reflecting and remembering are closely related, although each can also be studied without reference to the other. Although our primary interest concerns reflective processes, the focus in this study lies more on remembering. We are interested in what experiences are valued, and this can be approached by discussing memories of diverse experiences (especially because they are more clearly valued in retrospect (Zhang et al., 2014). As such, we build upon knowledge from the field of autobiographical memory on how such experiences are remembered.

The study of autobiographical memory involves all the events of one's life, ranging from milestones to mundane experiences. Autobiographical memories can be described with different levels of detail (Conway & Pleydell-Pearce, 2000). A single recollection often inclu-

des Event Specific Knowledge (also considered episodic memories, Conway & Loveday, 2015), is embedded in a General Event and is, on a higher level, part of a certain Life Time Period (Conway & Pleydell-Pearce, 2000). On the highest level of abstraction, our memories can be integrated into a life story (Bluck & Habermas, 2001). The life story should not be seen as a fixed story constructed near the end of one's life but rather as a continuous view on the past, present and future of one's life that changes throughout the lifespan. The construction of a life story is a reflective process, which can happen both deliberately as well as implicitly. People's life stories show that people of different ages value the past differently (Bluck & Habermas, 2001). Besides life time periods, life stories include important milestones (McAdams, 2001). Many of these milestones are part of the Life Script: events that are part of the normative expectations within a given culture to the patterns of individual life courses (Berntsen & Rubin, 2002). Milestones such as graduating from college, getting married or having children are often approached with great anticipation. Such milestones can be seen as *anticipated memories* because, even before happening, people expect these events to be valuable as memories and they are often deliberately captured.

## **Memories of everyday life**

In contrast to these anticipated memories, people also experience 'unanticipated memories': experiences from everyday life that become valuable memories, without expecting this at the time. In general, it can be difficult to predict how one might feel about remembering present experiences in the future (Zhang et al., 2014). By comparing conversations ranging from ordinary to extraordinary and experiences from an ordinary day versus Valentine's day, Zhang et al. (2014) found that people underestimate the pleasure of rediscovering mundane experiences more so than extraordinary experiences.

Such studies make a binary split between 'the mundane' and 'the extraordinary' (see for example also Bhattacharjee & Mogilner, 2014) but in practice, defining what constitutes everyday life exactly is challenging. As Felski (1999) put it: "*after all, everyday life simply is, indisputably: the essential taken-for-granted continuum of mundane activities*" (p.5). Because everyday life is characterised as being taken-for-granted, it is difficult to make explicit what is part of everyday life. For this study, we therefore formulated a working definition by specifying the most important things we consider not to be part of everyday life: milestones (McAdams, 2001), transitional events (Janssen & Hague, 2015) and holidays. This last aspect was specifically chosen because people create media in abundance during holidays. We recognise that more elements can be identified that are not part of everyday life, but this short explanation could be used to explain our scope to participants easily. Adopting the view that all other experiences could be everyday life also allowed us to study what kind of experiences from everyday life become valuable within a broad scope.

## Media of the mundane

As explained in Chapter 2, people's memories are often influenced by external cues. External memory cues can be defined as *"a piece of information that has a physical or tangible embodiment but has an internal effect: triggering a memory"* (van den Hoven & Eggen, 2014, p.3). A variety of objects and media can serve as cues, influenced what and how people remember. Such an item initiates a process of cuing: the activation of fragments within the self-memory system, this activation within the AM knowledge structures is, temporarily, a memory (Conway and Loveday, 2015).

Media can become meaningful through various processes, such as rituals, pilgrimage, or gift-giving (Belk, Wallendorf & Sherry, 1989). In some cases, media is specifically created for the purpose of remembering, which are considered souvenirs (Van den Hoven, 2004) or mementos (Petrelli, Whittaker & Brockmeier., 2008). Such practices are especially prevalent for special occasions; media of mundane experiences is less common and studied less frequently. Here, we discuss some studies with findings on media representing everyday life experiences.

A time capsule study of Petrelli et al. (Petrelli, van den Hoven & Whittaker, 2009) showed that items collected relating to events, places or experiences all included mundane aspects. In general, the time capsules *"often contained mundane elements of everyday life: ephemera that are generally thrown away, as well as recordings of familiar places and activities."* [p. 174]. Through their broad approach, only a part of all memories in these studies concerned everyday life experiences. Similarly, a few design studies include findings on everyday life aspects in personal media creation. A study by Lindley et al. (2011) focused on photos of everyday life created with Sensecam. When reflecting on the images eighteen months after capture participants became aware of incremental changes in everyday life as well as the 'normality', the things that were still the same. Such normality was also found in media of a holiday, in the study of audio recordings as *"Sonic Souvenirs"* (Dib, Petrelli & Whittaker, 2010). Even though the study focused on a holiday, a rather special event, the change in modality had an effect on the 'normality' of the collected cues. The cues reflected more mundane aspects of the holiday such as waiting for a ferry or the quarrelling of children (Dib, Petrelli & Whittaker, 2010).

A study on constructing life stories with photos (Frohlich, Wall & Kiddle, 2013) provides insights into how certain cues of seemingly unimportant everyday life events can become valuable in retrospect. Certain photos were valued because of 'outside of photo' activities: something that happened directly after or before the photo. Or because the depicted had a strong link to the present: a photo of a young child sitting behind the piano becomes

valuable when he later develops a fascination for music (Frohlich, Wall & Kiddle, 2013). These studies show that even special media can highlight more mundane aspects of life and that appreciation of this media changed over time. The research did not focus specifically on everyday life and thus provide only a limited perspective. This motivates us to explore everyday life experiences and memories more elaborately in our study.

## **Study aims**

The value of everyday life experiences changes, both over time and through deliberate reflection. But, as discussed above, little is known about how or why. Therefore, we aim to study the appreciation of mundane experiences in more detail. With the study described here, we intend to find out:

- What constitutes everyday life for people?
- What kind of experiences of everyday life do people mention as memories?
- Why are some everyday experiences considered valuable?
- When do these experiences become valuable?
- Which items represent experiences of everyday life?
- How do people appreciate present experiences?

With these questions, we aim to find out what aspects of everyday life are worthwhile to consider in reflection, informing our challenge of how to design for media creation in everyday life.

## **3.2 Method: Probes Study**

To better understand which experiences are valued in retrospect, we conducted an explorative qualitative study. We used probes to stimulate people to think about present and past everyday life experiences. We chose for the probes method (Mattelmäki, 2005) because this provocative and creative approach stimulates people to consider aspects otherwise taken for granted. The diversity of probes would allow for a variety of memories to be triggered and bringing probes into their homes gives people time to think about the topic over a longer period of time. Such a variety allows exploring which memories became most valuable. We therefore included exercises with diverse cues, including people, places, rituals, different time periods and media types. We combined these probes with interviews, to provide additional information, on other levels such as values.

The use of probes in interaction design finds its origin in the use of Cultural Probes as first introduced by Gaver, Dunne & Pacenti (1999). These Cultural Probes were used in multi-disciplinary design teams to emerge in a new context. Cultural Probes are described as *“collections of evocative tasks meant to elicit inspirational responses from people - not*

*comprehensive information about them, but fragmentary clues about their lives and thoughts.*" (Gaver, Dunne & Pacenti, 1999, p. 1). Since the introduction by Gaver, the Cultural Probes have inspired a number of methods, including Technology Probes (Hutchinson et al., 2003), Empathy Probes (Mattelmäki & Battarbee, 2002) and Generative Toolkits (Sanders & Stappers, 2014). As our process and aims differ from Gaver's original proposal of Cultural Probes, we use the broader term probes study. Probes can be defined as "*design-oriented user research toolkits that are based on self-documentation*" (Mattelmäki, 2005, p.83). Although the forms of probes vary greatly, they generally share three characteristics: they have an exploratory goal, concern the users' subjective world and are based on self-documentation (Mattelmäki, 2005). These characteristics motivated us to apply probes for our current question, as it suits the exploration of personal memories.

Originally, Cultural Probes were mainly initiated to serve as inspiration, and Gaver et al. (2004) have criticized their use in more analytical processes. Others adopt a broader view of probes, expressing that the method can be seen to serve four reasons, in addition to inspiration these included collecting information, enabling participation in the design process and supporting dialogue between designers and users (Mattelmäki, 2005).

We address the probes as a source of both inspiration and information, thus analysed the probes more structurally. However, for this information purpose probes alone are often not enough (Mattelmäki, 2005). Instead, probes are complemented with other activities, in our case interviews. In such a more structured process, the probes are used as familiarization (Mattelmäki, 2005). In context mapping studies, sets of exercises are used in similar ways to sensitize people for the topic at hand (Visser et al., 2007). Probes allow for familiarization in two ways: the participant is engaged with the subject matter, allowing more long-term reflections to be included. And the researcher can quickly become familiar with the person: allowing to dive deeper in the subjects more quickly, since a lot of information and inspiration is available at a glance, during an interview.

## **Probe kits**

Probe kits consists of a variety of artefacts and tasks, with a certain aesthetic quality and expressing, in part, the designer's hypotheses and intents (Mattelmäki, 2006). Our probe kits were split in three phases, designed to sensitize participants to the topic of memories of everyday life as well as their present everyday life. The first and third phases contained a task we wanted all participants to fulfil. In the first phase (one day) participants were asked to capture a weekday in their lives. No further instructions or examples were given to prevent predisposing them for a certain method. Because we were looking for mundane elements of life, a weekday was more appropriate than a weekend day, reducing the chance

of capturing an exceptional day. The second phase (six days), contained the majority of the artefacts and tasks. As is common in probes, participants could choose which tasks to complete, and in what order. The tasks were grouped in three themes: memories people had, media of memories people owned and media people did not own. The third and final phase (one day) was similar to the start. Participants were again asked to capture the same weekday as in phase one, to support discussion on their view of their present everyday life during the interviews. By focussing the first and final phase on the present and the second phase on the past, we aimed to gather insights on both these time perspectives. Specifically, we were interested if different values were seen between past and present experiences and if the recollection of valuable past experiences influenced the perception of the present in the final phase.

An overview of the provided materials can be seen in Figure 3.1, more detailed information on all exercises can be found in Appendix 1.

The introduction and individual exercises emphasised the focus on everyday life because most often people recall memories of special events. Similar to the approach by Jung et al. (2011) and Golsteijn et al. (2012) 'everyday life' was not further specified to allow discussion on what makes something part of 'everyday life'. To foster this discussion, we added a 'dictionary-exercise' to the set of exercises in phase two, asking to define 'everyday life' as well as name its opposite. The study was concluded with semi-structured interviews to discuss the value of the memories and to connect to present experiences. The probe exercises and interviews were conducted in Dutch (the native language of all participants and involved researchers), as a result, the quotes provided are translations.



Figure 3.1 Contents of the probes kit. Part A: 'Capture-your-day' exercise card. Part B1: dictionary exercise, notebook, exercise cards on: people, rituals, small things, and repetition. Part B2: a USB-stick, a CD, a pedestal for a 'museum', a photo folder and exercise cards on missing media. Part B3: exercise cards on media creation. Part C: 'Capture-your-day' exercise card.

The probes were handed out to a total of ten participants, who were recruited within the social and professional network of the researchers. Participants had no background in memory research and had no previous knowledge about the study. The participants ranged in age from 19 to 65 years and included a variety of professions and family situations. Of the participants four were male and six female.

## **Data analysis**

After transcribing all material, we analysed the probes and interviews in two different ways as they provided information on different levels of detail. Both analyses were primarily done through coding and clustering.

The results from phase B of the probe study were divided into individual instances. Of the 199 instances, 17 were excluded because they did not describe a memory. The resulting 182 memories were coded according to the content they described, resulting in the themes shown in Table 3.1 (p. 69). The coding process followed the steps as described by Braun & Clarke (2006) creating codes bottom-up (open coding). The reliability of the resulting coding scheme was validated by a second coder. This second, independent coder, used the created coding scheme to analyse the full dataset. For this coding, inter-coder-reliability was calculated for each theme using Cohen's Kappa, which provides the agreement between the two coders as a number between 0 and 1. This value was calculated for each of the themes separately, with results ranging from 0.50 to 0.95 (mean 0.73).

These values were seen as satisfactory, with moderate agreement for the themes 'home' (Kappa, 0.60), 'Religion' (Kappa 0.55) and 'unknown' (Kappa 0.50) and good to nearly perfect agreement for all other themes (for example the Kappa score for the theme Work was 0.95). Differences in codes were most often caused by one coder assigning more themes to a single quote than the other coder (e.g. only Home or Home and Family). The presented findings are the result of a discussion between coders to resolve these disagreements.

The interviews were analysed using a more nuanced approach to thematic analysis, as we were looking for the underlying values, requiring coding on a latent level (Braun & Clarke, 2006). We adopted open coding and a sequential approach to the data analysis of the interviews. During the interviews and transcription phase, initial categories emerged. Clustering the transcripts, memos and notes, led to the final categories that are described in the findings. This part of the analysis was done by the primary researcher.



### 3.3 Findings

The probes elicited a wide variety of memories; a total of 182 memories were visualised or described across the exercises of phase two. There were large individual differences, as participants collected between 8 and 45 memories. In this section, we will discuss the findings from the probes and interviews together, structured by our research questions.

#### **What constitutes everyday life for people?**

To be able to put the memories people recall into perspective, we will first report on participants' definitions of 'everyday life'. They described everyday life as "relating to activities done without thought", "happening unaware" or "what is done automatically". Some even included more negative descriptions such as boring or not worthwhile. In some cases, the definitions showed a more literal explanation by referring to events that occur every day. The opposite of everyday life was most often defined as 'special', combined with words such as incidental, unique, unexpected and exciting. The given descriptions of the distinction between these two sides show how some everyday activities can become special:

*"a regular visit to a lonely acquaintance, can sometimes become very special through the conversation of that day." [P4]*

In this quote, the change is incidental: a singular occurrence becomes special. In other cases, the transition changed the experience permanently. The participants' responses showed that 'everyday life' and 'special' are not always easily separated. We, therefore, conclude that defining everyday life by contrasting it to 'the special' does not suffice. In Section 3.4, we discuss a more nuanced definition of everyday life based on these experiences.

Characteristic of most of the participants' memories of everyday life is the fact that they are of repeated events or experiences. These memories are therefore not described using specific details, but on a more abstracted level, similar to General Events (Conway & Pleydell-Pearce, 2000). People often express 'how it used to be'. See for example the repeated use of 'often' in the following example:

*"We used to have a Super Nintendo in the attic. Often if we would play a game in the evening, my father would often play guitar. [...] He often did the same thing when I went to bed." [P1]*

Although the memories were mainly General Event descriptions of repeated events, they could include examples of specific events with high levels of detail.

*"Once a week I went to eat at my grandma on Sundays after swimming. Swimming makes you hungry, [I remember] the chloride and vegetable soup from a soup plate, and vermicelli and praying before dinner." [P10]*

In an anecdote such as this one, a general description is combined with detailed fragments that might not have applied to each occurrence but are related memories, grouped in the General Event.

### **What kind of experiences of everyday life do people mention as memories?**

The memories from the probes study were coded for their content. Table 3.1 shows the results of this process. As the themes are not mutually exclusive, one, two or three themes could be ascribed to an item. As a result, the percentages in the third column add up to more than 100%.

As can be seen in Table 3.1, people's memories mostly concern the themes of Family, Leisure Time and Home. There was a large overlap between these themes, as for example a memory would take place at home with family members. A memory received both codes if both aspects seemed to be important for the memory.

Memories related to Leisure Time included both organised clubs such as music groups or sport clubs and other leisure interests such as crafting or hiking. Memories concerning School and Work are not often mentioned in the probes and even less when asked which memories are most valuable. One participant explained that "work is different every day therefore not mundane". Another participant expressed the opposite feeling, that work is too mundane to mention:

*"In any case not [anything worth mentioning] during the workday, so we can skip to four o'clock." [P1]*

The memories concerning Religion were mainly mentioned by two older participants (63 and 65 years old) and concerned visiting the church, praying at home and other recurring rituals. The themes of Love and Friends often concerned relations that were not present anymore, either because the romantic relationship had ended or because it concerned friends that were not seen (frequently) anymore. A smaller amount of these memories referred to relations that were still continuing.

The theme 'Special Occasions' is an exception in the list, we do not consider these to be "memories of everyday life" because these refer to milestones, transitional events or holidays. P8 described a photo book that was made about an annual camping trip with friends:

*"In that book, everybody [added] memories of the happening of camping [...] if you talk about the everyday elements, that is the everyday life of those camping trips." [P8]*

As this quote illustrates, memories of special events can show characteristics of 'everyday life memories'.

Theme	Memories	% of total	Example Quote
Family	66	35,9%	<i>"Watching guilty pleasures on TLC with my mom." [P2]</i>
Leisure Time	48	26,1%	<i>"[A ritual was] cleaning my soccer shoes, getting the dirt off, cleaning it with a cloth or brush, getting the laces out, greasing them." [P6]</i>
Home	44	23,9%	<i>"When I was 12-13 years old, I would drink straight from [our kitchen] tap several times a day." [P7]</i>
Friends	16	8,7%	<i>"The song 'Du' from David Hasselhoff reminds me of the apartment with [friend] B. For a while, we would always play this song when we were cleaning." [P1]</i>
Work	12	6,5%	<i>"I delivered newspapers almost every day: dark, cold, my little MP3 player, alarm at 5:45" [P10]</i>
Love	12	6,5%	<i>"With [ex-girlfriend], in winter, we would often go for lovely walks when the sky was blue and the sun was out." [P1]</i>
Religion	11	6,0%	<i>"When I was in primary school, it was customary to go to church almost every morning. [...] This meant rising early to be in church at 8 AM and in school by 9 AM." [P4]</i>
School	9	4,9%	<i>"Mr. B could tell great stories, just like Mr. S. on secondary school." [P7]</i>
Special Occasions	37	20,1%	<i>"[I don't have any media from] my last birthday that my grandmother visited." [P9]</i>
Unkown	11	6,0%	<i>"I thought the L and O were one letter, so I always wrote my name [with those together]." [P10]</i>

*Table 3.1 Memory themes: the second and third columns show the number and percentage of memories that were coded for each theme. In the final column, an example quote is given.*

## Why are some everyday experiences considered valuable?

The primary focus of the interviews was to discuss which of the described experiences were valuable or important to people and why. Each participant described the value of two to twelve experiences. For some, descriptions were coded with multiple reasons for value. The reasons were clustered into the following categories:

- Repetition
- Social Value
- Connection to the present
- Influencing Life
- Exemplary of Character
- Illustrating Contrast

Each of these reasons will now be explained separately.

### *Repetition*

For some memories, no other argument is given than simply that it “always” happened. The self-assessed value of four memories focused solely on this repetition. All these memories were of events with a fixed time, place and activity, repeated either daily or weekly:

*“I think [I value it] because it was every day, you knew for sure that it was coming, and that was kind of nice.” [P10]*

This quote refers to her memory of a night-time routine, illustrated in Figure 3.2 together with a similar bed-time routine from a different participant.

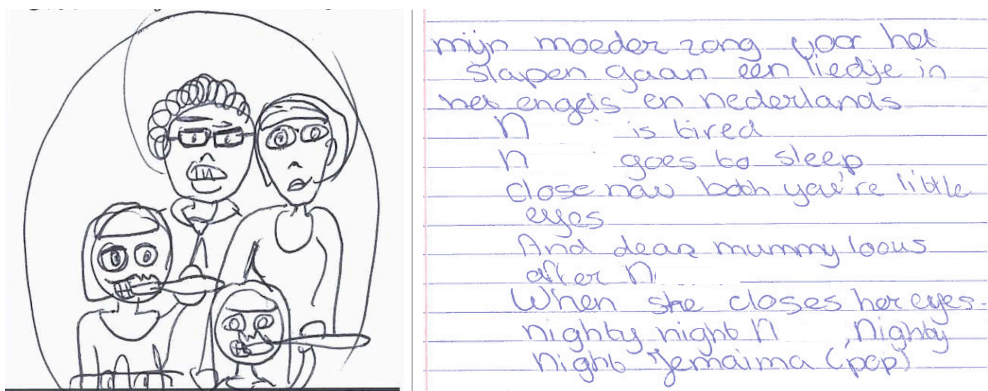


Figure 3.2 Example of repeated memories:

Left P10: Drawing of her parents asking “What was the stupidest thing today?” “And what the most fun?” while she and her sister were brushing their teeth.

Right P9: Song text of a lullaby her mother used to sing to her every day until she was nine, in both Dutch and English.

### *Social value*

The majority of memories were social, 158 of the 182 memories included references to others or were written in 'we'-form. Some memories were specifically valued for this social component, for representing a bond with certain people. The memories related to a wide variety of people, including parents, children, siblings, friends, lovers or colleagues. The social value was the most evident value when participants were asked to reflect on their valuable memories in general:

*"The warm memories are all connected to people." [P2]*

It was an overarching theme that participants themselves recognised in several cases. The value of social bonds was also seen when discussing the present as potential memories. Present relationships mainly related to parents, children or groups of friends.

### *Connection to the present*

The third theme of valuable memories related to memories with a strong link to the present. For example, if the event still occurred in the present as part of a weekly club. In some cases, the event did not literally continue in the present but was transferred to a new generation. P7 explained this in the following quote:

*"After school, I always went to my mother to tell her how it had been [...] there was always time for that, or she made time, and the same applies to my father. [I value] that in combination with [how we did this with] our own children later, always trying to talk things through every day." [P7]*

Transferring a memory as an experience for the next generation was even projected into the future when not applicable to the present.

### *Influence*

The example above of P7 talking to his parents had an additional value: it shaped his moral and in that sense influenced his life. This category, labelled influence, includes ten memories of 6 different participants. Besides moral, the influence of a memory was seen in shaping likes and dislikes, determining career paths and forming personality:

*"This [going to secondary school] has been determining for the rest of my life, in a way." [P4]*

The possibility to go to school, although a mundane activity on a day-to-day basis, was special because of the influence it had on P4's life, as it determined her first job. These kinds of influences on life can only be recognised in retrospect.

### *Exemplary of own character*

Half of the participants valued a certain memory because it was exemplary of their personality at that time. In some cases, these were memories of general events, but two participants described a singular event, with a high amount of Event Specific Knowledge, such as the

example of P4 during a certain morning at school:

*“I was a very obedient student [...] when I was in school and we were standing in line [...] I was yawning, and then the girl behind me coughed in my face. And I thought, oh my, I should be looking in front of me. And the teacher came towards me and she was scolding the girl behind me. And I was so surprised because I thought I was misbehaving.” [P4]*

Even though the memory is a detailed description of a singular event, it can be seen as part of a more thematic General Event, illustrating a certain character: “that’s the kind of things I did, that’s how I behaved”.

#### *Contrasting memories*

Eight out of ten participants mentioned at least one valuable memory that illustrated a contrast. We found a large cluster of memories (27), demonstrating such a contrast. These memories were diverse, and on further analysis could be split into four types of contrast. The first contrast was found when something was exceptional then but normal now. contrast was found in five memories, reported by two of the participants (65 and 63 years old). This contrast can only be recognised in retrospect and sometimes referred to smaller habits, as the following quote illustrates:

*“You cannot imagine now, but [grocery shopping] was really a getaway [...] We would go with the two of us. And you had to be washed and clean because you went grocery shopping.” [P4]*

The second type of contrast was the opposite of the previous one: an experience that was considered normal at the time but is exceptional now. Four different participants recognised this contrast. Similar to (Petrelli, Van den Hoven & Whittaker, 2009) these contrasts between past and present reflected both personal contrast and societal change:

*“That standing ashtray, that’s why I added this picture [...] smoking was done everywhere, that’s not allowed now anymore, but back then [...] it was just part of everyday life, smoking.” [P8] (see also Figure 3.3 on p.74).*

The third type of contrast was seen in memories of a regular event and an exception. The exception could be more exciting or could be a negative experience during a regularly positive event:

*“A dessert with strawberries, we ate that every Sunday [...] after that [...] I once became very sick, because I had a tooth pulled. [...] I think that’s the reason I remember it so well because the other experience is linked to it.” [P3]*

The extraordinary circumstances of the exception also made people remember the routine better.

Finally, a social contrast was found, relating to differences between them and others. A certain habit or event that was normal for the participant, but which they saw was different for others.

*“We were always allowed to play outside, on the curb, on the street, in the garden, [...] But they [friends] were never allowed to do that, so it was, for us it was normal to be allowed to do so, and what they did was very special to us.” [P8]*

This kind of contrast was sometimes already noticed at the time of the experience, for instance when discussing it with others.

### **When do these experiences become valuable?**

If a certain memory is valued in the present, but the experience was not valued when it occurred in the past, there must have been a moment of transition. For participants, it was often challenging to indicate when they became aware of the value of an experience. Only one participant indicated being aware of the value as soon as the repeated event stopped.

*“[The lullaby by my mother] became really important for me when the ritual stopped, [...] because [my mother] thought I was too old for that. At that moment I thought, I really don't like this.” [P9]*

For most memories, the value increased or changed some time later, but the exact timing was difficult to specify. In some cases, events were appreciated at the time as generally positive, but somehow got more value later, as the following quote about a cookie jar at P10's grandmother's home illustrates:

*“At that time I thought it was great, just because I was a child and it had candy. But later, I kind of realised that it really connected to my grandmother [as a person] and that for her, it was also to show that she was so happy that we were there.” [P10]*

In some cases, participants could point out when they started attaching value to the memory, which was a moment of change. These changes included changing jobs, a loved person leaving or changing roles within a certain experience. P7, for instance, appreciated his scout leader's effort and values when he himself adopted this role:

*“At the moment I became a leader. I was sixteen at the time, so on one side I was still part of the oldest group myself, but on the other side I was assistant leader, and then you start to make games yourself.” [P7]*

Only after changing roles he realised that the variety of games his leader organised represented important values of equality. However, it remains unclear how deliberate or elaborate this reflection was at that time. Changes in life also caused certain memories to be more linked to the present and therefore more likely to be retrieved during the study. Some participants expressed that they were aware of this:

*“I think this is mainly because recently we’ve been cleaning out their [grandparents’] house, then all of a sudden all those things I haven’t thought about in years come up again.” [P10]*

### **Which items represent experiences of everyday life?**

Photos are a type of memento often owned in great quantity. However, our findings suggest that this might be less true for memories of everyday life. Eight of the participants expressed regretting not having specific media of some of their everyday life memories. For many of the memories discussed no deliberate media (photos, film) were created at the time. Especially for memories related to the themes *School* or *Home* participants expressed having very little media and they thought this was regrettable. Figure 3.3 (Left) shows an example of a photo of everyday life around the house. From our sample, this was quite a unique example, as very few participants had such media of their everyday life, especially of their youth.

Instead of deliberate mementos, P8 included some photos that contained cues of everyday life in the background. She valued these pictures for the mundane aspects of life they represented even though the pictures were taken at special moments. For example, a birthday



*Figure 3.3 Left, P4: Unique memento: picture of everyday life, playing outside on the farm. Right, P8: Picture valued for the cue in the background: the ashtray reminding of a time smoking was generally accepted.*



picture was valued for the ashtray in the background that reminded her of the widespread habit of smoking at that time (see Figure 3.3, Right).

Similar to the findings in (Petrelli, Whittaker & Brockmeier, 2008) we found mundane objects as mementos besides photos. These were most often objects that were used in the activities such as a cookie jar, musical instruments or shoes. In cases where no mementos were owned participants could refer to environmental cues that they were aware of such as people, music, locations or situations that triggered a specific memory.

Participants expressed different aspects that they would value in media of everyday life. Some desired media that would represent the experience, the emotional value of an event or personal interpretation of the situation. In contrast, others wanted media that would better reflect reality and support remembering the facts. This desire came from conflicting memories with friends or family. Another reason to regret not having mementos was the desire for cross-generation storytelling, explaining everyday life to (future) (grand-)children could be supported with visual or physical media.

### How do people appreciate present experiences?

Two phases of the probes study were dedicated to capturing the present. On two days, one week apart, the participants captured the events and experiences of their days. This open exercise was approached in many different ways. Three participants listed their activities and three wrote more elaborately, similar to a diary. Figure 3.4 shows examples of these types of written accounts. The other accounts were more visual, including a pictorial overview, photo-collage, and drawn overview, see Figure 3.5 for examples.

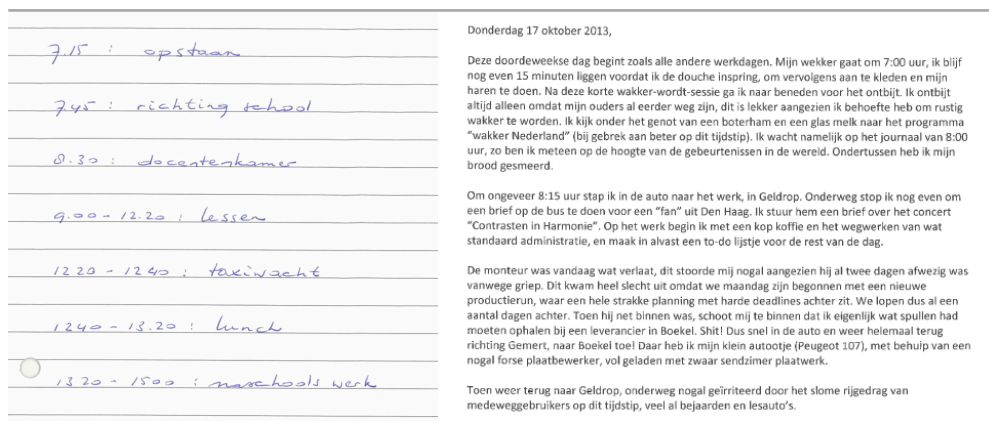


Figure 3.4 Left, P6: List overview of activities with time indications.  
Right, P5: More diary-like written account.

The two days to be captured were separated by the second phase, focussing on memories, which lasted six days. With this set-up, we hoped to ignite reflection on what aspects of everyday life would be valuable to capture. Participants could capture it in a different way or with a different focus the second time. The assignment did not prescribe the days to be captured in similar ways, but only a few participants changed their strategy. In all the text-based accounts the activities and representations were highly similar. Two of the visual accounts had slight changes: P7 changed from clock-orientation to a more symbolic representation of time in a photo collage, see Figure 3.5 (still time went roughly clockwise through the collage, but not as directly). P10 broadened her scope: the first time she focussed on food eaten on a day, the second time she included a variety of activities and aspects (see Figure 3.5). She reflected that if she would do such an exercise regularly, it would be interesting to put the focus differently every time such as on food or modes of transportation.

A changing view on present experience evolved more during the interview, rather than by the probes in themselves. The representations of the present were discussed during the interviews to reflect on whether or not they shared values with the valuable memories from the past. Approaching the present as future past was a challenging topic to discuss. It was especially difficult for participants to recognise more abstract elements of valuable memo-

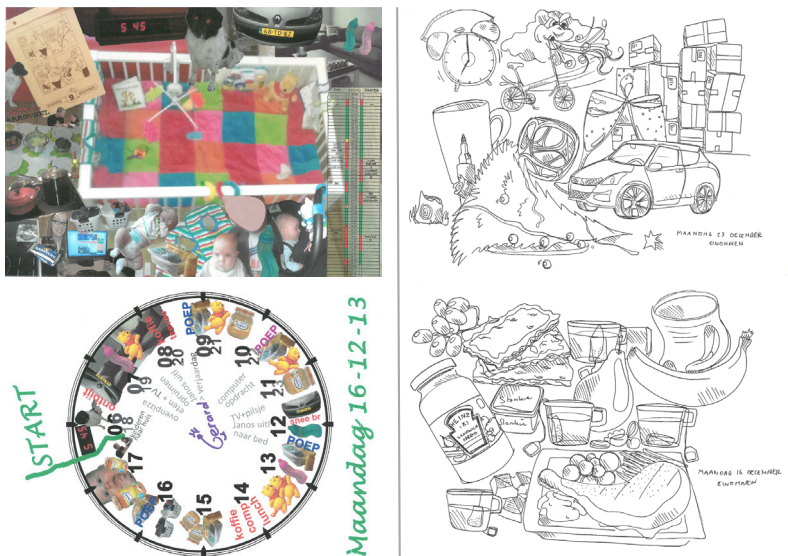


Figure 3.5 Left, P7: Photographic overviews with a loose approach to time (top) and a clock orientation (bottom).  
Right, P10: Drawn overviews with (top) and without a theme (bottom).

ries in the present. Experiences with social value that continued in the now or were passed on to the next generation were most easily recognised. Two of the participants (aged 19 and 20) reflected on how they would remember aspects of their present:

*“I think [I would remember] my chaotic character, especially if I have to go somewhere or have just come back.” [P9]*

This participant explained that she was very aware of the way she developed, as she explained this was partly due to her education in which personal reflection was very important:

*“Because it has already changed a lot in the past year, it has already become less, but I think it will keep on improving because I get older and will just get my habits. Hence I think I will look back upon it with a laugh when I am older.” [P9]*

As the quote shows, P9 was very aware of a recent change, the development of a character trait. Such awareness of current changes requires a high level of self-insight and deeper reflection.

### **3.4 Discussion**

The probes study described in this chapter aimed to explore which mundane experiences are valued in retrospect and how this appreciation develops over time. Various researchers have found that participants enjoyed recalling everyday (or mundane) aspects of their lives (Dib, Petrelli & Whittaker, 2010, Lindley et al., 2011, Zhang et al., 2014). However, these studies provided little detail on what aspects of everyday life are valued and why. With this study, we aimed to contribute to a more detailed understanding of the value of everyday life experiences.

Our findings show that memories of everyday life are diverse, relating to many different themes. Large clusters relate to family, leisure time and home. It is not surprising that family and home are frequently recurring themes. Many memories were recalled from the childhood period, in which home and family play an essential role. In the context of design for remembering, the home is more often studied as a place for memory rather than as a specified topic of remembering (see for example Csikszentmihalyi & Rochberg-Halton, 2002; Petrelli & Whittaker, 2010; Kalnikaite & Whittaker, 2011). In our findings, leisure time was more often mentioned than memories of school and work. School and work were often referenced on a very general scale, as an indicator of a certain Life Time Period (Conway & Pleydell-Pearce, 2000). Within the common themes, there were even a few specific scenarios that recurred several times, such as family dinners, night-time rituals and weekend routines (chores, groceries, sport matches). These events are not the typical high-level events (such as graduating or marriage) in a Life Script (Berntsen & Rubin, 2002), yet they can still

be considered somewhat ‘scripted’. Events such as family home dinners are socially and culturally “part of the normative expectations” in Dutch culture. As such, many people will have somewhat similar memories of these experiences.

Overall, our findings demonstrate that everyday memories are valued for a wide variety of reasons. There is not a single answer to why certain memories of everyday life are valuable, but the themes provide support when looking for present experiences with high potential to become valuable memories. Repetition, was an important reason for value, something that was “simply always so”. Yet it is difficult to use this theme more directive as not all things that are repeated with a specific frequency and over a set period are valued. Memories that are valued for their social relevance are more evident to people, even in this present. This resonates with the findings on social values the time capsule study by Petrelli, Van den Hoven & Whittaker (2009) and in the Memory Lane study by Kalnikaite & Whittaker (2011). Other important reasons for value, including connections to the present, influencing the life or representing one’s character, can only be valued in retrospect. These values require reflection and insight that can only come after a certain time. Similarly, the aspect of valuable contrast only becomes evident when people reflect on the meaning of experiences. In some cases, such as with social contrast, this reflection could occur at the time of the experience, in other cases reflection occurs later. Specifically, moments of change and transitions were seen as important for reflection, in accordance to Staudinger (2001).

## **Limitations**

When probes are used to study a specific topic, they inherently reflect some of the designer’s views on the topic and incorporate their assumptions. We hypothesized that collecting valuable past experiences would allow people to see value in present experiences, which would be expressed in the ‘capture the day’ exercise. However, this exercise had no specific goal indicated to the participants. Participants often seemed to capture their day primarily as a way to communicate it to the researcher. In contrast to the approach by Petrelli, Van den Hoven & Whittaker (2009), who specifically instructed participants to capture media to be rediscovered in 25 years. Such an approach might have better supported seeing value in present experiences. As a result, insights in the values associated with present experiences are limited and instead our results mainly concern the memories of experiences discussed in the second phase.

The exercises from the second phase used specific questions, which could cue specific kinds of memories. We aimed to mitigate this limitation by including a wide variety of tasks, allowing people to complete the exercises they wanted. Exercises that allowed for a broader interpretation were most useful (all exercises can be found in Appendix 1). A large

variety of memories with rich descriptions were often given in response to the exercise 'The little things in life', an open prompt to share small things that are appreciated. Similarly, the exercise 'Everyday Rituals' (which asked people to draw a ritual in three comic-like boxes) resulted in interesting memories. In retrospect, the exercise on 'Everyday People' was too restricted because it consisted of specific sentences to be completed. The exercise sparked interesting conversation, but in itself did not reveal much. Additionally, the exercise might have influenced the findings, as this exercise contributed greatly to the cluster of memories with social value. The values that are found are also influenced by the set-up of the interview. After laying out the collected probes, an open question was posed which memories were considered valuable. Answers might have been influenced by what memories participants find easy to discuss (e.g. easy to recall). Additionally, some private memories might have been very valuable but might have remained undisclosed.

In the following sections, we will discuss our study and findings in a broader context. Specifically, we will first reflect on the definition and scope of everyday life. Then, we discuss our findings in relation to the functions of autobiographical memory. We discuss how the process can be seen as a form of guided reflection for the participants. Finally, we formulate design directions for everyday media creation based on our findings.

## **Redefining everyday life**

The probes study provided a wide variety of memories that gave better insight into what aspects of everyday life people remember. Although several exercises focused on specific kinds of memories (e.g., describing valuable rituals) the collection of tasks together provided a broad scope covering many areas of everyday life. The 'dictionary' exercise (see Appendix 1) was very useful to understand people's interpretation of everyday life. Together with the collected memories and related discussions, the findings show that everyday life is not an easy area to define. Some memories are considered special, although the experience was mundane at the time. Other everyday life experiences are the result of deliberate moments of choice, such as the choice of a certain school. We, therefore, emphasise that although special occasions are not part of everyday life, parts of everyday life can still be special.

Because of this hidden value in everyday life, we argue that everyday life should be more often considered when designing for remembering because the value is easily overlooked by the 'normality' of everyday life. In designing for remembering everyday life, the definition of Felski (1999) can provide a focus. According to her, three key facets distinguish everyday life: repetition, a sense of home and experience of habit. The aspect of repetition was strongly present in our findings: almost all memories were of repeated events. 'Home'

was an important theme in the memories that were collected, but less so in Felski's interpretation as a meaning derived from feeling "the familiarity with the space around us". This value of 'home' was for instance found in valuing familiar places by Petrelli, Van den Hoven & Whittaker (2009). The experience of habit does not merely refer to an action, but an attitude. Our participants similarly reflected how activities 'were just done like that'. One exercise especially evoked these memories, by asking to draw everyday routines. In our view, Felski's (1999) three aspects can be used in future research to help participants focus on everyday life memories. The aspects can also provide guidance when designing to support capturing the everyday life by making it more specific how to recognise these activities through repetition, home, and habit.

### **Findings in light of the functions of AM**

As described in Chapter 2, autobiographical memory serves several functions in life. Reflecting on our findings, we see connections with the social, directive and identity functions. Most participants indicated they would appreciate having more media of valuable everyday life experiences. The reasons that were often given for wanting such media closely relate to the social function of remembering. People would use it to strengthen family bonds through (cross-generation) storytelling. Such stories enable explaining the contrasts between the past and the present but can also be used to explain personal histories. Several concepts have explored the potential of media-supported storytelling across generations, see for example Cueb (Golsteijn & Van den Hoven, 2013) and CaraClock (Uriu et al., 2009). Our findings show that mundane memories could be a valuable focus for or addition to such concepts.

The connection between our findings and the directive function of AM is less evident. In general, memories are used to make decisions about one's life and to 'direct' the course of events (directive function, Bluck et al., 2005). In a sense, this is related to the memories that are valuable because they are seen as influencing people's lives. In other words, at some point they were directive, although it remains unclear if people have deliberately used such memories for a decision or if they reflect on such influences afterwards. In this last perspective, those memories can be seen as contributing to retrospective sense-making. At certain moments, people reflect on the course of one's life and look at such influences and milestones to a coherent life-story and a coherent sense of self (Staudinger, 2001). The aspect of identity formation is seen in other themes as well. As such, a different goal for media could be, on a more personal level, to reflect on identity and personality. Participants valued several memories for relating to their character, closely related to the identity function of AM. Research has been done into the connection between media and identity, including digital photography as a tool for identity construction (Van Dijck, 2008) and the relation between digital media and teenagers' identities (Odom, Zimmerman & Forlizzi,

2011). However, these studies focus on projecting a person's identity to others, both in the home and through online display. As a complementary approach, we see value in studying the relationship between media and self-image, on a level of more personally and individually reflecting on identity through media of everyday life aspects.

### **Study as guided reflection**

The process of participating in this study turned out to be a form of guided reflection on the value of everyday life experiences. The guided reflection included all interaction with participants, from invitation to instruction, to probes and interviews. Participants reflected both on past and present experiences, which sometimes resulted in re-appreciating these as being important or discovering additional value in them. As mentioned above, considering valuable past experiences did not inherently change their view on the present. The guidance of the interviewer was needed to reflect on such present experiences. Outside of the scope of such a study, people's everyday activities and experiences might not frequently be the topic of deliberate reflection, as everyday life is typically taken for granted (Felski, 1999). In this case, participation in the research and explicit questions by the researcher provided an external trigger to do so. We believe interactive systems could also provide these triggers. We therefore conclude that in addition to the specific findings on values of everyday life experience, on a higher level, the study has contributed to our conviction that everyday life reflection is worth triggering and supporting.

### **Design for media of everyday life**

As our findings show, certain aspects of everyday life are appreciated as valuable memories. Based on the themes we formulate four conceptual design-research directions which will be discussed in the following sub-sections. These directions focus primarily on how to use media to represent everyday life experiences for later recall, without such recall being specifically reflective. Two directions are suitable to allow for memories of the past to be cherished in media by looking at creating media in retrospect and at repurposing existing media. Two other approaches are more suitable to capture the present for future remembering: creating media of repeated events and supporting selecting experiences.

### *Design Direction I: Creating Mementos in Retrospect*

Memories belonging to specific themes can only be valued in retrospect, such as experiences that influence the course of life. For these kinds of experiences, it is impossible to deliberately create mementos at the time. Instead, we could create mementos in retrospect, at the moment a memory is valued. Lifelogging can support this by capturing every aspect of everyday life and postponing the selection to a moment when the values have become clear. However, this results in a complex and elaborate selection process. Instead, we ask ourselves what kind of mementos people can create in retrospect without capturing vast amounts of data. MemoryBox (Frohlich & Murphy, 2000) enables the recording of memories related to objects 'later'. However, when no related objects are owned this approach is not suitable. Instead, the memory could be described or visualised in more abstract ways. We see a design challenge in stimulating people to create these kinds of memory representations at the moment of remembering, which is different from current practices focused on creating mementos during the experience. It raises the question how retrospectively created mementos (should) differ from items created in the moment of the experience.

### *Design Direction II: Repurposing Mementos*

Inspired by the 'background cues' as seen in the photos by P7, we propose repurposing mementos as an approach for both research and design. Going beyond photos, we could re-examine current mementos to explore how they cue everyday life aspects. These mementos are not created with the purpose to remember everyday life but might include aspects that cue this kind of memories, for example by showing objects, patterns or locations. As a research method re-examining current mementos could reveal additional valuable aspects of everyday life not recalled spontaneously, without the support of cues. Additionally, as a design direction, we could think about repurposing current media to support remembering everyday life aspects. This could be done by manipulating current media, emphasising certain aspects or by combining several existing items. A different approach is discussed by Hollis et al. (2017), where media is repurposed by presenting it in a different context. Specifically, they explain how social media posts are presented back to the users for targeted reflection. Similarly, media from special occasions could be presented in a different context or accompanied by prompts to look for mundane aspects. Through these processes of repurposing, we could create cues for memories of everyday that are currently not represented in items.



### *Design Direction III: Mementos for Repeated Events*

The majority of memories of everyday life are memories of repeated events; people express a general representation of “how it used to be” rather than specifically recalling a single instance. How can mementos support the remembering of the general experience rather than a specific occurrence? The currently dominant form of memento creation, photography, might not be suitable for this. Photographs often refer to specific, unique instances and induce a selective search strategy. As Van den Hoven & Eggen (2009) wrote: “*looking at a photograph might prompt people to focus on what can be seen in that particular picture only and to not think about the events before or after the photo was taken.*” [p. 61].

When focusing on repeated events, this selective retrieval can be seen as a downside: it will only support recalling a singular occurrence, possibly an unusual episode which is remembered better because it can be cued by its distinctive features (Hudson & Nelson, 1986). This raises the question what kind of memento is most suitable to remember repeated events and their value? Some designs, such as Pic Your Moment<sup>14</sup> or Echo (Isaacs et al., 2013), focus on repeated capture. With high frequency, such capturing may lead to certain repeated events being collected more often but these designs do not emphasise this repetition. Rather than a collection of representations of single occurrences (as can be created with such devices), there could be value in a single representation of a group of events. We see potential in approaching mementos as things that can grow over time, accumulating the repetitions of an event instead of representing a single instance.

### *Design Direction IV: Select Experiences in the Present*

Some of the themes of valuable memories can be used to recognise potential memories in the present. An interesting challenge lies in making people aware of (potential) contrast, an indicator for valuable memories. When designing to support people in recognising these contrasts focusing on generations could support recognising changes on a personal level. The design could also focus on societal changes, by looking at what used to be normal (such as the smoking). A designed system could help people to see what present aspects of everyday life might be considered special or surprising in the future. Such insight can be gained by seeing old pictures in their present locations, which emphasises change (see for instance a collection by photographer Larenkov<sup>15</sup>).

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<sup>14</sup> <http://www.picyourmoment.nl> Last accessed March 2019.

<sup>15</sup> <https://sergey-larenkov.livejournal.com> Last accessed March 2019.

## 3.5 Conclusion

In this chapter, we have described a qualitative study of everyday life memories. With this study, we explored which memories are considered valuable and how this appreciation develops over time. We conclude that mundane experiences might be considered boring at the time, but can have great value as memories. Sometimes, experiences are seen as valuable because of their repetitive occurrence. In other cases, more specific reasons for value are given: they hold a social value, have a connection to the present, influenced one's life, are exemplary of character or illustrated a contrast.

However, often people only appreciate these values if they deliberately think about it. Such reflection occurred for example at the time of life transitions or when a repeated event stopped happening. Additionally, the study served as a form of mediated reflection on these experiences. As such, our findings support the aim to design for reflection, as a potential way to appreciate such everyday life experiences. As this study can be seen as a type of guided reflection, we are interested under what circumstances such reflection occurs in everyday life. In Chapter 5, we explore what people's everyday reflective practices entail.

The study confirms our assumption that media of mundane experiences are rare. As our study focussed on memories, we formulate four design directions to support remembering with media: retrospective media creation, repurposing media, creating media of repeated events and selecting experiences for media creation. In Chapter 4, we will specifically explore design direction III, capturing repeated events. One of the most interesting findings of the study in this chapter is that the majority of the memories of mundane experience are of repeated events and if recalled, are described on the level of a General Event memory (Conway & Pleydell-Pearce, 2000). As media typically only capture a singular event, we are interested in how we can represent repeated events in media in abstract ways. This will allow to explore the potential of such media, both for remembering in general and for stimulating reflection specifically.



# Design Exploration 1

Based on:

Ine Mols, Elise van den Hoven, and Berry Eggen (2016), *Ritual Camera: Exploring Domestic Technology to Remember Everyday Life*. IEEE Pervasive Computing 15, 2 (April 2016), p.48-58. DOI: <http://dx.doi.org/10.1109/MPRV.2016.25>

# 4

## Ritual Camera: Creating Abstract Media of Everyday Life

**Abstract** Reflection plays a role in everyday life, throughout the lifespan. Yet, although many systems have been developed with the aim to support reflection, few are based on knowledge of how people currently integrate reflection in everyday life. In this chapter, we aim to contribute to this gap through a questionnaire on everyday life reflection practices combining both qualitative and quantitative questions. Findings provide insights in the wide variety of reflective practices that people engage in. The general findings show that reflection occurs frequently, involving diverse people and triggered by diverse events. Based on the questions a number of specific scenarios for reflection were clustered. These scenarios show that reflection occurs both through ‘dedicated’ activities as well as in parallel with other activities. We discuss the implications of these findings for the design of reflection support systems.

## 4.1 Introduction

As described in the previous chapter, people value many different everyday life experiences in retrospect. Examples of such experiences include walking to school through the fields or sharing the newspaper over breakfast. However, people often underestimate the value of these seemingly ordinary experiences at the moment (Zhang et al., 2014). For some experiences, the repetition of an event is the main reason for valuing it in retrospect, it was 'simply always like that'. But in most cases, specific reasons have been added over time. A memory can be, for example, connected to present activities, iconic of someone's character, remembered through an exception or in contrast with other people or with the present (as found in Chapter 3).

The everyday memories evoked by our probes (Chapter 3) were most often of repeated events. In this chapter, we explore how repetition and general event memories could be captured in personal media. Similar to our memories of such events, we explore how media can be created over time by combining multiple instances. We choose to combine multiple instances into more abstract visualisations as our memories of repeated experiences are often also more abstracted into General Events (Conway, 2005). We present the design of Ritual Camera, which explores two aspects of this process: the potential of a domestic stationary camera and the appreciation of more abstract visuals of repeated events. The concept was evaluated in a field trial with six families, focused on capturing home dinners. The insights from our design process, field study and reflections can further inform the design of reflective media technology for everyday life.

### Media of everyday life

Everyday life seems to be a straightforward thing, however, through its omnipresence, it can be difficult to define. As Felski (1999) put it: "*after all, everyday life simply is, indisputably: the essential taken-for-granted continuum of mundane activities*" [p. 15]. In an exploration of the meaning of context, Dourish (2004) argues that the 'ordinariness' of everyday life is not a given, but is actively constructed between social actors as it must be both constructed and accepted, even though a large part of this process is unconscious. Because of these unaware and taken-for-granted processes, the value for remembering ordinary experiences is often underestimated (Zhang et al 2014). Experiences seen as ordinary at the time, are seen as less ordinary several months later and people are more curious and interested in remembering them than they had expected (Zhang et al., 2014).

Our design work is grounded in theoretical knowledge about remembering and reflecting (Chapter 2). Specifically relevant for this study are the theories on levels of specificity of remembering and the self-memory system (Conway & Pleydell-Pearce, 2010). The autobio-

graphical memory knowledge base includes knowledge on different levels. The 'conceptual self' includes one's life story, structured in different themes, Lifetime Periods and General Events. On the most specific level, people remember episodic memories, with Event Specific Knowledge (Conway & Loveday, 2015, a more elaborate discussion of this theory and a visual representation can be found in Chapter 2, p.31). The everyday life memories we are interested in, are part of General Event memories. General Event memories concern clusters of experiences, either mundane or more special, for example describing a short specific period, a number of repeated or categoric events or a mini-history (Conway, 2005). A General Event moment of a specific period could for example concern 'last year's holiday to Spain'. General Events can also be grouped according to repeated events (e.g. weekly dinners with the family) or more thematically (e.g. memories related to basketball) (Conway, 2005). We are specifically interested in memories of repeated similar events. In the probes study described in Chapter 3, 46% of the collected memories of everyday life referred to repeated events, with repetition being daily, weekly or "often but irregular". These repeated event memories are similar to what Johnston (2001) refers to as layered memories: *"in the sense that many occasions merge into one in the telling of the story"* [p.3]. These explanations have guided our choice to focus on abstract media and have been inspirational to some of our specific visualisations, where multiple occasions are similarly merged into one visualisation. This process of visual abstraction is further described in Section 4.2.

Despite the value of memories of repeated events, participants in our study rarely owned any media of these experiences and often still did not create media of similar experiences in the present. Little research has been done focusing on media from repeated events. In some research, it is found that collections, built up over time, can become representations of repeated events. Petrelli et al (2008), for example, describe a collection of shells that together represented 'the family holidays'. However, such representations of more everyday life experiences are rare. Even when explicitly creating memory cues on a daily basis, important parts of a person's life such as profession, interest, and hobbies can easily become under-represented (Linton, 1982).

Based on these aspects we formulated two main requirements for media of everyday life. First of all, because of the nature of everyday life, capture should be unobtrusive and cost little effort. Secondly, the resulting media should support remembering multiple events. In our view, photos, as the most dominant visual media form, do not support remembering general event memories well. In photo-triggered remembering, people can be prompted to focus on what can be seen in the photo rather than including events before, after or 'out of frame' (Van den Hoven & Eggen, 2009). We argue that this makes photos less suitable for remembering general events as one photo only represents a single occurrence.

We, therefore, see opportunity in media representing a multiplicity of occasions in more combined or abstract visuals. We will further describe both of these aspects, effort in capturing and abstraction in visuals, in the following sections.

## **Effortful versus automatic capturing**

Traditionally, media creation was inherently effortful. In the age of analog photography, photos had to be taken, developed and printed manually. Even when part of this process was outsourced through photo-printing services and no longer required a private darkroom, photography was still an effortful practice, and people often had limited collections (Frohlich et al., 2002). With the advance of digital photography and the development of better automatic modes, photography became less and less effortful. Still, on some level, taking pictures requires attention and effort. This effort can focus one's attention on what is being captured (Henkel, 2013) but, in contrast, might also draw away from the actual experience one tries to capture (Mols et al., 2015). As such, investing effort in capturing a positive experience, sometimes makes the experience less positive. We consider this especially relevant on the context of everyday life, as those mundane or 'spontaneous' moments (Helmes, Hummels & Sellen, 2009) might be especially vulnerable to be disturbed.

In parallel to the process of photography becoming less effortful, it also became less selective. With the advance of digital photography, capturing became much cheaper with large storage easily available (Frohlich et al., 2002). Although this seems a positive development, the sheer quantity can reduce how much photos are used and enjoyed, as people often consider their collections badly organized (Frohlich et al., 2002; Rodden & Wood, 2003; Broekhuijsen, Van den Hoven & Markopoulos, 2017). Some concepts have therefore explored how the quantity of media can be reduced by reintroducing boundaries and limits (Niforatos, Langheinrich & Bexheti, 2014). Other counter-movements can be seen in the renewed interest in old-fashioned instant cameras such as Polaroid (footnote) and Instax (footnote).

With the advancement of technological possibilities, it became possible to capture photos without any deliberate effort, for example triggered by sensors. Pushed to the extreme, some have adopted an effortless and all-encompassing capturing strategy, referred to as life-logging (Sellen & Whittaker, 2010). Life-logging is considered to be the indiscriminating collection of information concerning one's life and behaviour (O'Hara, Tuffield & Shadbolt, 2008) often including the use of wearable cameras such as SenseCam (Hodges et al., 2006). With our focus on everyday life, life-logging is interesting for including media of mundane activities. Life-logging has been shown beneficial in specific situations, for example as a memory aid for people with dementia (Piasek, Irving & Smeaton, 2011) and to stimulate reflection (Lindley et al., 2009). However, it has also been criticized. Many life-logging



systems lack a specific description of their foreseen added value. Distinguishing up-front between the potential for different goals (e.g. reminiscing, reflection or remembering intentions) would be beneficial (Sellen & Whittaker, 2010). Without specific goals, life-logging concepts create an abundance of data that is very difficult (if not impossible) to manage. With a set of provocative camera designs, Pierce et al., (2014) debate if people might be better off with limitations, rather than the unlimited possibilities of digital photographic technology.

This distinction between effortful and selective creation on one side and automatic, indiscriminating collection on the other, is not binary. For example, the concept Other Brother (Helmes, Hummels & Sellen, 2009) explores partial automatic capture in the home context. It consists of a stationary rotating camera, that responds to audio and direct interaction in order to capture social events in the home. The results show how participants selected the focus of the camera by locating it in specific areas and made explicit sounds in an attempt to trigger the camera. These interesting insights in the combination of intention, effort, and automation motivate further research in the combination of personal selection and automatic creation, to which we strive to contribute with this work. For us, the personal selectivity is seen in the deliberate direction of attention and media creation to certain elements and automatic creation describes some level of automatic system action in the process of creation. For example, a person might set boundaries for creation by highlighting a certain active timeframe (personal selection) in which a camera decides to take snapshots (automatic creation). In this exploration, we focus on what values can be supported by transferring part of the creation process to an autonomous system.

## **Abstraction in visual media**

Memories are not saved in the media that are created to remember them. In essence, any type of media is an abstraction of a real-world situation, as it captures only parts of it. Memories are not 'stored' in these media, but the media provides cues to remember. These external memory cues can be described as *"a piece of information that has a physical or tangible embodiment but has an internal effect: triggering a memory"* (van den Hoven & Eggen, 2014, p.3). In the case of photography, the link between the information (photo) and the memory is often quite direct: one remembers what is in the photo. But photos can trigger related memories as well, for example something that happens out of frame or had happened after the photo (Frohlich, Wall & Kiddle, 2013).

Although photos can be seen to have some level of abstraction, they remain close to the experience as it has happened. In other words, those media types often aim to capture realistic representations of real-world events. Whether more accurately capturing an expe-

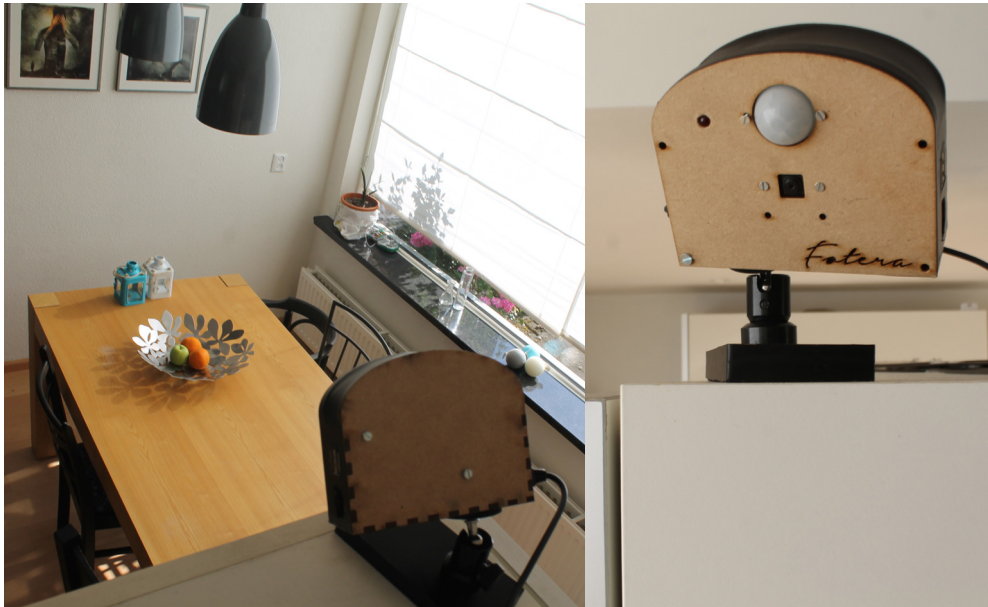
rience is supportive of remembering it, can be debated (Nairne, 2002; Henkel, 2011). Photos can even 'trick' people into remembering something which they have not (Wade et al., 2002; Henkel, 2013). Yet, those direct representations are often appreciated, for example, because they are very supportive of storytelling, one of the purposes of photo use (Broekhuijsen et al., 2017).

Other media types have a lower resemblance to our experience. For example, by being very selective or by disconnecting specific senses. Oleksik & Brown (2008) for example explored audio recordings and found that these cues were not necessarily self-explanatory but required a process of unravelling. This unravelling was in turn supportive of an engaging experience when remembering. Objects that are bought, kept or obtained in an effort to remember (also called mementos [Petrelli, Whittaker & Brockmeier, 2008] or souvenirs [Wilkins, 2011]) have a special characteristic here. They might have little resemblance with our perceptions at the time of experience (except with object such as miniature Eiffel tower keychain). In some cases, people deliberately obtain an item and make an association between what they want to remember and the object, an example of 'strategic memory protection' through objects (Zauberman, Ratner and Kim, 2009). Although it is uncertain if such a link will be successful memory cue in the future, as the memories that are triggered might change over time (Zijlema, 2018). At the moment of obtaining an object, there is a certain intention and potentially some expressivity, aiming to capture elements of an experience. We are interested in exploring these personal expressions by focussing on abstract media.

Abstract media is easiest to imagine in the visual modality, in which a parallel to abstract art and its expressivity can easily be made. Several (research) projects have explored novel additions to photography that include visual abstractions. For example, Context Photography (Ljungblad et al., 2004) explores sensors to manipulate the captured image, influenced by movement and sound. This process shifts the attention to other aspects of the experience it captures. Pierce & Paulos (2014) explore what can be captured in an ultra-low-resolution camera, further reducing the granularity up to only eight by eight pixels. In our exploration of abstract media, we can combine personal expressivity with direct (visual) capturing of an event. We aim to find what meaningful aspects can be expressed and what level of specificity or detail is needed for media to remain a meaningful cue.

## 4.2 Designing Ritual Camera

Based on our review of relevant psychological theory and design work, the premise to our design work is that, similar to our memories of repeated events, media could be created over time by combining, abstracting and collaging individual instances. Our interest is twofold. First of all, how can repeated events be represented in media in a meaningful way? This question initiated the design of Ritual Camera (see Figure 4.1), a domestic camera to create abstract media. The design process led to our second question: what is the potential value of a stationary camera within the home context?



*Figure 4.1 Ritual Camera positioned in a home context to capture the dinner setting*

Specific design choices were made to answer these two questions: the prototype was developed to recognize a repeated event through simple parameters and a diverse set of procedures for creating abstract media was developed. Because representing repeated events in visual media is a new direction, we choose for the concept to create a diverse set of visualisations for each participant. Similar to photographs, the intention of our visualisations was to support remembering. We are inspired by Johnston's (2001) descriptions of layered memories as "*many occasions merged into one in the telling of the story*" [p.3] to create more abstract media. Being able to create these abstract media of repeated events was the main reason to create a stationary camera for the home context. This sparked the question what other values this could have. We wanted to know if this direction fulfilled the requirement of capturing unobtrusively and with little effort. In addition, with the field study we

aimed to collect insights on how using a stationary camera can stimulate reflection on and appreciation of everyday life experiences.

Together, the design decisions to answer these two main questions lead to the concept for Ritual Camera: a camera that would create abstract visualisations based on media collected over time.

### Case: family dinner

Rather than exploring different everyday life events we focus on a single case in this study to allow comparing between participants without being influenced by what event had been captured. We choose to capture family dinner, which in most Dutch households, is a daily repeated event, that is often appreciated as a valuable memory. Previous research suggests that food preparation and consumption provide an interesting context for reminiscing as well as provide valuable experiences to be remembered (Grimes & Harper, 2008). Dinner as the context for remembering is for example explored through the concept 4Photos (O'Hara et al., 2012). Instead, our concept explores dinner as content to be remembered. To broaden the insights, after their experience with media of family dinners, participants were asked to speculate what repeated events they would potentially capture.

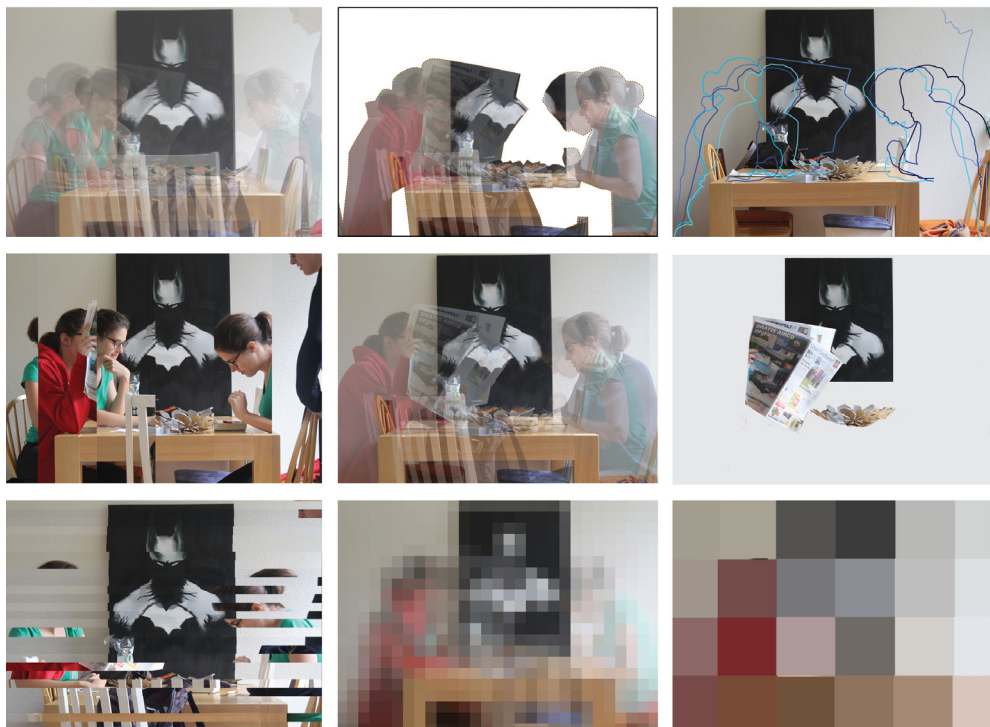


Figure 4.2: Initial explorations based on photos at the researcher's home.

## **Developing abstract media**

To explore abstract media as indirect representations of reality, we drew inspiration from theories of general event memories (Conway & Pleydell-Pearce, 2010), from values of everyday life memories (Chapter 2) and from different visual styles. The visuals were designed iteratively. First explorations were done with photos taken at the home of one of the researchers and focussed on combining images in layers and collages. More dynamic visualisations (short animations) were also considered but this direction was abandoned because the differences between dynamic and static visuals were considered to be too large. Dynamic visuals inherently include an element of time to be perceived, which was considered to be too different from visuals that can be seen in one glance.

These explorations (see Figure 4.2) were then discussed with a number of colleagues (both those involved in the research and others) to collect feedback on how the visuals were perceived by others. Based on the feedback, the visuals were improved upon to represent our sources of inspiration, to be clearly diverse from each other and to be aesthetically pleasing. This led to a selection of nine visual categories used in the study. For comparison, we present a complete set of one of the participants (see Table 4.1 - 4.3). However, it must be noted that not all styles turned out equally well for each participant due to differences in room layout and camera setup.

The following tables show all nine visuals. All visuals were designed and made by the primary researcher. To ensure the visuals were created similarly for all participants, structured photo editing procedures were used. We will briefly explain each visual and how it is made below.

## Characteristics of general event memories

Three visual categories are based on characteristics of general event memories: we wanted to emphasise the average situation, the repetition, and specific personal habits.

### a. Average

The *Average* visual averaged all visuals by overlaying all pictures on top of each other with low opacity.



### b. Repetition

The *Repetition* visual was made by presenting all images on a small scale in a calendar-like grid. This layout was chosen because we expected repetition to occur especially on fixed days of the week (e.g. Through weekly recurring activities or guests).



### c. Habits

For the *Habits* visual we chose to focus on objects that frequently occurred as potential symbols or indicators of habits. On all photos, objects were counted. The most common objects were cut out and copied into a single image (of an empty table), representing the frequency of occurrence.



Table 4.1 Visuals inspired by characteristics of general even memories.

## Values of everyday life memories

Three visual categories are based on the findings of the probes study (Chapter 3) on what aspects of everyday life memories are valued. Specifically, we choose the social value, personal actions and the value of exceptional experiences.

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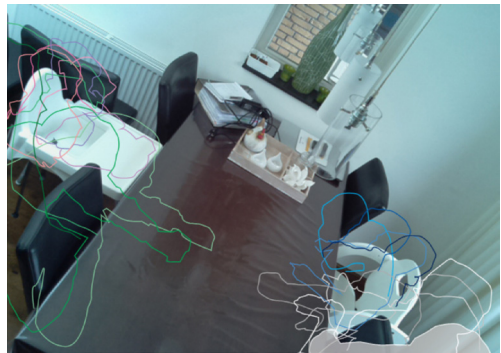
### d. People

The *People* visual was created by cropping the images of all people who were present during one week and merging these into one visual. People would be included for every time they were present and as close to their position at the table as possible.



### e. Actions

The *Action* visual similarly focused on the people that were present but represented them as outlines rather than photos. As a result, more emphasis is put on their posture and actions (reaching, eating, etc.) rather than their appearance.



### f. Exceptions

The *Exception* visual focused on collaging segments of pictures that were different from most other pictures. By reviewing all pictures, segments were selected that showed people, objects or practices that were not present in the other photos.



Table 4.2 Visuals inspired by the values of everyday life memories.

## Visual art styles

Inspired by different visual art styles, we introduced three more abstract visual categories: strips, pixel and blended.

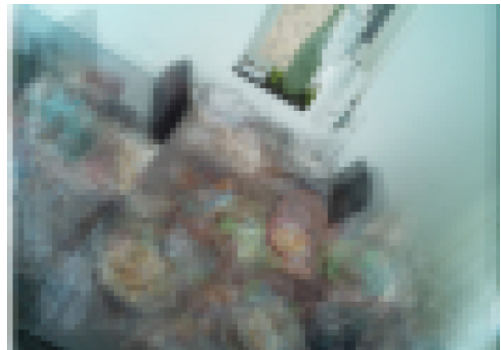
### g. Strips

The *Strips* visual was inspired by time-lapse photos of (for example) trees throughout the season that are integrated into a single visualisation. In a similar fashion, strips from each photo were taken, in a chronological order (e.g. most left strip is from day 1, next from day 2 etc.).



### h. Pixel

The *Pixel* visual was created by combining overlays of multiple experiences with a strong pixelating effect. The pixel size was chosen to contain some elements of recognisable outlines, but still significantly abstract to be different from the Average visual.



### i. Blended

The *Blended* visual was also created as a response to the Average visual. It was seen that through the process of overlaying, those visuals would usually become pretty dark. This had a strong effect on the emotions it could evoke. Therefore, a different overlay effect was chosen by blending all pictures based on the lightest segments.



Table 4.3 Visuals inspired by different art styles



## Prototype of a stationary camera

To collect the required visual material, a camera prototype was developed. A stationary camera, capturing the same perspective every day, was needed for many of the visual categories and fulfilled the requirement of unobtrusive creation. A specific prototype allowed us to develop the desired freedom in parameters that existing stationary cameras could not provide. The prototype consists of a camera and motion sensor connected to a Raspberry Pi, combined in a casing. A versatile base allowed the camera to be aimed at the dinner table, see Figure 4.1 (p. 93). The goal was to have one picture of dinner every day. However, with a single capture, the risk to miss actual dinner activity was too high, therefore the camera took up to six pictures within a specific timeframe, of which one was later selected. In the implementation of the concept into a prototype, several design choices were made. Ritual Camera is designed to look like a prototype that is still a work-in-progress, rather than a finished product. In our experience, a prototype that has the appearance of being work in progress stimulates honest responses from participants, while the prototype also needed a certain level of realism to stimulate imagined use. The shape and colours were chosen to be unobtrusive or non-outstanding in the home environment.

## 4.3 Method: Field Exploration

Ritual Camera was deployed in several households, to gather qualitative insights. The goal of this study was to gain insight into our two main interests: the way repeated events can be visualised and the potential value of a stationary domestic camera. The procedure was as follows:

- Step 1: Briefing:** consent procedure, interview on dinner experience and installation of the prototype.
- Step 2: Camera capturing photos:** approximately fourteen days, without interaction with the researcher.
- Step 3: Collecting prototype:** reviewing photos for consent (as part of the ethical procedure).
- Step 4: Creating visuals:** one photo from each day was selected, with these photos as input, the nine abstract visuals were made for each participating household.
- Step 5: Final interview:** one or two weeks after pick-up, interviews covered the experience, the different visuals and the potential of the concept.
- Step 6: Analysis:** coding was done based on a conventional content analysis approach (Hsieh & Shannon, 2005).

### *Briefing*

In the invitation and briefing we emphasised our focus on everyday life and visual media: *“We are researching how we can create visualizations of repeated everyday life activities, as a case study we are focussing on home dinners. [...] We are interested in whether people like the visuals based on these photos”*. No specific direction was given on what such visuals might be used for, whether decorative, for remembering or as reflection aid. The camera was introduced as a tool in this process, rather than an object the participants would use personally. During the period of capturing photos, the participants would not have any direct interactions with the camera.

### **Interviews**

The pre-interviews focussed on two aspects: participants usual capturing behaviour and their everyday dining experience. Participants were asked how they would describe their own capturing behaviour (did they take many photos or few, did they have specific collections?), as we expected this to influence how the visuals were appreciated. Secondly, we asked how their dinners would generally take place, this was both to determine where and how to position the camera and to be able to ask them afterwards if these aspects were captured.

On pick-up of the prototype, the experience was not yet discussed as we wanted to create the visuals first. Shortly afterwards, the final interview was planned to discuss the created visuals. These final interviews consisted of three parts. First, we returned to the questions from the pre-interview and asked (again) how dinner, in general, takes place and whether the past two weeks were average weeks or if exceptional things had taken place. Additionally, we asked how participants would like to see their dinner experience represented. In the second part of the interview, we discussed how the participants experienced the presence of the camera and if and how this influenced their behaviour. In the third part, we discussed the visuals, first by asking for a general response and then through a rank-order-task. When discussing this general response, no specific envisioned use for the visuals was given. Next, participants were asked to rank all nine visuals, three different times. First, from most valuable to least valuable, leaving it open for people to argue what constitutes value for these visuals. Then from most supportive to remembering to least supportive of remembering and finally on a scale of how much it “made them think” (as a trigger for reflection). The interview ended by discussing the potential future value of the Ritual Camera concept in a broader sense. An overview of all the interview questions is given in Appendix 2. Coding was done based on a thematic analysis approach (Braun & Clarke, 2006), resulting in several clusters. In addition, we compared responses between the different ranking tasks and between the different visual categories.

## Participants





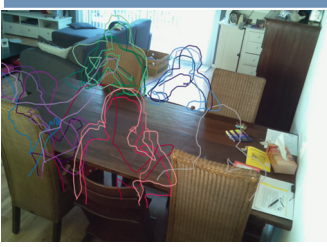
The concept was evaluated with nine individuals across five Dutch households who were recruited through word-of-mouth within the social network of the researchers. We selected a diverse set of household situations in terms of ages and number of family members. The participating families were:

- Single household: P1 (female 62 years) active collector of souvenirs and keepsakes and photographer during travel.
- Family with two children (aged 2 & 4), P2a (male, 38) and P2b (female, 32), take photos with their mobiles, especially of the children, in order to collect keepsakes of the children.
- Family with two children (aged 1 & 3), P3a (female, 29) and P3b (male 34), take mobile and digital photos, occasionally video.
- Couple, P4a (female, 67), P4b (male, 68), little media creation, but used to make a lot of analogue photos. Now mainly collect souvenirs from travel.
- Family with two children (aged 12 & 14), P5a (female, 46) P5b, (male, 51), very little media creation.

The final interviews were conducted with each adult family member individually in order to collect each person's individual opinion, with nine adult participants as a result.

## 4.4 Findings

To better understand the themes we discuss further on, we will first give an impression of the responses to the created visuals. Table 4.4 shows an example of each kind of visual category and both a general and a unique response. The spread across participants is indicated between square brackets, e.g. [3 of 9] to indicate three out of nine participants said similar things. After this overview of our data, we will discuss the five most relevant themes clustered in our two main interests: abstract media and a domestic camera.

Visual	General Response	Unique Reponse
<b>a. Average</b>		
	<p>Too vague [8/9]: <i>This one is very unclear, I can't really see anything in it. [P3a]</i></p>	<p>Recognition [1/9]: <i>You clearly see it is me, or at least, I see it. And a plate, very specific things. To remember dinner time, you need to see a plate. [P1]</i></p>
<b>b. Repetition</b>		
	<p>Positive about the 'natural' representation [6/9]  <i>On all these pictures you can simply see every day. [P3a]</i></p>	<p>too boring [3/9]  <i>This is just the normal way of doing, it's so mundane. [P5a]</i></p>
<b>c. Habits</b>		
	<p>triggers specific memories [7/9] <i>That is a returning habit, the baby bibs and the discussions on their pacifiers. [P2a]</i></p>	<p>Unique: too much coincidence [1/9] <i>This vase is too much of a coincidence, I received it as a gift and it stood there for a few days (but it is not normally there). [P4a]</i></p>
<b>d. Emphasising people</b>		
	<p>Valued for showing all people &amp; diversity [6/9] <i>I like how you see all of us in different postures and actions. [...] It really shows the diversity of dinner moments. [P2b]</i></p>	<p>Focus on posture [1/9] <i>This is quite confronting, to see how I always sit at the table so bent forward. [P4a]</i></p>
<b>e. Action</b>		
	<p>Beauty &amp; personal recognition [4/9] <i>I find this one really beautiful. You don't actually see people, but still for yourself, you know who they are, that is really beautiful. [P5a]</i></p>	<p>Unable to recognise [2/9] <i>This shows too little, you can see it shows people, but you can't recognise who they are. [P2a]</i></p>

Visual	General Response	Unique Reponse
<b>f. Exceptions</b>	Emphasising what is exceptional	
	<p>Surprise or insight after explanation [6/9]</p> <p><i>Now that you've explained it, it is funny to see. I thought the phone was a habit, but apparently it is an exception, luckily. [P5b]</i></p>	<p>Non-surprising [3/9]</p> <p><i>This is simply very recognisable for me [P4a]</i></p>
<b>g. Strips</b>	Summarising the weeks	
	<p>Difficult but some recognition [7/9]</p> <p><i>Those are all small strips, difficult to see a total image [P3b]</i></p>	<p>Focus on atmosphere [2/9]</p> <p><i>It is very unclear, but still you see some kind of summary. And the unclarity also shows how unclear it can be here sometimes with dinner and all the diversity in our schedules. [P3a]</i></p>
<b>h. Pixels</b>	Representing the dinner in an abstract manner	
	<p>too vague [7/9]</p> <p><i>This is the least clear one, it could be anyone [P1]</i></p>	<p>Focus on colours [1/9]</p> <p><i>It has a beautiful structure and nice colours. It feels very familiar, despite the abstraction. [P4a]</i></p>
<b>i. Blended</b>	Emphasising what changes	
	<p>Vague but some recognition [5/9]</p> <p><i>This one is mixed but you clearly see some typical dinner things, the plates, the bottles [P5a]</i></p>	<p>Focus on artistic value [1/9]</p> <p><i>I see a palette of colours, more of an impressionistic painting, but it doesn't relate to us or our dinner. [P4b]</i></p>

Table 4.4 All visuals, each with a description, an example image and a general and unique response, spread across participants between brackets.

## Abstract media

Participants were asked to rank the visuals according to different labels. First, concerning their general perceived value, second for the potential to support remembering in the future and finally for their reflective potential. The combined overall rankings can be found in Table 4.5. Overall, the pixel-visual and average-visual categories were consistently rated as of low value. Those visuals were often considered to be too difficult to recognise. In contrast, the people-visual was consistently highly appreciated. This is in line with our findings in Chapter 3, that many experiences are valuable for their social significance, not only in retrospect but in the present as well. For the other visuals, the rankings often differed per question, the explanations gave insights into the underlying reasons and values.

### *Media use*

The three different rankings show that the different visual categories held different values. A few contrasts stand out.

- The actions-visual was scored high for general value but low for the two other uses.
- The habits-visual was scored low for supporting remembering but high for both other uses.
- The exceptions-visual was scored high for reflective value but lower for other values.
- The repetition-visual was scored highest to support remembering, but mediocre for both other values.

We will shortly highlight what arguments were given that provide a reason for each of these contrasts.

Visual	General Value	Support Remembering	Reflective Potential
People (visual d.)	1	2	1
Actions (visual e.)	2	6	7
Habits (visual c.)	3	7	2
Blended (visual i)	4	4*	4
Repetition (visual b.)	5	1	5
Strips (visual g.)	6	3	6
Exceptions (visual f.)	7	4*	3
Average (visual a. )	8	8	8
Pixel (visual h.)	9	9	9

*Table 4.5 Average rankings of the visuals for different uses.  
Ranked, in which 1 = most suitable for this goal and 9 = least suitable for this goal.  
\* both visuals tied for fourth place*

When ranking the visuals according to their general value, some people considered the use of media for decoration in the home or as a gift to others, for which the aesthetics of the image play an important role. This was one of the reasons why the actions-visual was appreciated for this purpose.

The habits- and exception-visuals involved more interpretation in the editing process. These visuals were valued differently before and after explaining this process. After the explanation, they were considered to have high value for reflection. The exception- and habits-visual were strongly re-appreciated [6/9 and 7/9 participants] when the process was explained:

*"Luckily [seeing] us taking out our phones is apparently an exception." [P5b]*

*"[It is] weird to see that our daughter is an exception." [P3a]*

The habits-visual triggered explicit reflection during the interview in three cases, such as:

*"This is my bag from work, it's not even supposed to be there [...] Maybe I should put stuff away more often." [P3b]*

But people expected that it would not sufficiently trigger remembering in the future as it feels quite disconnected from the actual experience of having dinner. Instead, the repetition-visual scored high for remembering because for a visual to be valuable in the future it had to be easily recognisable and contain as much information as possible, which is why the repetition-visual category was highly valued for this purpose.

Overall, we can conclude that the different rankings show that the requirements for abstract visuals depend on their envisioned use.

### *Recognition*

On the first encounter with these unfamiliar visuals, people look for points of recognition, in the clothes they wear, the objects they use or the way things are done. In some of the more abstract visuals, this could be challenging, for example recognising people or what they were doing in the actions-visual. Using both specific elements (objects, people) as well as abstract concepts (composition, colours), people also recognised the atmosphere they value:

*"This, in a sense, shows the ambiance at home, it doesn't need to be tidy all the time". [P3b on habits-visual]*

The atmosphere of their everyday life was also recognised in the visual style of some images, in a more abstract matter:

*"The visual is a bit chaotic, which it can be at our table, chaotic and restless". [P2a on blended-visual]*

Recognising the ambiance in a photo is an example of successfully creating indirect representations of reality. The ambiance cannot be directly represented, but can be remembered through indirect representations.

Several participants reflected on the personal perspective that determines this recognition, especially in more indirect representations (such as the strips- or actions-visual):

*“If you show it to someone else, they wouldn’t know, but we know what it is, that makes it interesting. [It is] very familiar and well-known despite the abstraction.”*

*[P5a on pixel-visual]*

*“I have the impression that if you’ve been in these situations, you can get all sorts of things from this [visual].” [P3a on blended-visual]*

These quotes show how each person emphasises different aspects of a visual. Small parts of visuals can provide sufficient information if participants can still remember the specific context or cause.

### *Media visualising diversity*

When discussing possible visuals most participants explained that showing what is always the same is less interesting. Instead, showing diversity was often seen as an important value when ranking the visuals. This was appreciated for general value but especially for remembering. The repetition-visual was often appreciated for showing the diversity of family dinners, but it was seen in other visuals as well.

*“[The repetition-visual] shows that not one day is the same.” [P2b]*

*“[The people-visual], is a series, you see different things, different ways we interact with each other.” [P5b]*

Appreciating the diversity seems to be a contrast to our hypothesis that an average representation of a typical family dinner would be represented in a visual. In a sense, participants expressed that this diversity is part of their rhythm or habit.

*“[The actions-visual] offers a good view of the different situations and the different ways we function as a family during dinner time.” [P2a]*

Such a quote illustrates that for these participants, the diversity does not concern the extraordinary, but rather variations (such as in who is present or what is being eaten) that make up their everyday life.

## **A domestic camera**

It is uncommon to have a stationary camera within the home for personal remembering purposes and therefore, we discuss the experienced values and concerns.

### *Capturing everyday life*

In the interviews, people mentioned different everyday events that could be interesting to capture. The night-time ritual, e.g. of young children, was most often mentioned. Other suggestions were location rather than activity based, such as capturing the children’s play corner or the living room couch as a location of diverse activity. One participant suggested



to record front door activity, as this location would capture the widest variety of aspects of everyday life: family members leaving or returning from work and school, people getting in and out with equipment for hobbies as well as (regular) visitors. In discussing capturing dinner & other everyday life events, audio was often mentioned to be potentially valuable. These repeated events often focus on social contact and recordings of voices and conversations would be appreciated.

#### *Obtrusiveness of the camera*

When the prototype was collected, most participants mentioned that they quickly forgot the presence of the camera. Only one participant found the presence of the camera disturbing, others were more positive about the presence:

*“If I see [the camera], I have the tendency to pull a funny face or make a joke about it. But it hasn’t been annoyingly present.” [P3b]*

In most cases, participants quickly forgot the camera. The position, which was often out of sight, contributed to this. Some participants did express feelings of ‘being watched’ as the camera and images were now primarily perceived to be for the researchers rather than for private use. These privacy issues will be greatly reduced if people are more in control of the created media.

Summarising, the evaluation resulted in three main findings on abstract media. First, the value of visualisations depended on the envisioned use. Secondly, people valued showing diversity over visualising the average. And thirdly, people recognised more abstract or invisible notions of their life such as ambiance or behaviour in the visuals. In addition, reflections on a home camera showed many other potential activities to capture and only very limited issues with privacy.

## **4.5 Discussion**

The explorative study with Ritual Camera gave rich insights in the potential value of abstract media and of a domestic stationary camera, despite the limitations in size and duration which we will discuss here. Following, we discuss our finding in the light of our two primary aims: designing selective automatic capture and using abstract media as cues for remembering.

The time frame of the study presented in this chapter posed several challenges in relation to the subject of everyday life. It was uncertain whether two weeks would be sufficient to capture 'everyday life'. Responses showed that this period included both diverse and recurring situations, which for us was sufficient to capture everyday life for this exploration.

It remains a challenge to study how the capturing technology was embedded in everyday life in this time span. That would require multiple interactions with the device over a longer period of time. Still, the two-week period allowed us to get an impression of how an unobtrusive device could blend into everyday life habits, as there were periods when the device remained unnoticed.

The period between capturing and reviewing the media during the final interview was only a few weeks. Such a short time frame is similar to how people judge photos, shortly after capture. However, because everyday life experiences are most often valued in retrospect, this timeframe is less suitable to judge this value. A study on the long-term value of these abstract media as memory media would be of interest, ideally looking back several years. Finally, we recognize that the involved number of participants was limited. This sample size was chosen because it was a first explorative study into the value of abstract media creation. We were interested in individual differences and choose a small sample size to allow for in-depth interviews. Secondly, all adult family members in each household were interviewed separately, resulting in nine unique interviews. The number of individuals and different family situations involved were sufficient to collect a variety of responses and allowed for in-depth analysis of the collected qualitative data.

## **Design for selective automated media creation**

Overall, we see the design and prototype of Ritual Camera as an embodiment of the notion to combine automatic capture with personal selection. People are able to provide some direction on what is captured through camera position and sensor values, a process of personal selection. The camera then takes action based on these settings, considered as automatic capture. Ritual Camera can be seen as a demonstrator of a potential future direction for this type of media creation. The process has given us a more detailed understanding of how human action and system initiative might be combined in everyday life capture.

Rather than dealing with a large amount of media after capture, we propose selecting up front which elements (e.g. situation, event, context) to include in automated capture (in line with Sellen & Whittaker, 2010). With Ritual Camera, this is done by adjusting parameters such as position, sensitivity and time frame. After adjusting these parameters, there is no direct interaction with Ritual Camera, but it operates autonomously. The concept does not allow for interaction after the process of capturing is initiated, which challenges our common notions of control over our interactive devices. In addition, because the concept does not provide any feedback on its progress or results, it includes an element of surprise for the users, whereas most digital cameras provide direct feedback. These novel directions embedded in the design are seen as design research contributions in themselves as

they embody new potential camera directions, exploring the values of specific limitations (Pierce & Paulos, 2014).

The current set-up did not allow participants to experience the full potential of the concept in terms of personal control. The set-up did not include an interaction in which participants choose parameters, positioned the camera and adjusted these iteratively. The potential value of this process was explored in the interviews from which we conclude that when Ritual Camera is used over a longer period of time, the processes of adjusting these settings and the abstraction parameters become a process of creative media creation. This creation will include reflective decisions such as What do I consider valuable experiences to capture? With which scope will this be best represented (e.g. timeframe, location)? How do I want to represent it (settings for abstraction, for example choosing style)? Similar to the evolution of skill by the researcher during the creation process, users could develop a level of skill even though the result remains a surprise to some extent. Still, the closed camera and automatic capture maintains an element of surprise. The combination of deliberate choice to capture and surprising outcomes are essential to the potential 'double value' of abstract media creation in everyday life. It can support both appreciating aspects of everyday life in the present and help remembering them in the future. We think the aspect of creative expressivity and surprise is a crucial addition for the integration of mundane media creation in everyday life. As mentioned before, capturing everyday life is possible with current technologies but is rarely done. In most cases, media only become valuable after a long period of time, which makes it less likely for people to invest time, effort and/or money into it now. Selective automated capture could bridge this adoption gap because the surprising effects of abstraction can give instant satisfaction that can motivate current use. Repeated events are considered so 'normal' in the present that people will rarely capture them. When provided with a concept that can create surprising and satisfying media, they might capture more of such 'normal' life events, supporting valuable future use as well.

## **Design for abstract media creation**

In our abstract media, we aimed to represent repeated events in a meaningful way. Rather than approaching media as a direct recording of reality, we see media as cues for remembering. Cues are depending on contextual and personal factors: participants' recognition of aspects (e.g. outline of people, certain behaviour or meaning of objects) that would only be clear to them, show the highly personal nature of media as cues. Approaching media technologies as a process of "*designing effective retrieval cues*" (Sellen & Whittaker, 2010), rather than direct capture opens up the design space to allow for more creative or abstract representations. By creating abstract media, we move away from direct representations of the event and explore how more indirect, personal or expressive cues might be created.

A process of cue creation includes reducing the complexity of a complete situation to a limited visualisation that provides sufficient information, a very challenging and highly personal balance. Our findings show that for meaningful representation, media have to represent the diversity of a repeated event. Secondly, the representations have to be personally adjusted and suitable for envisioned use. Therefore, the control should partially remain with the user, as also explained above. The degrees of freedom in this control will also influence how far the complexity can be reduced into the abstraction. This can be compared to the process of direct visual abstraction through pixelating, such as the different levels of pixelation seen in Figure 4.2 (p.94). What level of 'grain' or specificity is needed to recognise a meaningful image? Do some outlines need to be perceivable or is a large pixel size that results in a mere colour palette enough? Such a scale is easiest to imagine for this direct pixelating process (see for example Pierce & Paulos, 2014), but applies to other forms of abstraction as well.

It will be challenging to determine how far the complexity can be reduced while still containing successful cues. This can be very challenging as seemingly unique cues can later become uninformative (Linton, 1982). It has also been found that asking only a question, rather than providing media (photos, odours or objects) can cue most detailed recollection (Van den Hoven & Eggen, 2009). This might be because the details in the media hamper the process of remembering or because the media contain information that people consider obvious and thus not repeat in their description (Van den Hoven & Eggen, 2009). Additionally, any media item can trigger memories that are not depicted, but are otherwise associated (Frohlich, Wall & Kiddle, 2012; Zijlema, 2018). Over time, the memories associated with any given media item can change, as new memories are associated or current events influence recall (Zijlema, 2018). This might be especially true for more abstract media types, as the 'hidden' or expressive meaning might be forgotten. In turn, the process of unravelling might contribute to a more engaging experience (Oleksik & Brown, 2008). Further research is required to determine how the appropriate levels of specificity and abstraction for each individual person and situation can be found.

## 4.6 Conclusion

In this chapter, we have described our first design exploration into media creation of everyday life experiences. With the design and evaluation of Ritual Camera, we have explored the potential value of a domestic stationary camera and of abstract media both for remembering in general and for reflection specifically. We have found that different forms of abstract media are valued differently, depending on their envisioned use.

We aimed to create media that would represent an average or general experience of a habit that is frequently repeated (based on our findings from Chapter 3). Instead, media was especially appreciated if it represented the *diversity* of the repeated experience. Several of the visuals were able to represent immaterial notions of the experience, such as the atmosphere, social interaction or habits. For these aspects, it is important that specific symbolic representations remain recognisable and that the overall aesthetic impression matches the atmosphere that people consider fitting (e.g. calm or chaotic). We highlight that in creating abstract media, the most important challenge is to explore how far the complexity of an experience can be reduced, while remaining recognisable and valuable. The level of abstraction is influenced by the degrees of freedom in control and the balance between user and system action. We propose that by combining user selection with automated system action, media can be created in unobtrusive ways, resulting in spontaneous and surprising media.

The different visualisations sparked reflection at the moment they were reviewed. We found that for the visuals that included some interpretation, insight in the creation process is required to appreciate their meaning. In the current implementation, participants were not actively involved in the creation process. We see an additional potential to stimulate reflection in the moment of creation. When people use a selective automatic camera more independently, the process of selection will stimulate reflection, by requiring decisions on what and how to capture. Reflection in creation is further explored in the second and third design explorations (Chapters 6 and 7).

Overall, this study as strengthened our view that media interaction can support reflection and has given us a more specific focus on media creation for reflection. As such, we continue by exploring the design space for reflection more specifically. This is done by studying current reflective practices through a questionnaire (Chapter 5) and through exploring potential future practices using a conceptual design space (Chapter 6).

Partially (Sections 5.1 to 5.4) based on:

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# 5

## Everyday Reflective Practices

**Abstract** Reflection plays a role in everyday life, throughout the lifespan. Yet, although many systems have been developed with the aim to support reflection, few are based on knowledge of how people currently integrate reflection in everyday life. In this chapter, we aim to contribute to this gap through a questionnaire on everyday life reflection practices combining both qualitative and quantitative questions. Findings provide insights in the wide variety of reflective practices that people engage in. The general findings show that reflection occurs frequently, involving diverse people and triggered by diverse events. Based on the questions a number of specific scenarios for reflection were clustered. These scenarios show that reflection occurs both through ‘dedicated’ activities as well as in parallel with other activities. We discuss the implications of these findings for the design of reflection support systems.

## 5.1 Introduction

As we have seen in Chapter 3, everyday life experiences can only be valued if people take the time to reflect on them. Reflection on everyday life has the potential to uncover the value of everyday life experiences. For instance, by uncovering slow change, appreciating small differences and gaining insights in personal habits. Additionally, reflection can have benefits for personal growth (Harrington & Loffredo, 2010), behaviour change (e.g. Li, Dey, & Forlizzi, 2011, Anderson et al., 2007) and personal well-being (e.g. Isaacs et al., 2013). With the design and evaluation of Ritual Camera (Chapter 4), we saw how media interaction can support such reflection. The probes study described in Chapter 3 can be seen as a way in which reflection was stimulated. People reflected on their everyday life experiences because of the probes and interview questions. As such, both studies give insight in the content or result of reflection, but provide little information about when and how such reflection normally occurs. To design for everyday life reflection, it is important to get a better understanding of its current occurrence. In this chapter, we focus on these current reflective practices.

We found there to be a lack of empirical work on this topic to inform our design process. The majority of research on (mediated) reflection is intervention based, as will be explained below. As part of the research, people are actively stimulated or prompted to reflect (in some cases through design). Little is said about how people reflect in their everyday life without such interventions. With the study in this chapter, we hope to contribute to closing this gap by exploring when, where and how people currently engage with reflection.

We address the question of what everyday reflective practices are, by conducting an online questionnaire. In this chapter, we will first give an overview of what is currently known about practices of reflection. Secondly, we describe our approach and the outline of the questionnaire. The questionnaire combines a standardized survey (the Self Reflection and Insight Scale, SRIS [Grant, Franklin & Langford, 2002]) with multiple choice and open questions specifically tailored to our aims. We used the SRIS as a general measure of reflection, as a way to potentially identify target groups and to explore its potential as a measure for success. With our multiple choice and open questions, we explore more specifically what the characteristics of everyday reflective practices are. The findings are split in two sections, the first describing the overall results, the second going deeper into what scenarios of everyday life reflection were described. We end this chapter with a discussion of what our findings mean for the design of reflection support systems.



## 5.2 Practices of Reflection

Most people engage in reflection throughout their lifespan (Staudinger, 2001). It is widely argued that reflection has a positive effect on wellbeing. Lyke (2009) found, for example, that higher levels of self-insight correlated with a higher subjective wellbeing. Throughout the lifespan, reflection is important in making life choices and supporting transitions. Reflection does not only occur in periods *leading up to* a choice or change, but people also reflect in order 'to establish a new normal' *after* a change (Staudinger, 2001). Next to these transitional periods, many people reflect on minor incidents or deviations from the norm that ignite 'breakdown' (Baumer et al., 2014). Breakdown is described as relating to Dewey's (1933) notion of doubtful or puzzling situations and Schön's (1983) description of situations of surprise, uncertainty or conflict. These studies provide a framework to look at the process and occurrence of reflection, but do not make the related practices specific. When designing for reflection, such practices can be very informative, but we found there to be very little research on this subject. The majority of work on reflection in HCI is instead intervention based. Here, we review some of these interventions for the characteristics of practices they reveal. Broad overviews of different ways of supporting reflection have been given by others sorted by domain (Baumer et al., 2014) or by level of reflection (Fleck & Fitzpatrick, 2010). An elaborate overview of different strategies adopted to support reflection is given in the design space for everyday reflection (Chapter 6). In this section, we do not focus on the designs themselves, but rather on what aspects of (potential) everyday life practices are uncovered through the interventions.

### Reflective practices and location

Diary writing is one of the clearest examples of a reflective practice. It is a specific kind of habit that people generally engage with at a fixed time and in a fixed place. As such, the reflective practice becomes 'ritualised' and is often repeated daily. By some, diaries are even seen as the 'purest form of reflection' (Travers, 2011). It has been found that individuals who kept diaries had higher levels of self-reflection than those who did not keep a diary. (Grant, Franklin & Langford). Diaries can take different form, ranging from small notes to elaborate daily stories, potentially written in a dialogic manner ('Dear diary'). Increasingly, handwritten diary practices are digitised and even moving online (O'Sullivan, 2005), and HCI researchers have explored reflective apps on mobile phones that build on diary aspects (for example Echoes (Isaacs et al., 2010 and Affective Diary, Stahl et al., 2009).

One of the advantages of supporting reflection with mobile applications is the possibility to use them anytime and anywhere. This creates practices that can be far more irregular, which means reminders might be needed. Different applications use such explicit triggers, for example by providing a theme to consider that day (GoSlow, Cheng et al., 2011). Echoes

(Isaacs et al., 2010), uses random timing throughout the day to trigger people both to create new media as well as to review earlier entries.

Other researchers have explored supporting reflection about locations, for example using maps and pins (Peesapati et al., 2010, Kalnikaite & Whittaker., 2011). For these designs, the reflection itself took place at a fixed location, but it can be easily imagined how such maps can be used for location based triggers “on-the-go”. Other HCI designs have explored the potential of reflection in a fixed location as well, especially when designing interactive objects or furniture for reflection. History Tablecloth (Gaver et al., 2006) or the ‘Key Table’ (Sengers & Gaver, 2006) are both ambiguous designs that spark reflection on both the object itself and the behaviour surrounding it. Through their interactions, the reflection with such objects is strongly localised. Giving data a presence in a (domestic) environment can also stimulate reflection on the spot with a broader topic. Reveallt (Valkanova et al., 2013) visualises energy usage in a shared entrance space. The presence triggers reflection on that location, although the topic is broader (or even intangible).

## **Automatic collection**

Reflective practices in the domain of lifelogging often rely on the automatic collection of data through mobile and wearable devices or trackers. One of the most commonly used devices is Fitbit, a wearable activity tracker. Reflection can occur both in-the-moment based on feedback the device provides, and when reviewing the data more elaborately (often at home on a computer). Such reflection occurs in different stages of the collection process (Li, Dey & Forlizzi, 2010). A reflective practice based on tracking often requires long and consistent use, which can be challenging as people forget to wear, charge or connect the device (Epstein et al., 2016).

Several projects have explored the potential of Sensecam, a wearable lifelogging camera. The medium is especially suitable to explore everyday life, because the media created throughout the day includes many mundane activities and is captured in a, for the user, unconscious way. Byrne & Jones (2009) explored ways of interacting with the content to reduce the quantity and create a storyline and found these interactions to support introspection and remembering. Reflecting on elements that normally remain unnoticed or are easily forgotten is one of the potential benefits of using automatically recorded media to support reflection. Providing multiple perspectives through multiple recordings can stimulate additional reflection on representing oneself to others (Lindley et al., 2009). Most studies review material shortly after it is created, instead, Lindley et al. (2011) focussed on reviewing Sensecam images after 18 months. This added value by supporting reinterpretations and uncovering incremental changes. In these examples, reflection occurred in media retrieval,

which was staged as part of the study, often in a lab location. As such, although the wearing and creation was easily integrated into everyday life, the studies provide little insight into when and how to integrate reflective review into everyday life.

## **Social reflection**

Designs in personal informatics often use social comparison or competition as a persuasive strategy (Cialdini, 2009). For example, by showing rankings, rewarding wins or challenging others (Maitland et al., 2006). In these cases, the reflection can still occur by the individual, but others have explored how this process can be made more social as well. The Bouncers application for example, relies on shared information and social persuasion, using communication amongst friends as a process of reflection and persuasion (Nelson, Megens & Peeters, 2012). The localised visualisations in Reveallt (Valkanova et al., 2013) relied on more direct contact instead of digital communication. Their design integrates reflection and comparison in the social practice of neighbourhood small-talk. Others have also explored how conversation can be used in reflection, Lovers' Box for example uses a creative process as pillar for reflective conversation with both a designer and one's partner (Thieme et al., 2011).

Other practices that include social reflection are often seen in educational context (with either coach or peers) or in therapeutic settings (with therapist or group). In some cases, these reflective conversations or group-sessions are also supported by interactive systems, such as online portfolio's or blogs (Orland-Barak, 2005). These social practices are very different from our focus, not just in topic, but because it is part of a specific structured process and there is a clear hierarchical difference between the people involved in reflection.

## **Measuring reflection**

As we are interested in designing for reflections, it is important to consider what measures of success can be used. This challenge is sometimes addressed by focusing on measuring the effect of reflection rather than reflection itself (for example by assessing the intervention's effect on wellbeing (Isaacs et al., 2013). In the questionnaire in this chapter, we wanted to find a suitable measure for reflection for three reasons. Firstly, to contribute to a general understanding of people's attitude towards reflection. Secondly, to potentially identify a target group which would benefit most from reflection support. And finally, to evaluate if a measure could be used for future design evaluations as a potential pre- and post-intervention measurement.

In areas dealing with written reflection, such as journals or student reports, entries are often coded to assess the level of reflection. For example, Kember (1999) developed a seven-category coding-scheme ranging from habitual action (non-reflective) to premise reflection (similar to Mezirow's 'critical reflection' [Mezirow, 1990]). Entries in Echo, a reflective journaling application, were similarly coded for the level of emotional depth (Isaacs et al., 2013). Coding is a suitable approach to assess written instances but provides little insight in someone's overall attitude towards reflection.

Questionnaires can provide more insights into such attitudes. Kember et al. (2000) developed a questionnaire for an educational context measuring four levels of reflection (habitual action, understanding, reflection, and critical reflection). The questionnaire's statements go more towards a general attitude, but are still limited to the attitude concerning a specific course. Other questionnaires on overall reflective attitude experienced problems in distinguishing reflection and rumination (a more negative, problem focused and often repetitive meta-cognitive process), which the Rumination and Reflection questionnaire aimed to resolve (Trapnell & Campbell, 1999). With similar aims, Grant, Franklin & Langford (2002) developed the Self Reflection and Insight Scale (SRIS), which measures different elements related to reflection and which is more applicable to measure a general attitude. We considered this scale to be most suitable for our goals as the statements were broadly interpretable and not limited to an educational or professional development scope. The scale was also easy to understand and short enough to be included in our survey. We will elaborate on the use of the SRIS scale in the following section.

## **5.3 Method: Questionnaire**

To get a better understanding of everyday life practices, we wanted to conduct a study with a relative large number of people and wanted to be able to ask a variety of questions. To do this, we conducted an online survey combining quantitative and qualitative questions, with multiple choice, checklists and open questions. A survey can elicit more honest responses and grant greater anonymity in comparison to focus groups or interviews (Jackson & Trochim, 2002), which was found to be worthwhile because the subject of reflection can potentially be sensitive. This approach allows us to gather a broad range of data on everyday reflection practices. The questions focus on conditions for and characteristics of reflection rather than the subject of reflection. With our approach to everyday life reflection the subject of reflection is left open for the users, it is one of the core elements of our open-ended design approach. The specific conditions the reflection occurs in are more relevant, as these can be used to create designs that can be easily integrated into everyday life practices.

## Questionnaire outline

The questionnaire was divided in several parts. All questions were evaluated during a pilot with eight participants. After the pilot, minor adjustments to the phrasing of questions were made; the data collected during the pilot is not included in the analysis presented here. Completion of the questionnaire took approximately 10 to 20 minutes and participants did not receive any (financial) compensation for participating. A full overview of the questionnaire can be found in Appendix 3. The outline is summarized below.

### *Part 1: Introduction & consent*

The questionnaire started with a brief introduction and a statement concerning the participant's consent to participate.

### *Part 2: Demographics*

Participants were asked to enter their gender, age and educational level. One of the suggested ways to minimise privacy infringement and to conduct ethical research is not to ask for more demographics than needed. We therefore only requested these three aspects, which we considered most relevant.

### *Part 3: SRIS*

The following page contained the statements from the Self Reflection and Insight Scale (SRIS) (Grant, Franklin & Langford, 2002). We considered SRIS to be the most suitable way to measure the general attitude towards reflection in everyday life. The statements are phrased in a general sense, making them applicable to everyday life rather than only to an educational or professional context. The SRIS requires responses to statements on a five-point Likert scale (strongly disagree to strongly agree). Statements include "I am very interested in examining what I think about" (need for reflection) and "I frequently examine my feelings" (engagement with reflection). The questionnaire as presented by Grant, Franklin & Langford (2002), is primarily split into two measures: Insight and Self-Reflection. Originally the Self-Reflection measure was further sub-divided into "Engagement in Reflection" and "Need for Reflection. We used this split, as both in psychology and design it is often believed that there can be a great difference between motive and acts (see e.g. Grant, Franklin & Langford, 2002 and Trapnell & Campbell, 1999). Therefore, similar to (Xu, 2011), we followed Grant et al.'s original design, splitting Need-for and Engagement-in Reflection.

### *Part 4: Definition*

After the SRIS statements, we introduced our definition of reflection. We deliberately did not include this in the invitation and introduction. There we instead referred to 'thinking about everyday life' rather than reflection as we were cautious of how people might interpret the term. Because the SRIS uses different phrasing to describe reflective behaviour, we

considered it best not to mention 'reflection' before. After the SRIS, we used a simplified definition to explain our scope of reflection as: "*thinking about your thoughts, feelings, actions or experiences*". In addition, we included the following explanation: "*We do not only refer to elaborate reflection or 'hard thinking' but include small moments of consideration as well.*" These statements were used to guide the multiple choice and open-ended questions.

#### *Part 5: Core questions*

The main body of the questionnaire concerned a set of questions on the characteristics of everyday life reflection. These included open questions, multiple-choice questions and questions for which multiple answers could be checked. Examples include: "How often do you have a moment of reflection in your everyday life?" "What are the causes for reflection? Which things regularly trigger you to reflect?" and "Can you describe a scenario of reflection?" (a complete overview of all questions can be found in Appendix 3).

#### *Part 6: Disclosure of aim & final questions*

Finally, we further explained our aims: gathering information to inform design for reflection. We posed a question specifically about systems: In what way do you think a product or system could support reflection for you? The final question left room for any other comments, questions or concerns.

## **Participants**

Participants were a convenience sample of 66 community members who were recruited through requests on several online forums and through snowball sampling. Calls for participation were spread within the Netherlands, and the questionnaire was conducted in Dutch. Of the 66 responses, 1 was excluded for being incomplete, resulting in 65 participants. Of these participants, 38 were female and 27 male. This sample included a broad age range (19 to 76) with the average age being 44 (standard deviation 15,7). Overall, the sample was fairly highly educated: 45% obtained a university degree and 38% completed higher degree vocational education. 11% of the sample completed secondary education and 6% intermediate vocational education.

## **Analysing the data**

Due to the diversity in questions, the data was analysed in multiple ways. In section 5.4, we will first present the general results. The SRIS scores are presented and statistically analysed using ANOVA. The other general results are based on the analysis of all multiple-choice questions and most open questions on characteristics. The open-question answers were coded on a semantic level, remaining close to their content. This is most suitable for the

open-ended survey questions, as they do not provide the richness of data required for latent thematic analysis. In the findings section, we present the prevalence between brackets, for example (3), at the level of data item (e.g. per participant) rather than how many segments are coded with a certain theme (Braun and Clarke, 2006). These open-questions themes are presented together with the multiple-choice findings that relate to them.

The open questions regarding reflection-scenarios collected rich descriptions, which we will present in Section 5.5 These answers were coded through a more elaborate thematic analysis, as described by Braun & Clarke (2006), for more detailed information about the coding steps, see Appendix 4.

## **5.4 Findings: Characteristics of Reflection**

In this section, we present the general results, summarising important characteristics of reflection. We will first discuss the results of the SRIS questionnaire and findings related to demographics. After that, we will discuss our findings thematically, combining both multiple choice and open questions.

### **Need for and engagement with reflection**

Both SRIS-Need and SRIS-Engagement use six items, ranked on a five-point scale, which are summed for a final score. The average score for SRIS-Need was found to be 23,37 (SD = 4.11). For SRIS-Engagement the average was 22,99 (SD = 4.5). Before doing the further analysis, the data were screened for violations of the assumptions of normality. Both SRIS-E and SRIS-N scores were negatively skewed (SRIS-E skewness = -.97 and SRIS-N skewness = -.98). For both values outliers below 14 were eliminated from the SRIS data set. As a result, 61 participants are included in the analysis of the demographics. With this data set, we reviewed the Shapiro-Wilk test for normality (Shapiro & Wilk, 1965) for SRIS-N (SW = .973, df = 60, p = .21) and SRIS-E (SW = .977, df = 60, p = .32). These results gave no reason to reject the assumptions of normality.

### **SRIS demographics**

We were interested in testing for difference for a number of variables: gender, age and educational level. A number of t-tests and ANOVA's were conducted, see Appendix 5 for these analyses. Here, we briefly report the results.

A t-test was conducted to compare both SRIS scores for gender (male / female). In accordance with previous work (Creed & Funder, 1998; Grant, Franklin & Langford, 2002), we found no significant differences for SRIS-Engagement between male (M = 3.74, SD = 0.68) and female participants (M = 4.04, SD = 0.60); ( $t(60) = 1.72, p = 0.090$ ). For SRIS-Need we

found a significant difference in scores for male ( $M=3,73$ ,  $SD=0.75$ ) and female participants ( $M = 4.14$ ,  $SD = 0.46$ ); ( $t(60)=2.48$ ,  $p=0.017$ ). Women showed a higher need for reflection with these scores.

Two separate one-way between subject ANOVA's were conducted to compare the effect of level of education on SRIS-E and SRIS-N. The educational levels were classified as 'University', 'Higher Vocational Education' or 'Secondary Education or Intermediate Vocational Education'. There seemed to be a light trend for SRIS-N to increase with level of education, with higher education showing a higher need for reflection: intermediate level ( $M = 3.75$ ;  $SD = 0.51$ ), higher vocational education ( $M=3.99$ ,  $SD = 0.50$ ) and University ( $M=4.07$ ,  $SD=0,54$ ), but this was not significant at the  $p<.05$  level [ $F(2, 59) = 1.250$ ,  $p = 0.294$ ]. SRIS-E was highly similar for all three levels [ $F(2, 59) = 0.063$ ,  $p = 0,939$ ].

To compare between age categories, data was split in five conditions (<25 years; 26-35; 36-45; 46-55 and >55 years). A one way ANOVA for differences between age showed no significant effect for SRIS-E [ $F(2, 59) = 1.186$ ,  $p = 0.327$ ] nor for SRIS-N [ $F(2, 59) = 0.858$ ,  $p = 0.495$ ].

Because we found very few demographic differences, we did not use demographics characteristics as a way to split the data for further analysis.

## **Reasons for Reflection**

There are a wide variety of reasons to engage with reflection or occasions that can trigger reflection. We will discuss causes for reflection on two different levels. First, we will discuss the circumstances that stimulate or require reflection on a 'major' scale, referring to different life time periods (Conway & Pleydell-Pearce, 2000). Secondly, we will look what causes for reflection were seen on a 'minor' or short-term scale.

### *Major scale: Life Time Periods*

As mentioned above, the quantitative analysis of the SRIS scores showed no significant difference between age groups. The qualitative data provided additional insight in certain life time periods with a higher need for reflection. Here, we present the findings based on a thematic analysis of the responses to the question "Was there a period in your life when you experienced a higher need for reflection?" Coding the responses to this question showed a few specific life time periods. These included: as part of education (3), as a parent (3) and when getting older (1).



Instead of referring to a specific period, the majority of answers were coded to refer to a transition between periods rather than a period in itself. Most prevalent changes were:

- Relationship changes (8): Most people referred to relationship problems, endings or periods of temporary separation. Only one person included a period of positive transition: falling in love.
- Educational Transitions (6): These entries included a variety of transitions regarding study such as the moment of choosing a course or direction, finishing school or quitting before graduating.
- Becoming a parent (5): Five participants referred to the period of childbirth and having children as a period of large change and increased reflection.

Less prevalent transitional themes related to illness & death (3), career (2) or moving house (1).

Other themes related less to transitions or periods, but rather to recurring life circumstances. These themes included:

- Stress or business (13): Most often referring to work related stress. One participant mentioned reflecting in periods that were either very busy or very calm.
- Intense emotions (6): these answers most often related to negative emotions such as frustration or anger, even including extreme emotions such as (long-term) depression.
- Personal struggle (4): although personal struggles might coincide or overlap with the experience of intense emotions, these answers did not specify such emotions but referred more abstract to personal struggle or circumstances, often related to insecurities or periods of doubt.
- Decisions (2): the life transitions mentioned before sometimes included decisions. Others referred more generally to moments in life when (large) decisions have to be made.

Several participants referred specifically to periods in which multiple of these themes overlapped. For example, P58 explained:

*“Between 2 and 4 years back, my need for reflection was at its highest. In this period, I broke up with my ex-girlfriend after a 4-year relationship, moved to a new apartment, which was bad and too expensive, quit university before graduation and got a job, which was below my education level.” [P58]*

To no surprise those times with many changes are periods with a high need for reflection.

### *Minor scale: causes for reflection*

We were interested in how conscious reflection is and whether people deliberately choose to reflect. 39% indicated that reflection just “happens to them” while 12% indicated they “consciously choose to reflect”. Almost half of all participants (49%) indicated that both apply equally. A wide variety of circumstances can be the motive or trigger for reflection. To the question “What are the causes for reflection?” the majority indicated at least three different causes, which can be found in Table 5.1. These results show that very few people have a fixed moment for reflection and a relatively small number of people is triggered by future events. Rather, (present) feelings, actions or events are frequent triggers for reflection. Other reasons for example included “seeing a friend I have not seen in a while” or “when I am tired”.

## **Characteristics**

The characteristics and circumstances of reflection scenarios are interesting to consider as inspiration for design. Specifically, we address the frequency and timing of reflection, social context and characteristics related to reflective habits or rituals.

### *Frequency & timing*

Most people reported reflecting several times a day (45%) or several times a week (23%). See Table 5.2 for the full spread. These self-reported frequencies of reflection (ranging from several times a day to once a month or less) show a moderately strong positive correlation

<b>Causes for reflection</b>	<b>Nr.</b>	<b>%</b>
my feelings	48	75%
something that is said to me	42	65%
my actions	39	60%
something that happens to me	38	59%
something that I see or hear	31	48%
something that is about to happen	18	23%
I have a fixed moment for reflection	5	8%
Other	8	12%
I don't know	1	2%

*Table 5.1 Causes for reflection; multiple answers were possible, number of participants and percentage of total indicated.*

with the SRIS-Engagement scores with  $r(63) = .64, p < .05$ . This provides additional support for SRIS-Engagement as a reliable measure for engagement with reflection. Only very few people indicated at the previous question to have a fixed moment for reflection (8%), still, the majority of people could indicate a time of day when reflection most often occurs. For 28% of the people, this was at night, with another 20% most often reflecting in the evening. The morning (9%) and afternoon (3%) were less common. For 37% of participants reflection occurs too irregular to pinpoint a time of day. This was especially prevalent among people who indicated reflecting several times a day.

### *Social context*

Reflection is a cognitive process often considered to be highly individual. However, our results show a variety of reflective partners as well. A large majority (88%) indicated also reflecting individually, but only a relatively small number of people indicated they only reflected individually (15%). Most people indicated reflecting both alone and with someone else. As Table 5.3 shows, a partner or friend is the most common companion (55% and 48% respectively). Other people who were involved in reflection included professional help (2), boss (1), children (1) and any other person (1).

Frequency of reflection	Nr.	%
several times a day	29	45%
several times a week	15	23%
once a day	12	18%
once a week	3	4%
once a month or less	2	3%
several times a month	2	3%
I don't know	2	3%

*Table 5.2 Answers to the multiple-choice question 'How often do you have a moment of reflection?'  
Second and third column indicate number of participants and percentage of total.*

Social Context	Nr.	%
alone	57	88%
with partner	36	55%
with a friend	31	48%
with a colleague	26	40%
with a family member	21	32%
with a group of friends	10	15%
other	5	8%

*Table 5.3: Answer to the question 'Do you reflect individually or with others?'  
Multiple answers were possible.  
Second and third column indicate number of participants and percentage of total.*

## Desires for change and support

The majority of participants are content with their frequency of reflection (69%). Others would prefer to change, with a similar amount of people expressing a desire to reflect more often (9%) or less often (11%). All who desire to reflect less often reflect once a day or more. People preferring to reflect more often showed a wider spread, from several times a month to once a day.

We ended the survey with an explanation of our intention to design reflection support systems and prompted for suggestions on what such a system might provide. 43% of the respondents were positive about what a system could offer and most of these people provided specific benefits or features such a system might offer.

Triggers were most often mentioned as a valuable type of support to be provided by a system. For different participants, the content or level of these triggers varied, from being mere reminder to being more explicit in supporting reflection:

*“A product or system could encourage me to reflect multiple times a day, on moments which I've deemed it most necessary. In that way, it can remind me on several key moments during a day, that it might be good to reflect on my actions.” [P59]*

*“An app that provides random reflection questions. This would help to sometimes step outside the mind-set or ideas you currently have” [P9]*

Others suggested inspiration from different sources such as suggesting other subjects or including quotes from philosophers. One participant suggested a system that could provide inspiration from the personal past, as this helps to put things into perspective:

*“By showing periods in life that happened and have passed before. Things usually seem longer in the future than in the past and things in the past are much easier to put into perspective” [P12]*

Finally, systems were suggested to help by being more positive (3), by making reflection more conscious (3), by ruling out distraction (3) or by helping to stop reflecting (3). Although the reflection characteristics had shown that reflection was often social, the system suggestions were all focused on individual reflection except one, P18 suggested

*“An anonymous reflection database from which I can compare my thoughts with others. <...> Or having an anonymous platform to reflect with others. Knowing how others would reflect without harming your image, because you do not know them.” [P18]*

Again, this suggestion highlights the importance of social context in reflection.

A smaller, but significant, number of people (25%) indicated having no desire for system supported reflection, either because they did not know how such a system could support them or because they do not feel the need for support:

*“I cannot imagine a product or system being of any help for me. I’ve learned to reflect since it is a vital part of my work, in a very personal and effective way. I don’t really need systems or products” [P9].*

About half of the people who thought a system would not help even (14% of all respondents) actively reject the idea of system-supported reflection. Two participants even rejected the process of reflection at all. Rejecting systems for reflection was most strongly expressed in the following two quotes:

*“Sometimes it is best to put away all products and just be silent and without any electronics.” [P10].*

*“I think reflection is very human, and no system or product could help me with that.” [P54]*

The remainder of the participants (32%) responded that they did not know an answer or left the question blank.

## **5.5 Findings: Scenarios of Reflection**

The questions that asked participants to describe one or two scenarios of reflection, gathered rich quality of responses. We therefore analyzed these answers separately. Through this process of bottom-up coding, the scenarios were clustered in 14 categories. Table 5.4 provides an overview of these categories and the number of answers in each.

Typically, a scenario is characterised by a setting (where), actors (who), goals or objectives (why) and events (what) (Carrol, 1999). Because participants described their scenarios as a response to an open-ended question, these elements were not always strictly present. We found that the reflection scenarios can be more specifically characterised by location, timing, duration, trigger, social context, activity, intentionality and type (level) of reflection. However, not each characteristic is important for each scenario, some are for example mainly determined by a very specific location (e.g. shower) or are grouped mainly based on the activity. As not all characteristics are relevant for each category, we only list relevant ones, for each category the dominant characteristic is listed first (see Table 5.5 and 5.6). In the coding process, two additional categories were added. The first captures a number of ‘non-scenarios’ that described too few characteristics to be clustered in a meaningful way (e.g. only a trigger, without contextual information). The last cluster represents a number of

Scenario Cluster	Nr.
Bed Time Thoughts	22
Daily Commute	17
Physical Activity	11
Pausing the Day	11
At Work	9
Reflective Conversation	8
Household Chores	7
Mini-Reflection	6
Dedicated Ritual	6
Occasional Writer	5
Relaxing Shower	5
Choose to Walk	4
Non-Scenario	20
Miscellaneous Scenarios	11

*Table 5.4 Overview of scenario clusters*

‘miscellaneous scenarios’, considered too different from the others to be grouped. Splitting these into a miscellaneous category is seen as a way to increase the within-theme heterogeneity (Braun & Clarke, 2006).

The twelve scenario-categories can be clustered in two main themes. The first cluster (Table 5.5) contains scenarios where reflection is the main activity. In these scenarios, the focus is on reflection itself or on a reflective activity (such as writing or speaking). In the second cluster (Table 5.6, p.131), reflection is a parallel process or secondary activity to something else which is unrelated (such as driving or cooking). We will briefly discuss the scenarios in each cluster.

*Table 5.5 Overview of scenarios that are considered reflective activities. Between brackets the number of coded segments is indicated. The second column summarises important characteristics. An example quote is given in the third column.*

## Reflective Activities

Title	Characteristics	Example Quote
Bed Time Thoughts (22)	<ul style="list-style-type: none"> <li>• during the evening / night</li> <li>• in bed</li> <li>• after “something” happened</li> <li>• takes longer than desired</li> <li>• both looking back and forward</li> </ul>	<p><i>I’m in my bed before I fall asleep and I think about the things that happened that day and which things will be happening in the near future. [P32]</i></p>
Pausing the Day (11)	<ul style="list-style-type: none"> <li>• one “sits down and thinks”</li> <li>• chooses to take the time</li> <li>• not doing much else</li> <li>• mostly at home</li> </ul>	<p>P23: In the morning between breakfast and travel-to-work. It happens more frequently on days that I am at home such as my regular day off or during the weekend. It mostly occurs when I sit in my home office.</p>
At Work (9)	<ul style="list-style-type: none"> <li>• on the job and about the job</li> <li>• mainly about personal interactions (with clients, students etc.)</li> <li>• for recurring interactions (classes, meetings etc.)</li> </ul>	<p>P55: At work, after my class I reflect on how it went (structure, pupils’ attention, learning outcome), if I’ve done the administration, to what extent several actions were effective. About 5 minutes after each class.</p>
Reflective Conversation (8)	<ul style="list-style-type: none"> <li>• reflection through conversation (can be reciprocal)</li> <li>• opportunistic</li> <li>• growing reflection</li> <li>• potentially during a routine activity or chore</li> <li>• often with partner</li> </ul>	<p>P38: Most of the time reflection occurs while having dinner or making dinner together with my girlfriend. This can take from 3 minutes to half an hour, depending on the depth of the conversation.</p>
Mini-Reflection (6)	<ul style="list-style-type: none"> <li>• short consideration taking seconds or minutes</li> <li>• occurs frequently</li> <li>• instantly after trigger (comment given or made)</li> <li>• just in the mind</li> </ul>	<p>P22: Over the day I have several little reflections about things I do or say or what people say to me. I reflect every time something moves me feel positive or negative.</p>
Dedicated Ritual (6)	<ul style="list-style-type: none"> <li>• at a fixed moment</li> <li>• planned reflection</li> <li>• dedicated (almost every day)</li> <li>• sometimes written</li> </ul>	<p>P3: I journal three pages every morning, a free structure brain dump. It makes things clearer. Patterns emerge.</p>
Infrequent Writer (5)	<ul style="list-style-type: none"> <li>• sometimes writes</li> <li>• digital or manual</li> <li>• when needed</li> <li>• to get things clear for oneself</li> </ul>	<p>P40: I write in my journal once every month. In difficult times, more often.</p>

## **Reflective activities**

Seven of the scenarios can be grouped as relating to reflective activities, see Table 5.6. In other words, reflection is the main activity. This can mean that the mental process of reflecting is the main activity or that another reflective activity such as writing or talking is involved. However, not all of these activities are deliberately started as an intentional act of reflection, it might just evolve that way (for example in 'Reflective Conversation') or happen to people (for example 'Bed Time Thoughts'). We will elaborate on this aspect of deliberate choice in the discussion (Section 5.5, p.143).

As can be seen by the examples, both 'Dedicated Ritual' and 'Infrequent Writer' included acts of (journal) writing. However, the scenarios were considered to be clearly distinct by their intentionality, trigger and frequency. The people who described a 'Dedicated Ritual' had a (daily) habit of reflecting, often on a planned time and location. Such a moment reflection would occur, regardless of whether there were specific triggers. Some of these rituals included writing, but others referred for example to meditation. In contrast to a fixed moment, the scenarios of 'Infrequent Writers' were triggered by a specific reason to reflect. In some periods, such a trigger may occur daily, but at other times people would not write for a long period before taking it up again.

In general, the scenarios do not refer to a specific topic of reflection, we did not include this in our question. Two important exceptions can be seen with scenarios that seem to have more focus in content of reflections. Firstly, the 'Bed Time Thoughts' scenario included more references to negative thoughts, worries and rumination. These scenarios also made more explicit references to events that were yet to come (for example the next day) than other scenarios. Secondly, the scenario 'At Work' has the most specific topic. These moments of reflections specifically relate to work topics, whereas for most other scenarios no topic was specified or topics differed widely between participants.

## **Reflection as a parallel process**

The categories in Table 5.7 all refer to scenarios in which reflection occurs in parallel to another activity that is generally unrelated. These are often activities that do not require a lot of cognitive capacities (such as chores or showering) or that involved being physically active (such as walking, cycling or doing chores). All these scenarios are primarily done individually.

Both the clusters 'Daily Commute' and 'Physical Activity' (see examples) include an element of time. In both categories, longer reflections often were described as starting out more intense and including aspects of letting go or putting things into perspective. Illustrating how reflection can be different depending on the amount of time spent.



Reflection as Parallel Process		
Title	Characteristics	Example Quote
Daily Commute (17)	<ul style="list-style-type: none"> <li>• to and from work</li> <li>• while cycling or driving</li> <li>• individually</li> <li>• focused on short term (past day, next day)</li> <li>• mainly focused on work</li> </ul>	P42: <i>When I cycle home after work I reconsider the day. What went wrong and what could I have done different. The ride takes about half an hour.</i>
Physical Activity (11)	<ul style="list-style-type: none"> <li>• while moving, reflection occurs / emerges</li> <li>• not planned to reflect</li> <li>• cycling, walking or sport</li> <li>• duration varies (10 minutes to hours)</li> </ul>	P20: <i>When outside, cycling solo after work for 2-3 hours. Usually at first the thoughts and problems are in my mind but after a while they start to disappear. They are not being solved but they're just not as important anymore and make place for the experience of being outside.</i>
Household Chores (7)	<ul style="list-style-type: none"> <li>• during a non-straining activity, done regularly</li> <li>• 'just happens' not planned</li> <li>• during chores like ironing, cooking, gardening</li> <li>• individual</li> </ul>	P64: <i>[I reflect] during household activities like ironing, for example about things people say for 15 min. or so.</i>
Shower / Bath (5)	<ul style="list-style-type: none"> <li>• in bath / shower</li> <li>• moment of relaxation</li> <li>• individual</li> </ul>	P28: <i>The other scenario when reflection often happens is when I am taking a bath. Most relaxing thing ever and the best place for short (around 10 minutes) solitary reflection.</i>
Chooses to Walk (4)	<ul style="list-style-type: none"> <li>• has intention to reflect</li> <li>• chooses to go for a walk</li> <li>• individual</li> <li>• often in nature</li> </ul>	P22: <i>Sometimes when I need conscious reflection time, I grab my dog and we go to the woods to walk and there I make things up in my mind.</i>

*Table 5.7 Overview of scenarios that are considered parallel activities. Between brackets the number of coded segments is indicated. The second column summarises important characteristics. An example quote is given in the third column.*

The clusters 'Physical Activity' and 'Choose to Walk' are similar in terms of activity, however it was decided to distinguish them based on trigger and intentionality. In scenarios that were clustered as 'Choose to Walk' people expressed that they felt a need to reflect and would choose to go for a walk (or run) in order to figure things out. In contrast, reflections in the category 'Physical Activity' would start *during* the activity without this being initiated for reflective purposes.

## 5.6 Process: Creating Photo Scenarios

We selected five categories to be further developed into photo scenarios. This step is taken as a way to bridge the gap between research findings and design process. The scenarios are used both as a means of encapsulating data from the fieldwork and as a tool to envision new design opportunities (Rizzo & Bacigalupo, 2004). Scenarios are seen as concrete descriptions of activities from a user, focussing on a specific task (Carol, 1995). The scenarios need to be sufficiently detailed so that design implications can be inferred (Carol, 1995). To enable this for a reflection activity we have chosen to combine visual material with descriptions from a first-person perspective. The latter allows to explain cognitive activities that are otherwise hidden and the visual material illustrates the context as inspiration for design.

The scenarios are written to represent the clusters, but were sometimes slightly adjusted to also represent the diversity of the overall sample. The scenarios were selected to create a diverse set of opportunities, although we looked at prevalence, it is not the only criterion. We wanted the selection to include both parallel and dedicated activities as well as reflection that emerges and reflection that is deliberately chosen. A variety of people is depicted in the photo scenarios, to represent the diversity of people who are engaged in reflection. This should be seen as a representation on the overall level, as individual scenarios are not necessarily depicted with a specifically relevant demographic representation.

Figure 5.1 - 5.5 show all five scenarios, for each we briefly highlight in the caption which unique characteristics can inspire design

## Bedtime Thinker

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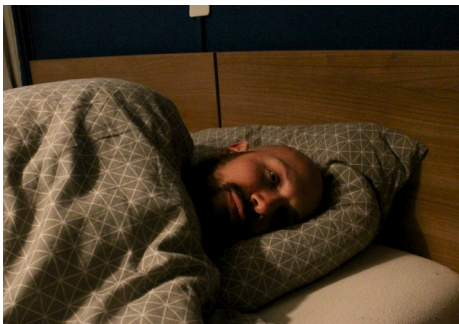
As I walk into my bedroom I notice the gymbag in the corner, all packed and ready. I was supposed to go to the gym with Rick today. But I sent him a message at the last moment to cancel.

---



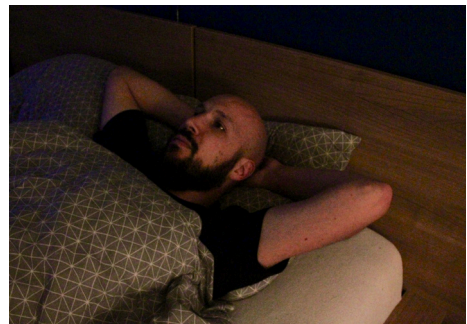
While I get ready for bed I reconsider my choice. I reflect on what happened and why. I get to bed but keep twisting and turning.

---



I keep on thinking and try to gain insight in why I act this way. I turn over and shake my head trying to shake off the restless thoughts.

---



I see the clock turning 2:00. Pfff, way too late already, I have so many plans for tomorrow, I should really sleep now.

---

*Figure 5.1 Scenario Bedtime Thinker. This scenario was described most frequently in the questionnaire. The unique qualities include: occurring in a fixed location and (relatively fixed) time and often having negative characteristics (worrying or ruminating).*

# Daily Commute

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It's 17:30, I walk out the office and cross the parking lot. I put my bag on the passenger seat and start the car.



Traffic is slow as usual. While I stare at the red light, my mind wanders to this morning's meeting.



While driving I reflect on what happened and how it's similar to the other meetings earlier.



Before I know it, I turn around the corner into our street, the 30 minute drive home is over. I take the key out of the ignition and sigh. In the hallway I drop my keys and wallet on the dresser.

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*Figure 5.2 Scenario Daily Commute. This scenario describes reflection during home-work commute. This most often referred to the moment of going home, although morning commute (with more prospective thoughts) was sometimes mentioned as well. The data includes a variety of modes of transportation. Unique qualities include: longer duration (which has an impact on reflection content) and transitional qualities. We included moments just before and after the commute as opportunities for design.*

## Choose to Walk

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It's weekend, I should be enjoying myself, just relaxing at home. But I keep feeling so restless. The stress about potentially buying a new house keeps me busy.



Thoughts keep bouncing through my mind. I'm done with it. I suddenly get up, put on my coat and go for a walk. I close the door behind me and head towards the park.



I stroll around the park, walking my favorite round. I'm still thinking about the house, but the green and air brings some rest to my head.



I sit down on a bench, overlooking the water in the park. I notice that walking has helped to put my thoughts in order.

---

*Figure 5.3 Scenario Choose to walk. From the scenarios 'physical active' and 'choose to walk' we have selected the latter for further exploration. There is more opportunity for design as the act of reflecting is more deliberate. Unique qualities include the importance of location and movement.*

## Pausing the Day

---



“Bye, I hope you win!” My 12-year old son Peter grumps and closes the backdoor, off to his soccer match. I clean up the breakfast dishes and make myself a cappucino.



Sitting at the kitchen table, I stare outside, where Peter left the garden gate open. This morning’s discussion lingers in my mind.



While holding my coffee I reflect on our conversation and his behaviour.



My thoughts are interrupted by Jenny, calling out from the top of the stairs. She can’t find her laptop charger, again. “It’s here!” I call out, already getting up to bring it to her.

---

*Figure 5.4 Scenario Pausing the Day. This scenario was chosen because one of its unique quality of being a ‘non-activity’. It describes a moment of pause in between other activities. Location and timing varies between the examples, but many occurred at home. This scenario was chosen as an interesting opportunity for design because in this moment a device could be used to elaborate on a reflection.*

# Reflective Conversation

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"Hi honey", he says, as he drops his bag in the corner. He stands behind me, as I am gathering dinner stuff on the kitchen counter. "How was your day?"



While I cut the vegetables, we continue talking. I didn't have the best day, but just bringing into words why I was irritated already brings relief.



While we set the table, his questions strike me. Our conversation wanders to the past.



While we sit down to eat, we reminisce of the great projects of our past. I notice it helps me to understand my current challenges.

---

*Figure 5.5 Scenario Reflective Conversation. In the multiple-choice questions, many people indicated reflecting with a trusted person. Unique qualities include its evolving nature (becoming more reflective over time). Although the conversations occurred in many different situations, we choose for a conversation between partners at the moment one comes home. We believe this is a scenario which can be recognised by many.*

## 5.7 Discussion

We set out to study current practices of reflection in everyday life. Our findings provide an overview of the frequency, timing and context of these practices. Additionally, we provide an overview of activities that are involved, either directly supporting reflection or occurring in parallel. The questionnaire was a suitable method to create such a general overview, but the adopted method has limitations and consequences as well, which we will discuss here. Secondly, we discuss the use of the SRIS-scale and if it could be used in future design studies. We follow-up by hypothesising how the scenarios can be connected to some of the characteristics of reflection, highlighting future questions. Finally, we more specifically discuss the implications of our findings for design.

### Limitations

The questionnaire was conducted in English, which resulted in language challenges for some participants, as English was a secondary language for nearly all of them, which several participants noted in the final question with room for feedback. Specifically, the negative statements included in the SRIS (for example “I don’t often think about my thoughts.”) caused confusion to answer on a disagree-agree scale. For the open questions, some answers were given in the participants’ native language, which were translated for inclusion in this chapter. Overall, no severe problems with the English language were seen in the answers. However, the secondary language enlarges the challenges to convey our view on reflection. We were concerned that participants might only consider elaborate moments of reflection, which is why we included a statement on smaller moments of ‘considering thoughts’. The high frequency in self-reported reflection suggests that respondents adopted this definition. Both for participants and researchers, it remains very difficult to determine when a meta-cognitive process should or should not be considered reflection.

Participants were recruited through an open call, which generally attracts more people who are interested in the subject. Although the call did not include the term reflection, the description still stated the research was on ‘thinking about everyday life’. We expect this to be one of the causes for the relatively high SRIS scores. In previous studies (such as, Grant, Franklin & Langford, 2002), SRIS scores were found to be normally distributed. In our case, the sample had a smaller amount of low SRIS scores, considered as negative outliers. However, rather than exceptions, these could be considered representations of a larger group of people with lower need and engagement with reflection. We argue that these people are underrepresented in our sample because of the open call. Previous studies were based on student populations and did not rely on an open call, resulting in a wider spread of participants’ interest in reflection. Overall, the misbalance in our participants has



not devalued our insights for design. In our approach, we aim to design for empowerment. In other words, we aim to support people who want to reflect rather than persuade people with no need for reflection. Therefore, our insights are suitable to inform our designs, despite the limitations of our sample.

### **SRIS use: target group & design evaluation**

As mentioned in Section 5.2, we included the SRIS questions for three reasons. We hoped to use the SRIS scores to contribute to a general understanding of people's attitudes towards reflection. However, as explained above, the scores were positively skewed, which limits our insights in this area. One of the ways we could have made more use of the SRIS-data was by making more connections to the others answer. For example, by performing a 'tertiary split' (Xu, 2011), a method in which the answers are split in three equal groups with relatively low, medium and high SIRS (sub)scores. Following, results from other questions (such as for example timing of day or used support) can be compared between these groups. Such an analysis could have helped to identify more specifically what the differences are between people with varying need for or engagement with reflection.

Our second aim of using the SRIS was to objectively identify target groups with a higher need for reflection. However, the analysis of the SRIS scores for different demographics did not show a clear group with higher needs. No significant differences for age were found, similar to Staudinger (2001) who found that the majority of participants (aged 25 to 85) engaged in reflection 'often'. In contrast to earlier research, SRIS-Need was found to be slightly higher for women. This is in line with Bryan et al (2005), who found that women, relative to men, were more likely to reminisce to gain perspective and self-insight. Despite this small difference in gender, the findings do not justify prioritising a target group based on demographics. Rather, the qualitative insights on life time periods, transitions and life characteristics showed the dynamic nature of the need for reflection, which will be more important for design than selecting target users based on demographics. This dynamic need has implications when designing for reflection, which we will discuss below.

The third aim of using SRIS was to determine if it was a suitable measure to be used in future design explorations. We wanted to know if the measure could be suitable to measure participants attitude towards and engagement with reflection before and after an intervention to measure its success. The results from the questionnaire show relatively small differences between people. We also expect the measure to be relatively stable over time as the statements are very general. We therefore consider the SRIS scale more suitable to measure the general attitude rather than a pre- and post-measure.

## **Practices and reflection characteristics**

The questionnaire focussed on the circumstance for reflection, rather than its content. Describing the reflective practices as scenarios raised questions on how these practices relate to or influence the characteristics of the reflection. We saw, for example, that some scenarios tended to be more topic focussed. The scenarios of 'Daily Commute' and 'At-Work' reflections were most often described as being work-related. The topical focus is especially interesting for the transitional experience of commuting. For many people reflecting on the workday was a way to close this aspect and transition into 'home life'. Other moments of transition, such as weekends or evenings seemed to trigger certain people to look forward rather than back. Connecting scenarios to a certain reflective focus is an interesting area for future research. Related questions include how scenarios can be connected to the depth of reflection and how certain contexts or activities relate to the valence of thoughts. Several scenarios (such as 'Pausing the Day' and 'Mini-Reflections') showed that there is a difference in level and duration of reflection, influenced by both circumstances and personal tendency. The available time can impact how deep people reflect. Similarly, it can change the orientation of the reflection. Some described that reflections can take a long time (for example during cycling for two to three hours), in which problems are initially important and intended to be solved. After a longer period of reflection, the problems are not necessarily solved but being put into perspective. These connections between time and level or direction, are worthwhile of further exploration, as we did not inquire specifically about these characteristics

## **Implications for design**

The main aim of the questionnaire was to inform the design of reflection support systems. Some people actively reject the potential for systems to help, because of the personal or human nature of reflection. A larger number of people could see benefits in reflection support systems. Therefore, although systems will not be suitable or desirable for everybody, the findings provide support for our design aim. With the scenarios, we have aimed to directly inform and inspire design by providing specific contexts that can be supported or enhanced. On a more general level, participants suggested that systems could help to remind, to make explicit, to inspire or to support the process. By combining these suggestions with the general results and scenarios, we formulate four more design considerations that explore what such support might be.

### *Enjoyment and rumination*

Design for reflection often embodies two assumptions about reflection. First, that reflection starts from a problem or challenge to be resolved and secondly, that reflection is a constructive process to reach such a solution. Based on our findings we want to emphasise two

alternative views: reflection can be focused on the positive as well and (on the other hand) there is a risk of reflection becoming too negative. Our participants shared a number of scenarios that emphasise the positive. These were all cases where someone reflected during a positive experience on how happy or good they felt. Although participants hesitated about calling this reflection, we do consider this part of our scope and see great value in how it can contribute to appreciating everyday life. Emphasising such positive views can be done by designs aimed at ‘enhancing joy’ (Pohlmeyer, 2014) to appreciate the experiences more in the moment.

The moments of positive reflection are in great contrast with moments of rumination, seen as “*a tendency to repeatedly self-focus on one’s past action*” (Harrington & Loffredo, 2010, p.41) often in a way that includes circular reasoning or negative spiralling. Although distinguishable theoretically, constructive forms of reflection and worrying or rumination are in practice often both referred to as reflection. SRIS is designed with the intention to differentiate between both (Grant, Franklin & Langford, 2002). However, in the open questions, some participants focused more on rumination, describing processes of worrying or stressful thoughts that show a negative spiral. This might be a reason for a part of the people to express a desire to reflect less often. Design for reflection often assumes positive effects and aim to increase its frequency or intensity, sometimes neglecting potential negative effects of reflection (Baumer et al., 2014). We emphasise that considering the potentially worrying effects of reflection and rumination is important. New design opportunities can be found in supporting people to *stop* reflecting, to reflect *less* or to specifically support constructive reflection avoiding rumination.

### *Social context*

Throughout our findings, the theme of social reflection was recurring. Very few systems support reflecting as a social practice, instead most focus on individual cognitive processes. Rather than designing for the individual ‘by default’, designers of reflection support systems should make a deliberate choice for individual or social reflection. One approach to the design of the system could be to take the ‘role’ of a reflective partner by asking questions. Alternatively, designers could also consider how systems might mediate or support social reflection practices. Lovers’ Box (Thieme et al., 2011) stimulates reflective communication between romantic partners in different ways: people can create messages for their partner (dialogue mediated by the system), they can talk with an artist to create these message (reflection about the system) and they can reflect together triggered by the system. In such ways, systems can support the reflective conversations that are already part of many people’s reflective practices

### *Dynamic use & sensitive triggers*

As we described in the findings section, the causes and timing of reflection can be discussed on two different levels: the major level of life time periods and the minor level of daily circumstances. Both of these are relevant to consider when designing to support everyday life reflection, seen in the design aspects of *dynamic use* and *sensitive triggers*. We expected to find a higher need for reflection in life time periods with high degrees of transition. For example, in ages 18-25 with changes in study, living environment and often relationship or social contacts. Although not evident from the SRIS scores and demographics, the related open questions show themes that result to such periods with high prevalence of personal life changes and education. Life circumstances play a large part in the need for reflection. Rather than only designing for incorporating reflective habits that should be performed 'from now on, daily, forever' designers should consider how support systems can facilitate more *dynamic use* over periods of time, including periods of lapsing and restarting (Epstein et al., 2016).

Dynamic needs also apply to the smaller time scale, which shows that on a weekly or daily bases circumstances determine the timing of reflection. On a minor scale, reflection can be both internally and externally triggered. Currently, reflection systems often intend to provide such triggers, relying on fixed moments (for example, GoSlow – Cheng et al., 2011) or random timing (for example, Echoes, Isaacs et al., 2010). Based on our findings, systems could use triggers that are more sensitive to the context by being more *intelligent* or more *peripheral*. A design challenge for intelligent systems could be found in recognising the causes for reflection, including emotions, conversations and actions. These characteristics differ highly between persons and between different moments and a system should learn over time what situation is optimal for a trigger to occur. Some participants rejected the idea of systems 'forcing' a structure or timing for reflection while others expressed appreciating reminders. In addition to the flexible timing, this requires flexibility in terms of initiative. System can use peripheral triggers (Bakker, Van den Hoven & Eggen, 2015) as a way to balance initiative between system and human. Rather than explicit triggers that suggest to reflect 'now' peripheral triggers can be used to draw attention towards reflection in a subtler way. As such, the device might be noticed, but can also easily be ignored, creating space to engage in reflection when it is more welcomed.

### *Intentionality of reflection*

The results show that reflection is not always an intentional act, instead it sometimes ‘happens to people’. Such intentionality is important to consider when aiming to support reflection, as most systems require the deliberate and explicit attention. The difference in intentionality was, for example, seen as the primary distinction between the categories ‘Physical active’ and ‘Choose to walk’. Although both include scenarios with reflection as a parallel process to walking, the choice is different. This distinction was considered to be very important because it has different implications when aiming to support such scenarios. For example, people who choose to walk, with the intention to reflect could bring along a device intended to support such reflection. However, if the process starts and evolves automatically during the activity, such a device would not have been brought. Mobile applications or wearable products that are always available for use could be a valuable direction for such evolving reflections. Additionally, one could consider designing systems intended to be used directly after such an activity, for example when coming home.

## **5.8 Conclusion**

In this chapter, we have described a questionnaire on practices of reflection. With this study, we explored how people integrate reflection in their everyday life. Ours aims were to select a target group, to evaluate the use of the SRIS scale and to gain insight in the characteristics of reflection to inform our designs.

We can conclude that most people reflect frequently and in diverse ways. The findings do not justify prioritising a specific target group based on demographics. Nevertheless, some periods in life spark a higher need for reflection, strengthened by certain circumstance (such as stress). Reflection support should therefore facilitate dynamic use over time and should balance initiative between user and system.

The SRIS scale was a useful measure to evaluate need for and engagement with reflection, but differences were relatively small. As the score mainly indicated a general attitude we do not believe the scale will be susceptible enough to measure small changes in a pre- and post-intervention measurement. Instead, we can separate measures of success in two aspects: how a system is integrated in existing practices and how the system influences characteristics of reflection (such as depth, valence or temporal dimensions).

The scenarios provide an interesting tool to explore the integration of support systems in reflective practices. We see these scenarios as one of the major contributions of this study.

They provide insight in what types of reflective practices are common, which can be used to inspire designs that can be better integrated in these practices. We have specifically used these scenarios for the designs described in Chapter 7. Additionally, because the SRIS was deemed unsuitable as a pre- and post-measure, the scenarios are used to evaluate how well concepts connect to participants' practices. They are therefore also used as part of the design process evaluation in Chapter 7.

Although the majority of participants are content with their current *frequency* of reflection, many indicate there is potential for systems to provide reminders or to support the process. The described reflective practices provide ample opportunity for design to support these complex processes. A wider range of design opportunities arises when considering the potential of reflective enjoyment as well as the risk of rumination. Additionally, we conclude that designers should consider dynamic use and flexible triggers, balancing system and user initiative. Finally, it is important to consider that reflection was not always started intentionally, which poses additional challenges for systems that need to be intentionally used for reflection. In parallel to this empirical exploration of the design space, we developed a number of concepts to explore the challenge through design. Several of the above mentioned design considerations can also be recognised in the design space described in Chapter 6.



# Design Exploration 2

Based on:

Ine Mols, Elise van den Hoven, and Berry Eggen (2016), *Technologies for Everyday Life Reflection: Illustrating a Design Space*. In Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '16). ACM, New York, NY, USA, 53-61. DOI: <https://doi.org/10.1145/2839462.2839466>



# 6

## Design Space for Everyday Life Reflection

**Abstract** This chapter describes the second design exploration, in which we explore design for reflection more broadly. Everyday life reflection can give insight, support action and improve well-being. People might want to reflect more often for these benefits, but find it difficult to do so in everyday life. Research in HCI has shown the potential of systems to support reflection in different contexts. In this chapter, we present a literature overview highlighting three commonly applied strategies. Following, we produced a workbook with a selection of conceptual design proposals, which show how systems can take different roles in the process of reflection: triggering, supporting and capturing. These roles and strategies together describe our design space. Through these dimensions and the concepts that shape the design space we contribute to the extensive body of work on reflection by providing a more nuanced view on how systems support reflection and provide a language to differentiate between different approaches. Additionally, we discuss three themes which are recurring in our concepts: holistic reflection, open-ended design and integration into everyday life.

## 6.1 Introduction

In parallel to our exploration of the current practices of reflection to inform design, we explore the challenge *through* design in this chapter. In our first design exploration, described in Chapter 4, we have studied how we can create meaningful media of everyday life experiences. The design and evaluation of Ritual Camera showed that the review of abstract media stimulated reflection. The media provided a different perspective on familiar events, but the reflective process as a whole was highly dependent on the process of the study. People started thinking about capturing everyday life experiences when being invited for the research and were further triggered by the presence of the camera, the ranking tasks and other interview questions. In other words, part of the reflection was supported more by the researchers, rather than the concept. In this second design exploration, we focus on the potential for systems & concepts to adopt this role. The exploration is not limited to visual media (like Ritual Camera), but explores a broader design space for our specific aim: to support everyday life reflection.

As mentioned before, everyday life reflection has many potential benefits, but engaging in it is far from straight forward. It is a complex process involving many contextual factors. Design to support reflection is therefore a challenging, but worthwhile ambition. In this chapter, we build upon the conceptual grounding by Baumer et al. (2014) and the landscape described by Fleck & Fitzpatrick (2010), aiming to make their dimensions more specific and applied to the domain of everyday life reflection. As part of a research-through-design process, we present a conceptual design space. We have chosen to develop a range of ideas to explore the potential dimensions through the process of designing. Through the multiplicity of ideas, a design space emerged (Gaver & Martin, 2000) presenting alternative design concepts that support reflection in different ways. We use the process of designing these alternatives and the resulting set as a way to reflect on design for reflection in general.

In this chapter, we describe this design space by presenting concepts and the roles we see systems can take in the process of reflection. Before doing so, we will discuss related work in order to define reflection and discuss common supportive strategies. We end the chapter by discussing on our own work and process, within three themes: holistic reflection, open-ended design and the integration into everyday life.

## Scope

Reflection is a term used in different areas and with a variety of definitions. With the design space, we explore a specific type of reflection, everyday life reflection (more elaborately discussed in Chapter 2). As this scope is vital for understanding the design space, we will briefly repeat its definition and characteristics.

Despite its widespread use, the term reflection often lacks a thorough definition in HCI work (Baumer et al., 2014; Consolvo et al., 2006). Here, we discuss some definitions of reflection to better ground our work and explain our perspective. Baumer et al. (2014) explicitly provide a very inclusive definition of reflection as *“reviewing a series of previous experiences, [...] putting them together in such a way as to come to a better understanding or to gain some sort of insight”* [p. 94]. This broad definition gives a good starting point for the types of processes we focus on but provides little insight in how this review leads to insights. This process is described in more detail in the model presented in (Staudinger, 2001) in which reflection is reviewed within a psychological view on autobiographical memory. Here, reflection is seen as *“remembering plus further analysis”* [p. 150]. This analysis is divided into multiple layers, first of all split in either evaluation or explanation of the remembered experience. On a third layer, the model describes the underlying processes that provide more grip on the processes involved in reflection: abstraction, comparison, categorisation etc. We combine these process aspects with the type of insight we strive for, inspired by Mezirows (1991) theory. Specifically, we build upon his definition of critical self-reflection as *“reassessing our own orientation to perceiving, knowing, believing, feeling and acting”* [p 13]. From a memory and HCI perspective we are interested in the role external triggers play in this process. Together, these bring us to our definition of everyday life reflection as: *“Remembering and analysing past, present and future experiences in order to reassess our perceptions, beliefs, feelings and actions regarding our everyday life.”* This definition is the basis for our concept development, however, first we will discuss related work on reflection support with a more inclusive perspective on reflection.

Reflection has been extensively discussed in the context of learning and professional development (Mezirow, 1991; Schön, 1983; Tchetaigni, Nkambou & Bordeaux, 2007). Within healthcare and design, reflection often gives insight (Baumer et al., 2014). Rather than ‘only’ insight, the foreseen benefit in much work on personal informatics is action. The line of reasoning suggests that showing users data about themselves will lead them to do something, presumably something different from and better than what they are already doing (Li, Dey & Forlizzi, 2010). Rather than reflection for these specific goals, we focus on what we call everyday life reflection, referring to all deliberate and critical thought processes concerning our day-to-day activities. This includes themes such as work, health, relationships,

leisure time and personality. We see value in engaging in everyday life reflection regularly, as a way to gain self-insight and improve overall wellbeing. A moment of reflection can bring the mind at ease, provide a feeling of confidence or help solve problems.

## 6.2 Strategies from Literature

Reflection takes time and for many people it does not come naturally, they usually need a reason to reflect or at least encouragement to do so (Fleck & Fitzpatrick, 2010). An overview of different ways of supporting reflection can be given by domain (Baumer et al., 2014) or sorted by level of reflection (Fleck & Fitzpatrick, 2010). In Chapter 2, we have described a selection of designs for reflection that bring forward important elements for design. In this chapter, we are interested in analysing designs and methods of reflection on a more abstract level. We were interested in strategies currently adopted, both within and outside of HCI. Based on a broad review of methods and tools in different fields including personal informatics, HCI, therapy and education we describe three main strategies to stimulate reflection. We emphasise that this is not a complete overview of all possible strategies, but a summary of the most recurring strategies in our literature review.

### Dialogue driven reflection

Reflection often occurs in dialogue, this is most evident in therapist dialogues or teacher-student dialogues. We refer here specifically to verbalised dialogue, either in written or spoken form, rather than the more abstract notion of reflective conversation with ‘material’ as Schön introduced (Schön, 1983). In dialogue driven reflection, questions or explicit prompts are used to encourage reflection. Within therapy or education such a dialogue is often done between “uneven partners” in which one takes the lead but people also reflect with friends or peers in group sessions (Orland-Barak, 2005). In relation to HCI, dialogue driven reflection can be about a design (André et al., 2011) or mediated by a system. A combination of both is seen in the design of Loversbox (Thieme et al., 2011). In this design people can create messages for their partner (dialogue mediate by the system), talk with an artist to create these message (reflection about the system) and can reflect together triggered by the system.

Examples in which the system takes the leading role by asking questions can be seen in Echo (Isaacs et al., 2013) and the use of experience tags in photos with Storytellr (Landry, 2009) in which the system poses questions such as “How do you feel?” “What theme do you associate with this event?”. Such questions create a dialogue between system and user, which can give direction in what to reflect upon. However, we see that in many systems the

dialogue often ends after an initial question. An intelligent system would engage further in dialogue driven reflection by posing follow-up questions. In conclusion, we see that dialogue driven reflection is characterised by the use of verbalised questions. The role designed systems take in such dialogues differs.

## **Information driven reflection**

Presenting data can be a trigger for reflection, at least it is a premise often seen in personal informatics (Li, Dey & Forlizzi, 2011). Data can be very helpful when reflection is aimed at uncovering patterns or for reflection aimed at behaviour change. Different characteristics of information are used to stimulate reflection: invisibility, comparison, ambiguity or multiple views. Information driven reflection is effective when revealing information that is otherwise invisible or cannot be directly observed, such as steps taken during the day (e.g. Consolvo et al., 2006). Data Souvenirs (Aipperspach, Hooker & Woodruff, 2011) for instance, reveals 'hidden' digital data in the physical world to stimulate reflection. Sometimes data is presented in a specific way, for instance to allow for comparison (e.g., comparing neighbourhood energy consumption in Reveallt, Valkanova et al., 2013). For these types of applications clarity of information is important. The opposite effect is seen in other cases, where the ambiguity of the data triggers reflection (see for example History Tablecloth [Gaver & Martin, 2000]). Finally, information driven reflection can be supported by providing multiple views on the data to enable exploration, for instance of personal memory artefacts in MemoryLane (Kalnikaite & Whittaker, 2011) or design processes in Freed (Mendels, Frens & Overbeeke, 2011). These examples show the diversity of potential applications of information driven reflection and the important role the systems and interactions play in this. Many of these are more goal-oriented types of reflection, for example to move more or to use less energy. Such specific goals influence data-collection as well, which makes collection part of the reflective cycle as well, as Li, Dey & Forlizzi (2010) demonstrate in their stage-based model of personal informatics. With a specific goal, it is important to focus in all steps of preparation, collection, integration, reflection and action. With the use of Sensecam images, Lindley et al. (2011) explored reflection with a more open approach. When reviewing Sensecam images, participants for instance reflected on their social interactions or on incremental change over a long period of time. In short, information driven reflection can be concerned with many different types of information, although the majority of systems within HCI uses quantitative sources. What we see as main characteristics is that the information is primarily collected and/or presented by the system, not by the user.

## **Expression driven reflection**

Reflection can be an internal process, but can also be based on externalising thoughts and feelings. In diaries and in reflective writing the reflection occurs while striving to express oneself. Expression driven reflection is traditionally seen in personal diary writing, which Travers (2011) even considers as the purest form of self-reflection, in therapeutic writing (Wright & Chung, 2001) or in more creative areas such as art therapy (Collie, Bottorff & Long., 2006). Orland-Barak (2005) has explored expression driven reflection as part of a portfolio in teacher education, however portfolios were dominantly descriptive and emotional rather than showing critical reflection. Additional guidance on what to reflect upon could help. Such a more guided approach to expression driven reflection was explored by André et al. (2011). They designed expressive avatars, in which busyness, stress, health and engagement can be expressed. These choices require consideration and as such stimulate to reflect on our wellbeing.

We see expression driven reflection as the processes that involve choices on how to express internal experiences (thoughts, feelings etc.) into external media. The process supports reflection by requiring to make these experiences more specific to be able to externalise them. This can take different forms (written, visual) and can be strongly guided by a system or very open-ended.

## **6.3 Process: Developing the Design Process**

By looking at this variety of examples of supporting reflection we see a gap in concepts that support everyday life reflection. In many existing concepts, we see that a very specific subject is reflected upon, for instance energy usage (Valkanova et al., 2013), movement or professional development (Orland-Barak, 2005). In our definition of everyday life reflection, we focus on a broad set of past, present and future experiences, leading to a more holistic type of reflection. Based on Staudinger's (2001) view of life reflection we see everyday life reflection as a process of looking for connections across domains with the possibility to reflect on deeper beliefs or presuppositions (Mezirow, 1991). This is a highly individual and personal process and to allow for this requires an open-ended approach to reflection.

Inspired by the work by Gaver et al. (2006) we develop a set of alternatives to explore this design space. These concepts were developed iteratively. First ideas were individually generated by the primary researcher and coded for their potential value (brainstorm A). After that a brainstorm with three colleagues, all involved in related media interaction projects. The brainstorm was aimed at maximising and minimising these concepts (brainstorm B). Each

concept was elaborated upon to see how it could be expanded upon, enlarged or exaggerated. And in turn, each was explored on how to make it smaller, narrower or how to split it up into parts. Because these concepts were highly influenced by the researchers' original ideas and direction, a third brainstorm was set up to more broadly generate ideas (brainstorm C), involving colleagues with a background in interaction design, but with no connections to the project. The central question was: "In what ways can we stimulate reflection in everyday life?" Our general definition of reflection as "*thinking about actions, thoughts and feelings*" was used as a guideline. A narrow definition or specific goal of reflection was deliberately not discussed with the four researchers involved in this brainstorm, in order to explore the design space more widely.

Together, these workshops resulted in a set of 48 ideas. The results were analysed in a group discussion as part of brainstorm C, by comparing them to the strategies found in literature, consequently also refining these strategies (resulting in the three presented before). Through these brainstorms and discussions, a set of 25 concepts was developed. In this chapter, we use a selection of these to illustrate what insights we gained from this process. Specifically, reflection on our concepts gave insight in the roles we see systems can take. We hope that both the emerging design space and the individual concepts can inspire to look at design for reflection differently.

## 6.4 Findings: Design Space

Reflection is often done with someone else, who takes a supporting role (a tutor, psychologist or peer). In the personal context of everyday life reflection, systems can take this role of a 'reflection partner' in various ways. Systems can trigger reflection, support the process of reflection or enable capturing reflections. These roles cannot be completely separated and a system can adopt different roles at different moments in the process.

### Triggering role

Similar to how a comment or question from a friend gets you thinking, an interactive system can take a triggering role. Based on our concepts, we identify different types of triggers that a system can provide. *Content triggers* provide direction for what to reflect on, for instance by presenting collected data, personal media or provocative questions. To stimulate everyday life reflection, we focus on presenting data from a broad range. However, people's self-image can be conflicting with the image presented through data. The concept DataZen (Figure 6.1a) therefore allows people to adjust the pattern presented based on their personal view on how the data should represent their present or preferred future.

Both specific quantitative data (e.g. as discussed in Li, Dey & Forlizzi, 2011) and the ambiguous visualisation of data (e.g. Fleck & Fitzpatrick, 2010) can be seen as content triggers. Being more open than content triggers, *direction triggers* give a suggestion for the type of reflection without limiting the content of the reflection. The Balance concept (Figure. 6.1b) for instance suggests to reflect on two sides of a situation (e.g. positive and negative) without prescribing what this situation should be. The most open-ended systems provide



### **Datazen**

A small zen-inspired garden used as an ambient display. Through vibration in the bottom, patterns in the sand are created that are based on measurements of activity, stress and wellbeing (based on wearables). You can choose to edit, disturb or change the display, by changing the sand patterns by hand or with tools.



### **Balance**

A wooden balance that functions as a subtle display of the balance in your life as it stores your thoughts on its positive and negative sides. You can tap to record on either side, adding weight to that side. Balance provides a physical trigger, an abstract representation of state and an archive of previous thoughts.



### **MirrorMirror**

The bathroom is a typical place to start and end a day. In a moment that we look at ourselves, MirrorMirror stimulates to look at ourselves in a more reflective way. To take a moment to consider the day, the week or ourselves. Contours of hands trigger to stand still a moment. When hands are placed, the mirror slowly starts to draw an outline around you. It takes three minutes to make this outline, stimulating to take this time to reflect.

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Figure 6.1 From top to bottom: concepts with content triggers (a. *Datazen*), direction triggers (b. *Balance*) and opportunity triggers (c. *MirrorMirror*).



*opportunity triggers*. These are similar to what Daris (2003) considers 'generic prompts', asking people to 'stop and think' without a certain topic or direction. Concepts such as MirrorMirror (Figure 6.1c) indicate that there is (or could be) time and space for reflection, without giving any further direction.

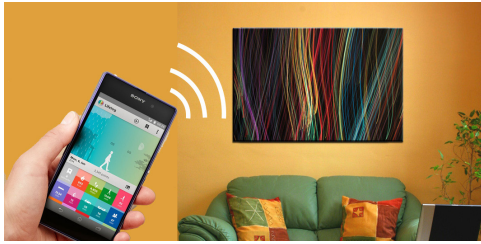
## **Supporting role**

Technologies for everyday life reflection can be designed to provide support in the process of reflection. This can be done both after a person has been triggered by the system, and if reflection is initiated by the person. Support can for instance be given by exploring layers in system-collected data, step-by-step (LifeTree concept, Figure 6.2a) or exploring user generated media in a more playful way (OddOneOut, Figure 6.2b). Rather than free exploration, MixedEmotions (Figure 6.2c) stimulates reflection by supporting a *process of guided choices*. The process of MixedEmotions can be seen as an example of embodied questions. Very few of our concepts use explicit, verbalised questions, in contrast to some of the dialogue driven reflection systems discussed before (Isaacs et al., 2013, Landry, 2009). Instead, we see opportunity for concepts that use more subtle prompts and embodied questions. This can be seen in the concept PeelAway (Figure 6.2d) which uses the embodiment of layers to dig deeper into underlying aspects of a thought or problem. PeelAway supports reflection not only through an embodied question but also through physical action. The action of peeling away, or in the Fragile Worries (Figure 6.3a) concept breaking figures is supportive of the cognitive and ungraspable process of reflection.

Finally, the subtlest form of support, is seen in providing environment support. After being initiated by the user, PastScape (Figure 6.3b) creates an environment for reflection by creating a metaphorical distance from current activities to allow for reflection. In this case, such an environment is created through audio, but more physical forms of environment support can be considered as well.

## **Capturing role**

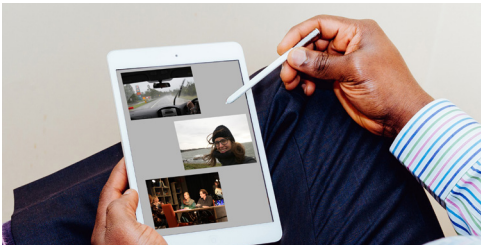
Rather than triggering to start reflecting, systems can support rounding off the process by supporting externalisation. Externalising thoughts and reflection requires self-expression, in words or otherwise, which we described as an expression driven strategy, in the literature review in Section 6.2. This can help to bring peace of mind, a focus in FragileWorries (Figure 6.3a). With the capturing role, we focus specifically on a certain type of externalisation: capturing reflections to serve as content triggers in the future.



### LifeTree

A beautiful piece of art on the wall in your house, with a hidden meaning. As the patterns represent patterns in your live visualizing activity, social engagement, stress and health. The interactive art piece allows to explore aspects of the data to find peaks, patterns or surprises. At the same time functions as a more peripheral trigger for reflection without invading your privacy.

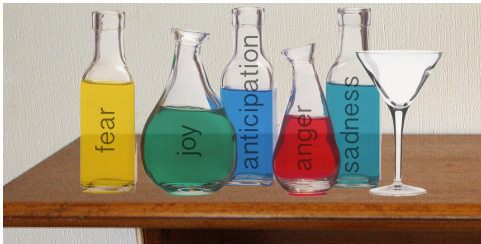
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### OddOneOut

A short moment on the couch playing a nice little game with your pictures. The game of “odd one out” stimulates looking at hidden similarities and differences between random photos from your personal past. With all associations, a growing web of related photos is created which can be reviewed and explored.

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### MixedEmotions

Every day is a mix of experiences and emotions, but at night we need to let them go. MixedEmotions creates a night-time ritual that is relaxing and supports a good night sleep. Creating a herbal mix every night, stimulates reflection because each bottle represents an emotion. How did your day taste? Which bottle empties the quickest?

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### PeelAway

Getting to the core of a problem can help us gain insight. On each segment of PeelAway an aspect or thought can be written and peeled off, stimulating to write down underlying aspects and explore underlying thoughts or assumptions, resulting in more critical reflection.

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Figure 6.2 Systems that take a supporting role, from top to bottom  
a. LifeTree, b. OddOneOut, c. MixedEmotions d. PeelAway.

As mentioned in the Balance concept (Figure 6.1b), an 'archive of thoughts' can emerge. For a meaningful future recollection, some level of organisation is needed. In the Balance concept, this is provided by splitting the thoughts into two opposite categories. The Trail Concept (Figure 6.3c), focusses on a more spatial and environment-based arrangement, by allowing people to leave reflective messages in specific locations. Similar to Echoes (Isaacs et al., 2013) a collection of responses to earlier reflections could emerge.



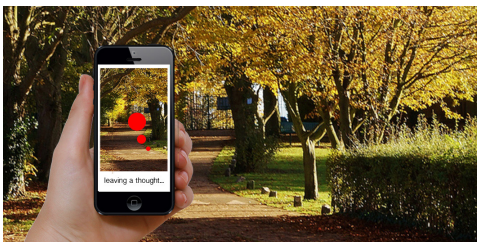
### **FragileWorries**

A set of abstract ceramic figures that can be written upon. Figures can then be broken to let go or show how vulnerable worries are. Shards can be saved as a reminder of past struggles or disposed-off to truly get rid of the past.



### **PastScape**

Hear a soundscape from the past, connected to the location you are in. Scroll through the decades. Was there a city here? Do you hear cars or horses? Provides opportunity to get away from the present, get to a different place, see things in a different perspective.



### **Trail**

Reflection often requires getting away from everyday life activities, for instance during a walk. With Trail, you can save thoughts or reflection on specific locations, creating your own garden of thought to which you can return for future deliberation. Creating not only an environment but personal messages to your future self.

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*Figure 6.3 System that support externalising reflection (a. FragileWorries, c. Trail) and/or provide an environment for reflection (b. PastScape, c. Trail)*

## 6.5 Findings: Dimensions of a Design Space

In the introduction, we presented multiple strategies: dialogue, information or expression driven reflection. Through our open brainstorm and discussions, we added new findings concerning the roles a system can take. Some roles are more complementary to certain strategies. For example, information often takes a triggering role, systems based on expression driven reflection rely on a capturing role and dialogue is a strong form of support. However, the strategies and roles can be seen as two dimensions describing a space. In Figure 6.4, we have mapped our concepts to this design space, this shows how several concepts change roles during the reflection process: the visual aspects of LifeTree provide content triggers, but the opportunity to explore the layers of data behind this provide support. The Balance concept shifts through all roles: the physical form and current status trigger to reflect, the interactivity that changes the scale supports reflecting from multiple perspectives and finally the recorded messages are captured and can be later retrieved. In such a concept, a system adopts different roles consecutively, someone is first triggered to reflect, then supported within this process and finally helped to capture the reflection for future reference. However, we emphasise that this is not necessarily needed, some concepts might merely trigger without providing additional support. We believe concepts that provide some level of additional support are more likely to enable deeper reflection, but designing for all roles in each concept is not needed.

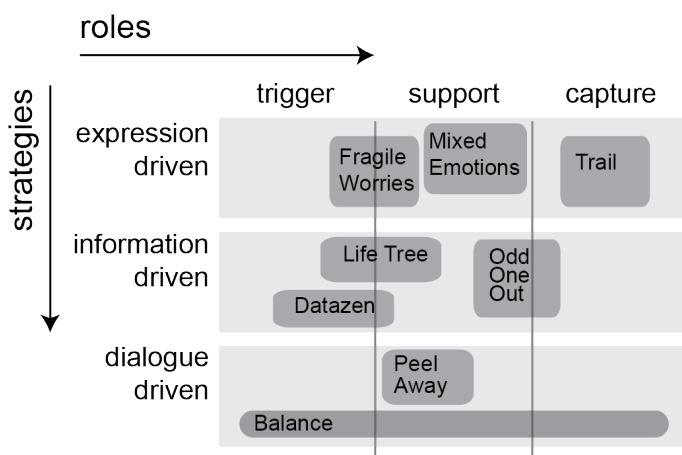


Figure 6.4 Mapping conceptual reflection systems in an emerging design space. Some concepts are positioned across multiple roles.

When mapping our concepts to the two dimensions of three roles and three strategies, we found that some concepts seemed to adopt a different strategy, not yet captured in our overview of most commonly found strategies. As a result, we define a fourth strategy: environment driven reflection (see Figure 6.5). This strategy focuses on creating contextual elements that are beneficial for reflection. With these contextual elements, a “space” or environment is created, that is supportive of reflection. Both PastScape and MirrorMirror provide such a space and further inspiration can be drawn from the notion of restorative environments (Aipperspach, Hooker & Woodruff, 2011). The visual exploration of the space across these two dimensions has informed our further design process. Based on the visual design space we can classify existing designs, explore potential redesigns and identify gaps.

The systems described in Section 6.2 illustrated common *strategies*. We can now also describe what *role* they primarily take and thus position them within our design space. For example, DataSouvenirs (Aipperspach, Hooker & Woodruff, 2011) is an information driven design that takes a triggering role and more specifically provides content triggers (what to

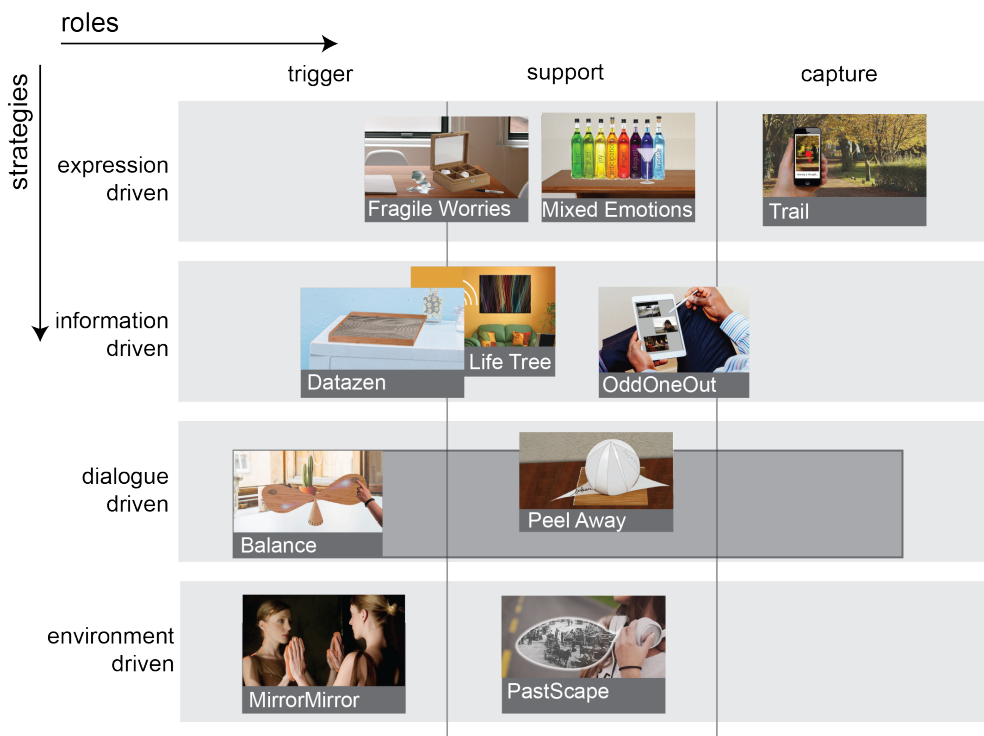


Figure 6.5 Extending the design space with environment driven strategy. Some concepts are positions across multiple roles (Background behind Balance positions it across all three roles).

reflect upon). Freed (Mendels, Frens & Overbeeke, 2011) is another information driven design, but in the process, it adopts different roles. For example, elements of the design process to be reflected upon can be expressed in the system for future retrieval (capturing role). These elements are then presented to the user (triggering role) and can be explored in multiple views (supporting role). We do not believe that there is a preferred combination of strategy and roles, but that they can be used in explorative ways to find the optimal for a specific context.

Once concepts are mapped on the design space, the dimensions can also be used to redesign reflection systems: for example, a regular diary is expression driven and focussed on capturing reflection (top right corner), but can be redesigned to include dialogue driven triggers, see for example the physical diary by Mols & Markopoulos (2012), the redesign is indicated in Figure 6.6. Thirdly, the two dimensions illustrate opportunities within the design space. The visualisation of the design space (Figure 6.6) for instance triggered the question how we might design for expression driven triggering. This led to the idea of a 'ThoughtsCanvas': an empty canvas that triggers to express, but fades after a night sleep, leaving no trace. In this way, the entry cannot be revisited and the trigger remains open, which positions the concept in the top left corner.

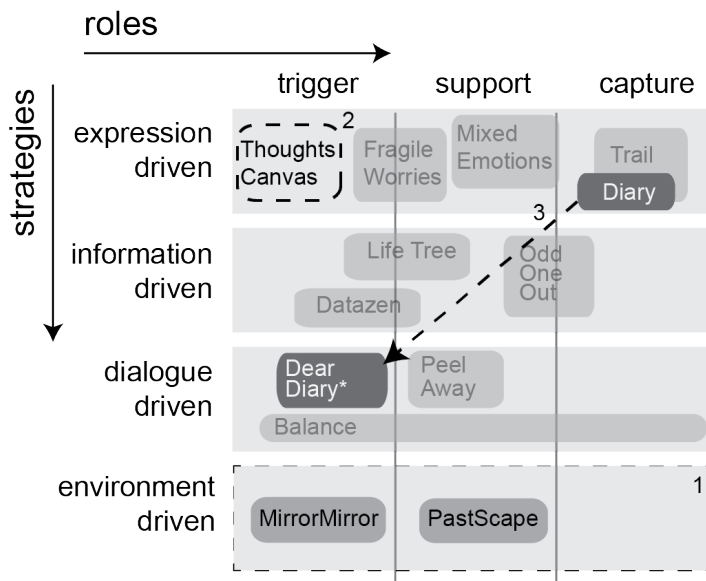


Figure 6.6 Design space highlighting additional findings of our exploration in dotted lines: describing an additional strategy (1), identifying opportunities for design (2) and positioning a redesign (3).

\* DearDiary concept described in Mols & Markopoulos (2012)

## 6.6 Discussion

We have presented this design space as inspiration and guide, giving direction to potential future work on supporting reflection with a more holistic and open approach.

Concepts were generated iteratively, with different people involved in different phases. Iterations have shaped the design space, as have our discussions and analysis. From a critical perspective, we should recognise that most of the involved researchers have been involved in a reflection-driven educational system and therefore all have quite a reflective attitude. Therefore, similar to (Baumer et al., 2014) our work is based on the premises that people benefit from reflection and focused on people willing to engage in reflection. We do not focus on a persuasive approach, but rather focus on empowering people who have a desire to reflect (more often) but who could use support to do so.

We have built upon work by (Baumer, 2015, Baumer et al., 2014, Fleck & Fitzpatrick, 2010, Tchetagni, Nkambou & Bourdeau, 2007) to provide specific dimensions aiming to give more direct suggestions for design. We believe the design space and the dimensions contribute to the existing body of knowledge on design for reflection by providing a language to describe concepts and to specify clear directions for design. Others have also described common approaches to support reflection. For example, classified by level of reflection (Fleck & Fitzpatrick, 2010) or across dimensions of breakdown, inquiry and transformation (Baumer et al., 2014). Both these approaches are primarily focussed on characteristics of the reflection. Instead, our dimensions are on a design level, describing the strategies and roles on a system level. We therefore believe this space to be easier to translate to design. The approaches described in the aforementioned classifications, can be easily mapped to our space to allow for further comparison. For example, Fleck & Fitzpatrick (201) describe a possibility for technology to be a *“tool through which knowledge and experience is recorded”* (p.219), which we describe in our capturing role. They also explain how technology can prompt for explanation and 'ask reflective questions' which in our dimensions can be classified as a system adopting a triggering and supporting role with a dialogue driven strategy.

Although we have strived to make both dimensions (strategies and roles) as specific as possible, they are still on a conceptual level. The design space is not a bounded problem space, but rather describes a complex context in which we pose interventions (Baumer, 2015), which can help us to better understand reflection itself. The value of these concepts can only become clear in use, through a process of meaning making, the concepts have been designed to allow for multiple meanings (Sengers & Gaver, 2006). However, this also means that, in use, they might be used more pragmatically or functional rather than reflec-

tive. Only long-term evaluations in real contexts can uncover the reflective potential of these concepts.

Although we believe our dimensions can be useful for any type of reflection, we specifically aim at everyday life reflection focusing on insight (rather than behaviour change or skill-development). We review the concepts and their unique aspects in comparison to existing concepts for reflection, highlighting three themes that are specifically important for everyday life reflection: holistic reflection, open-ended design and integration into everyday life.

## **Holistic reflection**

We set out to design for everyday life reflection, which we define as *“Considering and analysing past, present and future experiences in order to (re-)assess our thoughts, beliefs, feelings, and actions regarding ones everyday life.”* (see Section 2.2, p.37, for an elaborate discussion of this definition). Therefore, most of our concepts do not focus on a specific behaviour or domain. We see the biggest benefit for everyday life reflection in how different experiences, life aspects or domains can be connected and compared. Such more holistic reflection has the potential to create deeper insights, such as how personal life and work interact or how past experiences influence current responses to social triggers. We see that the designs support such holistic reflection in different ways. For example, by providing only an opportunity trigger (MirrorMirror) or by focussing on an emotional level (MixedEmotions). When specific content is used, room for interpretation is created to allow for multiple aspects to still be involved. For example, by combining different data but presenting it in an ambiguous way to leave the interpretation up to the user (in Datazen) or by forcing to compare elements within a diverse set of photos, stimulating to look for similarities and differences on more abstract levels (OddOneOut). Through these mechanisms, we believe a broad spectrum of thoughts, beliefs, feelings and actions can be reflected upon, thus stimulating to approach it more holistically.

## **Open-ended design**

Because of the personal and holistic nature of everyday life reflection, designing for it should be approached with a high degree of openness. As explained in our approach (Section 1.6, p. 16), we set out to design for open-ended reflection. The notion of open-ended design became more specific in reviewing our concepts and the design space in this exploration. Most of our concepts have in common that they are open-ended in both topic and process. Systems primarily provide direction or opportunity triggers, leaving room for interpretation. The concepts do not prescribe a specific set of steps for reflection, but adopt a more open and flexible approach (Ekebergh, 2007). Still, some systems, especially those adopting a supporting role, incorporate multiple steps, for example by exploring different



views or layers. These supportive steps are still presented in an open-way, allowing to be performed in different ways.

There are different levels on which a system can be open to interpretation (Sengers & Gaver, 2016), more elaborately described in Section 1.6, on p. 17. In this design space, concepts are primarily open on the ‘middle level’, creating room for interpretation how a system relates to people’s life. What activities is it appropriate for? And what role can it play in one’s life? The game of OddOneOut for instance, has no specific goal and its meaning or benefits can only be interpreted through use. Another aspect of open-ended is the opportunity for personal appropriation. The Balance concept is an example that can be easily appropriated to use for different types of life balances (positive & negative, work & leisure). Designing open-ended systems supports both appropriation in terms of content and in terms of integration into everyday life, discussed below.

## **Integrating reflection into everyday life**

Reflection requires time, structure and encouragement (Fleck & Fitzpatrick, 2010). For systems to contribute to these elements, they need to be integrated into everyday life. For everyday life reflection to truly improve reflection it needs to become a habit adopted over a long period of time. Integrating systems for reflection into everyday life in a meaningful way is very challenging. Echo (Isaacs et al., 2013) for example is a concept strong in all roles of triggering, supporting and capturing, however it is less integrated in everyday life. Echo triggers at random moments, which leads to surprising entries, but can also be disruptive. There are many moments during the day when the resources for reflection (time, mental effort, isolation) are not available. Allowing for better integration into everyday life can be done in several ways.

### *Everyday life rituals*

Reflection requires time and attention and the skill to reflect develops over time. Concepts such as Balance recognise this and aim to create a new ritual for daily reflection, with a fixed location and timing, for instance when coming home. Other concepts integrate reflection in current everyday life rituals (MirrorMirror), reducing the effort required to adopt the new habit. In OddOneOut, we adopt a more flexible approach and aim to “lighten” the process of reflection by game elements.

### *Layers*

Enabling embedding reflection in everyday life is also achieved by designing for the different ‘layers’ of reflection. As described by Fleck and Fitzpatrick (2010) and Kember et al. (2000) reflection on the deepest layers are not always necessary. Instead, concepts can support multiple layers, by allowing for both reflective descriptions or comparison (first

layers) as well as more critical or transformative reflection on a deeper layer (Fleck & Fitzpatrick, 2010). Such designs will allow for short moments of interaction as well as for more time-consuming and deliberate reflection (for critical or transformative reflection). E.g. adding a note to the Balance concept is a small moment of insight, but reviewing past balances and their potential pattern over time is on a deeper layer. Although interactive systems might be most suitable to stimulate more descriptive levels of reflection (Fleck & Fitzpatrick, 2010), we can combine these layers with different interaction styles to support more critical reflection.

### *Social roles*

In our design space, we focused on systems that take the role of a reflective partner, allowing users to engage with a dialogue with themselves (Brown, 2009). However, we could also imagine systems that mediate or support reflection with a partner. Although not explicitly designed for this purpose, several concepts can stimulate reflective conversation through their presence in the home environment. The presence of another person can encourage to give justification or explanation of the system or media (Fleck & Fitzpatrick, 2010). The abstract representation in concepts such as LifeTree or Balance allow for responses from close ones when meaning is shared. E.g. partners living together can start a conversation if they see much has been added to the Balance. One could even use such a system together rather than individually. At the same time, Balance takes the privacy of reflection into account, for people not informed about the meaning, it remains an abstract sculpture. Including intimate others in the process of reflection can support integrating reflection into everyday life.

## **6.7 Conclusion**

In this chapter, we have described our second design exploration into reflection in everyday life. We have explored a broader design space by developing concepts and analysing their roles.

Based on our review of literature we found three most common strategies to support reflection, from a range of domains. The different strategies, dialogue driven, information driven and expression driven can all be supported by interactive systems. However, most of these drives often provide a very specific scope: the information or dialogic questions are focused on a specific topic or steer towards a certain conclusion (e.g. to walk more). Instead, we are interested in how these drives can be used for more holistic reflection. In our concepts, a higher degree of openness is seen, that allows to connect multiple areas of reflection. A fourth drive was added to our space, based on our concepts, that suits this openness espe-

cially well. With environment driven reflection, we describe a number of concepts that create a (metaphorical or physical) environment in which reflection can occur.

Based on our conceptual work, we have found that concepts can generally take three different roles: triggering, supporting and capturing. When a concept provides a trigger, this can provide a specific topic (content trigger), but for a more open-ended system this might be subtler (direction trigger) or completely open (opportunity trigger). By combining strategies and roles, a design space is illustrated across these two dimensions. This space provides a more detailed and design-focused way to classify existing designs and to provide direction to support reflection.

We believe the design space and its dimensions can be used for different areas of design for reflection. Within our specific scope of everyday life reflection, we highlight that our concepts illustrate how to design for more holistic reflection, how to create open-ended designs and how to design for integration into everyday life. We identify different ways to design for integration into everyday life through presence in the home, connection to rituals, the use of social roles and layered interaction. We will further explore this integration in Chapter 7.

Our first design exploration focused specifically on abstract visual media. In this second exploration, we took a broader approach and only a number of our concepts focus on media creation and retrieval. For our third exploration (Chapter 7), we select three concepts from the design space that include media creation to fit with our specific research aims. Additionally, the three themes brought forward in this space are central in the field-exploration of the concepts in our third exploration. We use these concepts to compare how different roles relate to open-ended reflection, to explore holistic reflection with media and to validate the integration of concepts for reflection into everyday life.

# Design Exploration 3

Partially (Section 7.2 and 7.3) based on:

Ine Mols, Elise van den Hoven, and Berry Eggen (2017), *Balance, Cogito and Dott: Exploring Media Modalities for Everyday-life Reflection*. In Proceedings of the Eleventh International Conference on Tangible, Embedded, and Embodied Interaction (TEI '17). ACM, New York, NY, USA, 427-433. DOI: <https://doi.org/10.1145/3024969.3025069>

# 7

## Balance, Cogito & Dott: Mediated Reflection

**Abstract** In this chapter, we explore media-supported reflection through the design and deployment of three concepts. In contrast to prevalent reflective approaches that are based on system-collected data, we explore how user-created media can support personal reflection. We focus our designs and evaluation on the value of open-endedness and the integration into everyday habits and routines. Three concepts were developed, focusing on different modalities: Dott uses visual media, Cogito uses text and Balance uses audio. We evaluate these concepts in an in-the-wild study that is both explorative and comparative. By discussing the similarities and differences with participants, we found that the concepts stimulated integrating reflection in everyday habits, although not through the scenarios that inspired the concepts. We discuss what constitutes good opportunity for reflection and how triggers can be used. Secondly, we discuss how different characteristics of reflection were influenced, including continuation, temporal dimension and especially depth. We conclude the chapter with a discussion of our findings: highlighting the value of media creation, the importance of the domestic context, the different phases of open-ended use and the opportunities to reach depth in reflection.

## 7.1 Introduction

In the previous chapter, we have described a conceptual design space with twelve concepts. To go beyond their conceptual contribution, we wanted to evaluate a selection of these concepts with users. In this chapter, we present the design and field exploration of three concepts to support everyday life reflection. With these concepts, we compare three different media types: visual media with *Dott*, textual media with *Cogito* and auditory media with *Balance*. We choose to explore this subject by doing a comparative study, where the participants actively take part in comparing the designs. By exploring these concepts in-the-wild, we are able to compare how they affect the characteristics of reflection and explore whether and how media-supported reflection can be integrated into everyday life. In the following sections, we discuss our design process and the three concepts in detail. These concepts are based on our theoretical understanding of everyday life reflection as described in Chapter 2 and on the empirical understanding of reflective practices as described in Chapter 5. The resulting three concepts are implemented and evaluated. Our results are based on in-depth interviews, that were conducted on each concept individually and in a comparative way. We present our findings in two sections: the first describing how the designs support the integration of reflective practices in everyday life and the second focussing on how the designs mediate reflection. We end this chapter with a discussion of several of the design elements and their impact.

### Concepts for a comparative explorative study

This study uses a comparative explorative approach. By testing three concepts, we aim to explore the effects of media modality and interaction on the characteristics of reflection. We take an in-the-wild approach, deploying the devices at the homes of people over a longer period of time (Rogers & Marshall, 2017). Rather than the comparison taking place post-hoc by the researchers, the participants are actively involved in the comparison during the final interview.

Traditionally, comparative (lab)studies compare conditions or designs that differ on a single variable. Such a ‘controlled’ comparison is sometimes also implemented in a prototype and deployed in the wild. Isaacs et al. (2013), for example, explored the difference between recording and reflective mode of the journaling app *Echoes* (Isaacs et al., 2013). Other examples include variations in algorithms and interfaces, without changing the concept in itself (e.g. the Smart thermostat in [Alan et al., 2016]) or varying multiple interaction characteristics (e.g. light interaction in [Werff et al., 2017]). In our case, the primary variable is media modality, but in contrast to traditional approaches, this difference is merely the starting point. Each variation is designed to be a valuable concept in its own right. To allow for

comparison, several constraints were set, important differences evolved during the design process. Both the constraints and differences will be discussed in Section 7.2.

## **Media supported reflection**

We are interested in exploring media-supported reflection, as media systems can take all the roles discussed in Chapter 6: they can trigger, support as well as capture reflection. In Chapter 2, we clustered a number of design examples based on specific design characteristics that have been inspirational to all our work, such as presence, re-interpretation and creative creation.

For the design of media-supported reflection systems, we were inspired by different types of media interaction. Based on the extensive history of written accounts for reflection (O'Sullivan, 2005) we wanted to include textual media. Similar to our work, others have explored how text-based applications can support reflection in an open-ended way by not restricting the topics or scope (Cheng et al., 2011; Isaacs et al., 2013). Similar open-ended possibilities are also seen in the use of visual media, which is more often studied for remembering (Van den Hoven, Sas & Whittaker, 2012). To use visuals for reflection, we were inspired to use a higher level of abstraction, as such ambiguity could spark reflection (Gaver, Beaver & Benford, 2003). The design of Context Photography, for example, captures everyday experiences in an abstract and surprising way, enabling to capture a personal perspective (Håkansson et al., 2006; Ljungblad et al., 2004). This inspired us to look at visual abstraction as a form of reflective expressivity. Reviewing such abstract visuals creates room for interpretation (Gaver, Beaver & Benford, 2003). We saw similar possibilities in the use of audio recordings, as it has been found that hearing such recordings involves a process of "unravelling" to interpret their context and meaning (Olkesik & Brown, 2008).

## **7.2 Designing Balance, Cogito & Dott**

The designs of the three concepts play a crucial role in this study. In this section, we describe the overall approach and design process. The set of concepts described in Chapter 6 forms the starting point of our design process. For this study, we are specifically interested in concepts that use different types of media, forming our primary selection criteria. Secondly, we base our selection on a number of the photo-scenarios from Chapter 5. We have chosen to use the scenarios 'Rethinking Commuter', 'Pausing the day' and 'Reflective Conversation'. We saw connections between these scenarios and specific concepts within the space. Below, we will illustrate for each of the three concepts, how the scenario inspired specific design adjustments. In a separate section (7.3), we describe the final designs and

prototypes. This provides a clearer overview of the three concepts as they were evaluated and provides us with additional opportunity to highlight some of the design rationale. In other words, this section focusses on the process of designing, the next one on the resulting designs.

## **Constraints in the design process**

Developing the three concepts starts from their difference in media modality. We formulate a number of constraints in the design process to make the concepts more suitable for comparison. Firstly, we focus our designs on supporting *individual reflection*. As was found in Chapter 5, reflection can be both a social and an individual process. We wanted to focus our designs on individual reflection, as we believe more support might be needed in this process. Individual reflection can be especially challenging and solitary moments spend in contemplation are becoming more rare (Carr, 2011; Diefenbach & Borrmann, 2019). However, one of the concepts was inspired by the scenario of reflective conversation (see section on 'Designing Dott'). To allow for a more equal comparison between concepts we focussed the evaluation of this design on the impact it had on an individual's reflection.

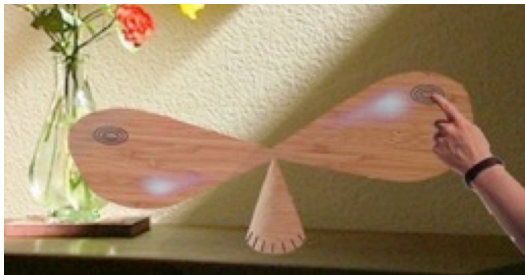
The second constraint is a focus on *home use*. We choose for all concepts to have a focal point in the home and incorporating elements of tangible interaction through dedicated devices. However, part of the creation can occur on mobiles for easy access, with the potential for 'on-the-go'-use. The third constraint in concept development determines that each concept includes both *media creation and media retrieval*. Both processes can stimulate reflection in an open-ended way. People are free to create media on any topic, thought or feeling. The systems provide no steering questions, but merely an opportunity for reflective media creation. Finally, the concepts are designed to have a *low threshold for interaction*. The interactions are intended to be light-weight, quick, and easily integrated in current daily habits and routines.

## **Designing balance**

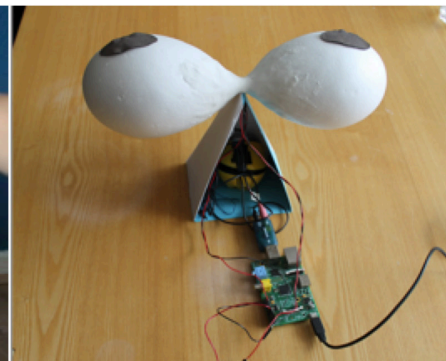
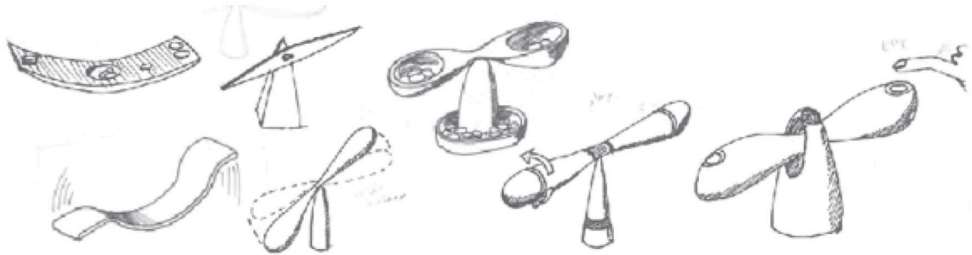
We choose the scenario Rethinking Commuter (Chapter 5, p.134) for further exploration (see Appendix 6), but decided not to add any interaction to the moment of commuting itself. Both in a car and on a bike, such interaction could easily be too distracting. Instead, we consider the moment of coming home as an ideal moment to introduce a design. For many people, the commute was seen as a mental transition from work into home life. We want to introduce a design that can help wrapping up this reflection. The concept 'Balance' is suitable to be adjusted to this scenario (see Figure 7.1, top). The externalisation (recording) of spoken thoughts fits well with wrapping up a reflection and the interaction can be short and thus suitable for the moment of coming home. The design of Balance required little



adjustment and remained closest to its original design (as introduced in Chapter 6, p.154). Balance would be positioned in a clearly visible location, ideally in the hallway or close to where people enter their home. We focus on recording spoken messages, although the concept initially also included recording environmental sounds with a mobile phone. With these messages, symbolic weight was added to the different sides. We explored different possibilities, for example by adding physical tokens (see Figure 7.1, middle), but choose to implement a tap interaction instead. This allows incorporating a dynamic process in which the balance would be restored over time, which would be more challenging with physical tokens. Finally, we considered different options to replay past entries. The original design used a scrolling wheel to scan through messages chronologically. Instead, inspired by the



An abstract object, inspired by a balance, is used to save recordings on two sides, representing opposite aspects of life, e.g. positive and negative, or work and home. Each data entry adds weight to one of the sides. By turning a ring on the base, past entries can be replayed.



*Figure 7.1 Development of the Balance design. Top: original concept description from design space (Chapter 6). Middle: exploratory sketches. Bottom: early prototypes of the Balance concept.*

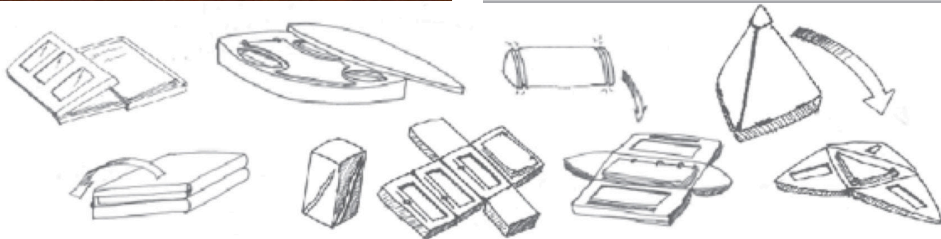
scenario, we considered what would be a fast way to play a message as trigger for reflection on the way out. We therefore choose to implement a random replay function on each side.

## Designing Cogito

We choose to build upon the scenario 'Pausing the Day (see Chapter 5, p.136), as it seems a suitable moment to introduce a reflective interaction. Additionally, we combined this with inspiration from a second scenario, the "Mini Moments of reflection throughout the day". Based on the study described in Chapter 5, we formulated this scenario to represent the smallest instances of reflection in everyday life, brief moments with small realisations throughout the day (see Chapter 5, p.129). Combining these two scenarios allows for small moments of creation and more elaborate moments of media retrieval.



Getting to the core of a problem can help us gain insight. On each segment of Peel-Away an aspect or thought can be written and peeled off, stimulating to write down underlying aspects and explore underlying thoughts or assumptions, resulting in more critical reflection.



*Figure 7.2 Development of the Cogito design.  
Top: original concept description 'PeelAway' from design space (Chapter 6).  
Middle: exploratory sketches.  
Bottom: early prototype of the Cogito design.*

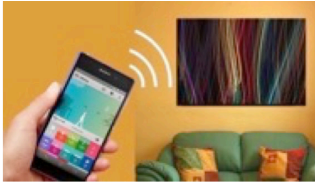
We connected this scenario to the concept ‘PeelAway’ from the design space (Figure 7.3, top, see also Chapter 6, p.156), focussing on textual media. This concept appealed to us for the embodiment of opening up or uncovering hidden layers. The ‘Pause the Day’ scenario connects well with reading such messages, which typically takes time. Inspired by the small moments, we intent messages to be send to the device during the day.

We explored different ways for messages to be brought together. We found it interesting to find a way to put together multiple messages, which would allow for combining and comparing (an important process within reflection, Staudinger, 2001), such as looking for common themes or change over time. Three messages would be an ideal number for this, as it allows looking for ways in which two of the messages are more similar than the other. This eventually lead to the pyramid shape of Cogito (see sketches in Figure 7.2). Because the scenario ‘Pausing the Day’ often takes place in common areas within the home, we designed Cogito in such a way that messages would be hidden. At the same time, we wanted the concept to provide peripheral triggers that could stimulate picking up the device during these ‘pauses’. We therefore incorporated a rim of light that could provide feedback (see full design rationale on p. 178).

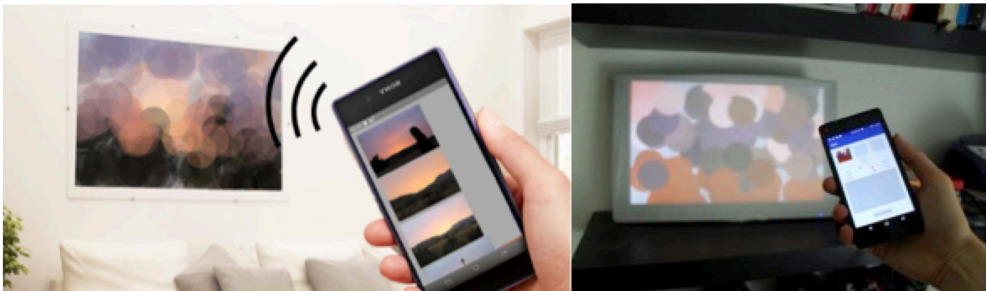
## **Designing Dott**

Finally, we choose the scenario Reflective Conversation for further exploration (see Figure 7.6), especially because we believe it is a very common scenario. Visual media could be a suitable match for the conversation scenario, as it allows multiple people to discuss what is visualised. What interests us in the Lifetree concept (see Figure 7.3 top, p. 174) is the potential of an art piece in the home, serving as a conversation starter, but safeguarding privacy through abstraction.

We changed the concept quite significantly, most of all by changing the source of the visual to be personal photos. This enables users to take a more active role in the creation of media. Secondly, it allows for more personal expression, which we believe to be beneficial for reflection. Different possibilities to automatically generate abstract media based on personal photos were compared (see Figure 7.3 middle, p. 174). We choose to allow for including 1-3 photos, which enables combining multiple events or multiple instances of a similar event (inspired by the dinner visuals, as seen in Chapter 5).



A beautiful piece of art on the wall in your house, with a hidden meaning. As the patterns represent patterns in your life, visualising activity, social engagement, stress and health. At the same time, it functions as a more peripheral trigger for reflection without invading your privacy.



*Figure 7.3 Design process of the Dott design. Top: original concept description from design space (Chapter 6) on abstract art titled 'LifeTree'. Middle: explorations of digitally generated visualisations based on a set of photos seen on the left. Bottom: New visualisations and early prototype of the Dott design.*

## 7.3 Final Design Descriptions

In the previous section, we have described how the designs evolved, what aspects have been explored and how they are connected to the different scenarios. Here, we focus on describing the design as they have been implemented, describing the general design, interaction aspects and implementation for each.

## Design 1: Balance

With the design of Balance (see Figure 7.4) we explore the auditory modality. Balance is a device in the home that uses tangible interaction to create personal voice memos. The object has the shape of a balance, allowing recording messages on two opposing sides. Initially Balance was focussed on recording positive and negative aspects about a day. However, this mapping is not integrated in the design but left open to users. During the explanation, the idea of opposing meanings is introduced, as examples positive/negative or work/private life are used. The object is designed as a prominent object in the home to function as an embodied trigger.

By tapping either side of Balance a 10 second audio segment is recorded. The more force is used when tapping, the more 'weight' is added to the message and to that side. As if it were a scale, Balance moves to a tilted position as a result of the weights added. As such, Balance represents the evaluative balance between two sides. One of our assumptions is that it can stimulate to record something on the other side, providing a more diverse view of one's day. Media can be replayed by touching one of the sides, a random recording from that side will then be played.



*Figure 7.4 Balance prototype in use*

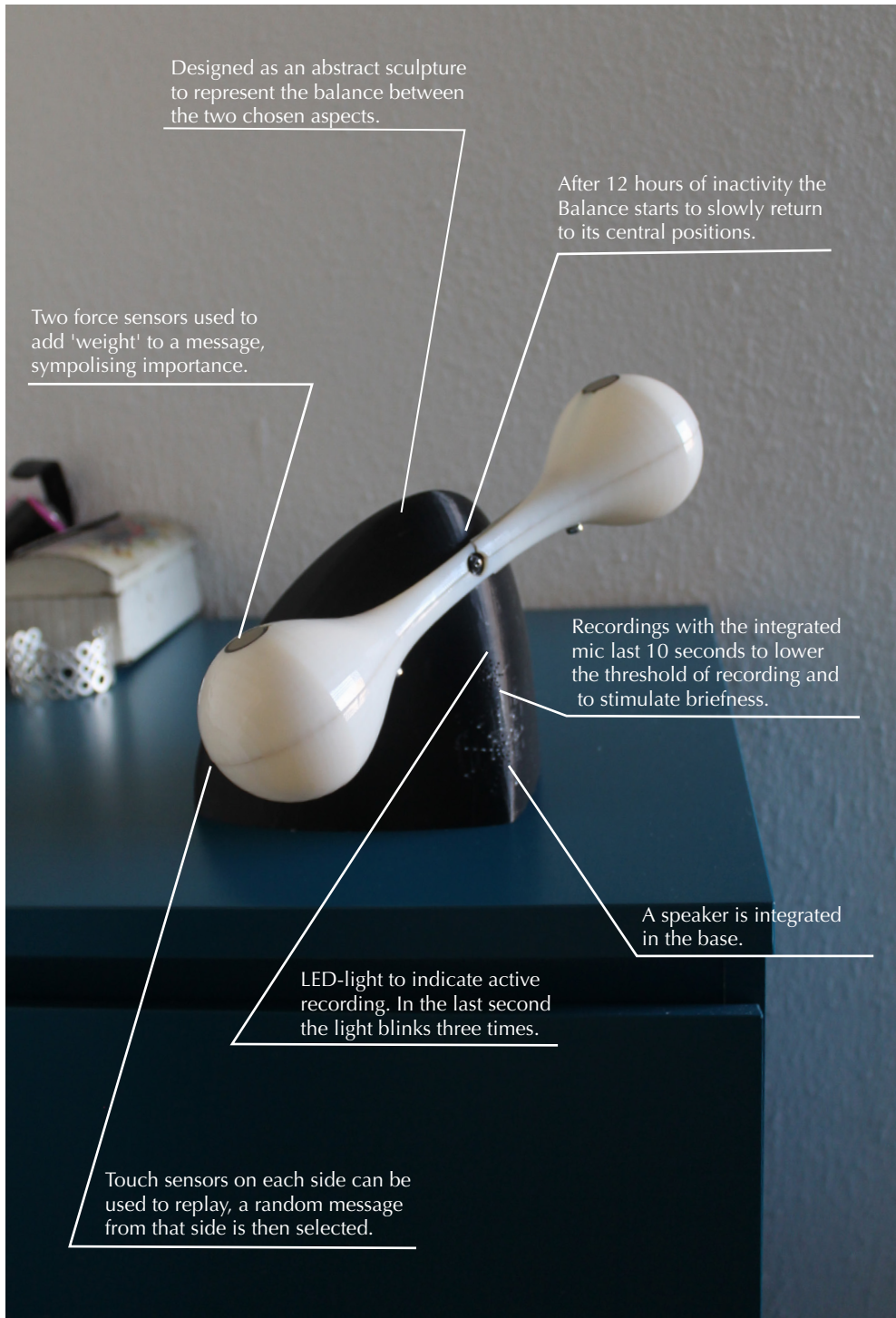


Figure 7.5 Balance prototype with important aspects of the design rationale.

## Design 2: Cogito

Cogito (see Figure 7.6) uses text to stimulate reflection. Using regular text-messaging services, a user can send short messages during the day, which the Cogito object receives. This pyramid shape is positioned at home and can be opened up, displaying three messages. Messages on each screen can be browsed to look for interesting combinations of messages that spark new insight by comparing between or abstracting across messages. In the centre of the pyramid an additional note-pad is placed to allow for hand-written notes during more elaborate reflection.

In the bottom of the pyramid a rim of light is integrated to communicate Cogito's state. With this light, we aim to stimulate both regular sending and reviewing messages, for which three states are used. When the Cogito pyramid has not received messages in a long time (more than 24 hours) the device is considered 'empty'. The light slowly glows, subtly attracting attention to send something. When Cogito has received many messages but these messages have not been reviewed yet, the device is considered 'full'. The Cogito pyramid then attracts attention to be opened up by pulsating actively. If the device is regularly used for both sending and reading, it does not need to attract extra attention, the light is simply on. To review messages, the closed pyramid can be opened up manually, by unfolding its sides. Internal screens show the most recent message and two random older messages. As the screens are 16x2 character displays, longer messages use scrolling to be displayed, multiple lines move across the screen automatically. Above each screen is a touch sensor to browse messages. When browsing, a new message is chosen randomly.



*Figure 7.6 Cogito Prototype in use.  
Photo by Bart van Overbeeke Photography*



Figure 7.7 Cogito prototype with important aspects of the design rationale.



### Design 3: Dott

Dott consists of a mobile phone application and a connected photo frame (see Figure 7.9). With the app, people can create abstract visualisations based on photos selected from the phone's gallery. Users can select one to three pictures, which form the basis of an abstract visual based on colours. A random selection of individual pixels is used to generate colourful dots. In the resulting abstract visualisation, specific elements of photos can no longer be recognised. With this transformation, we aim for the media to represent both the event and a personal perspective.

The app includes several parameters that can be adjusted to change the appearance of the visual. These parameters are: many/few, small/big and subtle/bright. Each time the user presses 'create', a visualisation with the selected parameters is generated. Figure 7.8 shows examples of different settings with the same source photo. Only when pressing 'save and upload' the current visualisation is uploaded to the photo frame. Splitting the creation and upload in two steps, allows for more creative exploration of different settings before a visual is uploaded. The photo frame always displays the most recent visual and cannot be interacted with. Previous visuals can be browsed in the app.

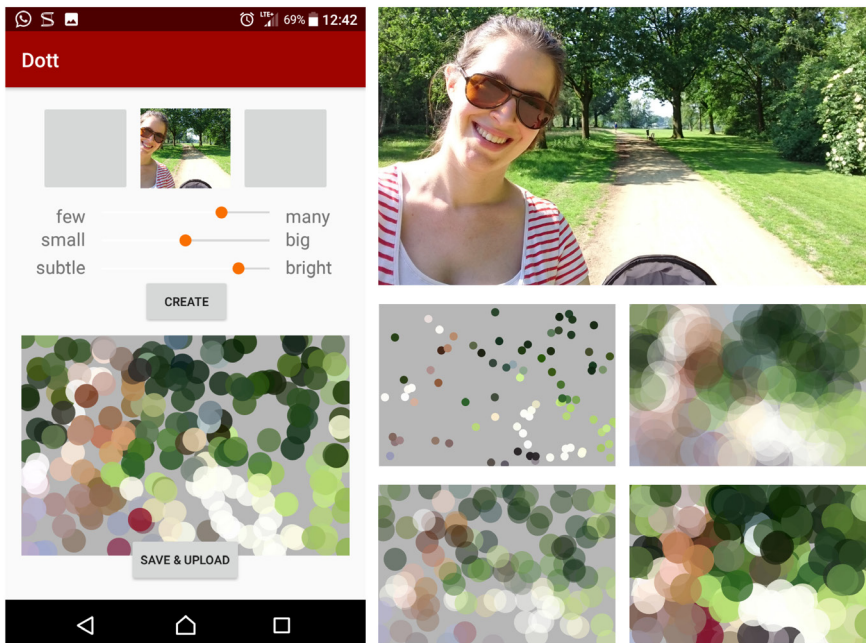


Figure 7.8 Left: Dott interface. Right: Examples of Dott visuals with the same source image (top) but different parameter settings (bottom).

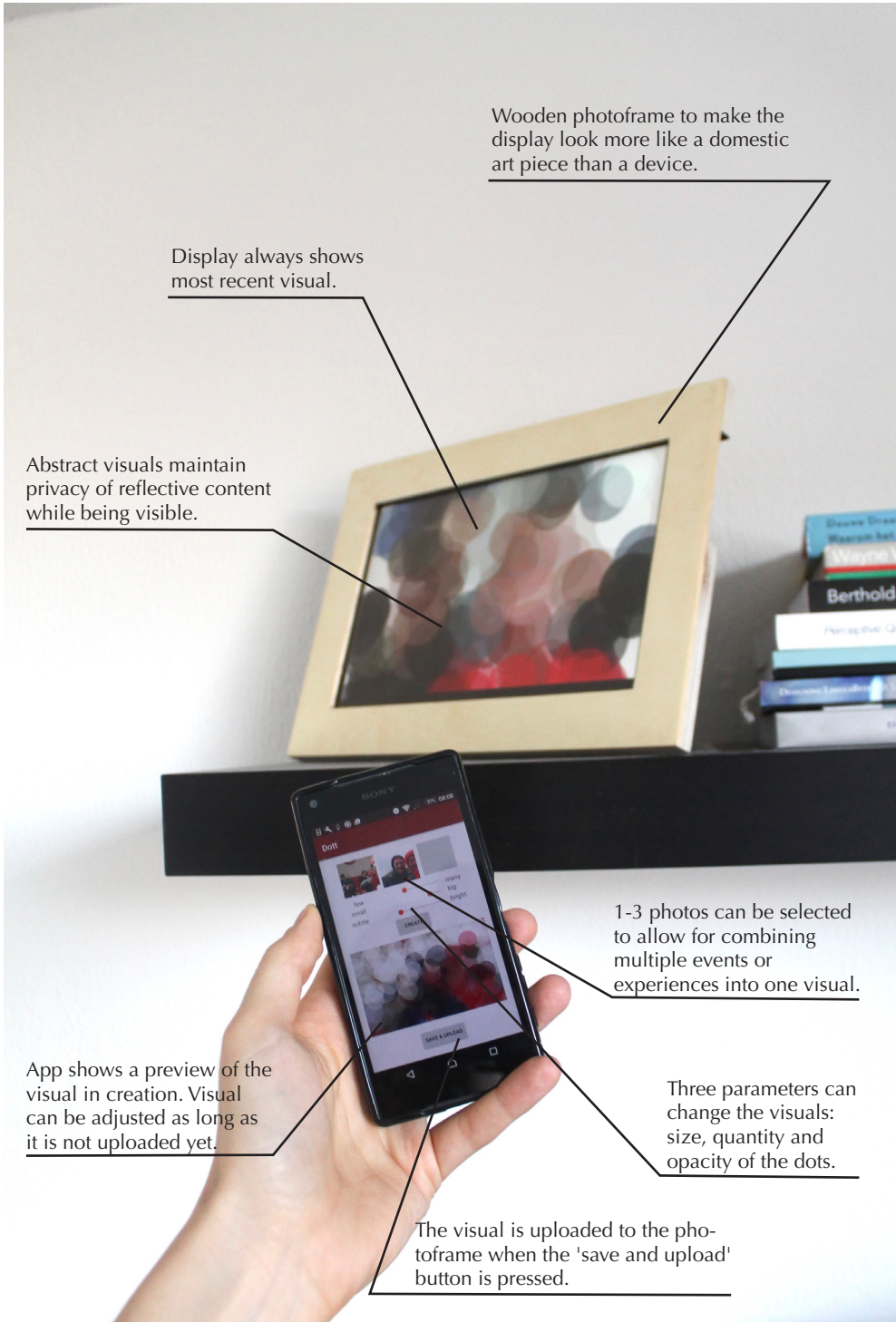
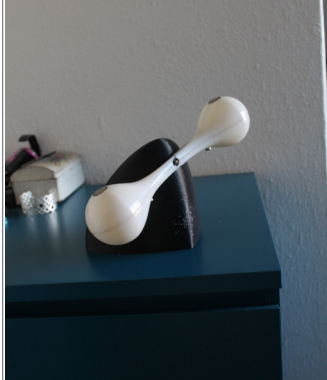




Figure 7.9 Dott prototype with important aspects of the design rationale.

## 7.4 Method: Explorative Comparative Study

As described in the introduction of this chapter, we developed these concepts to conduct a comparative explorative study. In Table 7.1, the three concepts and their main differences are summarized. By testing three concepts, in the wild, we explore how the concepts can be integrated into everyday life and how media modality and interaction affect characteristics of reflection. Rather than comparing the concepts post-hoc by the researchers, the participants are involved in the comparison through co-reflection.

Balance	Cogito	Dott
		
<p><b>Audio:</b> personal voice messages recorded on one of two opposing sides, adding weight to that side.</p>	<p><b>Text:</b> short messages sent from a mobile phone are stored and displayed in the Cogito pyramid.</p>	<p><b>Visual:</b> abstract visualisations generated based on photos and several parameters</p>
Mode of retrieval		
<p>If one of the sides is tapped, a random message from that side is played back.</p>	<p>Media is retrieved by opening Cogito, three messages are then displayed.</p>	<p>Media is retrieved by looking at the Dott frame, which always displays the most recent visual.</p>
Behaviour		
<p>When not used, Balance slowly returns to the central position, in balance.</p>	<p>A rim of light in the bottom of the pyramid indicates if the object is 'empty' or 'full'.</p>	<p>The Dott frame always displays the most recent visual, previous visuals can be seen in the app.</p>

*Table 7.1 Brief summary of the three concepts; for each concept the media type, mode of retrieval and behaviour is explained.*

During the home study, each participant used all three concepts consecutively, each for approximately two weeks. The order of the concepts was counter balanced, see Table 7.2 (p. 185) for the orders. We visited each participant four times. During the first visit, we interviewed the participant on his/her attitude towards reflection and current practices. After this interview, the first concept was installed and explained. The participants were instructed to use the devices to “reflect on their everyday life experiences”. Specific instructions on what such reflection might entail or when it should be done, were not given to suit the open-ended nature of our designs. Further instructions included the interactions with a device and how to respond in case of an error (see Appendix 7 for material). During the second, third and fourth visit we started with a concept interview followed by installing and explaining the next concept. During the fourth visit, the study was concluded with a comparative interview about the differences in use, reflection support and experience using a number of comparative scales. Additionally, we discussed advantages and disadvantages of each concept. The outline of all interviews, including the comparative scales, can be found in Appendix 8. During the use of the concepts, media was primarily stored locally (with the exception of Dott, which used cloud storage). During the interviews, all media was transferred to a laptop for discussion. To ensure privacy, the media was not browsed by the researcher directly, at any moment in the process. During the interviews, participants were asked to browse the media and share (show) specific examples to discuss. For these examples, additional consent was asked for saving and sharing them.

## **Participants**

For this explorative study, we choose to recruit six participants to explore each concept in depth with each person. This number also allows us to counter-balance the order of concepts. Participants were recruited in two ways. Participants from the questionnaire study (Chapter 5) who had indicated interest in future concepts were invited. Secondly, open calls on social media platforms were used to attract new participants. With all interested people a short intake interview over the phone was conducted, to see if participation is possible. As the Dott concept is prototyped as an Android application, participants with an Android phone were preferred. In two cases an Android phone was lent to a participant, for this concept specifically. All participants received a €15 gift voucher as compensation for potential costs of mobile services.

An overview of the six participants, including some general demographic information, is given in table 7.2 (p. 185). Because the concepts were primarily designed for individual use, the focus in the evaluation was on the individual even-though most participants shared their household with one or multiple family members. Other members of the household were not interviewed (in contrast to the evaluation of Ritual Camera (Chapter 4) which

involved all adult family members). During the concept interviews, some questions were asked on how others responded to the concept.

## **Analysis**

By visiting the users multiple times and interviewing them on each concept individually as well as comparatively, we gathered rich descriptions of their experiences. Together, the interviews accumulated 16.5 hours of recordings, which were transcribed for analysis. We adopted thematic analysis with a primary open-coding approach (Braun & Clarke, 2006). We started from the data and our coding scheme evolved over several iterations. In total, this resulted in 2151 applied codes. Most segments had several codes associated to them, including to which concept it referred. Codes were clustered into several themes (e.g. General Use, Reflection Characteristics, Integration into Everyday Life) and with an iterative approach, some of these themes were then split into sub-categories. For example, 69 segments were coded as relating to a 'trigger', this was further analysed and split into multiple types of triggers. The results are presented according to these clusters.

### *Analysing Depth*

For the depth of reflection, a separate analysis was conducted. In our primary coding, 69 segments were coded in this category, but reviewing these segments did not provide a clear understanding of the depth in reflection. We therefore analysed all example media discussed in the interviews with a more theory-informed coding process. We found that reflection primarily occurred at the moment the media was created. We thus focussed our efforts on discussing how and why specific media examples were created. Other studies analysed the media itself (see for example, Isaacs et al., 2010), but for us this was not sufficient. The explanation in the interview was needed to provide insight in what level of reflection occurred. Of all the 283 created media items, 54 were discussed in the interview with sufficient details to include in this analysis.

This analysis was informed by several theories on depth of reflection, (for an overview of models on both iterative and vertical dimensions see e.g., Mann, Gordon & MacLeod, 2009). Initially, we started categorising our selection of 54 examples according to the four levels described by Hatton & Smith (1993): descriptive writing, descriptive reflection, dialogic reflection and critical reflection. However, we found that a large section of examples did not fit well with these categories. We have therefore fine-tuned the categorisation by merging some of the layers with the more nuanced seven category coding-scheme developed by Kember (2010). We added a second non-reflective category, based on Kember's (2010) description of introspection. Additionally, we merged the definitions of both these schemes for the critical reflection category, making this slightly broader. Still, this left us

with a number of examples that were diverse and challenging to code. For these examples, we adopted a more bottom-up approach, looking at which reflections were similar. This led us to four categories, which we then compared to the existing coding schemes, finding similarities with the levels of descriptive reflection and dialogic reflection. As a result, our final coding scheme consists of seven categories, which are discussed in Section 7.6.

## 7.5 Findings: Integrating Reflection in Everyday Life

The way participants use our concepts is influenced by their personal experience with reflection and their attitude towards reflection. We therefore first present an overview of these aspects, as discussed in the pre-interviews, in Table 7.2. This table additionally provides an overview of the order in which each participant received the concepts and the number of media that was created with each concept.

We will first present the general experience of using the concepts. We discuss how the use of the concepts compares to the scenarios that inspired them. Participants were not specifically instructed to use the concepts in these ways, so a wider variety of habits was seen. We therefore describe more in general how creation was integrated in everyday life habits, discussing the role of opportunity and triggers. This section is concluded with our findings on media retrieval.

### General use

During the period of use, participants created an average of 16 media instances with each concept. Averages for each concept are close (Balance 17, Cogito 15 and Dott 14) but there are large individual differences (see Table 7.2). Overall, participants engaged more in media *creation* and less in media *retrieval*. Specific numbers for retrieval cannot be given, as this was not tracked.

In a few cases, participants stopped using a device after a few days, this was seen with Balance (P02, P03 and P05) and with Cogito (P02). In two cases, this was due to technical difficulties with Balance, where an unreliable sensor made the interaction unpredictable and potentially frustrating. There were two participants who stopped using a concept after a few days because they disliked the concept (one case with both Balance and Cogito). Although the experiences of these participants regarding these concepts was therefore limited, their opinions were still included in the analysis. In the interview, some extra attention was given to discussing the potential value beyond technical difficulties.

Most interactions occurred during the late afternoon or evening and for most participants a moment of interaction meant creating a single media item. Table 7.3 (p. 186) shows examples of how each concept was used.

	Reflective experience & Attitude	Concept order	# of media created		
			B	C	D
<b>P01 Female 78</b>	Very reflective, in past worked as therapist, often reflects on a personal and emotional level. Is concerned with themes of late life stages.	D-C-B	29	28	33*
<b>P02 Female 45</b>	Is more pragmatic in her approach, focuses on the here-and-now. Often reflects in her occupation as teacher, during professional development courses.	C-D-B	9	6	14
<b>P03 Female 23</b>	Is reflective both on a personal and professional level. Learned to reflect (in writing) during study, in personal life sees reflection as being incorporated in many activities, including conversations.	B-D-C	6	9	15*
<b>P04 Male 62</b>	Reflections are diverse: ranging from considering essential life experiences to how to improve a recipe. Used to reflect more when he was still working. Used a diary during a specific time in his life.	B-C-D	16	11	13
<b>P05 Male 58</b>	Considers himself to be rather philosophical. As teacher reflects together with students on their progress. Frequently reflects in personal life as well, for example during his commute (focussed on short term) and while sitting and staring into his garden (more long-term).	C-B-D	4	18	8
<b>P06 Male 32</b>	Reflects often in work, is mainly oriented towards learning, working efficiently and improving himself. Reflects often after meetings or studying sessions. Keeps notes of personal lessons learned.	D-B-C	40	18	6

*Table 7.2 Overview of participants. For each participant, their attitude towards reflection as discussed in the pre-interview is summarized.*

*Column three presents the order in which each participant used the concept; B = Balance, C=Cogito, D = Dott.*

*\*For P01 and P03 an Android phone was lent to enable using the Dott application.*

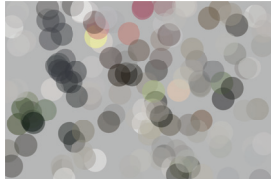

Balance	Cogito	Dott
<p><i>After all the trouble with the dentist yesterday, today was a good day again.</i></p> <p>P04: "There was a lot of stress at home and this was actually when it was over again."</p> <p><i>Escalation in the office resolved well, with the help of M.</i></p> <p><i>Could not resolve the escalation in the office on my own [...] I can develop my insight in this process more.</i></p> <p>P06: "On both sides I recorded a message. What I am content with [...] and what could be improved."</p>	<p>A good night sleep puts things in perspective.</p> <p>P01: "Well, it's a saying, but you really have to experience it yourself [...] so I really wanted to note that down."</p> <p>Weekend ! ! !</p> <p>P02: "This is just, pfew, passed another workweek. [...] It was just brief and to the point."</p>	 <p>P05: "This little pink dot, that's [the statue of] a piglet [...]. For me it's a criterium that there is some recognition in it for me."</p>  <p>P01: "I've ended with a certain goal I want to work towards [...]. To make this I made a composition with objects, here on the countertop"</p>

Table 7.3 Examples of how each concept was used.

For most, recording spoken messages on Balance felt somewhat awkward, either because it felt unnatural to talk to an inanimate object (P05) or because they didn't want to hear back their own voice (P04). Sending written messages to Cogito was a more familiar interaction. There was some variation in how the messages were sent, due to technical differences between phones and operators. As a result, some participants could easily read back messages on their phone, which they preferred over reading on the Cogito object, which was often considered to be somewhat cumbersome and impractical. Overall, creation with both Cogito and with Dott was considered to be simple. Most participants considered the Dott frame and visualisations an aesthetic addition to their interior. Most people used Dott to create visuals with existing recent photos, looking for a combination of pictures and settings that still contained some recognisable elements (example bottom-left). Most participants preferred to use a single photo rather than blending multiple, to make it easier to recognise elements. P01 used Dott in an exceptionally expressive way (exampleTable 7.3, bottom-right). She created visuals to represent her feelings and goals, using both existing photos



and creating new compositions as source material. Her use of Dott was deeper, more emotional and more iterative than that of most other participants, which made her an exception on many of the themes below.

### **Habit scenarios** [61 coded segments]

As mentioned in the design section, each concept was improved based on a specific scenario of reflection. During the pre-interview or the installation of the designs, we did not explain which scenario inspired which concept, nor instructed people to use a concept in that specific way. Instead, we discussed the specific scenario *after* a concept had been used. During these interviews, it became clear that the concepts were rarely used in the specific way of each scenario, to little surprise, as the designs were deliberately open-ended. We therefore draw conclusions on a more general level relating to these scenarios.

With several of the concepts, the moment of coming home or entering the room was mentioned as an important moment to *notice* the device and be *reminded* to reflect, even if the action occurred later. Such a triggering effect of visibility was also expected from Dott, especially in social interaction (see below).

Finally, the scenarios 'Pausing the Day' and 'Mini Reflections' inspired the design of Cogito. We expected sending messages to be so quick and easy that it could be done in between activities. However, for most people, this required more attention and time than we had thought, resulting in mainly sending a (number of) message(s) at the end of a day. This also relates to the fact that more elaborate reflection occurred at the moment of creation with all concepts, including Cogito.

#### *Social interaction*

Inspired by the Reflective Conversation scenario, we expected the direct visibility of the media in Dott to trigger such talk. It surprised us that instead the closed design of both Balance and Cogito, in which media is hidden, sparked more conversation. Partners were curious of what was captured and even a little suspicious. Some participants also indicated that using these devices sparked conversation more indirectly. For example, P6 wanted to record something, but did not know exactly what he wanted to say about this. He later had a conversation about the topic, to figure it out, but the media was not a direct trigger for such a conversation.

Other responses, either by family members or visitors often concerned the new (and surprising) object in the home. Resulting in conversation about the study-participation, rather than any of the specific media or reflections.

## Integrating creation into everyday life

For most participants, the creation of media did not have a fixed moment. This was seen strongest with two participants who had no fixed day-time activities such as work.

*I don't really have fixed times [to use the concepts], but then again, I don't work, my grandchildren are a bit older, so I have a lot of time on my hands [...] So I did it at many different moments and that suits me. I'm not the kind of person to say 'in the morning it has to be so and so' [with a fixed routine]. [P01 on Dott]*

Although to lesser extent, such variation was seen for almost all participants, both in terms of timing on the day and in terms of amount on each day (e.g., much was created on one day then nothing for several days). Dott had the most varied timing, several participants expressed that this was the easiest concept to use 'in between' other things as it was both mobile and light-hearted. Balance was used on a more regular moment by half of the participants

*In my case just in the evening, then it's quieter here, than I have nothing around me for a moment, then I can do those things. During the day, that's not for me, because I constantly have the kids asking questions and such. [P02 on Cogito]*

Even when creation happened on similar moments on most days, this was not because it was planned as such. Use happened on a regular moment because opportunity for creation arose on similar times each day, usually in the evening.

### *Opportunity [73 coded segments]*

Rather than a fixed timing, the devices were used when *opportunity* arose, 73 segments from the interviews were coded in this category, including the quote by P02 above. But what constitutes an opportunity?

*That's when you have time to yourself, start of the evening as well, especially if I'm alone, not if other people are at home. I really consider this something to use when you are alone. [P05 on Cogito]*

*It takes time, to put [thoughts] into words, what you considered good or bad. And to do that, that's often end of the day. Then you can sit down and think: what went well, what went bad, and usually I would [use Balance] then. [P06 on Balance]*

These quotes include several themes there were mentioned by most participants. This includes a state of *calmness* (13 codes, 5 out of 6 participants,). Additionally, most considered creation easiest when *alone* (6 codes, 3/6p) and when there was some *time* (5 codes, 3/6p). For most participants, opportunity arose most when they were at *home* (5 codes, 4/6p). Within the home, the devices were mostly located within a shared space, such as the living room, which created some challenges for the preferred solidarity. The creation with Cogito and Dott was appreciated for being more mobile, even though in practice the mobile use was often limited to within the house. In most cases, because of these characteristics,

opportunity did not arise *during* an experience or activity. Opportunity arose more when *looking back* at an experience (or the day as a whole). As such, moments included coming home (looking back at the day) or Saturday morning (looking back at the week), or for example lunch break at work (looking back at events of that morning). Most participants did not create any media during experiences, not even for Cogito or Dott, that were intended to be quick. In some cases, a picture for Dott was created but the abstraction was made later.

*Trigger [87 coded segments]*

As timing was not fixed, we are also interested in what triggered people to create something. The physical presence (13 segments, 4/6p) of the different concepts was an important trigger to create something. People saw the device, which triggered them to make something. Sometimes the making started from a thought that was already in their mind, other times the presence of the object triggered to start thinking. However, not in all cases people had something to record when they were triggered by the presence of the device.

*If I would come home I would see it and think, I could record something, but often I didn't have anything specific (on my mind) that I wanted to record.*

*[P03 on Balance]*

As the quote shows, the trigger of physical presence connects to the routine of 'coming home' as the device was often noticed when entering the room. However, the quote also shows that there needs to be an internal motivation as well. In several cases, people were primarily internally triggered to reflect and create. This was sparked by an *emotion* (9 segments, 5/6p) or an *insight* (6 segments 3/6p).

*I came home happily, that time, I think, the time is not included, is it? [I think] it was beginning of the evening, after dinner, that you look back at the day with a lot of fulfilment. [P05 on Cogito]*

Both for emotions and insights, it was expressed that this had to be 'worthwhile', significantly emotional or a significant insight.

In other cases, *external triggers* (9 codes 2/6p) lead to reflection and creation. For one participant, conversations with others triggered creation several times, with different concepts (P03). P01 was frequently triggered by external inspiration such as art or books. Finally, an important trigger was seen in people's desire to comply with the *research participation* (14 codes, 4/6p). Often, this coincided with seeing the device or with being reminded of the research by an upcoming appointment.

For the different concepts, more specific triggers were observed. In the case of Dott people were frequently triggered by receiving new photos (from others) or by making a photo explicitly for Dott (triggered by the situation). With Dott, use was also frequently triggered by

curiosity: how would this photo turn out on the frame, rather than more reflective intentions (see Figure, 7.10). Additionally, creation was sometimes triggered by seeing the old visual and wanting something different.

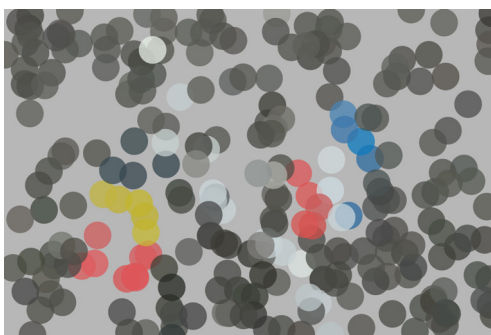
The design of Cogito used a rim of lights as trigger by indicating if the device had not received anything in a long time (thus inviting to create) or was filled with unread messages (thus inviting to retrieve). Several participants mentioned the lights, but only for one participant this was a real trigger to create. Others expressed that the lights were not clearly visible enough (as it was summer, and usually light inside) or the different states were too difficult to distinguish. Balance used dynamic behaviour as well to serve as trigger, the position of Balance restored to the centre over time. However, the position of the Balance had little meaning to the participants, as the addition of symbolic 'weight' to the messages was not used (influence by technical difficulties as well). This system behaviour did therefore not provide the trigger to create as expected.

### **Integrating retrieval into everyday life** [99 coded segments]

With retrieval, we refer to the moment of 'using' the media that has been created earlier. This relates to reading messages (Cogito), listening to messages (Balance) and looking at the current or earlier visuals (Dott). This does not actually require actively retrieving files with these concepts, but is done by opening Cogito, tapping Balance or simply looking at Dott.

As mentioned in the section on general use, most participants focused on creating media and retrieved media less frequently.

*As I said, I wasn't really focussed on it, so I think I might have read it back four or five times. But I haven't used it that often.* [P06 on Cogito]



*"It is more just to see, how those colours would turn up on the screen, [instead of] a way to express my mood. I wanted to see [what would happen] because you have very few colours, but at the same time they are very recognisable."* [P04]

Figure 7.10 Example of P04 on Dott, illustrating curiosity as a trigger

From the coded segments on media retrieval, the largest amount related to Dott (45/99, 6/6p). It can be assumed that retrieval with Dott occurred more frequently, as it requires no active interaction; the visual is simply always present in the room, making retrieval easy or even implicit.

For many people, the 'success' of retrieving some media depended on whether they would remember the context of creation, or what the media represented for them. With Cogito and Balance, the brief messages were often sufficient to cue rich recall:

*[Just] to keep it brief. And then I hear by the tone of voice [what I mean] and I can immediately recall the whole situation. [P01 on Balance]*

For Dott, responses were diverse. Some people considered it easy to recall what the visual represented, for others it became more or less meaningless. This seems to partially depend on the effort invested in creating the visual and the significance of the represented experience. If the experience was very unique, it was easier to recall, even from an abstract representation.

*Then it has to be something that is stored in your memory very well, this I will remember, but with other photos, maybe I couldn't remember so well.*

*[P04 on Dott]*

If the user invested a lot of effort in creating an appealing visual, the connection between experience and visual was also more actively made, making it easier to remember. During the interview, several visuals were also seen of which participants could no longer tell what it was or why it had been created, even though the visual was a maximum of six weeks old.

As these examples show, when looking at the visuals most people recalled the past experience that it represented. P06, instead, used the photo that was on display as a trigger to think about his current day, even if it was unrelated to the visual.

*I do think about it, because I have put up that visual, so you think about the photo and go back to that moment. But I try especially to think back about the current day. It is not [a trigger to] reflect about what happened at [the moment of] the shot. I try to [reflect] about today. [P06 on Dott]*

For him, the photo frame was a trigger to reflect on the day, more than an actual representation of an experience,

### **Impact on present mood [14 coded segments]**

Retrieval was often explained as having an impact on present mood, this was especially seen with positive visuals (Dott), but also with positive messages (on both Balance and Cogito). When retrieving such media, people remembered what had happened or simply became happy from the bright colours of a visual. Some participants even mentioned posi-

tive responses at the moment of retrieving more negative messages, for example demonstrated in the quote by P05, who read a message on being annoyed by his pupils who would not pay attention:

*[It brings forward] a smile, yes. At that moment, I am fed up more than when I read it back. If I read it, I just think, yes, that's how it goes. [P05 on Cogito]*

In contrast to such a positive response, the visuals of Dott were also more often mentioned as having a potentially negative influence. Especially darker or more chaotic images would make people feel frustrated or annoyed and would trigger new creation because they wanted the visual appearance of Dott to change. In these cases, this emotional effect had little connection to the original event, even photos of positive events could turn out too chaotic or dark.

## 7.6 Findings: Mediating Reflection

In this section, we focus more specifically on the characteristics of the reflection which occurred in the usage of our concepts. The first few aspects are based on codes from our open coding as described in Section 7.4. We start with how different reflections were connected and how attention was given to different temporal perspectives. We then discuss how participants perceived the difference in depth of reflection between the concepts. We performed an additional analysis for this depth, as the self-reported comparisons gave little insight. Based on the literature on reflecting, a specific coding scheme was developed for this analysis. A large part of this section is dedicated to this analysis of depth, as we consider it one of the most important criteria for reflection.

### Reflection: continuation [44 coded segments]

We were interested if people made connections between different media items, either with themes or causal relationships, as this could be seen as a way depth might be achieved in reflecting. We, therefor, asked all participants to rank the concepts on a scale from 'singular reflections' to 'connected reflections', see Figure 7.11.

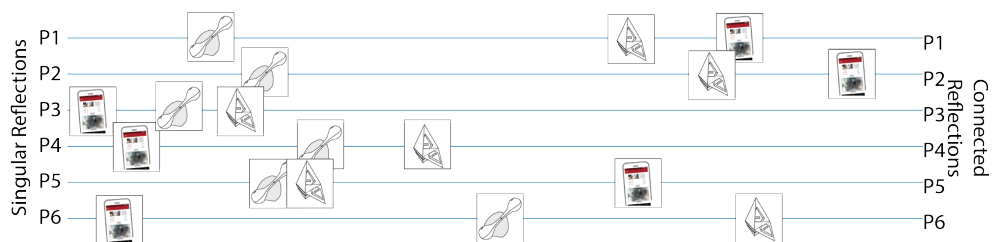


Figure 7.11 Ranking of all concepts on the scale from singular to connected, made

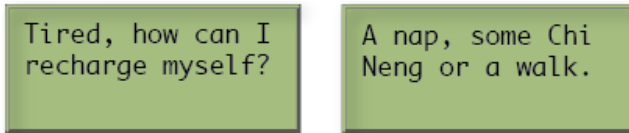


Figure 7.12 Cogito messages by P01 that show a connection.

Many referred to the reflections as being mainly singular: every reflection and media-item was a thought in itself, rather than a continuation of previous thoughts. In part, this was influenced by the open-ended nature of the concepts. There was a wide variety of topics and no specific goal or trajectory that the reflections related to. This made it more challenging to make connections.

The highest agreement is seen with Balance, which almost all participants considered to be singular reflections. The random replay of media with Balance made it difficult to connect to relevant earlier reflections.

*I consider Balance the most difficult in use, because you press the button and expect to hear the [last] recording back, but then it's shuffled. [P02 on Balance]*

*With [Cogito] I had more connected reflections because every time I could easily read previous messages and keep a certain line [of thought] going. [P01 on Cogito]*

Reading back earlier messages sent to Cogito was easy, often at a glance on their phone before creating, which allowed continuing an earlier thought. We expected people to read multiple messages in Cogito and look for similarities or differences, stimulating connections. However, in retrieving the messages most people focused on one message at a time. Additionally, retrieving media rarely triggered new creation, which could be another way to make connections to the present.

Although larger thematic connections were rarely seen, we see some connections being made in pairs of messages, containing a goal or question and a response. P06 tried to use Cogito in specifically this way. Similarly, P01 sent two messages a few hours apart, see Figure 7.12. In other moments, very similar messages occurred two or three times, because something was clearly on participants' mind, although no explicit connections between them were made.

## Reflection: temporal dimension [65 coded segments]

We asked participants to indicate on a timeline to which time-period the reflections with each concept related (see Figure 7.13 for an example). In addition to these self-reported values, we looked at the examples for each concept to see what temporal dimension they included.

The uses of Balance and Cogito were mostly similar: mainly present-focussed, with connections to the future being made in the form of lessons or goals. These goals are more elaborately discussed in the section on Descriptive Reflection (p.199). Connections to the past were rarer, only in two cases [P1 & P4] there were references to a more distant past, but this was due to clear external influences. With P1, reading a book on behavioural patterns that evolve in childhood triggered this and for P4 it was a message on a terminally ill friend of 20 years. Only with such explicit triggers, connections to a more distant past were being made. Dott has an even narrower focus, mostly on the recent past. This was mainly because visuals are based on existing photos, for which recent material was primarily used. Reflections often remained focussed to the event that was depicted on that photo. The abstract visualisation is not seen as an expression in itself, but as a ‘hyperlink’ to the photo, which

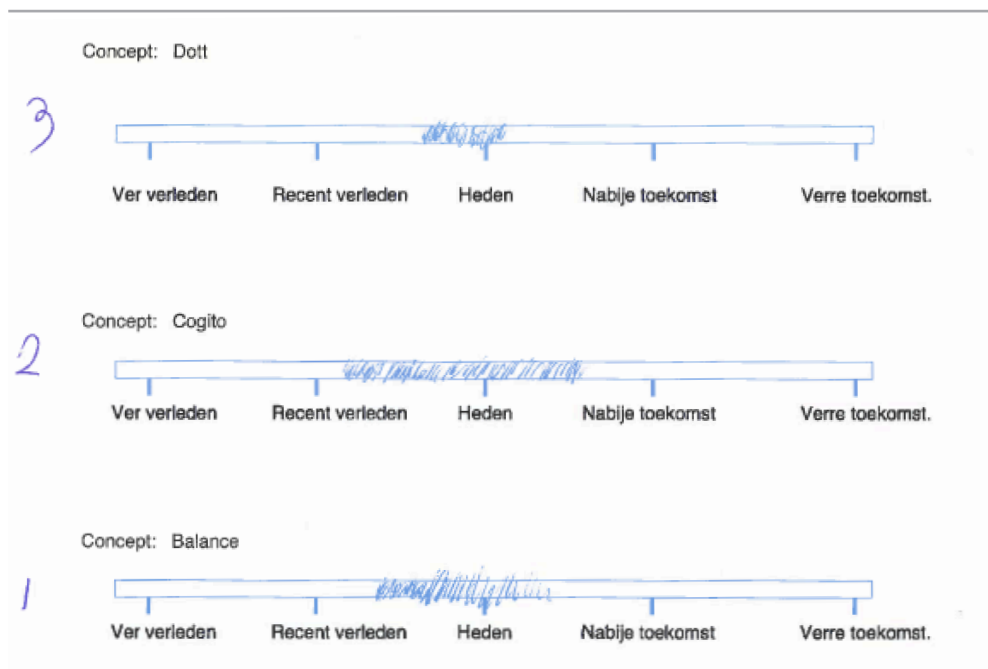


Figure 7.13 Example of indication of temporal dimensions by one of the participants.  
Each timeline reads from left to right:  
“distant past - recent past - present - near future - distant future”.



in turn is a cue to the event. P01 is an exception, with her deeper, more expressive use of Dott, she was reflecting on life phases and setting goals. She was therefore very future oriented with Dott.

### Self-reported depth [69 coded segments]

Similar to the ranking scale used for the connected or singular reflections, we asked participants to rank all concepts on the depth in the reflections, see Figure 7.14. From these rankings, we saw that the extent to which depth is reached in spoken or written word is strongly influenced by personal preference. Some participants feel more comfortable to express such thoughts in spoken word and others in text. With Balance, P04 and P05 had a clear aversion to record more deeper thoughts, as to them, it felt awkward to speak something like that towards an object. P03 and P06 reached more depth with Balance, each in a different way: P06 reached more depth because he could use the split between a positive and a negative aspect in a very useful way. P03 reached depth because she experienced a threshold that required what she recorded to be more important or significant.

*“It is also that if you are going to say something, out loud, then it really makes you think what you are going to say, at least in my opinion. We are so used to typing, but recording [...] your voice, you don’t do that so often, [...] That was a bigger deal for me than writing and sending [...]. Especially do I think it’s worthwhile to record? Typing a message is not that “valuable” but recording something is more of a hassle, so...” [P03 on Balance]*

For most participants, creating messages with Cogito reached some level of depth. This concept has bigger potential to reach depth when reading multiple messages and looking for connections, but this was rarely done (as discussed above in the section on 'continuation'). The interview was now in some cases a stimulant to reflect across multiple messages,

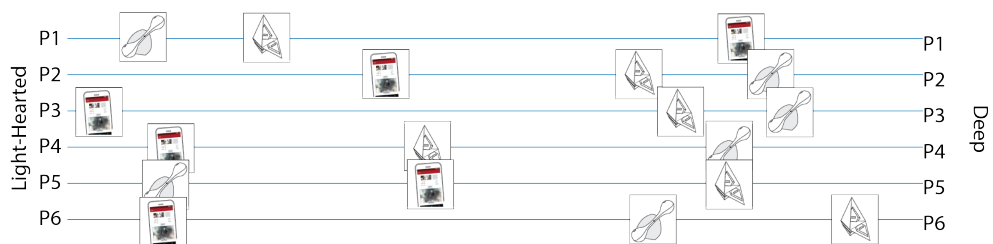


Figure 7.14 Ranking of all concepts on the scale from light-hearted to deep, made by each participant in the concluding interview.

for example for P06, who even made connections between reflections made with Balance and Cogito:

*“Well, now that I talk about it with you, [something] really stands out. I send [to Balance] at the start that I was annoyed because [my partner]. didn’t respond as I had expected when I put up a lamp [...]. And now my last message to Cogito is “Annoyed that I don’t get more attention from [partner], do I give her enough attention?”. Yes, maybe something like that, that it can surface over time, do you give each other enough attention.” [P06]*

Dott was considered to be most light-hearted and even superficial by most participants. The visuals were mainly made on an aesthetic level, with little expressivity. Recall usually remained on a superficial level (‘oh yeah that happened’). In all concepts, the ‘light-heartedness’ is also seen as an advantage. Participants thought it made it easier to do in short moments and is useful if a person has a tendency to make reflections very deep and emotional.

### Analysing depth of reflection

For this additional analysis, we used the examples discussed in the interview. We analysed 54 examples, see Table 7.4 for the spread across participants and concepts. These examples were selected because they included substantial explanation of what and how the media was created, providing sufficient information to assess the level of reflection. For Balance, we could include 18 examples, out of 104 created media items. For Cogito, this was 24 (out of 90) and for Dott only 12 (out of 89) were discussed with sufficient detail for inclusion in this analysis.

	Balance	Cogito	Dott
P1	3	6	3
P2	0	3	2
P3	3	4	3
P4	4	4	2
P5	2	5	2
P6	6	2	0
	18	24	12

*Table 7.4 Examples included in the analysis of depth of reflection. Rows show spread across participants, columns show spread across concepts.*

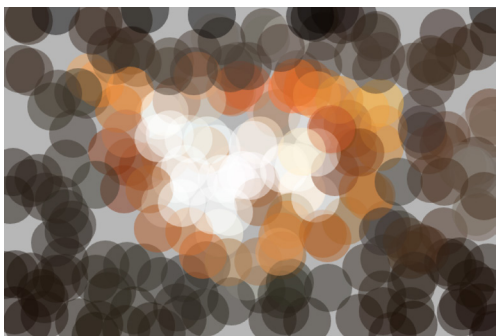
By combining existing coding schemes by Hatton & Smith (1993) and Kember (2010) with bottom-up coding, the following coding scheme was developed:

- Description (non-reflective) (6 examples)
- Introspection (non-reflective) (7 examples)
- Descriptive Reflection (24 examples)
  - Instance with explanation (11 examples)
  - Instance with goal (4 examples)
  - Generalisation (9 examples)
- Dialogic reflection (5 examples)
- Critical Reflection (5 examples)
- Uncategorised (6 examples)

### ***Description***

Hatton & Smith (1993) used the category Descriptive Writing to cluster written segments that described events in a non-reflective way, simply stating what had happened. Similarly, we use this category to describe examples that in both media and explanation focussed on describing what had happened with very little (or no) evidence of reflective or interpretative thought. This category contains only examples of Dott, a total number of six examples.

Similar to the example by P03 in Figure 7.15, participants mostly explained the visual and the photo on which it had been based. Such explanation does not give any value or importance to the experience, nor does it include explicit emotion or consideration of how it had been represented. In these cases, the event had usually been chosen because of the aesthetic qualities of the photo or visual, rather than because of the significance of the event or related thoughts.



*P03: "I was lying on my bed and listening to music on my iPad on Spotify. This is the album cover, so this [grey part] is the Spotify screen with [in the middle] the album. It was a pretty boring photo, because there are no people on it or anything, it was really just the album cover, but on [Dott] I thought it was kind of cool. Because now it is really easy to recognise".*

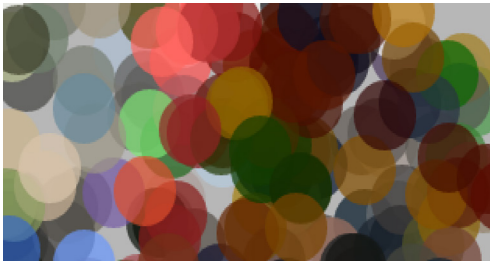
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Figure 7.15 Dott visual by P03 illustrating description.

### ***Introspection***

Most categorisations of reflection levels do not include specific references to affection. This was also observed by Kember (2010), who included a coding category ‘introspection’ on the level of non-reflective categories. With this category, we adhere to his definition that these examples include an expression of feelings. They do not include the explanation of how or why these feelings have developed, as that would be considered reflective thought. The category contained examples of all concepts, with a total of seven examples, with a bit more of the Balance concept.

The feelings we see expressed in this category are usually not very intense or severe. They mostly consider being happy or content (see for example Figure 7.16. Two examples included more negative feelings, being nervous or being sad. In some cases, the emotion was somewhat mentioned in the message (Cogito or Balance) but in more cases, it was implicit and only became clear from the explanation. The message by P06 (Figure 7.17), for example, is merely descriptive, and although it was a spoken message in Balance, it contained very little emotion in his tone of voice. But P6 recorded it on the positive side and explained it was a great feeling of relief when this happened. However, little explanation about the development of this feeling or other exploration of what had happened was given, which is why we did not code it as being more reflective.



*P02: This is [...] from the “playground days”. That must have been from the bouncy castle, here look [at the photo]. Those were really fun [days], well actually just a two-hour morning. [...] But that [playground] is really a little paradise and it was just such a fun morning”*

---

*Figure 7.16 Dott visual by P02 illustrating introspection.*



*P06: “We had a really long discussion with my father [who suffers from depression] and he didn’t want to sign and he wouldn’t sign. But without him, the whole thing can’t happen. [...]. So if you have finally convinced the man to sign, it really give you a “YES”-feeling.”*

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*Figure 7.17 Balance recording by P06 illustrating introspection.*

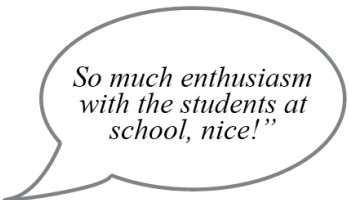
### ***Descriptive Reflection***

The level of descriptive reflection is seen as the first or lowest level of reflection, described by Hatton & Smith (1995, p. 48) as *“not only a description of events, but some attempt to provide reason or justification for events or actions, but in a reporting or descriptive way”*. For the type of reflection in our study, we interpreted this category as including some level of explanation or consequence. We found three categories that can be connected to this level: 'Instance with explanation', 'Instance with Goal' and 'Generalisation'. Together, these make 'descriptive reflection' our most commonly seen level of reflection, with a total of 24 examples.

#### *Instance with explanation*

A lot of the examples in our study, considered a specific experience (rather than a group of experiences or a time period). In this category, we clustered examples that added some aspect of reflective thought to such an experience. Frequently, this included an emotion and some arguments for why this emotion arose or why it was considered important. As we adhere to Kember's view that this is more than mere introspection, we consider this to be descriptive reflection. Especially because the explanations are often quite simple and are not part of a more elaborate or deliberate process of unravelling. The category contains a similar number of messages from both Cogito and Balance, but only a single Dott example.

Reflections such as P05's message on Balance (Figure 7.18) show several elements: an event (practice exams), an emotion (happiness) and an underlying reason (others are thankful, one feels important). Most of the reflections in this category contain these elements, but there is some difference in which of these are also expressed in the media. In P05's message above, for example, the actual event (practice exams) is not mentioned, just a consequence of it (enthusiastic students). In other cases, the message itself was more explanatory, including both the event and explanation. Other media examples include only an emotion, such as P01's message to Cogito (Figure 7.19, p.200).

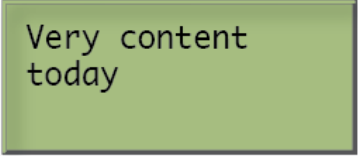


*So much enthusiasm with the students at school, nice!”*

*P05: “Yes, that must have been the practice exams, those are super important and really nerve-wrecking, because one day later they have to do the actual exam. And well, it’s just a fun day, a lot of people are continuously claiming your time and very thankful if you take half an hour of your time for them.”*

*Figure 7.18 Balance recording by P06 illustrating introspection.*

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Very content  
today

P01: *“That’s connected to [an earlier message], to do the things I like to do, which you tend to forget by all the stupid chores that need to be done.”*

---

Figure 7.19 Balance recording by P06 illustrating introspection.

In the interview, she explained this connected to an earlier message, in which she reminds herself to make more time for herself. This example shows that in some cases, the depth of reflection emerged over several media items.

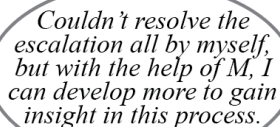
*Instance with goal*

Similar to the category above, this category focuses on reflections that describe a specific instance of an experience. However, rather than explore why something had happened or why a certain feeling was felt, the reflections focus on how to address the experience in the future. These goals were very specific to the situations.

P03 reflected on an experience that she knew would be recurring next year, expressing that she enjoyed an annual sailing trip, although beforehand she doubted about joining. As she explained:

*“When I came home I thought, I have to document this, that I actually really like it, that, even if I don’t feel like it, I should really go, because it is just so much fun. So that’s why I sent that message” [P03 on Cogito]*

Another example, from P06’s use of Balance, similarly related to a very specific event, but the goal focussed more on a trajectory (see Figure 7.20). We consider these reflections to be different from the previous category, because they included a specific goal so deliberately. However, in terms of depth of reflection, they are both on a similar, descriptive level.



*Couldn't resolve the escalation all by myself, but with the help of M, I can develop more to gain insight in this process.*

P06: *“I was content that we did not connect ourselves to something that we did not agree upon. If I think what I could do better, I wasn’t able to solve it independently, I needed someone else, and in hindsight, that might not have been needed. If I develop myself further, it will go better [in the future].”*

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Figure 7.20 Balance recording by P06 illustrating introspection.

### *Generalisation*

When clustering the examples bottom-up, this category quickly developed, containing examples from both Cogito and Balance. We were surprised to find that there were so many examples phrased in similar ways: representing a general lesson or reminder to self. Similar to the previous category, goals or future plans were formulated, but rather than at a specific level, these were formulated much more in general. To be able to come to a generalisation, at least some level of reflection is required. However, the examples in this category did not show explicit proof of more deep or deliberate exploration, which is why we consider it descriptive reflection rather than explorative reflection. It seemed to be pretty straight-forward lessons, often phrased in familiar ways, such as well-known sayings or expressions. See for example the messages by P01 in Figure 7.21.

The messages included both reminders for the present (such as P01's message above, Figure 7.21, mid) and for the future (such as P03's message, Figure 7.21 right). It was interesting to see that participants found the concepts to be especially useful to record these kinds of messages. Several mentioned that it felt more 'useful' because these are the kind of messages that are more meaningful and useful to retrieve sometime in the future.

### ***Explorative Reflection***

In our clustering, we developed a category in which an issue or situation was further explored, with five examples. We considered these examples to demonstrate a deeper level of reflection than those in descriptive reflection, as multiple possible explanations were explicitly considered. A second characteristic was that all these issues were unresolved, an answer was not found or a final explanation was not given. One of the clearest examples was given by P04, sent to Cogito just before leaving for a two-day trip.

In his explanation, (see Figure 7.22. p.202) it becomes clear that the message is part of his search for an explanation. He considered the experience suitable for a message to Cogito, exactly because of the fact the he had not found an answer yet:

*"Because I am wondering why. I can't find a proper reason. You would expect that already during preparation I do not feel like going. But that only happens at the moment we are about to leave. Then I think "I have so much to do, why do I have to go" [P04 on Cogito]*

---

A night sleep helps to put things into perspective.

I first have to take care of myself

If I ever buy a car, it should be an automatic

---

Figure 7.21 Cogito messages illustrating generalisations. Left and mid by P01, right by P03.

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Strange to realise again and again. I look forward to a day out during the booking, but just before departure, I just as well want to stay at home.

P04: "At the moment we need to leave, I think, 'sigh' a kind of stress or something, then I'd just as well stay at home. But once I am off and the door is closed then it is gone again. That's just so weird. [...] I have it all the time and I can't figure out why that is?"

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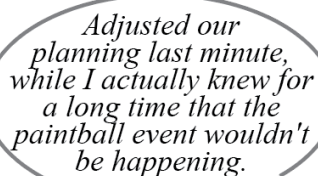
Figure 7.22 Cogito message from P04 illustrating explorative reflection.

In some cases, the questions were rather implicit, as we saw in this message by P06 (Figure 7.23). In our interpretation, this reflection shows an implicit question of "why do I do this?"

We see similarities between our cluster and Hatton & Smith's description of dialogic reflection, although we do not believe them to be exactly the same. In accordance with their definition, these examples show a 'stepping back' from the events and, more specifically explore "possible alternatives for explaining and hypothesising" (Hatton and Smith, 1995, p.48). The examples show a certain 'discourse with the self', however, our examples share a specific quality that is not addressed by Hatton & Smith in the fact that a final answer or resolution is not found. Fleck & Fitzpatrick (2010) explain that this level includes 'cycles of interpreting and questioning' and it could be said that the media in this category was made somewhere in the middle of such a 'cycle'.

### **Critical Reflection**

For our cluster of critical reflection, we merged two different views on this level of reflection. The first, based on Hatton & Smith (1993), focusses on connecting outwards. It refers to reflections that take into account their socio-political or historical context. The second, based on Mezirow (1991), focusses more on turning inwards, critically examining one's previous beliefs and presuppositions. Although initially, both views seem opposite, turning



Adjusted our planning last minute, while I actually knew for a long time that the paintball event wouldn't be happening.

P06: "This Friday I would go paint balling, but we cancelled last minute, while actually... I knew for a long time that it wasn't going to happen. But I hadn't cancelled or moved it. [...] In the end, [it resulted in] just all kinds of trouble. While it wasn't needed, that's actually a waste."

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Figure 7.23 Balance recording by P06 illustrating explorative reflection.





P01: "I ended with a goal I wanted to reach. I do a lot of things all together and I am very curious so I am always looking to do new things. That's why there are so many dots. Here, this, it mainly has to do with colours [...]. So, red reminds me that I shouldn't be too individualistic, that I become selfish. The violet colours that are more at the top, connect to my spiritual

life, which I want to keep. Depth. There is also a little green dot, that's what I know I can do. I am firmly with my feet on the ground and I love nature, so that's all well. But how am I going to bring it all into balance?"

---

Figure 7.24 Dott visual from P01 illustrating critical reflection.

outwards or inwards, we see similarities because both rely on making connections to one's personal values. The examples that we have gathered in this cluster, might not be seen as sufficiently 'critical' for the specific coding schemes by e.g. Kember (2010) or Hatton & Smith (1995). However, for us, it was worthwhile to distinguish a level that was the most critical, as seen within our sample of everyday life reflection.

In this cluster, we have three examples of P01's reflective use of Dott and two additional messages to Cogito (by P01 and P03). The clearest example of P01's critical reflections with Dott is seen in the visual that she made to end her period of use (see Figure 7.24), formulating a personal goal.

This example shows how P01 reflects on her deeper personal values. Because she had such a specific goal for this visualisation (expressing a goal), she made a specific composition with objects on her kitchen counter top that would create the right colour palette. This example strongly turns inwards, to personal values. The example in Figure 7.25 (p. 204) of the message send by P03 to Cogito, also relates to personal values but is more connected to its wider societal context. Again, this includes a goal, although not all examples in this category were this much goal oriented. In this message, P03 connects her personal behaviour to her values regarding society. The high occurrence of a single participant's examples in this cluster (4/5 examples) also shows that this level of reflection requires a certain personality or can be seen as a skill that needs to be developed.

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It is better to buy some clothes of more expensive quality than to buy a lot of cheap clothing.

*P03: "That's something I've been considering the past years, which I always want to do but then forget again. Then I end up at H&M and buy the cheap stuff. But that is something I want to be stricter about for myself, because I know that in the long run it makes me happier. [...] It should just become a habit for me. So I thought, if I send this, then I get reminded as well."*

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*Figure 7.25 Cogito message from P03 illustrating critical reflection.*

## 7.7 Discussion

The research-through-design study comparing Balance, Cogito and Dott gave rich insights in the potential of media based reflection technology. In this section, we first discuss our results regarding our study design. Secondly, we discuss our primary contribution: showing that reflection can be supported in creation rather than (only) retrieval. We explore what it means to reflect within the context of the home and how open-endedness plays a role in this context. Finally, we discuss if and how, depth in reflection can be supported through design.

### Explorative comparative study

Comparing multiple designs, in-the-wild, and involving participants in this comparison, is a rarely seen approach. Here, we share some of the insights we gained regarding this combination of exploration, comparison and evaluation.

In the design and development, we experienced that it is challenging to develop three concepts that are simultaneously sufficiently similar and interestingly different. In hindsight, Cogito and Balance were too similar, the reliance of both concepts on words (and thus on verbalising thoughts) made them more similar to each other and very different from Dott. Focussing the audio concept on soundscapes or environmental recordings could have made the concepts more equally spread across the 'design space' (Gaver & Martin, 2000). To allow participants to experience the concepts first-hand, they were all implemented in interactive prototypes. We aimed to integrate role, implementation and look-and-feel into each prototype (Houde & Hill, 1997). However, the technical implementations created some obstacles that inhibited evaluating the concepts to their full potential. For example, the force sensors in Balance were unstable, which made recording more difficult. Secondly, the design features that were intended to serve as peripheral reminders (restoring position of Balance over time or fading lights in Cogito) were too subtle in most home environments.

Some participants could easily use the prototypes as a starting point (moving beyond technical challenges), not judging it by its actuality but by its potential (Odom et al., 2016) but for others, this created an unsurmountable obstacle.

In the final interview, we emphasized the differences between the concepts by using comparative scales (similar to Werff et al., 2017). This was a useful way to stimulate people to view the concepts from different perspectives. However, the strong emphasis on differences, made it more challenging for us to analyse the similarities between the concepts. The systems share many characteristics as well, such as individual home use, combining media creation and retrieval, and having a low threshold. Prompting the participants to discuss the similarities more explicitly would have strengthened our insights in this area.

## **Reflection in creation**

The use of Balance, Cogito and Dott showed that many participants reflected during the *creation* of media. We see this as the primary contribution of this study, because design for reflection (with media), almost always focusses on media retrieval. In some cases, this media is primarily system collected (for example by Sensecam [Lindley et al., 2011], or sensor-based [Lin et al., 2006; Consolvo et al., 2008]). If the users are involved, media creation is often focussed on creating ‘logs of events for future retrieval’ (Fleck & Fitzpatrick, 2010).

Existing mechanisms to support reflection in creation often use prompts (Fessler et al., 2017), an approach especially taken to trigger written reflection. As an alternative to such content-triggers, we introduced using opportunity or direction triggers (Chapter 6). Cogito relied on opportunity triggers while Dott and Balance provided some direction. We found that direction triggers are easier to interpret and to make meaningful for most people, compared to only giving opportunity. In addition to such direction triggers, we recognise several mechanisms in our designs that supported reflection in creation. Primarily, we see that the concepts supported reflection by stimulating to *externalise* thoughts and feelings (thus being expression driven, Chapter 6). Isaacs et al. (2010), found externalising to be just the first step, with reflection mainly occurring on retrieval of media, but we saw reflection already (and primarily) happening in the creation phase. Especially with Cogito and Balance, creating media required to bring into words what one is thinking or feeling. In addition, the *briefness* of the messages was often seen as a stimulant to get to the core of a thought and make reflections more specific. Other mechanisms that supported reflection were seen in the possibility to *adjust the media* during creation (thus resulting in mini-iteration) and by having a certain *threshold*. The dominance of supporting reflection through media retrieval can be seen in the suggested techniques for designing for reflection as presented in the

literature review by Fleck & Fitzpatrick (2010). Their techniques include asking questions, presenting different perspectives on media, using recorded media as an external view and reorganizing media. These are valuable techniques to which our study contributes new ways of supporting reflection in the moment of creation. Still, reflection can of course be well supported during the review of previous media or even by repurposing or remixing previous media as suggested in Chapter 3. We consider our findings on supporting reflection during creation as a more novel contribution, as reflection is more often stimulated in retrieval or review.

## **Design for domestic reflection**

In both the pre-interviews and the evaluation it became clear that 'home' is an important place for reflection. It was seen as one of the core characteristics of good 'opportunity' for reflection and even mobile creation was often done at home. In the literature on reflection, few examples are seen of such 'domestic reflection', which is influenced by the dominant focus on educational or professional aims. Others focus more on the interaction with (mobile) systems, with little reference to the context in which such interactions take place (Li, Dey & Forlizzi, 2010). We conclude that for reflection to be integrated into everyday life, considering its context is crucial.

The value of the home as a physical context is more explicitly recognized in the area of design for personal remembering. There, home is seen as a shared place, in which objects of memory take a crucial role (Petrelli et al., 2008). In this context, objects are used for comfort, as a conversation starter and to display identity (Petrelli et al., 2008). In these examples, more attention is given to the home as a social space, which is shared with family members, friends and others. With our focus on individual use, our insights into designing for the home as a social context are limited. To integrate reflection into everyday life it is clear that children, housemates, or family members play a role, for example because they cause a disturbance, are involved in reflective conversations or because they are curious. Even with designs aimed at the individual, home as a social context deserves more attention.

Several researchers have explored giving digital media a presence in the home and found instances of reflective conversation (Helmes et al., 2011; Odom et al., 2014), even though their primary aim was for other types of remembering such as reminiscence (Sellen & Whittaker, 2010). Petrelli Whittaker & Brockmeier (2008) found that mementoes serving reflective purposes were more often found in private rooms, such as bedrooms or studies. The area of design for reflection would benefit from taking such a nuanced view on the context of the systems and processes.

As mentioned above, *'home'* was one of the core attributes of good *opportunity for reflection*. As the open-ended designs were not used in a pre-scribed way (in timing, process or otherwise), use relied on opportunity and triggers, stimulating the creation of flexible habits. On a larger scale, we have seen (especially in Chapter 5), that the need for reflection is similarly irregular, changing with certain periods and across the life span (see also Staudinger, 2001). Rather than aiming for establishing habits "from now on and until forever" (Fogg, 2009), it would be valuable to consider designing reflective technology for temporal, cyclic or irregular use. This requires a perspective in which periods of non-use (or 'lapses', see Epstein et al., 2016) are accepted and integrated in the design. A system could for example stimulate reviewing earlier material, which was found to be most successful if no explicit prompts for re-uptake were given (Epstein et al., 2016). Making the media accessible on other platforms (such as a phone or computer) might enable this better, as a dedicated device in non-use might otherwise be forgotten, inhibiting building a reflective habit. In general, an approach that focusses on irregular or cyclic use would benefit from designing dynamic systems. A combination of active and reactive behaviour stimulates exploration in open-ended systems (De Valk, Bekker & Eggen, 2013) and can provide peripheral triggers in the home. Cogito, for example, used light patterns to achieve this, which could be even more dynamic. Allowing users to adjust dynamic behaviour of the concepts to specific (family) situation is beneficial, as it allows the system and its 'agency' to take a suitable role within the home (Helmes et al., 2011).

*'Time'* was a second important attribute of good opportunity, as both reflection and system interaction take time. In a certain sense, taking a distance from everyday life while being integrated into everyday life, are add odds with each other. It might be one of the reasons why transitional moments were seen in everyday practices (Chapter 5). Other current habits were interwoven with everyday practices as well, for example by existing in between activities or by 'pausing'. In our evaluation, we saw that, even during short moments, a reflective interaction can stimulate taking a small distance. However, when aiming to support deeper reflection (see section on 'Depth in Reflection', p.209), more elaborate interaction might take more time. Reaching more depth also requires more mental distance from an experience (which a system can help, for example by providing an external perspective). Integrating this into everyday life will become even more challenging.

## **Design for open-ended reflection**

We designed our concepts to support open-ended reflection, both in terms of content and regarding the integration into everyday life. Some participants had trouble determining how to use the concepts in a meaningful way or what media to create. We made our concepts

open to interpretation in a way that the general purpose was set (to reflect), but the specific steps were not (Sengers & Gaver, 2006). In our study, we recognise how this requires people to “define use through use” (Redström, 2008). This process takes time and we can draw a parallel to the different stages of open-ended play, described by De Valk, Bekker & Eggen (2015). In their paper, they describe how people go through stages of invitation, exploration and immersion (potentially in an iterative way). The model is primarily described based on short-term use, but here we use it to understand the longer process of making meaning of our concepts for reflection.

In the first stage, invitation, people are drawn to interact with objects (De Valk, Bekker & Eggen, 2015). For our study, this invitation happened with an actual, written invitation. The wording in these invitations and instructions matter greatly for open-ended designs. For example, as an alternative to introducing a system as being ‘for reflection’, Cogito could be introduced as a way to “send messages to the future” or to ‘capture your thoughts’ or to “compare your daily experiences”. Each instruction will result in different (first) use. Pierce & Paulos (2015) designed Camera Obscura as a way to similarly explore the packaging, instructions and display of their ‘prototype’ to allow it to ‘speak for itself’. This shows how creating open-ended designs, goes beyond the design of only the object, but includes all forms of communication involved. On this level, we believe our instructions to have been sufficiently successful. Framing the concepts to be used ‘for reflection’ was useful as it gives a clear purpose. This also allowed for evaluating on whether the device successfully supported this aim, together with the participants. However, in our instructions, words such as daily, everyday, or every day, might have given a focus on the present day, which might have influenced focus on present experiences.

In the second stage, people explore the possible interactions with an open-ended system (De Valk, Bekker & Eggen, 2015). The potential interactions with our systems were clear, thus exploration focussed on creating interactions (and thus media) that are personally valuable. We saw several people who created their own constraints: using either single or multiple photos, setting a specific topic for each period or focussing on capturing goals and responses. Exploration could be further supported by providing immediate feedback and allowing for physical flexibility (De Valk, Bekker & Eggen, 2015). Exploring different locations within the home for example, changes how systems are perceived and integrated into family routines (Helmes et al., 2011). Our prototypes were not sufficiently flexible to be moved around the house and people did not feel inclined to explore this. More frequent media retrieval could provoke people to re-evaluate their creations and thus explore additional ways to create. Of course, the study duration also plays a role here. From a methodological perspective, it would be interesting to provoke exploration more explicitly. People

often have a tendency to want to follow research instructions and to do it 'well'. After an initial period of use, it might be good to explicitly instruct people to explore the device in a personally relevant and meaningful way.

Finally, people can move into an immersion stage, being involved in the interaction and attaching meaning to it (De Valk, Bekker & Eggen, 2015). There is a parallel between this stage and the level of open-to interpretation that Sengers & Gaver (2006) describe as finding aspects of personal life which the design fits to. One of the aims in design for open-ended play is to allow people to keep finding new opportunities and possibilities (De Valk, Bekker & Eggen, 2015). Initially, we saw that our designs, in contrast, would be explored until a suitable integration in everyday life was found. However, as desire for reflection changes over time, it could be argued that people re-enter stages of exploration. It is also clear that for reflection to reach this level of immersion and thus of meaningful integration, takes time. Study duration is a topic of increasing debate within HCI, becoming more relevant as the domain opens up (Crabtree et al., 2013). In our two-week study, participants had the opportunity to interact and explore, but immersion could only be hypothesized in the interview.

## **Depth in reflection**

We see depth as one of the defining characteristics of reflection. In our scope of everyday life reflection (Chapter 2), we described that we aim for 'some level of criticality' assuming that more depth would make reflection more meaningful. In our results, we see examples which are highly valuable in everyday life, already at the level of descriptive reflection (first reflective level [Kember, 2010; Hatton & Smith, 1999]). For example, reflections on this level provided reminders for the self, set goals or unravelled emotions. We consider the next reflective level, explorative reflection (similar to dialogic reflection [Kember, 2010]) of interest. In our analysis, all examples on this level focussed on questions that were unresolved. We see an interesting design opportunity to allow for such media to be reviewed later, with novel additions being made over time (such as done in Echoes [Isaacs et al., 2013]). Fleck & Fitzpatrick (2010) suggest that this level especially could benefit from systems with ambiguity, which is interesting to explore further.

Most of the media *creation* showed medium levels of reflection. In general, we believe more depth can be attained in media *retrieval*, especially with more elaborate exploration. With Cogito, we aimed to stimulate comparing multiple instances, but this was rarely seen and requires more emphasis or instruction. Media exploration could be designed in a layered way, starting with a single instance and unfolding in interaction. Such a process would support inquiry (Baumer et al., 2014), exploring different perspectives, connections and comparisons. We see potential in combining different media types; both user-generated and automatically collected (such as meta-data or sensor-based information). Similar to GoSlow

(Cheng et al., 2011) the visual (colour, colour-composition or photo) can form a thumbnail or summary of a reflection. This allows combining the emotional and intuitive strength of visual expression with the details of text. The visual elements allow for the reflection to have a presence in the home, without disclosing too much personal information. Inspired by the area of information decoration, such ambient displays should focus on the aesthetic qualities of the media to create a valuable addition to the domestic context (Eggen & Mensvoort, 2009). With deliberate interaction, related media can then be explored. These media should cover a wider span of time, as depth in reflection is easier to achieve when taking such a broader perspective. The systems were currently present-focussed, but exploring change and stability over time has bigger potential to evoke transformative or critical reflection.

It can be debated whether the highest levels, of critical or transformative reflection, can be evoked with design. Fleck & Fitzpatrick (2010) state that interactive systems might be especially useful to stimulate lower levels of reflection (such as descriptive and explorative), from which higher levels could emerge, while those higher levels are more challenging to design for directly. In our study, we saw examples of critical reflection with two of our participants. Although criticality in reflection is influenced by a personal reflective attitude and skill level, we believe criticality can still be stimulated through design (although without guarantee). As described above, we believe that criticality can be supported by combining creation with retrieval, adopting a layered approach with multiple media types and stimulating a broad temporal horizon (Shipp, Edwards & Lambert, 2009).



## 7.8 Conclusion

In this chapter, we have described our explorative comparative study with three concepts for everyday life reflection. We have designed Balance, Cogito and Dott to explore how media interaction can evoke reflection and how reflective practices can be integrated into everyday life.

In the study, we aimed to support reflection by combining media creation and media retrieval. In contrast to most approaches that stimulate reflection with media, reflection mainly occurred in creation rather than media exploration. The concepts supported reflection by requiring to express thoughts and feelings and additionally through briefness, iterative creation and having a threshold. Media retrieval triggered some reflection, but more elaborate interactions for exploration could strengthen this.

The designs aimed at open-ended reflection, both in content and habit. The content of the reflections was diverse, with many topics of everyday life included and were primarily present-focussed. Few connections between reflections were made, which is one of the reasons that only middle levels of depth were reached. However, we saw that these levels were very valuable for everyday life, including generalisations, instances with explanation and instances with future goal. Only in a few cases, higher levels of reflection were seen in a more explorative or critical form. We believe these levels could be further stimulated in designing specific media-retrieval interactions, combining multiple media types and stimulating a broader temporal perspective.

With our concepts, we also explored how everyday life reflection can be integrated in current habits. Based on our findings we conclude that this often does not rely on fixed moments, but instead both *opportunity* and *triggers* play an important role. For most people, quite specific circumstances result in good opportunity for reflection: a moment of calmness, having time, being alone and preferably at home. We introduce domestic reflection as a scope for reflective design that takes this context into account. For reflection to be truly integrated in domestic practices takes time, as people are likely to first go through a process of exploration and meaning making.



# 8

## Design Considerations for Everyday Life Reflection

**Abstract** As a way to generalise our findings, we formulate seven design considerations for everyday life reflection in this chapter. With these considerations, we hope to inspire further research and design into this area. The first few considerations focus on our scope of everyday life reflection, based on our theoretical and empirical work, we discuss how everyday life reflection can be understood. The other considerations, are focussed more specifically on using media as a way to support reflection. These aspects are primarily based on our design explorations and evaluations. In these considerations, we highlight how media and reflection interact and what aspects need to be taken into account when designing for this purpose.

## 8.1. Introduction

People frequently reflect in everyday life. Reflectively examining the world is one of the aspects that distinguishes humans from other animals (Dewey, 1933). Both in research and industry, many people have aimed to support reflection with interactive systems (for overviews see for example, Baumer, 2015; Fleck & Fitzpatrick, 2010). In this thesis, we have explored design for reflection within the specific scope of everyday life, rather than the more common areas of education, professional development or health interventions. We propose the concept of ‘*everyday life reflection*’ as a worthwhile area for design, which we defined as “*Considering and analysing past, present and future experiences in order to (re-)assess thoughts, beliefs, feelings, and actions regarding ones everyday life.*”

To support this type of reflection, we have explored ways to stimulate people to think about their lives, individually, within a trusted environment and through media technology.

Based on our exploration of this design space, we formulate seven considerations regarding design for everyday life reflection. Considerations are a way to formalise our insights, based on both theoretical and empirical understanding. They can be seen as generative intermediate-level knowledge, a type of outcome in design-research that is “*more abstracted than particular instances, without aspiring to be at the scope of generalized theories*” (Höök, & Löwgren, 2012, p.23:1). The considerations are broad aspects to be taken into account when designing, rather than detailed procedures or guidelines. We adhere to Stolterman’s (2008) view that “*designers can be prepared-for-action but not guided-in-action by detailed prescriptive procedures*” (p 61). The contributions from research-through-design are primarily generative: they are concerned with what might be rather than with what currently is (Gaver, 2012). Such generative knowledge claims are therefore intended to inform the generation of new ideas and design.

Based on our work with media-supported reflection we will discuss the following considerations:

1. Everyday life reflection is a personal and flexible type of reflection.
2. Reflection can support both appreciating and directing everyday life.
3. Everyday life reflection includes past, present and future.
4. Flexible reflective habits are based on triggers and opportunity.
5. Everyday life reflection can be stimulated both through media creation and media exploration.
6. Human effort and system effort can provide complementary value to support reflection.
7. Deeper levels of reflection require more elaborate support.

With these considerations, we hope to inspire and inform those who design for reflection, either with the specific scope of everyday life reflection or by bringing more ‘everyday-elements’ into other types of reflection. Some considerations focus specifically on using media to support everyday life reflection, although we recognize this is just one way to design for reflection.

## 8.2 Consideration 1:

### **Everyday life reflection is a personal and flexible type of reflection.**

Over the course of our design-research process, it has become clearer which aspects characterise everyday life reflection. Because it focuses on everyday life, it is primarily **a personal form of reflection**. Research on reflection frequently takes an alternative scope such as professional reflection (reflecting on the findings of a study) or societal reflection (considering trends or developments). Instead, we see everyday life reflection to be primarily person-focussed (‘about me’). Many different elements can be involved, including work or society, but the essence is about oneself and one’s everyday life. Different aspects of everyday life are valuable for consideration, such as home, family, leisure time, work, or school (Chapter 3). We consider everyday life reflection to be especially valuable if it takes a holistic perspective, looking for connections between such aspects.

The notion that everyday life reflection is personal also relates to whether one sees reflection as a personality trait. Reflection can be seen as a developmental process, learned over time (see for example, Moon, 1999), as an activity within a cycle (see Li, Dey & Forlizzi, 2010) or as a personality trait (Trapnell & Campbell, 1999). To some extent, it is a combination of these, but we find it important to note that there is a large variety in **personality traits that influence reflective behaviours**. These traits include a person’s self-consciousness (Trapnell & Campbell, 1999) and differences in motives such as the need for autonomy, the need for self-knowledge or their values and fears (Trapnell & Campbell, 1999). The development of reflection as a skill during an education can influence people’s attitude towards reflection in other aspects of life as well. In general however, it remains relatively stable over time. We have explored the use of the Self-Reflection and Insight Scale (Grant, Franklin & Langford, 2002) as a measure for this attitude (Chapter 5), finding little difference, potentially because, from our sample, all participants had relatively high scores. Differences in personality traits can also determine on what level someone reflects (see for example, Chapter 7). Some people remain more pragmatic (on the level of activities), others consider more abstract and deeper aspects such as their identity or personal mission (Korthagen & Vasalos, 2005).

In general, everyday life reflection frequently occurs in day-to-day life. Most people report high frequencies, reflecting daily or at least multiple times each week (Chapter 5). However, very few people have a fixed habit of everyday life reflection, instead it should be seen as a highly irregular form of reflection. People who have a systematic reflective habit, such as ending each day with writing in a diary, are an exception. For most people, **everyday life reflection is seen with irregular timing and a variety of activities**. For example, a single person sometimes reflects while talking with a partner, other times he lies awake reflecting in bed and yet another time purposely goes for an extensive walk.

Additionally, everyday life reflection does not follow a fixed process. When reflection is used in education, a structured sequence of steps is usually promoted, such as acting, looking back, reviewing essential aspects, creating alternatives and having a trial (ALACT model, Korthagen & Kessels, 1999). In everyday life, **the process of reflection is flexible**. People frequently switch between different 'stages' or 'modes' of reflection, without deliberately using these stages. It is therefore also more suitable to support this type of reflection in an open and flexible way (Ekebergh, 2007). Additionally, people do not always actively choose to reflect, but it 'happens to them' (Chapter 5). In our view, everyday life reflection is not an activity in itself, but a mental process people engage with, often in parallel to other activities. Both for intentional and unintentional reflection, these activities include commuting, walking, exercising or doing chores (Chapter 5).

Although reflection occurs frequently, **the need for reflection varies over time**, another aspect demonstrating its flexibility. People express a higher need for reflection in periods of change (regarding education, career, living arrangements, and relationships) or in periods of stress, intense emotions or personal struggles (Chapter 5). Life can be seen as a series of alternating periods of change and relative stability (Levinson, 1978, as quotes by Staudinger, 2001). People reflect both in anticipation of such change, and afterward to establish a 'new normal' (Staudinger, 2001). In line with Staudinger, everyday life reflection can serve different functions in different lifetime periods. These functions include, for example, identity formation in adolescence, the desire to share knowledge and teach others in midlife, and death preparation towards the end of life (Staudinger, 2001).

#### *Implications for design:*

Everyday life reflection requires to be supported in an open and flexible way, similarly stated by Ekebergh (2007). Expecting people to follow specific steps in reflection or doing it in a fixed way neglects the flexible and personal nature of everyday life reflection. **Open-ended design for reflection focusses on creating the right circumstances for reflection** but without strict guidance. With open-ended design, we refer to designs that are not restricted

in their use, but can be interpreted, explored and appropriated (Redström, 2008).

The use of open-ended design also aligns with our belief that everyday life reflection requires more flexible ‘habits’. It should not be supported by designing for a fixed activity, in a fixed moment, in a fixed place. Instead, reflective systems should remain open to different types of use, in a place and time suitable for the individual. Devices should be easily available, to be used when people feel an opportunity or desire. We therefore propose to support reflection using **designs with a physical presence in the home** (Chapter 7). Others have found that giving media a presence has the advantage of serving as reminders (Zekveld et al., 2017), eliciting serendipitous reminiscing (Van Gennip, 2018) and stimulating rich interactions with media (Odom et al., 2012). However, giving objects a presence in the home, is not enough to establish habits. It is important to consider what *opportunity* is ideal and how reflection can be *triggered*, we discuss these aspects in detail in Consideration 4.

Because the need for reflection varies over time, **designs should not require to be used ‘every day’**. Although many concepts do not strictly require this, it can feel as a failure if a day is skipped. In written journals, which are sometimes even dated, having ‘gaps’ or empty pages can feel disturbing or like a failure (Mols & Markopoulos, 2012). Incomplete records of tracking can even lead to people abandoning the habit altogether (Epstein et al., 2016). Therefore, creating media should add to a collection without the collection requiring structural creation. To support this, it is for example useful to consider alternatives to chronological ordering. Dates should not be the primary structure, as this often emphasises gaps, but can be useful as meta-data.

That habits of reflection are flexible also results in the desire for use to vary greatly over time. Although the scope of our in-the-wild study (Chapter 7) was too short to uncover such patterns in using reflective devices, it can be assumed there will be periods with low- or no-use. Designers often strive for long-term and consistent use, but should instead accept that use can be intermittent or cyclical (Epstein et al., 2016). From this perspective, **it is important to design for re-uptake** after a period of non-use or ‘lapse’ (Epstein et al., 2016). Media created in the past can be presented to stimulate new creation, especially when this is framed positively, celebrating past successes rather than providing explicit suggestions for new uptake (Epstein et al., 2016). For dedicated devices (such as our media objects with a presence in the home) such representation of past media should be on a different platform, as the device is currently not used and might be out of sight. As media can be transferred and stored online, media can be presented by e-mail or with a related mobile app. Introducing past media (in a different form) can provide a trigger for new creation, without criticizing a period of non-use.

## 8.3 Consideration 2:

### Reflection can support both appreciating and directing everyday life.

Everyday life is characterized by repetition, the experience of habit and a sense of home (Felski, 1999). As Felski defined it, everyday life can be seen as “*the essential taken-for-granted continuum of mundane activities*” (p. 15). In our study of everyday life memories (Chapter 3), we similarly found that **everyday life experiences are often taken for granted** when they occur. They are so normal, that there seems to be little value in them, or in cherishing them for the future. This value changes over time, but some specific reflection can be needed to appreciate mundane experiences (Chapter 3). Design for reflection is often based on an assumption that reflection has positive effects (Baumer, 2015). Studies refer to a variety of potential benefits, including supporting personal growth (Harrington & Loffredo, 2010), improving wellbeing (Isaacs et al., 2013) and directing learning (Slovak, 2017). Here we propose two important benefits of everyday life reflection that could be considered when designing: creating appreciation and providing direction. Both rely on past experiences, but appreciating is more connected to the ‘present’ and directing is more concerned with ‘the future’. As such, this consideration is closely related to Consideration 3, which focuses on these temporal aspects.

We found different aspects that make experiences more meaningful. In some cases, experiences are seen as valuable merely because of their repetition. In other cases, they show a social value or have a connection over time (to the present or by influencing one’s life). Finally, experiences can be valuable if they are iconic of character or highlight a contrast (between people or across time). Often, an awareness of these values developed over time or was uncovered through explicit reflection (either in the study or earlier). **Reflecting frequently can support appreciating mundane experiences** by uncovering these values. As a large part of our lives is ‘taken up’ by everyday life experiences, it would be worthwhile to appreciate them more. Such positive thoughts and gratefulness even have a positive impact on wellbeing (Emmons & McCullough, 2003). People who were prompted to frequently express gratitude were found to experience more positive affect, were more inclined to help others and expressed more satisfaction with their life as a whole (Emmons & McCullough, 2003). Appreciating mundane elements for their current and potential future value is not easy. During the probes study (Chapter 3) explicit questions were needed to make people review their current everyday life for such values.



**Everyday life reflection can also support making choices**, thus connecting to the directive function of autobiographical memory (Bluck & Alea, 2002). In part, our memories support decision-making by allowing us to synthesize (or imagine) future experience (Schacter & Addis., 2007). The directive function relates to a wide range of choices: from the shaping of (simple) likes and dislikes (e.g. not choosing pistachio ice-cream in the future) to complicated choices of life-paths (e.g. determining a career path). Although such more life-changing decisions might be rare and relate more to special occasions or milestones, everyday life aspects play an important role in making such decisions. For example, one might imagine very mundane practices when considering moving house: where will I wake up, where will I have breakfast, how do I commute to work. As such, reflecting on everyday life experiences supports life decisions. But smaller decisions, specifically regarding behaviour, are made throughout everyday life. The importance of reflection in these moments of choice is recognised in research focussing on behaviour change often aiming at ongoing behaviours such as eating healthily, moving more or using energy wisely. In such behaviour change processes, reflection-in-action (Schön, 1983) plays a considerable role, as these decisions often need to be made explicit before a behaviour is incorporated and automated. Both elaborate reflection when making large decisions (reflection-on-action), as well as ongoing behavioural choices (reflection-in-action), connect reflection to the directive function of memory (Bluck & Alea, 2002).

*Implications for design:*

In everyday life, media is created for a large variety of reasons, including serving as practical reminders or sharing stories with others (Lux, Kogler & Fabro, 2010). Often, media is created with future retrieval in mind, for example, taking photos to serve as future memory cues (Van den Hoven & Eggen, 2014; Sellen & Whittaker, 2010). For reflection, media can similarly be created for future retrieval: focussing on reflection at the moment media is reviewed. In turn, such review can stimulate appreciating these mundane experiences, but similar to the probes in Chapter 3, this appreciation is then only in retrospect. **Media creation can better support appreciating the present, if the creation is reflective.** In contrast to 'point-and-shoot' photos, such creation needs to be more deliberate, a more explicit choice. It has been found that creating media (e.g. taking snapshots) can distract from an experience resulting in remembering it less (Henkel, 2013). In contrast, it has also been found, that media creation can enhance an experience (Mols et al., 2015). People can perceive something more vividly or rich because they are capturing it, especially when this is done in alternative media types. Because of such influences, we believe reflection in creation is needed to support present appreciation, further discussed in Consideration 5 as the balance between capturing and expressing.

For systems that support behaviour change, specifically within personal informatics, reflection is seen as an important step in the interaction process (Li, Dey & Forlizzi., 2010). The use of personal informatics for behaviour change can be split into two phases: discovery and maintenance (Li, Dey & Forlizzi, 2011). During discovery, people collect a broad set of data, looking for interesting areas, connections, and causalities. The second phase concerns ‘maintenance’, which still refers to changing something (thus maintaining a specific behaviour towards a goal), not necessarily that a goal has been achieved and needs to be maintained (e.g. maintaining a certain weight). Reflection plays a role in both discovery and maintenance. Characteristic of the discovery phase is that people do not yet know what they are looking for. Therefore, people often (automatically) collect a wide variety of data (Li, Dey & Forlizzi, 2011). As an alternative to system collected data, **personal media can support the discovery of patterns and increase awareness of behaviours**. Selecting up-front what is tracked is not needed, as open-ended media creation allows any type of observation to be captured, whether it relates to for example healthy eating, energy usage or active lifestyle.

Personal media focussing on everyday observations and experiences can be grouped on specific topics for behaviour change, but can also be explored more holistically. Such elaborate reflection is more likely to only occur occasionally, for example during important transitions or when making life-choices (Chapter 5). During periods of change, people reflect before, during and after a transition (Staudinger, 2001). Systems can support this process by shifting roles in such a change, for example, by shifting the focus from looking ahead to looking back. Concepts for holistic reflection should allow looking back over longer periods of time. However, reflective media might not have been created in earlier times, so **retrieving previous reflections should be complemented with other media**. Even if previous reflections have been saved, additional media is valuable as the meaning of experiences changes over time. It is therefore valuable to explore media which was created for other purposes, as they can highlight mundane elements or everyday behaviours (Chapter 3).

Reflection concerned with the directive function of memory is often goal-oriented. The directive function concerns using memory to solve present problems and to direct present and future behaviour (Bluck et al., 2005). As such it is closely related to the field of behaviour change. When designing systems for behaviour change two stages of use can be identified: discovery stage (asking goal, history and context questions) and maintenance (focussing on status and discrepancy) (Li, Dey & Forlizzi, 2011). One of the risks of goal-oriented reflection is that it can focus on negative aspects as long as a goal is not achieved yet (a discrepancy between the desired and current state; Li, Dey & Forlizzi, 2011). When looking

back, most people's memory has a positivity bias (Walker, Skowronski & Thompson, 2003). But when reflecting on current discrepancies keeping a positive mindset can be challenging, reflection can even become rumination (Trapnell & Campbell, 1999). We, therefore propose, exploring how systems for reflection could improve this type of reflection **by stimulating capturing and expressing the positive**. Focussing on positive elements in reflection can be challenging. In our study on everyday practices, we found several people with moments of reflection of 'enjoying joy'. Some even doubted if this should be considered reflective (Chapter 5). We believe that, especially in reflection for the directive function, focussing sufficiently on the positive is important. It has been found that behaviour change is more successful when celebrating minor achievements (Fogg, 2011). Especially in the maintenance phase, after which a goal is set but the change is still ongoing (Li, Dey & Forlizze, 2011). Therefore, a critical view of why certain things are not succeeding should be complemented with a positive view. In the design of Balance (Chapter 7) we explored, very literally, how we could support balancing different perspectives by recording two perspectives in reflection, often mapped to positive and negative aspects of the day. In our findings, we saw examples of how such positive prompts supported people to take a more positive perspective on everyday life experiences.

## 8.4 Consideration 3:

### **Everyday Life Reflection includes past, present, and future.**

To some extent, past, present and future are always included in reflection. During our design-research process, our focus and scope have shifted from reflective remembering to everyday life reflection. This term better emphasises the processes we are interested in. In our view, reflecting on the present creates direction for the future, but **relies on remembering the past**. The inclusion of past experiences can be either implicit or explicit. For example, one can deliberately recall a previous presentation to reflect on how to prepare for a current one. On a more implicit level, previous experiences shape how we feel or talk about current and upcoming events. In the mind, both past and future are closely related: imagining future experiences (in the mind) is highly similar to recalling past experiences (Schacter & Addis, 2007; Conway, Loveday & Cole, 2016).

In part, **the inclusion of different time periods relies on personality traits** such as the temporal focus (Shipp, Edwards & Lambert, 2009) and temporal depth (Bluedorn, 2002). Temporal focus is the extent to which an individual is inclined to focus her attention on past, present, or future. The temporal depth, also described as 'past and future horizon',

is a related concept that refers to the distance towards either past or future that is being considered. Combining these traits shows how people divide their attention differently. For example, with a close temporal horizon and future focus, one might often contemplate about the following day. In contrast, someone with a distant temporal horizon and a focus on the past might frequently reminisce about childhood memories. Both traits can vary across different topics and are culturally influenced (Shipp, Edwards & Lambert, 2009).

Reflection is often triggered by something that recently happened, and to a lesser extent by things that are about to happen (Chapter 5). With media-supported reflection, we similarly saw that **most reflections are relatively present-focussed**, triggered by events of that day (Chapter 7). In our study on media-supported reflection, most reflections were on a level of 'descriptive reflection' (Hatton & Smith, 1995), for example by describing an event and some clarification for why something happened or by generalising a lesson learned from a specific experience. Only in a few cases, deeper levels of reflection were seen with people reflecting in an explorative or critical way. The short time period of most reflections, focusing on the present, could have influenced this depth. Deeper reflections are more likely to occur when considering a longer period of time, for example looking at the development of a character trait or personal growth over time.

#### *Implications for design*

In our study focussing on media supported reflection (Chapter 7), we saw that for most people **future-oriented media feels useful to create**. A large part of the media (especially written or spoken) included reminders for the self, general lessons learned or specific future goals. People created media in this form because it felt useful, they could easily imagine that retrieving such messages later would be valuable. This could relate to specific elements of behaviour change, future choices or personal development goals. For many people, goal-setting is easier done in language-based media, but exploring visuals for goal setting might be worthwhile. Systems can stimulate using visual media for goal-setting, which can more easily serve as powerful reminders 'at a glance'.

In addition to creating media from the present and/or for the future, it is also very valuable to support reflection for past experiences of which such media does not exist. We can consider **repurposing existing media to reflect on the past**. Media of special occasions (such as birthdays or holidays) might also represent more mundane elements, for example by the location, background objects or clothes (Chapter 3). Prompts can be used to review past media in a more reflective way, for example by considering 'out of frame' events (Frohlich, Wall & Kiddle, 2012): what lead up to the picture, what happened after or what (personally) has changed since then. Similarly, photos created for social purposes (such as sharing

online) can be used for reflection by reviewing them in new ways (Thomas et al., 2018).

To better support reflection on different time periods, **reflective systems should allow focusing on different time-scales**. For most people, it is relatively easy to reflect on the short term, such as considering today's events and planning tomorrow's actions. However, reflecting on more longitudinal elements, such as past growth or future ambitions, can be challenging. Systems focussing on media retrieval can support taking such a more long-term perspective. Elements such as tagging, ordering and clustering can support the underlying processes of reflection such as comparing and abstracting (Staudinger, 2001). Reflecting over longer periods has a higher potential of reaching more depth, although the relationship is not one-on-one. Whether depth is a success factor for everyday life reflection and how it can be supported is more elaborately discussed in Consideration 7.

## 8.5 Consideration 4:

### **Flexible reflective habits are based on triggers and opportunity.**

To support reflection, we aim for people to integrate it into their everyday lives. In other words, we aim to facilitate the creation of habits. Habits can be seen as behaviour that is performed easily, automatically and frequently. Design to create habits is extensively studied in the domain of behaviour change (Fogg, 2009). In this area, reflection is often studied as a means for behaviour change. For this consideration specifically, we look at reflective habits as a change in behaviour. Throughout this thesis, we have described reflection primarily as a mental process. In contrast, a habit refers to behaviour, to an action. **Reflective habits can be described as re-occurring behaviours that are likely to evoke or support reflection.** In our overview of reflective practices (Chapter 5), we saw many such habits. Some were done specifically with the purpose of reflecting, such as going for a walk, writing in a journal or having a conversation. Others are habits that frequently would result in reflection, such as doing chores or commuting. With design for reflection we similarly aim to create activities, such as media interaction, that have a high potential for eliciting reflection. This illustrates our view that the reflection itself (as a mental process) cannot be directly designed but can only be elicited. Our aim is therefore not to design reflection as such but to "design for reflection" instead.

**A variety of events can be the trigger for reflection.** We found that people are frequently triggered by a feeling, something that was said, was done or happened (Chapter 5). These experiences are the material that is reflected upon, but other triggers related more closely to

when reflection occurs (such as a conversation on the end of the day). The trigger that leads to the timing of reflection can coincide with the topic of reflection (e.g. by giving a reflective prompt), but can also be different. In our study with Balance, Cogito, Dott (Chapter 7), we often saw both triggers to occur at different moments. An experience that evokes reflection and a system element that triggers to engage with the reflective system. These triggers can occur at very different moments.

**Whether or not someone engages in reflection depends on both motivation and suitable opportunity.** Many of the habits described above create such an opportunity, for example, doing chores is an activity that does not put a strain on cognitive abilities, allowing reflecting in parallel. In our study of Balance, Cogito and Dott (Chapter 7) we found that ‘having time’ is one of the crucial characteristics of opportunity, similarly found by Fleck & Fitzpatrick (2010). Other characteristics include: feeling calm, being alone, and being at home. Combining these characteristics with the pattern of people’s lives, the opportunity might arise at similar times each day (e.g. after the children have been put to bed) or vary greatly (e.g. whenever sitting down in the garden). Even when good opportunity arises, reflection will only occur if motivation is sufficiently high. In our study on everyday reflective practices we found that such motivation (or experienced need for reflection) varies greatly, both in the short term as well as during different periods in a lifetime.

*Implications for design:*

Implementing triggers in design has been elaborately explored in persuasive technology, often based on the behaviour model as presented by Fogg (2009). He describes that triggers can only succeed if people have both sufficient motivation and ability to perform a certain behaviour. In our work, we focus on people who are generally motivated to reflect, but could use some support. In our studies, we similarly had participants that were relatively motivated to reflect, but their ability relied on the context and circumstance. Therefore, **recognising a good opportunity for reflection allows triggering at optimal times.** Fessl et al., (2017) similarly emphasise the importance of timing of reflective systems in order not to disturb the flow in work environments. Some of the characteristics of opportunity that we found in the domestic context can be challenging to recognise by a system, such as calmness. Others could potentially be measured, for example being at home and/or alone. Based on iterative learning, systems could optimise how to time triggers that have a high potential to result in reflection.

As mentioned above, both everyday life experiences and systems can trigger to engage in reflection. Often systems use triggers with two functions simultaneously: triggering to reflect and triggering about what to reflect (e.g. showing energy usage data [Valkanova

et al., 2013]). When a specific topic is given, we consider these triggers **content triggers**. This type of trigger is often data-driven, but can also include prompts: Are you satisfied with what you've eaten today? Have you had a productive week at work? In some cases, content triggers are provided in a way that includes a certain 'judgement', for example because a certain goal is not reached (for example, "You have not taken enough steps today"). In our design explorations, we have found two additional types of triggers that are used less frequently in design systems: direction- and opportunity triggers (Chapter 6). An **opportunity trigger** has the highest degree of openness: it merely suggests that there might be time and opportunity for reflection. These triggers are similar to what Fogg (2009) refers to as 'signals'. For such a trigger to succeed, people have to be highly motivated, as it does not provide any further support. A **direction trigger** provides some suggestions for consideration, without restraining the content. Examples of direction triggers could be: What is one difference between today and this day 1 year ago? Or: which aspect of yourself are you most proud of? Or name something positive and negative about today? (Balance design, Chapter 7). For different situations, different types of triggers can be most useful. For the broad scope of everyday life reflection, content triggers can best be used with a wide variety of prompts over time, to cover a broad range of topics. We found that direction triggers are easier to interpret and to make meaningful for most people, compared to only giving opportunity (Chapter 7). Our Balance design is an example of how such triggers can be designed as 'embodied questions' rather than using language prompts. We consider designs that use form and interaction as a way to present choices to people as more elegant solutions compared to language-based questions, as such embodied questions provide room for interpretation (Sengers & Gaver, 2006). Other possible directions for embodied questions include indicating importance (through weight, as in Balance), expressing emotion (through colour as in MixedEmotions, Chapter 6), provoking exploring a topic from different perspectives (multi-sided-media) or suggesting taking distance (through proximal interaction, inspired by Marquardt et al., 2012).

Many systems (including those that stimulate reflection) use invasive triggers, especially when looking at reflection applications. Such triggers are often alarming and interrupting making the timing of reflection 'system-initiated'. These triggers might use a fixed moment each day (e.g. GoSlow [Cheng et al., 2011]) or random timing (e.g. Echoes [Isaacs et al., 2013]). As reflection requires specific circumstances (opportunity), these triggers can easily come at a bad time, resulting in annoyance, rather than uptake. However, without any triggers, a system fully relies on user initiative: to remember to reflect and to use the design. We therefore consider it worthwhile to explore further how **user and system imitative can be balanced by designing more peripheral triggers**. Systems can trigger in the periphery of attention and then shift to the centre for deliberate reflection (Bakker, Van den Hoven &

Eggen, 2015). If such peripheral triggers are well-designed, they will be more easily perceived and acted upon when opportunity arises (when people have mental resources and time). A system might start to attract attention (with certain light or sound patterns that are not ‘alarming’), but this is only perceived if the user is also ready for this. The light in Cogito (Chapter 7) explored such triggering, but the chosen light patterns were too subtle. Embodying such triggers in devices that take a permanent location does seem to be suitable. In many cases, opportunity often arose in the same context. In such a fixed place, proximal interaction could play a role as well: the system disclosing more specific information as triggers, the closer a user moves to it (see e.g. Ballendat, Marquardt, & Greenberg, 2010).

In contrast to the flexible approaches based on opportunities and triggers, designers can look at specific current habits that can be an ‘anchor’ for reflective behaviour (Fogg, 2011). We have found twelve **specific scenarios of everyday life reflective practices that include anchors for new habits** (Chapter 5). For example, based on the prevalent scenario of reflecting during a commute, a concept could be designed on which car keys are put or hung. Objects used in household chores could be combined with reflective triggers, such as a dishwashing brush or towel. The concept MirrorMirror (Chapter 6) proposes integrating opportunity triggers in the habit of brushing one’s teeth. These systems will have a smaller ‘target audience’, as it depends on whether or not this existing behaviour is applicable to a user. However, there is a relatively high chance of ‘success’ as the trigger is integrated into an existing habit.

## 8.6 Consideration 5:

### **Everyday Life Reflection can be stimulated both through media creation and media exploration.**

Reflection can be stimulated in multiple ways. We found that common strategies include conversation-driven, expression-driven and information-driven (Chapter 6). Initially, our main intention was to support creating media that could be reflected upon when retrieved, a type of information-driven reflection. However, it became clear that in the creation of media, a lot of potential lies as well. Creating media is an interpretive act, in any occasion. First of all, this starts with the selection of when to create something and what to capture. Additionally, people have to choose how to represent their experience. The availability of possibilities stimulates alternative considerations (Güldenpfennig, Reitberger & Fitzpatrick, 2012b) influencing perception as well (Mols et al., 2015). By leveraging these aspects, we can **stimulate more reflective creation**.



Reflective media creation requires a combination of expressing and capturing. Media creation is often focussed on capturing: **bringing (aspects of) the external world to the media**. The clearest example of capturing is seen in ‘point-and-shoot’ photography: capturing facts like “this building looks like this” or “I am here now”. In essence, all types of (factual) logging similarly focus on capturing: e.g. logging activities, tracking locations or saving financial transactions are all about transfer aspects of the external world to media. We are interested in media that includes a more personal perspective, thus including **expressing: bringing (aspects of) the internal world to the media**. These can include emotions or thoughts. Media that is only about expressing is rare, tracking one’s mood could be seen as an example (Hollis et al., 2017). Diaries are strongly about expressing, but usually have a factual component as well, for example expressing current worries in combination with what has happened.

We believe that aspects of expressivity can be added to the more capture-focussed practices, a potential area for future research (see also Section 9.5). The **combination of expression and capturing can make creation reflective**. This can be done explicitly by for example adding captions to photos (“loved this afternoon”). But it can also be implicit, creating photographs in a more expressive way. One can consider: what will best capture this atmosphere of this day out with friends? And decide not to take a photo of the landmark that is visited, but instead take a picture of a group of friends having lunch on the sidewalk. Taking such a specific perspective creates the inclusion of expression, making the creation itself reflective.

As more frequently done, reflection can also be supported when retrieving media. For us retrieval includes any type of actively perceiving the media, such as reading, seeing or hearing. **Reflection is best supported through active and deliberate retrieval: media exploration**. We identify four ways media exploration and reflection relate. First of all, retrieving existing media can make people recall a previous experience and reflect on it from the present. This is most similar to the model of Life Reflection that focuses on ‘remembering plus further analysis’ (Staudinger, 2001). This type also includes recalling multiple past experiences, looking at change or growth. In Chapter 7 we found that remembering the context of creation is important, which is especially true for this relation. Secondly, exploring media can support recalling a previous reflection (and additionally reconsider how this is perceived now). For example, reading a diary (or entries in Cogito) on how an event was previously perceived. Recalling previous reflections is very challenging without external support. It seems that people are better at remembering what has happened rather than how they thought about it at the time. Recalling previous reflections is also included when remembering intentions (Sellen & Whittaker, 2010), such as recalling goals and reflection on how one is progressing.

The third type of relation to media is when it evokes an immediate reflective response without deliberate consideration of specific episodic memories or an elaborate reflective process (Zijlema, Van den Hoven & Eggen, 2017). Such a response has a connection to the memories associated with the media, but those remain abstract. Finally, exploring media can trigger new thoughts, new reflections, without connecting to previous experiences. This is especially true for reflective prompts (from a system), but can also happen in seeing personal media from a different perspective.

For any reflective design, these four types of media responses can be considered. In our experience with interactive media, the first two have been most supportive of reflection.

*Implications for design:*

To make media creation reflective requires **combining capturing and expressing**. Many types of media creation currently focus on capturing, to which more expressive elements could be added. For example, combining photos with notes/tags (see for example, Landry, 2009). Such combinations are further explored in the creation of Media Objects (Güldenpfennig, Reitberger & Fitzpatrick, 2012b). Attaching some element of expression can also be done by adding *value-based-metadata* to it (for example, weight and side in Balance, Chapter 7). What is being expressed through methods such as suggested above is not always easy to recall at retrieval, storing additional meta-data can help. We see potential in both more ‘regular’ meta-data (time, location) and more extended approaches to meta-data. As reconstructing the context of creation was often found to be important (Chapter 7), it could be interesting to save what was scheduled in one’s agenda or (cloud stored) photos that were made on the same day (but not for a reflective purpose). Such additional information should not immediately be presented but could be explored as additional ‘layers’ to media (Consideration 7). A different way to support expressing is through *selectivity*, which can relate both to the quantity (see for example Niforatos, Langheinrich & Bexheti, 2014) or the length of creation. We found that requiring *briefness* stimulates reflecting on what is the essence of an experience (Chapter 7). Reducing the quantity of media that can be created, is one way of creating a ‘threshold’ for creation. Such a threshold can stimulate reflection, as something has to be ‘important enough’ to invest the effort in creating something about it.

One of the pitfalls of selectivity is that it can lead to one-sided creation, for example emphasizing ‘the good times’. Unmediated memory is known for having a ‘positivity bias’ (Walker, Skowronski & Thompson, 2003) or in everyday language called ‘rosy retrospect’. It has been argued that this function of memory should not always be canceled out by media that presents ‘harsh reality’ (Isaacs et al., 2013). However, for reflection on aspects such as personal growth or emotional development, a more varied picture of everyday life experiences needs

to be captured. It seems like it is often easier to recall what has happened, but much more difficult to recall the nuances of feelings and thoughts. We observe a **trade-off between specificity and ease** (both in creation and retrieval). Expressing current experiences in great detail might be most fruitful for future remembering but it is not easy, nor to create, nor to retrieve. Compare, for example, a full diary entry with a single sentence. The trade-off between specificity and ease is not just about quantity, different modalities have different effects as well. A personal voice memo might hold great detail and personal emotion but is less easy to retrieve (and create) than snapping a photo. Although it is a delicate trade-off, we conclude that current interactive systems often overemphasize ease of creation, some more attention should be given to the need for specificity.

To stimulate reflection in media exploration, we propose three directions: comparing, repurposing and iterating. It is valuable to **compare multiple media items**, to look for similarities, differences or growth. We designed Cogito with the intention of comparing three written messages but found that (without specific instructions) most people would focus on a single one when reading (Chapter 7). Explicit prompts could be: "In what ways are two of these items more similar than the third?" (OddOneOut, Chapter 6) or "What do these two items have in common?" Looking for similarities can stimulate exploring multiple perspectives, especially when done with *random combinations*. Prompting to look for similarities between two random media items creates a 'force fit', a mechanism used in creative techniques which stimulates looking at subjects from multiple perspectives (Michalko, 1991). In some cases, a simple similarity might be such as 'both are from a holiday', but it is interesting to look for combinations that spark richer or deeper insights such as 'both represent the start of a new phase'. In addition to such 'force fit' a different way of comparing is by providing *temporal emphasis*. This can be done by presenting multiple instances in chronological order. The app Timehop<sup>16</sup> or Facebook's 'On this day'<sup>17</sup> present media from the past, emphasizing how long ago it was. This often elicits responses about how much has changed or how 'time flies'.

In a sense, Timehop provides a way of repurposing media, content that was created to share with others, is presented back to the creator to serve a different aim. In Chapter 3, we have suggested **repurposing existing media through reframing**. Presenting existing media in alternative ways can emphasize the everyday elements within them. Or existing media can be used to highlight elements to be reflected upon. Thomas et al., (2018) explored how Facebook content could be used to reflect on life stories by turning photos into a 'triptych'.

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<sup>16</sup> <https://timehop.com> Last accessed March 2019.

<sup>17</sup> Currently presented as <https://www.facebook.com/memories> Last accessed March 2019

By selecting a combination of three photos to be framed, people viewed their content in different ways, looking or a 'story to tell'. In this way, they combined selection with remediation, finding new personal value in media created for social purposes. With such approaches, people can be stimulated to look at their media in different ways, which could be applied more broadly than only on social media content.

Finally, reflective media exploration and creation can be integrated, allowing to modify or add to previous reflections. Isaacs et al. (2010) request users of Echoes to re-rate their emotional response to past events and allowed adding comments. We consider adding elements to the media over time, *iterative creation*. Such creation over time can highlight how the perception of events changes when more time has passed, for example resulting in less heavy emotions (Isaacs et al., 2010). In the study of mediated reflection (Chapter 7) we saw people creating questions or prompts for further consideration, which we described as a level of explorative reflection (similar to Dialogic reflection, Kember, 2010). This level is especially suitable for iterative creation as it often relates to questions that were unanswered, for example about behaviour people did not yet understand themselves.

## 8.7 Consideration 6:

### **Human effort and system effort can provide complementary value.**

One of the core aspects of supporting reflection through media-interaction is the active role people take in this process. Although not all media is by definition create by the owner, we focus specially on media that is created intentionally by people to capture or express. The fact that such media is human-made is one of the defining elements of how we distinguish media-driven from data-driven reflection. Some media (for example text) can be made in analogue ways as well, but creating media using interactive systems has several advantages. These include the use of interactive triggers, the ease of storage and finally the role automation can play. Different aspects of people's interaction with media can be automated: creating, sorting, selecting or adding metadata. Both human creation and system automation hold value for reflection and we suggest considering a combination of both.

People have to take action to create media, in other words: **media created by people, requires effort**. Different types of media creation require different levels of effort: taking out a smartphone and snapping a picture is much less effort than carrying around a notebook, sitting down and writing pages full of reflections. Investing effort in what is created

has potential benefits, it could, for example, support better remembering, as people make a more deliberate decision to capture something. At the same time, it has been argued that creating media, such as taking photographs, inhibits encoding in memory, resulting in what has been called the ‘photo-taking-impairment effect’ (Henkel, 2013). Media creation can distract from having attention for what one is doing or perceiving, which has frequently been expressed by artists, criticising recording at concerts.<sup>18</sup> In contrast to such views, effort in media creation can also create more attention and focus perception (Mols et al., 2015). This is especially true if the media creation involves senses that are less frequently used in media creation (such as audio). For reflective media creation, we conclude that investing effort is often worthwhile, even more so because media creation often does not take place during an experience, but in retrospect, such as at the end of the day (Chapter 7). At such a moment, investing effort in capturing something about the experience will improve remembering it, because it is brought to mind again and repetition leads to better remembering. Additionally, only through effort, a personal perspective can be expressed and we suggest that combining capturing with expressing is beneficial for reflection (Consideration 5).

As an alternative to human-made media, automatic creation has frequently been explored. It has been described as one of the core goals of media systems in ubiquitous computing (Abowd & Mynatt, 2000). Automatic media management has been explored for functional goals, such as storing books, notes and emails, even when such digitisation was still a future vision (see for example ‘Memex’ by Bush, 1945). Extensive automatic creation has been explored to support remembering, see for example the extensive work with Sensecam (Hodges et al., 2006). It has often been explored for the advantages that automatic creation allows capturing more or even ‘everything’. Lifelogging is one of the areas concerned with aiming to collect ‘everything’ and create a ‘full log of life’ (Gemmell et al., 2002). Lifelogging seeks to be effortless and all-encompassing (Sellen & Whittaker, 2010). Such creation results in huge quantities, with large challenges of management and access. Although lifelogging holds the potential to capture valuable mundane elements of life (Lindley et al., 2011) the ‘costs’ are relatively high: there is an abundance of media, and wearing a camera can be uncomfortable, socially awkward, and even ethically challenging (Wolf et al., 2014). Despite these high costs, automatic creation could be preferred in some cases. For example, discovering which elements of everyday life are most interesting requires collecting ‘anytime, anywhere and often’, automated data collection can reduce the burden of

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<sup>18</sup> For example: Ian Brown said (May, 2013): *“If you put your cameras down you might be able to live in the moment. You have a memory there of something you’ve never lived.”* As reported on <https://www.entertainmentwise.com/The-Stone-Roses-Make-Triumphant-Return-As-They-Play-First-Gig-In-16-Years/> Last accessed March 2019.

doing so. (Li, Dey & Forlizzi, 2011). However, these authors have also argued that automation can reduce users' engagement with their data, mitigating the advantages for reflection. Their view supports our view: user effort and system automation should be balanced.

In our work, we found that **automated media-processing can provide two additional values in everyday life reflection**, either by providing insight or eliciting surprise. On retrieval, automatically created or processed media can provide insight, by showing things from the perspective of 'the system'. A system can present information that cannot be directly perceived, such as steps taken in a day. It can also be a perspective from the system that infers something, a certain system interpretation. A system can, for example, decide that something is an exception or that a frequently used object represents a habit (Chapter 5). Secondly, automatic creation can evoke surprise on retrieval. The images have not been seen before, as the user was not involved in creation, people might not have been aware of the creation or of the event occurring (Lindley et al., 2011). In Chapter 5 we saw that alternating the visuals, creating abstractions, evoked surprise, even shortly after capture, as it provided a novel way to represent an event.

#### *Implications for design*

As both human-effort and system-automation hold unique benefits, it is interesting to look at a valuable combination of both. In contrast to all-encompassing recording, we therefore propose to consider **selective automation in creation**. All types of media creation are somewhat selective, based on available systems, but rather than seeing such selection as a downside, we see selectivity as a strength. In personal informatics, selection is an important part of the reflective process as well (Li, Dey & Forlizzi, 2010). In everyday life, we see the largest benefit of automation in capturing what otherwise would not be captured. But user-based up-front selection can make creation more reflective. As proposed in Chapter 5, an automatic sensor-based camera can become more reflective by allowing users to explore different settings. Determining a place, perspective, and sensor values for the camera that together result in valuable media thus becomes part of the reflection. The decisions focus on deciding what is worthwhile to capture and how this can best be represented. Especially when done iteratively (e.g. moving the camera every month or so), this becomes reflective. As automatically generated media is often hidden, as digital files on the system that collects them, presenting the media in physical form can make an interesting combination. For example, by delivering printed booklet via post (see, for example, Groovebook<sup>19</sup>) or printing individual photos with a device at home (see for example, Odom et al., 2012).

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<sup>19</sup> <https://www.groovebook.com> Last accessed March 2019.

<sup>20</sup> <https://www.makeuseof.com/tag/find-photo-google-photos-organize/> Last accessed March 2019.

For user-generated media, there is great potential in **automatic processing of media** such as tagging, grouping, sorting, combining (Cogito), or abstracting (Dott and Ritual Camera). Algorithms for processing often focus on metadata, but increasingly also use image recognition, allowing to sort photos by people, untacked locations or objects (for example, using Google photos to search for ‘coffee’ in your personal collection<sup>20</sup>). Storing metadata can result in more interesting visualisations, such as location-based (Kuchelmeister & Bennett, 2014) or time-based. For different goals, different ‘cuts’ across aggregated data are interesting (Epstein et al., 2016). For example, showing all media created in the early morning will allow for exploration and comparison, a central process of reflection (Staudinger, 2001). Supporting such analysis with a system can evoke more depth in reflection, on a level of dialogic or explorative reflection (Fleck & Fitzpatrick). Such reflection explores relationships between pieces of experience or information (Fleck & Fitzpatrick, 2010), which can be supported by providing multiple perspectives on the information.

Automation can generate interpretation, several of the visualisations of our Ritual Camera included such interpretation (Chapter 5). For these visuals to be seen as valuable requires **transparency of system intelligence** (“this is an exception – because I only saw this person once this week”). For intelligent systems, trust is very important and transparency increases such trust. Alternatively, and in contradiction to the previous suggestion, **a system can present ambiguous information**. The data do not provide a clear picture and the system does not communicate exactly what it is showing or how this was created. Such visualisations have a high openness to interpretation (Sanches et al., 2010). Interpreting then not only supports reflecting on the system and its intention (e.g. Gaver et al., 2006), but also on personal behaviour. In these cases, the system’s authority (as presenting the ‘reality measured through data’) is reduced (Sengers & Gaver, 2006). One direction to achieve this is by allowing users to ‘overwrite’ a system’s presentation of data (see for example Zengarden, Chapter 6).

## 8.8 Consideration 7:

### **Deeper levels of reflection require more elaborate support.**

One of the most discussed characteristics of reflection concerns its depth or level. In HCI work on reflection, the different levels are not always made explicit, especially when a detailed definition of reflection is lacking (Baumer, 2015). In some cases, reflection is presented as equal to ‘revisiting’ an event. Others strive for more ‘transformative’ reflection,

resulting in a change in practice or an increased understanding of why and what happened (Slovak et al., 2017). Fleck & Fitzpatrick (2010) present an overview of five levels of reflection that can be considered in HCI, based on the work of Hatton & Smith (1995), Mezirow (1990) and others. Their overview emphasises that **different levels of reflection have different value**, which we also saw in our studies on everyday life reflection (Chapter 7). We saw that through introspection, people became more aware of involved emotion, on a deeper layer of dialogic reflection, potential causes for experiences were explored. On a level of critical reflection, people explored the connection of events to their personal identity or societal views.

Research in the domain of education and professional education often strives for more critical reflection. To assess such levels of depth, coding schemes or frameworks are used, often built on the work of Mezirow (1981). He initially distinguished seven levels of reflective thinking (1981). The deepest level, presented as ‘critical reflection’ or ‘premise reflection’, refers to the ‘*very premises on which problems are posed and defined in the first place*’ (Mezirow, 1990, p.12). The core model of reflection (Korthagen & Vasalos, 2005), presents layers of reflection as going from the outer (environment, behaviour) to the inner (identity, mission). In our evaluation of mediated reflection, we found that everyday life reflection is often concerned with the more outer layers of reflection, considering environment, behaviour and competencies (Korthagen & Vasalos, 2005). People seek for an explanation of what has happened (‘reflective description’ Hatton & Smith, 1993, Fleck & Fitzpatrick, 2010) or explore relationships between multiple events or aspects (‘dialogic reflection’, Hatton & Smith, 1993, Fleck & Fitzpatrick, 2010). Exploring connections (explorative reflection) and critically examining underlying premises (critical reflection) requires considering multiple experiences. As such, **deeper reflection often requires taking a broader temporal horizon**. Although the relation between depth and temporal breadth is not one-on-one, they are clearly connected. Deeper levels of reflection are therefore more likely to occur in long-term use, although there are other ways to involve the (distant) past and distant future as well (see Consideration 3). Reflections on these layers were particularly valuable and supported the functions of autobiographical memory such as mood regulation and direction (Bluck & Alea, 2002). For us, this highlights that **for valuable everyday life reflection, levels of critical or transformative reflection might not always be needed**. This might be seen as a way in which everyday life reflection can be distinguished from reflection in educational context.

#### *Implications for Design*

Some have argued that technology is especially suitable to directly support the lower levels of reflection, from which higher levels may follow (Fleck & Fitzpatrick, 2010). We consider



that for deeper reflections, the different roles a system can take need to be considered: triggering, supporting and capturing (Chapter 6). As discussed in Consideration 4, triggers can take different forms, ranging from emphasising an opportunity to providing direction and presenting content to reflect upon. However, **when more depth in reflection is preferred, mere triggering might not be sufficient**. In an overview of reflective systems, only a few approaches were found that were enhanced with other types of guidance (Fessl et al., 2017). In our design space, we emphasized this by describing the roles a system can take and similarly found that many systems adopt a triggering role, but few a supporting role (Chapter 6). In line with our open-ended approach and the value we see in different levels of reflection, such a supporting role should allow for more depth but not require it. Support can be given by given by **complementing triggers with more subsequent questions**. These questions could be verbatim, or in more embodied forms of interaction (see for example the concept PeelAway, Chapter 6). Inspiration for such question-based support can be taken from various interview strategies which have been developed to explore personal values. For example, it has been stated that for any situation or behaviour asking '7 times why' will uncover the problems behind problems (Serrat, 2009) and has similarly been used to uncover underlying values. Alternatively, rather than incorporating these questions in a system, depth could be attained by allowing interactive systems to be complementary to social roles in reflection (Slovak et al., 2017). This is more often seen with teachers or coaches in an educational context (see e.g. Fessl et al., 2017), but can be implemented in everyday reflection as it frequently occurs with friends, family or partners (Chapter 5). In such a process, a system might prompt, but other people provide the needed support to attain depth.

When including media, systems can **take a supporting role by using multiple layers in media exploration**. By initially presenting a small aspect, or easy to perceive media type, the threshold to start exploring can be low. People can then go for inquiry (Baumer, 2015) by exploring more. For example, a text-based system might first present a single line, then show the full entry, on further exploration presenting the time and date. It can also allow people to 'zoom out' and show media that was created on the same day or week. Exploring different layers allows going into more depth when this is desired, enabling pattern exploration, comparison, and abstraction (Staudinger, 2001). Such different views also allow people to see things from 'multiple perspectives', a technique frequently used to support reflection (Fleck & Fitzpatrick, 2010).

In the model of 'core reflection' (Korthagen & Vasalos, 2005), the deeper levels (identity and mission), are also more abstract. It has been found that remaining on the level of abstract considerations has a higher chance of having negative effects (Watkins, 2008). Becoming

more concrete, by translating these insights into actions, can be beneficial. Engaging in deeper reflection has the additional risk to keep on going, which can turn reflection into more negative rumination (Chapter 5; Watkins, 2008). A novel design direction can be identified in **helping people to stop reflecting by capturing their thoughts**. In addition to triggering roles or supporting roles, systems can focus on a capturing role. Allowing people to capture current thoughts can help to ‘empty the mind’ or to let go of worries (see for example *FragileWorries*, Chapter 6). Capturing thoughts into more specific (mediated) form, also helps in making the abstract more specific. Additionally, these captured thoughts can be elaborated upon in the future, when a better opportunity arises.

## 8.9 Conclusion

In this chapter, we have presented seven considerations for everyday life reflection that are a way to generalise the insights from our research-through-design-process. The first few considerations focus on our scope of everyday life reflection, the second half is more focused on the use of media for reflection.

Our first consideration describes everyday life reflection as a personal and flexible type, in terms of content, process, and integration in life. The second focuses on two benefits that are worthwhile to explore: supporting appreciation and directing of everyday life. The third consideration focuses on the temporal dimension, emphasising that reflection is not just a way of looking back, but also concerns the present and future. Together, these considerations highlight some of the important findings about what everyday life reflection entails.

Based on our overview of everyday life reflective practices, we propose that flexible reflective habits rely on triggers and opportunity, which can be applied to designing reflective systems. We focussed our design explorations on media interaction and found that creation and exploration of media each hold potential, discussed in the fifth consideration. The next consideration discusses how the effort required for media creation can be complemented by automating parts of the media interaction. We end our considerations with a discussion of the desired depth of reflection. Many systems focus on triggering reflections, but to reach more critical levels of reflection, more elaborate support is needed.





# 9

## Discussion & Conclusion

**Abstract** In this thesis, we have explored design for everyday life reflection by adopting a research-through-design approach. In this chapter, we discuss our insights from multiple perspectives. We come back to the research questions posed at the start of this thesis and compare the mediated reflection in our evaluations to the scope of everyday life reflection as we intended to support. Following, we explore how our insights can be generalised to the broader related themes of reflection, everyday life and media interaction. Finally, we present a number of future research questions. These questions address how to deepen our understanding of our specific scope and secondly how to explore novel related directions.

## 9.1. Introduction

In everyday life, most people reflect frequently. It is a way of thinking to process experiences, to come up with potential solutions to problems and to gain a better understanding. Everyday life reflection serves many purposes, such as creating and maintaining a personal identity and supporting behaviour change. Yet reflection can also be challenging, as it requires time, effort and attention. We observe a trend that moments of everyday life reflection might be fading, as more and more of our time is filled with action and distraction. We identify an opportunity for interaction design to support everyday life reflection by creating new reflective habits.

In this thesis, we have explored design for everyday life reflection by adopting a research-through-design approach. Our work is guided by a design challenge focussed on how to design media creation systems that support reflection in and on everyday life. The thesis started by laying down the groundwork, from a theoretical and empirical perspective. We started by discussing our understanding of everyday life reflection with a variety of concepts and models from the literature on remembering and reflecting (Chapter 2). These theories shaped our scope, defining everyday life reflection as a type of reflection that serves different functions, occurs throughout the life-span, focusses on everyday aspects, has a certain level of depth and does not follow a strict process. To inform what everyday aspects would be worthwhile to consider, we conducted a probes study exploring what experiences of everyday life are considered valuable and how such value develops over time (Chapter 3). Reflection plays an important role in such value changes and the study turned out to be a form of guided reflection.

Based on the probes' findings we articulate four potential design directions, of which we explore one in our first design exploration (Chapter 4). Each design exploration focussed on different aspects of our design challenge and this first design focussed on using abstract media to capture a frequently repeated event. With our design Ritual Camera, we captured everyday home dinners and discussed a number of abstract visualisations with the family members. We have found that different forms of abstract media were valued differently, depending on their envisioned use. Some visuals sparked new insights or evoked personal reflections, which strengthened our view that media interaction could be used to support reflecting *on* everyday life reflection.

As the reflection in both Chapters 3 and 4 was evoked by the research and designed materials, we wanted to know more about how people normally reflected in everyday life. We, therefore, studied the occurrence of reflective practices with a questionnaire study (Chapter

5). The results showed that reflection occurs frequently, although the need varies in different moments and life time periods. Reflection was seen in many different forms, including different contexts, social situations, and activities. Specifically, the study brought forward a range of reflective habits that inspired our design explorations.

In parallel to this empirical study to inform design for everyday life reflection, we conducted a broad conceptual exploration of the design space, by developing a range of concepts for reflection (Chapter 6). The design space is shaped by two dimensions: representing reflection strategies and system roles. We found that commonly used strategies include information-driven, expression-driven and dialogue-driven and added an additional strategy that focusses on environments for reflection. Secondly, based on our concepts, we found that systems cannot just trigger to reflect, but adopt a supporting or capturing role as well. The design space brought forward a number of important aspects to support everyday life reflection, including holistic reflection, open-ended design, and integration into everyday life, which we explored in our third and final design exploration. For this, we developed three concepts, Balance, Cogito and Dott, which were implemented into prototypes to be explored in-the-wild. The evaluation gave insight into how media creation and exploration can support reflection and how such habits can be integrated into everyday life (Chapter 7). With these concepts, people primarily reflected during media creation and their reflections were often present or future focussed. We found that people reflected on different levels of depth, primarily on a descriptive or dialogic level. Finally, the integration of reflective habits into everyday life patterns did not happen at a fixed moment but relied on good opportunity and triggers.

Based on our design explorations and our theoretical and empirical understanding of reflection, we presented seven considerations for design for everyday life reflection (Chapter 8). In the following sections, we discuss these studies and findings in a broader perspective.

In the following Section (9.2) we will discuss the scope of everyday life reflection as we presented in Chapter 2. We discuss these characteristics as measures of success for our designs, and how our understanding of the scope has shifted. This evaluation has contributed to answering our research questions and design challenge, which are discussed in Section 9.3. Our challenge was formulated on the intersection of three themes: reflection, everyday life and media interaction. In Section 9.4, we discuss how our findings could be generalised to the broader research areas of each of these themes. We discuss our process and methodological insights in 9.5. To build upon our findings, we propose a number of follow-up questions for future research in Section 9.6. We discuss potential directions to deepen the understanding within our specific scope and identify two novel design directions for reflection. We end the chapter by coming full circle with our final concluding remarks.

## 9.2 Discussion of the Scope of Everyday Life Reflection

Reflection is frequently studied or designed for within HCI research, but too often its scope and goals are ill-defined (Baumer, 2015; Fleck & Fitzpatrick, 2010). To create a stronger basis for our research, we have stated specifically what type of reflection we aim to support (Chapter 2). We introduced the term ‘everyday life reflection’ and described a number of important characteristics. We have also described how reflection is studied in different ways with different measures of success, such as coding for reflective depth (e.g. Dymont & O’Connell, 2011) or evaluating a reflective system’s effect on wellbeing (Isaacs et al., 2013) others seem to assume reflection has happened when a behavior or pattern change can be observed (Baumer et al., 2014). These are just a few examples and Baumer et al. (2014) argue that most studies in HCI lack a clear measure of reflective success, which might come from a lack of clear definition or theoretical grounding. We have, therefore, chosen to evaluate our work on a higher level by coming back to our theoretical grounding in this section, discussing our work in light of the different characteristics of reflection.

### Functions of reflection and autobiographical memory

Autobiographical memory (AM) serves several functions in life, most commonly described as the social, directive and identity function (Bluck & Alea, 2002) with an additional function relating to mood-regulation (the adaptive function, Bluck et al., 2005). In Chapter 2, we have argued that everyday life reflection can relate to all these functions, but we saw our primary contributions in the domain of the identity and directive functions. We choose this emphasis because increased self-insight (identity function) is believed to be beneficial for wellbeing (Harrington & Loffredo, 2010) and reflective systems often support behavior change (directive function) by focusing on taking action based on reflection (Li, Dey & Forlizzi, 2010). In an elaborate review of reflection in HCI, Baumer et al (2014) found a significant number of papers (15 out of 76) in the category ‘reflection and self-knowledge’, but it can be argued that much of these do not, in fact, support the ‘identity function’ of AM but are primarily behavior focused. We consider these data-driven processes in which people look for patterns, set goals and track progress more related to the directive function of AM. In our design explorations, and specifically in the use of Balance and Cogito, we saw how media creation can also support this function. People created media to express goals, lessons or ambitions that helped to direct their future. We saw only a few examples of media supporting the identity function in our concepts, potentially because it requires deeper reflection (Korthagen & Vasalos, 2005), which was seen less. Aggregated media review, exploring multiple instances over a longer period of time, could result in more depth as it allows for comparison and generalisations (Staudinger, 2001). Such insights would connect better to the identity function. To some extent, the media also supported the



mood-regulating function, especially with negative feelings. Media creation and reflection helped to put things into perspective, lessening the intensity of emotions, similarly found by Isaacs et al. (2013). Finally, we saw little proof of our designs supporting the social function of memory, relationships with others were only rarely topic of reflection in our evaluations. Although people frequently reflect with others (Chapter 5), sometimes also with our designs (Chapter 7), there was little support that these reflections supported the shaping of social bonds. Instead, social connections with others were supportive of reflection, which is an area for future research (see Section 9.5).

Altogether, we conclude that we saw examples of different functions of memory being supported through mediated reflection. More specific design efforts could support depth to focus on identity or provide triggers to reflection on social bonds more specifically.

## **Reflection and life transitions**

We characterized everyday life reflection as a mode of thinking that occurs throughout the lifespan, at least from the development of sufficient cognitive skills and a view of the life story in adolescence (Staudinger, 2001; Bluck & Habermans, 2001). In our evaluations of designs for mediated reflection, we found that people in very different life phases appreciated the potential value. The reflections with Ritual Camera and Balance, Cogito and Dott were also clearly influenced by the life phases of participants. For example, families with young children more deliberately reflecting on time passing by quickly. A participant in her twenties focused on career choices and one in her eighties reflected on accepting the final stages of life, in accordance with the functions of life reflection as described by Staudinger, 2001). Such examples are valuable additions to the taxonomy of functions across different life phases, as it shows specific everyday examples, whereas the classification is primarily based on general self-report (e.g. asking “why do you think about your life”). As the phrasing of such questions strongly influences the answers on how and why people reflect (Staudinger, 2001) it is valuable to see that the media as data show similar patterns. Yet this topic clearly requires a longitudinal evaluation and a larger participant sample, exploring how engagement with reflection changes before, during and after life transitions.

Across all ages, the reflections with the open-ended designs included many everyday aspects, such as work performance, conversations with a partner or family activities. Still, it often concerned the ‘somewhat outstanding’ experiences. For example, a teacher reflected with Cogito on his preparation for annual exams, or an upcoming holiday (Chapter 7). To capture or reflect on what is ‘truly’ mundane, more specific direction would be needed. Based on our probes study and the experience with Ritual Camera, we see that with a specific focus, media can trigger reflections on very ordinary aspects, which can be valuable and appreciated.

## Levels of depth and detail

With everyday life reflection, we wanted people to consider their actions with some level of criticality or deeper introspection. We stated that we aimed for reflection that included: re-assessing thoughts, beliefs, feelings, and actions (Chapter 2). In other words that it was 'personal and somewhat critical'. This first aspect was clearly achieved, all reflection we saw in our studies was personal. People did not reflect on general levels such as concerning a theory in research (What does this theory mean for my work?), but always about their person (What did I do? How do I want to develop?). The reflections with our media concepts for open-ended reflection (Chapter 7) were often focused on actions (why did this happen, why did I do this). Most reflections we saw were on a descriptive or explorative (Hatton & Smith, 1995), by others considered as the first and second layer of reflection (out of four layers as described in Fleck & Fitzpatrick, 2010). We observed some responses on these levels as well, when people reviewed the visuals created with Ritual Camera (Chapter 5). For example, exploring why certain things are as they are or making remarks about certain habits they want to change. With Balance, Cogito and Dott, people relatively often also examined their feelings about these events (why does this make me stressed). The underlying beliefs were rarely assessed in our studies, so we only saw a few examples of critical reflection (Hatton & Smith, 1995), which related to either personal values or the broader societal context. Although such criticality was rare, we still believe systems could provide support for such criticality specifically, in contrast to Fleck & Fitzpatrick (2010), who primarily see support on the lower levels from which higher levels can but not necessarily will follow. Because our systems were so open-ended, reaching criticality relied heavily on the user's initiative. A more layered interaction could support this better (Consideration 7, Section 8.8), which is an interesting direction for future work (see Section 9.5). However, on a more fundamental level, it might be very challenging to facilitate critical reflection within habits that are integrated into everyday life. To achieve depth requires taking distance from a situation, to look at it differently or to evaluate more elaborately. Not surprisingly, such reflection more often happens when people (are required to) step out of their daily habits such as during holidays or life transitions (Chapter 5). It is therefore to be expected that deeper reflection is only attained rarely, even when facilitated through interaction. Such flexible desire for levels of depth are an interesting challenge for future work (see Section 9.5)

Because more critical reflections were rare, we could conclude that our designs have not really been able to stimulate criticality. However, when reviewing our results, we consider most reflections 'successful', even without such criticality. We conclude that the media interactions on the levels of descriptive reflection or explorative reflection (Hatton & Smith, 1995) were more meaningful and personally relevant than we had expected (Chapter 7).

People could create goals or generate valuable insights on these levels. Rather than stimulating to go deeper, designs should facilitate different levels of reflection. Systems should be designed with a layered interaction with media, allowing for further inquiry (Baumer, 2015) when desired (Chapter 8, consideration 7). As such, depth becomes not something that is prescribed (e.g. deeper is better) but can be one of the open aspects in open-ended reflection.

## **Past, present and future**

In our definition, we explicitly stated that everyday life reflection could focus on past, present and future experiences, with different temporal horizons being possible (e.g. both near- and distant past or future). However, we considered it important the reflections are connected to the present. This reduces the risk of dwelling on the past or ‘postponing’ things to the future. Overall, we can conclude that our mediated reflection gave direction for the future, focusses on the present but was firmly based on the past. Reflections with our media systems (Balance, Cogito and Dott, Chapter 7), were all connected to the present, being triggered by present experiences. At the same time, most media were future-oriented, expressing lessons, goals or ambitions. For most reflections, the temporal horizon (Blue-dorn, 2002) was very small, reflections were focused on that same day with some occasional connections into the more distant future. We can identify three reasons that influence this present-focus. First of all, when in the middle of everyday life activities, it is likely for people to be thinking about current needs and desires. To think about other times might need more specific external triggers. Secondly, this is the nature of media creation (capturing what is there at the moment), especially with the visual media of Dott, which were based on photos being currently made. And finally, this present-focus is caused by a methodological limitation, in which people were told to reflect on a day or every day, which also implied (wrongly) that the research desired focus on current experiences.

With more longitudinal use, we expect the role of media *retrieval* to increase, allowing for potential connections to be made and broadening the temporal distance. Supporting a larger temporal distance would be useful as it allows to synthesize across experiences and make comparisons, both crucial elements for reflection (Fleck & Fitzpatrick, 2010; Baumer, 2014). However, exploration will have to be supported through aspects such as thematic or chronological ordering; storing meta-data; and providing multiple perspectives. In line with Fleck & Fitzpatrick (2010), we propose that systems can support more depth in reflection by facilitating the exploration of (layers in) media, the reorganization of knowledge and the exploration of multiple perspectives.

## Characteristics as success criteria

We can conclude that some aspects of our scope were clearly recognized in our system evaluations. The creation of media was clearly reflective, designs supported the directive functions by capturing lessons and goals, there was always a connection to the present and people in different life-phases could use the systems in personally relevant ways. For other aspects of our scope, we have found less support in our evaluations. Primarily, we saw only few examples of the criticality we set out to provoke. Our studies had few participants, so personal style and individual level of reflective ability are of great influence here. Yet, we also saw that valuable insights were reached on other levels. Secondly, media retrieval happened less with our final designs, although Ritual Camera gave valuable insights on how media retrieval can support reflection, especially through providing a system perspective on mundane experiences. Both these aspects, the lack of depth and the underused potential of media retrieval, might be caused by the short-term studies. Another aspect of our scope that we did not achieve to full extent was the focus on everyday aspects. In our final design evaluation, most reflections concerned somewhat exceptional events. The open-ended reflection concepts provided insufficient support to consider ‘truly’ mundane aspects, external perspectives provide better stimulation, as was seen with Ritual Camera and the probes exercises.

In this section, we discussed the characteristics of everyday life reflection to explore if they can be used as success criteria. Evaluating the success of reflective systems within HCI is a challenge (Baumer et al., 2014) amongst others because it can be difficult to distinguish reflection among a range of meta-cognitive processes (Draper, 1999; Watkins, 2008). We focus on a specific type of reflection, so not any type of ‘thinking’ would be categorized as a success. We, therefore, consider a discussion such as this section a useful way to review our findings, highlighting for which aspects of our scope support or proof can be found and for which not. We consider this a useful way to make the success of reflection support systems more measurable, not in a quantitative but in a qualitative way.

## 9.3 Research Conclusions

Our research has primarily been guided by a design challenge, which we identified on the intersection of our three central themes: everyday life, reflection, and media interaction. We formulated this challenge as:

*How can we design media interaction systems  
that support reflection in and on everyday life?*

To contribute to this challenge, we formulated three research questions to guide our work, each emphasizing one of the three themes.

1. Which everyday life experiences become meaningful memories, and which are valuable for reflection?
2. What are people's practices, values, and desires concerning everyday life reflection?
3. How do system-supported media creation and media use influence reflection?

In the following sections, we will answer each question separately, before coming back to our overall design challenge.

### **Question 1: Which everyday life experiences become meaningful, and which are valuable for reflection?**

Everyday life experiences are often, arguably by definition (Felski, 1999), taken-for-granted. Yet from personal experience, we also know that mundane experiences can become valuable memories. In our probes study, we explored this further. We found that valuable personal memories often concern family, leisure time, and home. Much smaller numbers of valuable memories relate to friends, work, love, religion, and school (Chapter 1). In our exploration of mediated reflection (Chapter 7), the media showed a similar variety of themes, with friends, family, leisure, and home all included. In contrast to the findings in Chapter 1, reflections often also related to work (similarly found in our questionnaire, Chapter 5). These themes are often considered valuable for reflection as this is an area of development and growth, one of the benefits of reflection (Harrington & Loffredo, 2010).

These topics of valuable memories could arguably be used to provide direction for everyday life reflection. For example, suggesting people to reflect on family, leisure time and home, as these would be most likely to become valuable in the future. However, we believe the topics should not be seen in such a prescriptive or directive way. The value of everyday life reflection lies especially in its openness, both in content as well as in process (Ekebergh, 2007). Themes could, however, be used as suggestions for people to explore areas they might otherwise not reflect upon. We especially appreciate reflections in which connections between multiple areas are being made, reflecting on everyday life in more holistic ways. Many people experience a desire to explore connections between different facets (Li, Dey & Forlizzi, 2010) and it is arguably a core element of reflection – synthesizing across events to arrive at some greater understanding (Baumer et al., 2014). Such connections allow for more depth in reflection, connecting aspects from the environment and behaviour to deeper levels of personal competencies, identity, and goals (Korthagen & Vasalos, 2005). In terms of memories, such connections involve memories on different levels, ranging

from episodic memories or anecdotes to general event memories and their life time period (Conway & Pleydell-Pierce, 2000).

Although some topics were frequently recurring, the importance of memories is not so much determined by topic, but rather by their underlying value (Chapter 3). In earlier research, it was found that cherished objects are often valued because they refer to events, relationships or the self (Csikszentmihalyi & Rochberg-Halton, 1981). Based on a house-tour study, Petrelli et al. (2008) added a more detailed description of values: including objects that represent family bonds, are nostalgic, aesthetically pleasing or represent moral values. To this understanding of mnemonic values, we contribute specific reasons for mundane experiences to be considered valuable (even without objects being owned). Specifically, the experiences were retrospectively valued because they are: often repeated, representing a social connection, connected to the present, influenced the course of life or form a contrast (Chapter 3).

We found that these values evolve or change over time (Chapter 3). Recognising these values relies on reflection, for example, through temporal or social comparison, examples of a level of analysis that distinguishes reflection from reminiscence (Staudinger, 2001). This process of re-appreciation further inspired us to look at reflecting on everyday life as a valuable domain to be explored. Rather than 'only' reconstructing the events from memory, we were interested in how people can be engaged in some level of abstraction, comparison or analysis (Staudinger, 2001). Especially because the value of everyday life experiences changes, we consider them to be highly valuable for reflection. Additionally, there is an interesting interplay between everyday experiences and milestones or life transitions. Many life transitions greatly impact one's everyday patterns, such as where one lives, how one commutes or what activities one engages in. Therefore, we often reflect on past mundane experiences and preferred habits when making important milestone choices, an example of how memories are used for their directive function (Bluck & Alea, 2002). Such considerations are part of how people reflect before, during and after transitions (Staudinger, 2001) and draws an interesting connection between the (often unaware) everyday patterns and explicit moments of life choices.

In conclusion, some everyday life experiences are more likely to become meaningful than others. This is more determined by their underlying values, rather than only their topic. The perceived values of an event or experience can change over time, and this appreciation often relies on reflection. We believe everyday life reflection becomes more meaningful if connections across multiple experiences and themes are made.

## **Question 2: What are people's practices, values, and desires concerning everyday life reflection?**

Reflection is often conceptualised or described as a mode of thinking which people frequently engage in (Dewey, 1933; Kahneman, 2011). Despite this theoretical occurrence, we found a research gap in when and how such reflection specifically happens in everyday life. Using a questionnaire, we explored what kind of reflective practices are common. The study confirmed Staudinger's (2001) findings that, regardless of age, most people reflect frequently in everyday life. Reflection occurs in diverse ways, but not often as a fixed habit or routine (Chapter 5). Instead, most people could identify a variety of flexible habits, of which a number occur in parallel to other unrelated activities, such as chores or commuting. Other times, the reflection was supported by specific activities, such as talking, writing or walking. We have captured these diverse practices in a number of scenarios that can be inspirational to design (Chapter 5 and Chapter 7).

Such flexible habits rely on a suitable opportunity for reflection. One of the crucial factors often described before is that time is needed (Fleck & Fitzpatrick, 2010; Li et al., 2010; Fessl et al., 2017). Others have described abstract conditions such as who can be considered 'privileged enough' to reflect (Baumer et al., 2014), at which step in the development of reflection people are (Fleck & Fitzpatrick, 2010) or their level of self-criticism (Li et al., 2010). As part of creating a good opportunity for reflection, people often need encouragement (Fleck & Fitzpatrick, 2010). These are very abstract and high-level conditions for reflection. To this, we add more contextual elements based on our in-the-wild design evaluations (Chapter 7). For most people, it also included a moment of calmness, being alone and preferably at home. 'Calmness' does not necessarily mean not doing anything, but a certain level of (mental) rest, often for example experienced during chores or mild physical activity or at the end of a day.

This research question also addresses what people's desires are in terms of support. In the questionnaire, we asked for people's desires directly (Chapter 5). Most people were satisfied with their frequency of reflection, so increasing this frequency is not a goal in itself. Some expressed they would appreciate support, but others rejected the idea of system-supported reflection. It is difficult to assess the reliability of these answers, as they depend highly on what people imagine a system might provide. Therefore, we use our design explorations to provide additional insight into what such desires might be. The prototypes allowed people to experience the potential of media supported reflection. In the review of media created with Ritual Camera (Chapter 5), people especially appreciated the potential to show patterns and habits that cannot be directly perceived, which others have also described as one of the potential benefits of using systems for reflection (Fleck & Fitzpatrick, 2010; Baumer,

2015). In the exploration of Balance, Cogito and Dott, (Chapter 7), we found that people appreciate the potential value of media to serve as reminders of previous reflections and conclusions. When using these systems, some people desired more direction, more explicit support, as they found it challenging to use our open-ended systems in a meaningful way. We elaborate on these supportive elements in the answers to research question three.

Our insights into everyday practices are primarily based upon our questionnaire (Chapter 5), a method that relies on self-report. Specifically, it requires people to report their own general behaviour, looking back over a longer period of time, answering when, where and how certain behaviour occurs. It can be questioned if people are sufficiently aware of their own moments of reflection. The reliability of their answers is additionally lowered, because people were asked to answer in general terms such as “I frequently examine my feelings” and “I often think about the way I feel about things” (from Grant, Franklin & Langford, 2002). Methods that collect data in-the-moment, over a longer period of time, such as experience sampling (Larson & Csikszentmihalyi, 1983), might bring forward different information on frequency (when) and types of reflective activities (how). Others have similarly noted that the answers on how and why people reflect will differ depending on how the question is asked (Staudinger 2001). In the case of system-supported reflection, self-reported behaviour can be supplemented by analysing the created media. Isaacs et al. (2013) for example performed elaborate textual analysis on the media created with Echoes. However, specific consent is required, as reflective media might be very personal.

All these findings are based on the perspective that a reflective attitude is desirable, which forms the backbone to our work. But how is reflection valued by others? Our research showed that reflection can also be associated with more negative aspects. In our questionnaire, people mentioned processes of worrying, mulling or negative self-thought (Chapter 5). It is important to recognize that, although constructive reflection is a positive process, it exists within a broad spectrum of types of ‘repetitive thought’ that also include many processes with negative effects (Watkins, 2008). For example, rumination can be described as “the tendency to repeatedly self-focus on one’s past action”, often without a constructive conclusion or new perspective is being reached. Projects on reflection in HCI often assume positive effects and neglect the potential risks (Baumer et al., 2014). In line with Baumer et al. (2014), we therefore emphasise that framing reflection in a certain way and providing support for a constructive process is important. Although we stand with our primary perspective that reflection is valuable, a nuanced approach is required. In Section 9.5, we elaborate on future research that focusses specifically on supporting positive and constructive reflection.



In conclusion, most people engage in a variety of reflective practices, which we captured in a number of scenarios to inspire design. More generally, the notion of opportunity for reflection can support better integration into everyday life. Earlier research has described more abstract conditions for reflection, to which we add the contextual factors of calmness, being alone and being at home. Most people did not express an explicit desire for reflection support, but in the evaluation, most appreciated the potential of systems to provide a new perspective, to support expression and to remind of previous reflections. We recognise that limitations of our approach lie in the reliance on self-report and the focus on positive experiences.

### **Question 3: How do system-supported media creation and media exploration influence reflection?**

In everyday life, reflection is often a process which occurs just in the mind, although support can be given by complementing external factors such as talking or writing. Reflective media systems inherently influence how reflection occurs. In our studies, we found first of all, that interaction with reflective systems makes the process more deliberate. For example, interacting with a system has a specific start and end, transitions that are less deliberate when reflection occurs during other activities. Secondly, rather than remaining in the mind, using a system makes the reflection more tangible. This makes reflection more deliberate as specific actions are consciously chosen, such as recording, sending or adjusting parameters (Chapter 7). Media systems could further benefit from facilitating reflective actions such as creating, opening, choosing or selecting. Such actions contribute to existing overviews of activities that could support reflection, making them more specific. Moon (1999), for example, suggests encouraging review and revisiting or the use of ill-structured material to create situations that require aspects of reflective thought. Through interactive systems, such 'situations' can be translated into supportive interactions such as selecting or structuring media.

Secondly, when answering this question on the influence of media interaction of reflection, we observe an influence on the temporal focus of the interaction. In many reflective systems that use media, reflection primarily occurs when viewing the media (such as Isaacs et al., 2013; Fleck, 2008; Lindley et al., 2009; Landry, 2009). In such systems, the creation of media is instrumental to future reflective retrieval. In our exploration with Ritual Camera, we similarly found examples of reflection supported through media exploration (Chapter 5). In such moments of retrieval, the reflection is primarily focussed on the past. However, the designs of Balance, Cogito and Dott, required more deliberate creation, which we found to support reflection in complementary ways. During creation, reflection is more focused on the present and future; many goals or lessons were expressed, supporting the directive

function of memories (Bluck & Alea, 2002). In addition to this temporal focus, we see that retrieval and creation are complementary as they use different drives. Creation can support reflection through externalisation, by being expression driven. This is one of the drives rarely explore in HCI-projects, which are most focussed on information or conversation driven approaches (Chapter 6).

Thirdly, one of the most important influences we explored with Balance Cogito and Dott, is that on the depth of reflection, often seen as one of its core characteristics (see e.g. Kember, 2010; Martins & Santos, 2010; Fleck & Fitzpatrick, 2010; Dymont & O'Connell, 2011). Media creation with our systems demonstrated elements of introspection, prospection or generalisation but often did not include higher levels of criticality (Chapter 7). We believe reflection in creation can be supported by stimulating a combination of capturing (external aspects) and expressing (internal aspects) (Chapter 1). Our interactions did not yet support a good combination of both, as Dott often primarily represented an event (capturing the external) whereas Balance and Cogito often mainly captured thoughts (expressing the internal) sometimes without reference to the event. This is seen as one of the reasons that that reflection during media creation is primarily on a descriptive reflective level. It demonstrates some elements of introspection, prospection or generalisation but often does not include higher levels of criticality (Chapter 7). Media exploration has a higher potential to reach depth, as generalisations or comparisons across multiple instances can be made (Staudinger, 2001). Additional support to achieve depth could be given by combining system data with personal perspectives. In our evaluation of Ritual Camera (Chapter 5), we found a systems interpretation (for example about habits) provided valuable insights. In the area of personal informatics, Li, Dey & Forlizzi (2010) have similarly argued that designs can benefit from combining system and human effort. System-collected data can perceive things that people cannot (such as accurately tracking activity) but inherently limits the scope to what can be measured or sensed by a system. Media allows people to express aspects which systems cannot measure, which is why we see potential in combining both.

Finally, we saw that media was primarily created of positive events or with a positive tone (Chapter 7). We consider this an interesting observation, as reflection is often associated with problem-solving or with resolving challenges. On the other side, media in general is created more of positive experiences (Chaften, 1987). Arguably the use of interactive media systems could make reflection more positive, avoiding the negative consequences of rumination. However, only focussing on positive experiences is not the solution, as reconsidering more negative past experiences helps to put them in perspective (Isaacs et al., 2013; King, 2001), which is a major benefit of reflection. It remains unclear if and how media can help to put more negative experiences in a positive light through constructive reflection, a

topic for future research (elaborated upon in Section 9.5).

In conclusion, we see that system-supported media creation and exploration primarily influences reflection by making it more deliberate. Secondly, systems influence the temporal focus, turning towards the present and future in creation and more towards the past in media exploration. We found that systems could influence the depth in reflection, with potential ways to support people to be more critical. Specifically, we consider this more likely to happen if capturing and expressing are combined in creation and if system and user perspectives are combined. Finally, media supported reflection could influence reflection by being more focused on the positive, but more research into this aspect is needed.

### **The design challenge: How can we design media interaction systems that support reflection in and on everyday life?**

Our three research questions have all contributed to our understanding of everyday life reflection and how interactive systems can play a meaningful role in this process. They have helped us to address our design challenge, by informing our three design explorations. Based on this process, we have formulated seven design considerations (Chapter 8). Here, we summarize our main insights on how to design media interaction systems to support reflection.

First, we conclude that everyday life reflection can best be supported using open-ended systems. This allows for exploration, appropriation, and flexible use. In our view, the open-endedness should manifest itself both *in* reflecting in everyday life and *on* everyday life. In other words, both in use and content (Consideration 1). In terms of use, we suggest creating systems that do not rely on a fixed timing or a fixed process but support flexible habits. Building upon our understanding of flexible habits and opportunity, we add that reflective systems should have a (subtle) presence in the home (Consideration 1) allowing to be perceived in the periphery of attention and slowly drawing attention (Bakker & Niemantsverdriet, 2016). Using such triggers allows for the initiative to be more balanced between person and system (Consideration 4). Specific triggers are especially needed after a period of non-use, to stimulate re-uptake (Consideration 1).

Secondly, with open-ended reflection in content, we emphasize that systems should not frame specific topics or constrain considerations to a certain domain, but support all aspects of everyday life. Such a broad view allows the discovery of patterns and behaviours during the process without defining a scope up front (Consideration 2). As such, we prefer using a diversity of content triggers or more open direction triggers as suggestions for what to reflect upon (Consideration 4). We describe three levels of triggers, ranging from content to

direction and opportunity triggers. Another way to open up the scope is to stimulate people to review existing media in different ways, through reframing or repurposing (Consideration 3). Media can be created in many different ways and forms, some extensive (such as diaries), some very small (such as single words or snapshots). One of the challenges of open-ended creation, especially with abstract media is finding a balance in the trade-off between specificity and ease (Consideration 5). Elaborate media that describes an experience specifically can be very supportive, but very effortful to create and retrieve. In turn, more simple media can be created quickly and effortlessly but might provide less support both in creation and retrieval, as the effort is not necessarily negative but can be supportive of reflection (Consideration 6).

Thirdly, we have argued that triggering to reflect, is merely one of the *roles* reflective systems can take (Consideration 7) and that such roles can be combined in different ways with *strategies* (Consideration 5). In addition to a triggering role, systems can also *support* the subsequent process and *capture* reflections for future consideration. It is best if this support is open and flexible, as a structured step-by-step process would not fit the nature of everyday life reflection (Ekebergh, 2007). Based on a review of related literature and our design exploration, we formulated four important strategies (Chapter 6). These strategies are: dialogue-driven, information-driven, expression-driven and environment-driven. They should be seen as some of the more commonly used dimensions (similar to the position taken by Baumer, 2015), as reflection can be stimulated in a myriad of ways. In our view, designers of interactive systems often focus on the first two and can benefit from implementing more expression- and environment-driven mechanisms. For example, the overview presented in Fleck & Fitzpatrick's (2010) focusses on technologies for recording and revisiting in different ways, which are primarily information-driven, with some aspects of conversation. All rely on forms of information and conversation, with little room for expression. One of the advantages of using expression driven systems is that it reduces one of the risks of data-supported reflection: a focus on automatically observable, quantifiable metrics, which may have significant ramifications on the impact that reflection might have (Baumer et al., 2014)

Fourthly, as explained in our third research question, when focussing on media for reflection, designers should consider reflection both during creation and exploration of media, as their values are complementary (Consideration 5). Earlier research often focusses on media or data exploration in which collection or creation is instrumental to future retrieval rather than valuable in itself. Combining both types of media interaction can create reflection on both the short and long term; regarding single experiences and building connections; being expression driven and information driven. Media creation can be especially supportive of appreciating the present and directing the future (Consideration 2). In such processes,

investing effort in creation is not a bad thing, rather than creating technologies that create large quantities of data in an indiscriminate way, we there suggest to focus on effortful creation or selective automation (Consideration 6).

During both these stages of media interaction, systems should not just trigger (to create or retrieve), but provide additional support if deeper reflections are preferred. Systems can support processes of comparison and abstraction, which are fundamental for reflection (Staudinger, 2001), by presenting multiple media together or by providing multiple perspectives (Fleck & Fitzpatrick, 2010). Presenting media in multiple layers or across a longer time frame can support additional depth (Consideration 3 and 5). Depth might not always be needed, but if it is desired, triggering might not be enough (Consideration 4 and 7) and additional support through layers or perspectives might be needed to allow people to focus on inquiry (Baumer, 2015).

In conclusion, we propose to design for reflection by recognising the open and flexible characteristics of everyday life reflection. This requires going beyond content triggers into a more open-ended approach. We present a broad design space that combines four strategies and three roles (Chapter 6). Systems can benefit from shifting more between roles and can support more depth in reflection by presenting multiple perspectives or layers. Finally, specifically for media systems for reflection, we see that creation and retrieval have complementary values if both processes are designed in a reflection supportive way.

## 9.4 Generalization

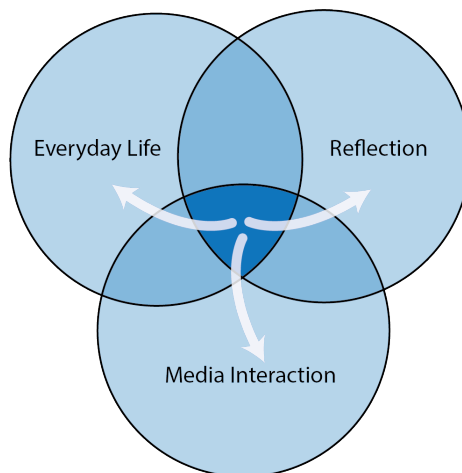
As discussed in the introduction, the work in this thesis is characterised by the combination of three themes: everyday life, reflection, and media interaction. It has therefore built upon theories from each of these areas. Similarly, the findings can be generalised to these themes as well, discussed here. Additionally, we put forward how our experience in research-through-design can inform others taking this approach.

### Generalizations about reflection

Our research focusses on everyday life reflection as a specific type of reflection.

Reflection in recent work often focuses on more instrumental reflection, either as part of learning in an educational context or in a process of behaviour change. With our work, we have brought it back to a more general level of reflection concerning ‘how we think’ (Dewey, 1933) being part of our system of conscious thought (‘system 2’, Kahneman, 2011). Such a view sees reflection as a more abstract notion, which can concern any phenomenon rather than a specific step-by-step-process with a concrete outcome. We hope this more abstract view can inform the discourse on reflection to be raised to such a more abstract or philosophical level.

Secondly, we see that much of the research on supporting reflection focus on informing the process. Supporting reflection ‘outside-in’ by providing data, provocative prompts or questions. Based on our experience with personal media, we believe that the process of turning reflection ‘inside-out’ could also benefit from support. At the core of reflection, the process includes being able to bring to the surface underlying thoughts or beliefs. This is



*Figure 9.1. Our research on the intersection of three themes also contributes to each of these areas separately.*

for example facilitated by expressing thoughts, in speech, text or otherwise to which more attention can be given.

In addition to such a general view, our insights could be more specifically applied to the context of education or professional development as well. Our findings could be used in such areas to stimulate researchers and practitioners to look at reflection more holistically. We argue that these areas could benefit from integrating more everyday aspects into their reflection. We believe broader everyday experiences could be integrated in reflection for behaviour change. Often, interactive systems for behaviour change focus on a single behavioural aspect (for example food), using system based sensors for tracking. Such designs would benefit from including a more holistic perspective on reflection, allowing people to express personal perspectives and related experience. Similar connections could be made in educational reflection.

For everyday life reflection, we found that different layers hold value and that the deepest level (critical / transformative reflection) might not always be the aim. Similarly, in education, considering when such criticality is required, and how often it can be achieved would be valuable. Especially because available time is often limited, which can influence the depth of reflection that can occur (Fessler et al., 2017). Our strategies for achieving depth could be explored in these areas as well, especially those supporting taking multiple perspectives (similarly suggested by Fleck & Fitzpatrick, 2010), such as layered media interaction and different temporal views (Chapter 8, Consideration 7).

#### *About Studying Reflection*

Both for participants and researchers, it is challenging to determine when a metacognitive process ('thinking') should or should not be considered reflection, despite (theoretical) definitions (see also, Baumer et al., 2014). In our studies, we aimed to minimize this effect by scoping everyday life reflection with several specific characteristics, such as depth and temporal focus. These characteristics made it easier to instruct participants. We consider such descriptions helpful in distinguishing what type of reflection is being studied, as it is studied in so many different domains and for different outcomes (Baumer et al., 2014; Fleck & Fitzpatrick, 2010).

As mentioned before, a more longitudinal study would greatly improve our understanding of reflection in everyday life. Yet, the duration of our final evaluation (6-8 weeks) showed to be of valuable length as well. Even though the need for reflection fluctuates dependent on life transitions and major events (as described in Chapter 5). The study period already brought forward many of such occurrences (in 'medium' size). Within our small group of six participants, we observed changing jobs, moving house, and smaller 'typical' events such as

going on holidays. To evaluate concepts for reflection, studying use ‘in-the-wild’ is crucial. Yet, the required effort of a longitudinal study should be balanced with the goals of studying reflection. For example, when studying topics of everyday life reflection, more short-term approaches can suffice. On the other hand, when exploring the changing values over time or the different temporal distances to be supported, longitudinal studies are needed.

## **Generalizations about media interaction**

Our research has focused on interaction with media for a specific goal: to reflect. In everyday life, people interact with media for a number of individual, social and utilitarian purposes (Broekhuijsen, Van den Hoven & Markopoulos, 2017). People create digital media in abundance, even increasingly of more mundane aspects (Van House, 2011, Broekhuijsen, 2018) but often do not interact with the media to their full potential (e.g. Whittaker, Bergman & Clough, 2009; Broekhuijsen, 2018). From our studies on interacting with reflective media, some lessons can be drawn relevant for this broader field. Primarily, we believe that triggers for frequent media interaction can be given by creating devices that give media presence (see, for example, Gennip et al., 2017), provoke more physical interaction and use peripheral triggers. Others have already explored how media presence in the home can allow for exploration and interaction to be integrated into current activities (e.g. Helmes et al., 2011). Cogito was our first exploration into giving devices a behavior, in this case, a rim of light that indicated the ‘fullness’ of the device to attract attention. Such system behavior can serve as a peripheral trigger, as an alternative to alarms or notifications that are invasive to one’s attention (Bakker & Niemantsverdriet, 2016). We consider this a promising direction that could further stimulate frequent media interaction.

In our study with Balance, Cogito and Dott, dedicated media was created for reflective purposes. Our findings regarding creation mechanisms that stimulated reflection, could also be used to bring more reflectivity into other types of media creation. This might result in a more balanced approach, for example between capturing special occasions and the mundane, or between cherishing a positive memory (‘rosy retrospect’) and representing a more realistic view. In times of analogue photography as the main medium, scarcity was often a cause for reflection, which experiences were sufficiently important and or aesthetically pleasing to invest time, effort and money in. Some researchers have suggested reimagining such scarcity (Niforatos, Langheinrich & Bexheti, 2014) to which we add other mechanisms to stimulate reflection. For example, using ‘briefness’ or selectivity, capturing in only a few words or visual detail, stimulates reflecting on how to capture the essences. We also found that introducing some effort in capturing might be beneficial. Other interactions could explicitly stimulate to combine capturing with expressing, for example through tags or media abstraction.



## Generalizations about everyday life

HCI is increasingly concerned with everyday life as it has shifted from the workspace into our homes, everyday lives and culture (Bødker, 2006), going beyond efficiency and into the messy, intimate and contested aspects of everyday life (Odom et al., 2016). However, the aim to study and design for everyday life is rarely made explicit. We hope to contribute to a more detailed understanding of what everyday life is and is not: it can be defined in contrast to special occasions, relates to both the planned and unplanned and is often habitual. Many everyday behaviors remain similar over longer periods of time or change slowly. External perspectives are often needed to make people aware of specific everyday life behavior or experiences, as we saw in our probes study (Chapter 3). With design for reflective habits, we have focused on supporting flexible habits, based on opportunity and flexible triggers and this approach can be valuable for a broader range of everyday habits.

One of the biggest challenges in evaluating designs for everyday life is assessing their integration in routines. Ideally, this requires longitudinal evaluation, but this does often not fit in an iterative or reflective design process. The “how long should my study run for?” is hotly debated within HCI research (Crabtree et al., 2013). In our experience, studies running several weeks show initial steps of exploration and appropriation. A more phased study set-up could stimulate participants more explicitly to explore other uses. For example, instruct participants to use a design for two weeks in a specific way, then allow them to explore how the system can be used in personally relevant ways for several weeks. Stimulate them to move the device around, (which greatly influences how it is integrated into activities, see e.g. Helmes et al., 2011) or to find alternative uses, to modify or combine with other objects. Such actions allow for technology to become part of the home and for people to experience ‘lived with’ qualities (Odom & Wakkary, 2015; Odom et al., 2016). However, people might be hesitant to change the use of prototypes, which is why specific instructions about such open-endedness might be needed. Hallnäs & Redström (2000) similarly state that their designs need to be “carefully framed and introduced”. We agreed that instructions matter greatly, especially with open-ended design, where the way a concept is introduced, offered and delivered should be designed as well (see for example the experimental distribution of ‘Camera Obscura’ in shops, Pierce & Paulos, 2015).

## 9.5 Research-through-Design Approach

In our process, we have adopted a research-through-design approach (Zimmerman, Stolterman & Forlizzi, 2010). Here, we present a critical discussion of this process as well as its limitations. Additionally, we explore how our methodological insights can be generalized to inform others practicing Research-through-Design.

### Process & limitations

Research-through-design has been criticized for not giving sufficient attention to the process in reporting (Zimmerman, Stolterman & Forlizzi, 2010), highlighting that the act of designing should not be a 'black box' (Fallman, 2003). On the level of the individual studies, we have addressed this by articulating how the designs came into being. For example, by highlighting the earlier iterations (e.g. of visuals in Chapter 4 or concepts in Chapter 7) or by explaining the steps of developing multiple ideas into concepts (Chapter 6). One of the limitations of this research as a whole is that less attention is given to how the individual studies together form the research-through-design process.

We consider the approach as a whole to be a reflective process (Schon, 1992; Fallman, 2003) with sufficient open-endedness in terms of outcome for earlier studies to impact the direction of the research. However, as problem setting and problem solving are intertwined (Fallman, 2003) one of its limitations can be seen in the challenges of determining clear success criteria. The three themes (reflection, media interaction and everyday life), were at the centre from the start, but during the process, more emphasis has shifted towards reflection (especially based on insights from Chapter 3 and 4). This research opportunity was chosen because it is a current and meaningful challenge, present in our early finding. We recognize that insight in our process is limited by the amount of detail we provide about our own reflections.

During the process, alternative paths could have been chosen, resulting in different outcomes, as will be explained separately (p.261). Additionally, there are specific connections between individual studies that could have been stronger, by implementing earlier findings in later design explorations. These are discussed below.

#### *Limitations in connecting studies*

The limitations of individual studies have been discussed in each chapter. Some additional limitations are seen in the way the different studies informed one another.

Unfortunately, not all our earlier recommendations are implemented in our final design exploration. For example, supporting a positive perspective is only mildly addressed in Balance and no specific design aspects support it in the other concepts. It is one of the aspects in which our trio of concepts can be considered being 'too open'. In general, for

some participants it was difficult to make meaning of the open-ended concepts and more support was needed. This applies even more when aiming to achieve more depth. Although we have analysed in great detail what depth was reached, the concepts only embodied a few hypotheses on supporting depth (such as stimulating evaluating with Balance or comparing with Cogito). Supporting depth through more elaborate interactions is therefore still an area for future research (see Section 9.6).

Additionally, Ritual Camera showed the potential of a system action to provide a unique perspective (in this case, abstraction through visual processing). But such an external perspective was not implemented in the concepts in Chapter 7. Instead, the focus relied much more on personal expressivity which can be one of the reasons truly ‘mundane’ events were rarely considered. Although combining human effort and system input is a consideration (see Section 8.7), we have relatively little insights on how this balance should be reached. Finally, our early research (Chapter 3) showed that the meaning of everyday experiences as well as related media changes over time. Yet the evaluations of our design interventions all reviewed material on a single moment, relatively short after creation. Thus, our design evaluations gave little attention to these changing values, for which more long-term research is required.

#### *Alternative paths*

One of the pivotal moments in our research was the choice after the probes study which direction to continue on (Chapter 3). The option to focus on repeated events was seen as an interesting concept because between media qualities and psychological theory could be made. The aim to create new media types moved the focus of the research more towards the present, rather than the past. After evaluating Ritual Camera, the focus of creating media in the present was set even more specifically on creating such media for reflective purposes in the present, rather than the potential for future values. A different, but very interesting research process would have followed from focussing on one of the other directions. Either with a focus on past experiences (through repurposing) or by focussing more on future value (through present selection).

## **Generalizing insights about artefacts**

The act of ‘making’ is central in research-through design, as it is generative and exploratory (Gaver, 2012). Concepts are often used as explorations of theoretical frames and as embodiments of new ideas (Stolterman & Wiberg, 2010). Concepts can be manifested in different ways such as drawings, mock-ups, conceptual descriptions (e.g. Chapter 6), technology probes (Chapter 5) or through elaborate and more refined prototypes (Chapter 7) which might be considered ‘research products’ (Odom et al., 2016). The roles of prototypes within design research varies greatly, such as provoking critical thoughts, supporting

open-ended exploration or validating hypotheses (Stappers 2010; Wensveen & Matthews, 2015). As a result, the creation of designs and reflections upon them can result in a range of topical, procedural, pragmatic and conceptual insights (Gaver, 2010). Based on our work, we propose that concepts and prototypes can be used to gather knowledge on three distinct levels: regarding implementation, experience, and concept. Here, we do not consider these as phases in the development (e.g. first a concept then a design then a prototype), but as looking at the contribution on different levels.

First, on the *level of implementation*, findings often relate to the specific form and performance of a design. They often concern the prototype, are low-level and suitable for concrete iterations to improve upon aspects such as performance, reliability, and appearance. Some insights on implementation might be gathered during first-hand use in the development (Pierce & Paulos, 2015; Odom et al, 2016). In our development of Ritual Camera (Chapter 5), personal deployment at the homes of one of the researchers helped to improve sensor sensitivity and camera angle. In Balance, Cogito and Dott (Chapter 7), insights on this level relate to the readability of the screens of Cogito, the accuracy of force sensors in Balance and the pixel selection process in Dott.

Secondly, insights can be gathered on the *level of experience*, focusing on the interaction with a design, the user experience and the integration in everyday life. These insights are useful for developing future designs within the specific scope and provide answers to research questions. Such insights are more abstract than the aspects of interaction, stretching into the values and risks of the design. For example, the perspective of the Ritual Camera photos triggered associations with images from security cameras, caused by the view from a top corner of the room. Odom et al. (2016) claim that when exploring the relation between humans and systems or their integration in everyday life, prototypes might not suffice. Instead, it requires a more sophisticated artefact which they call *research product* (Odom et al., 2016). Design products are described as artefacts that are intended to be evaluate as ‘what is’ rather than ‘what might become’ (Odom et al., 2016). We consider our artefacts of Balance, Cogito and Dott to be close to this definition, they are inquiry driven and have higher levels of finish, fit, and independency (Odom et al., 2016). These higher levels of *finish, fit, and independency* allow for more long-term deployment, which is especially suitable to gather insights on this level.

Finally, on the most abstract *level of concept*, we see that the creation of research artefacts contributes to a high-level understanding. In design research, especially when on an explorative level, we are often interested in conceptual or high-level insights. In our case, we are more broadly interested in exploring the value of *media supported reflection*,

beyond our specific designs. A prototype allows people to experience specific aspects of a concept, which forms the gate to imagining the conceptual value (Wensveen & Matthews, 2015). Different kind of questions should be asked to provoke people to explore an artefact's potential on multiple levels, for example to look beyond its technical limitations or to imagine other, more personally relevant uses. Another mechanism that helps to reach this level of insight is synthesising across different artefacts, as we did together with participants in the evaluation of Balance, Cogito, and Dott (Chapter 7). Similarly, we used the design space (Chapter 6), to reflect on this level. For us, the visuals in photographic style (compared to sketches) helped to support imagining personal use and relevance to raise conceptual insights.

In our view, different insights about a design can (and should) be collected, on the implementation, the experience, and the broader concept. Especially in field deployments, experiences on the implementation level can prohibit people from assessing an idea on its conceptual level. A certain prototype level (especially of fit, finish and independency, Odom et al., 2016) is needed for higher levels to be explored.

## 9.6 Future Research

In addition to answering our primary research questions, our work also raises new questions within this specific scope and highlights new opportunities. Specifically, we raise questions to deepen our understanding of everyday life reflection and to advance the design of media systems to support it. Then, we propose two new design directions to explore: one focusing on social reflection, the other on wearables for reflection.

### **Future work on understanding everyday life reflection**

Our research has scoped everyday life reflection as a valuable area of study and has increased the understanding of this specific type of reflection. Future work could contribute further to the understanding of this complex process. First, we raise questions on how a desire to reflect is experienced by people. We have studied the need for reflection, using a standardized scale (SRIS, Grant, Franklin & Langford, 2002), finding little differences in the 'amount' of experienced need. It can still be assumed that the desired type of reflection differs in different life phases (Staudinger, 2001). From an experience perspective, it is interesting to explore more qualitatively how a 'need for reflection' is perceived. Do people recognize this as a need, or is it an 'unease' or a general dissatisfaction with their current state, that, in retrospect, can be seen as a need for reflection?

Secondly, our understanding of everyday life reflection can further be advanced by considering its emotional valence more deliberately. We found that it can be difficult to distinguish reflection and rumination. In everyday life, both modes of thinking might blend. Watkins (2008) describes many types of repetitive thought, highlighting different valences of content and diverse consequences (positive or negative). Some of the reviewed studies focused on repetitive thoughts in specific mental dispositions, such as depression. These studies often highlight potential risks of reflection, that can increase negative feelings. For us, this raises questions on how, in a general population and in everyday life, different emotional valences of thought shift from one to the other. When and how does positive reflection become ruminative? And when and how can rumination be turned into more positive and constructive thinking?

Finally, we believe much can be gained from a more detailed understanding of the benefits of everyday life reflection. In different contexts, reflection has been connected to a wide variety of positive effects, including increasing adaptation and self-development (Dewey, 1933), improving wellbeing (Harrington & Loffredo, 2010), and improving 'openness to new experiences' (Trapnell and Campbell, 1999). It would be worthwhile to explore which of these benefits hold for more casual types of reflection. Which apply in the short-term and which are only achieved with longer and consistent reflection? And finally, which of these benefits are most appreciated in everyday life and can be a motivation to engage with reflection? A better understanding of the benefits of reflection can help in framing design interventions as helpful.

### **Future work on media interaction for everyday life reflection**

In our research, we have explored a specific type of designs to support reflection: interactive systems that use personal media. We have found that both creating and exploring media holds potential for reflection, but that more support might be needed as very open-ended designs were not suitable for everybody. Future research is needed to explore exactly how media creation and exploration are complementary. In our final study (Chapter 7) we found the primary support for reflection to occur during creation, but how will this evolve when a system is used over a long period and media from longer ago can be explored?

In addition to this longitudinal value, we consider the exploration of supporting depth in reflection one of the most interesting future directions. How can systems support people in achieving more depth, towards a level of critical or transformative reflection (Mezirow, 1990; Fleck & Fitzpatrick, 2010)? We propose several directions that might be worthwhile to explore: iterative interaction, layered interaction and human and system perspectives. Interacting with media in an iterative way would allow people to reconsider past experien-

ces in a new light. In our design explorations in-the-wild, reflecting on a certain experience only happened a single time. Many models of reflection in learning rely on iterative cycles of action and reflection (Korthagen & Vasalos, 2005; Gibbs, 1988; Li, Dey & Forlizzi., 2010). Isaacs et al., (2013) explored how an application could be used to support such revisiting, finding that values change and that revisit supports a more nuanced view on negative experiences. In addition, it would be interesting to explore how a layered interaction can support depth. In such an approach, people might initially see little information or only a single item of media but have the potential to explore related items. Epstein et al., (2016) discuss the use of aggregated data to stimulate reflection, compressing data of a certain period into different (simplified) views. Similarly, we could explore how aggregated media might support reflection. Finally, we believe combining system effort and human effort is worth further exploration. How can expressive media creation be combined with system collected data? Can objective data (such as used in the area of personal informatics) be combined with a subjective, personal perspective? We believe such different views will support a more critical perspective.

In this process of providing more support, additional opportunities lie in focussing on how to stimulate positive and constructive reflection. Reflection is often associated with problem solving or tracking goals for personal improvement (for example, Travers, 2011; Choe et al., 2017; King, 2001), which means it potentially involves recalling negative experiences (for example, why a goal is not achieved or how someone responded to a problem). Recalling more negative experiences or challenges had the risk of becoming mulling or worrying. Distinguishing reflection from the negative process of rumination can be very challenging (Harrington & Loffredo, 2011; Grant, Franklin & Langrod, 2002; Trapnell and Campbell 1999) and, in practice, one can turn into the other (Chapter 5). In our explorations with media supported reflection, we found that many of the reflections were positive, concerning happy events and positive emotions. This might be influenced by the act of media creation or the specific interactions in the used designs but this is highly speculative. We, therefore, consider this an interesting area for future research. It would be interesting to explore further if media systems can contribute to a more positive focus, contributing to our perspective that everyday life reflection can contribute to appreciating mundane experiences. Such positive practices can have a positive effect on personal well-being. King (2001) for example found that writing about our hopes and dreams (positive, future focussed) has health benefits, whereas therapeutic writing is most often focussed on processing negative or even traumatic experiences (King, 2001). However, systems do not need to focus only on the positive, but could be a valuable contribution by providing support for more constructive reflection on negative events, rather than mulling or rumination (Watkins 2008). An interesting direction for future research would be to explore if valuable combinations

between human- and system-perspective can be made. For example, to counter negative aspects with positive views, for example based on earlier media creation.

Our designs focused on media created specifically for reflection, which most people rarely do. Yet from a broader perspective, media is created in abundance. As mentioned in Section 9.4, our insights could be used to make other types of media interaction more reflective. Rather than creating more, a specific direction worth exploring is the re-use of media for reflective purposes. For example, how can valuable connections to social media be made? Media on social platforms is sometimes re-presented to people, for reminiscing or for reflection (e.g. On This Day<sup>21</sup>), but is only presenting posted content back to people enough? In our probes study, we found that photos of special occasions could be re-appreciated when explored with a focus on mundane elements. Through a process of remediation, people could be stimulated to explore media from different perspectives, for example, by looking for themes or storylines (Thomas et al., 2017). We believe that visual abstraction, such as explored with the use of Ritual Camera (Chapter 5) and Dott (Chapter 7), could be another valuable area for remediation. By morphing or merging existing media, emphasis could be given to specific elements, stimulating reflecting on the content of the media.

We have explored how systems can be integrated in existing habits and how flexible habits can be created using triggers and opportunity. However, we also observe that many of the ‘natural’ moments of reflecting are fading. Moments in which the mind can wander, such as waiting, commuting or doing chores, are increasingly filled with other activities (Wayne, 2016; Carr, 2011). Future research could explore how to stimulate non-use (of distracting devices) to create time for reflection. Increasingly, phones and apps<sup>22</sup> explore stimulating non-use for varying reasons, such as more personal social interaction<sup>23</sup> or safe driving<sup>24</sup>. Exploring specific triggers to stimulate reflection during non-use would be interesting. In a related vein, we wonder what the effect of using reflective devices is, beyond their moment of use. In other words, if someone reflects with a device once a day, will he also reflect more frequently (or better) without the device? Such questions will require longitudinal in-the-wild studies, using a combination of measures to find such effects.

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<sup>21</sup> Currently presented as <https://www.facebook.com/memories>. Last accessed March 2019.

<sup>22</sup> Popular apps include Forest (<https://www.forestapp.cc/en/>) Mute (<http://www.justmuteit.com>) and Moment (<https://inthemoment.io>). Last accessed March 2019.

<sup>23</sup> In the app MOB people can challenge their friends not to use their phone and set penalties such as paying the next round (<https://itunes.apple.com/us/app/mob-the-anti-antisocial-game/id882927718?mt=8>) Last accessed March 2019.

<sup>24</sup> Campaign ‘Mono’ by the Dutch government – discouraging the use of smartphones during driving <https://www.daarkunjemeethuiskomen.nl/rijmono/over-de-campagne> Last accessed March 2019.



## **Design direction: casual social reflection**

Our design explorations have focussed on supporting individual reflection. However, we also found that people frequently reflect with a trusted person, such as a partner, friend, colleague or family member (Chapter 5). In other contexts, reflection is often seen in fixed social (hierarchical) structures such as teacher-student or therapist-client. Everyday life reflection is more reciprocal, with reflection frequently occurring in conversation with an equal peer. We see an interesting opportunity for design to support such reflection, by sharing information or media with each other. Research in this area could explore how to balance disclosure and privacy. Our designs of Cogito and Dott, explored this through hiding media or through abstraction of visible media. We found that visible media can trigger social reflection, but hidden media might even more so, due to curiosity. Different layers in media interaction would be an interesting way to explore a balance between disclosure and privacy.

Systems for social reflection could focus more on triggering and capturing roles of a system, as the support is primarily provided by the other person. Systems could benefit from the strength and nuance of reflective conversation, rather than aim to replicate this aspect. We believe that the social context can be very supportive, by asking questions and helping to figure something out, potentially also as a way to reach more depth in reflection. Social context sometimes plays a role in reflective systems, by creating communities, collaborations or competition (e.g. Maitland et al., 2006). However, this is rarely on a personal and engaging level, but often concerns superficial comparison of data with friends, neighbours or online communities. We envision a more personal and intimate sharing of thoughts, which Branham & Harrison (2012) have introduced as ‘mutual reflection’. In this approach, the focus of reflection is the self and the other. They have developed a ‘diary built for two’ to explore this design space for intimate couples, finding new ways in which shared systems might support reflection. Another interesting example is found in Lovers’ Box (Thieme et al., 2011), which stimulates reflection with one’s partner, about their relationship. The process of reflection was mediated by the researcher and an editor, and as such was a one-off experience. How can such social reflection be meaningfully integrated into everyday life? And how might other social combinations reflect, such as groups of friends or families? This area opens up the possibility to explore reflection as an informal social process, which it often is (as found in Chapter 5), but which is rarely supported with systems.

## **Design direction: wearables for reflection**

Our design explorations focused on domestic reflections, all our systems relied on a presence within the home. We found that even the systems that allowed for mobile creation, were often used at home, where opportunity would arise (Chapter 7). Potentially, media

creation was not easy enough to happen on-the-go and in-between other activities. We think reflection on-the-go is worthwhile to explore further, especially because it could be used complementary to domestic reflection. On-the-go would have the advantage of being closer to the experience, or even facilitating reflection-in-action (Schön, 1983). It can also integrate into the habits of walking, running or commuting as activities of reflection (Chapter 5). For such reflection, the use of mobile and wearable devices could be further explored.

Mobiles and wearables are often used within personal informatics, especially to sense or track certain behavior. The most well-known and frequently used devices track daily movement, both in the commercial domain (e.g. Fitbit<sup>25</sup>, Nike+ Fuelband<sup>26</sup>) and in research (e.g. Consolvo et al., 2006). Reflection is often seen as a separate step within the tracking process (Li, Dey & Forlizzi., 2010), often happening when aggregated data is reviewed on a computer. Some devices combine such long-term views with feedback in-the-moment, such as rewards for achieving goals or reminders to move, having an immediate impact (Fritz et al., 2014). Such triggers stimulate more short-term reflection-in-action. Others use wearables as sensors and focus the reflection on the smartphone (e.g. Sanches et al., 2010). Yet rarely, mobility is discussed as an explicit advantage for reflection. Within an educational context, Garcia et al., (2018) discuss the advantages of a smartwatch for situated reflection, allowing students to connect theories to experiences in everyday life. Similarly, we identify a design opportunity in designing wearables for everyday life reflection that connect experiences and locations more strongly. As part of our design space, we presented the concept Traces (Chapter 6), which would allow thoughts to be ‘dropped’ in specific locations for future retrieval. What would the benefits of such location based reflection be? As we found that our mobile creation was rarely used, we wonder how reflection-in-action using wearables best be combined with reflection-on-action at home.

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<sup>25</sup> <https://www.fitbit.com> Last accessed March 2019.

<sup>26</sup> <https://www.wearable.com/fitness-trackers/not-so-happy-birthday-nike-fuelband-2351>  
Last accessed March 2019.

## 9.7 Concluding Remarks

This thesis opened with a number of scenarios of everyday life reflection. For one person, it might be walking the dog. For another, it is chatting with their partner while doing the dishes. We can add that it might also be creating an abstract visualisation, expressing the chaos of today's workday. Or it consists of listening to last week's recordings, expressing enjoyment of a coffee in the sun. Based on our research, we conclude that interacting with media can support meaningful reflective habits. Such a list of examples does not necessarily reflect different people, as we found that most people engage in a variety of reflective habits and activities, depending on their moods and needs.

This thesis set out to find new ways to support reflection in an on everyday life. We approached this challenge by focussing on media interaction to support individual reflection. The research concludes that media interaction can indeed support everyday life reflection, both during media creation and media exploration. Design for open-ended reflection allows for flexible use and holistic reflection, but requires specific motivation from its users. Our insights contribute to the understanding of everyday life reflection and how designers can support this process.

On a more general level, this research can be seen as an exploration of the notion of 'everyday life'. A concept which is omnipresent, yet rarely made explicit as a focus in research. Determined by feelings of home, sense of habit and repetition (Felski, 1999). Everyday life experiences are often taken-for-granted, but at the same time valuable when deliberately considered. In our research, we have focussed on making individuals consider their own everyday life more. On a higher level, this thesis represents a view that the everyday perspective in research and design should be made more explicit. Although it is often designed for, the scope often remains implicit. We believe researchers should more often make their assumptions *about* and scope *of* everyday life more explicit. We would like to end on the note that everyday life is an area worth considering, both on an individual level through reflection and as a research scope.

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# A ppendices

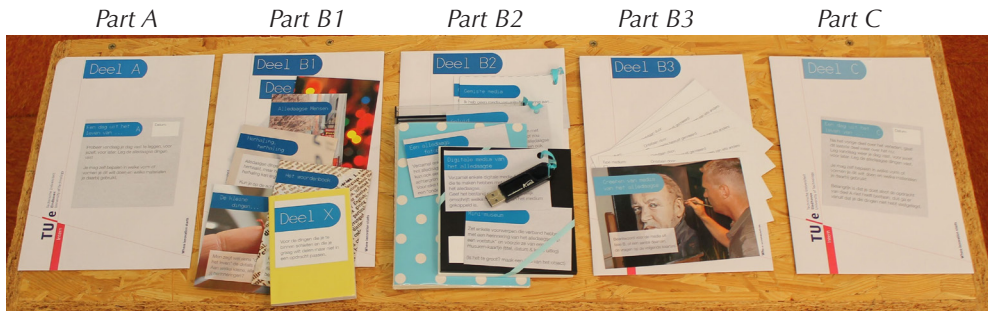
## Overview of Appendices:

Appendix 1:	Chapter 3	Detailed information on all probe exercises
Appendix 2:	Chapter 4	Full overview of questionnaire questions
Appendix 3:	Chapter 4	Coding steps of analyzing the scenarios
Appendix 4:	Chapter 4	Statistical analysis of SRIS data
Appendix 5:	Chapter 5	Interview questions of Ritual Camera
Appendix 6:	Chapter 7	Exploratory sketches on scenarios
Appendix 7:	Chapter 7	Instruction material on prototypes
Appendix 8:	Chapter 7	Interview questions Balance, Cogito & Dott

# Appendix 1: Chapter 3:

## Detailed information on all probe exercises

### Overview of probes set as handed out to participants



Overview of exercises (for explanation of exercises, see below) from left to right:

Part A: Capture a day exercise

Part B1: Exercises on everyday memories

Part B2: Exercises on media of everyday memories

Part B3: Exercises on creation of media of the everyday

Part C: Capture a day exercise

# Instructions on probes exercises

## Instructies

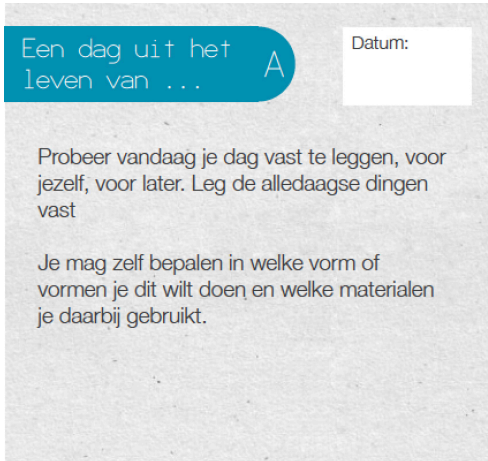
1. Kies een dag in de week uit, een gewone “normale” dag, een dag die de meeste weken hetzelfde is, bij voorkeur een doordeweekse dag. Begin op die dag met opdracht A, je kunt hem vooraf al wel bekijken. Om de studie op tijd af te ronden moet deze dag uiterlijk vrijdag 18 oktober zijn.
2. Doe vervolgens in de loop van de week opdrachten uit deel B. De opdrachten zijn verdeeld in 3 fases, doe eerst 1 of enkele opdrachten uit fase 1, daarna uit fase 2 en ten slotte uit fase 3. Je hoeft dus zeker niet alle opdrachten te maken!  
Je kunt de opdrachten kiezen die je het meest aanspreken en je mag er zo veel maken als je wilt, verdeeld over de week. Bekijk bijvoorbeeld eerst de opdrachten van fase 1 en leg de opdrachten aan de kant die je aanspreken om te doen. Als je deze opdrachten gedaan hebt bekijk dan de opdrachten van fase 2, etc.
3. Maak na een week, op dag 8, deel C open en maak opdracht C. Dit is dus op dezelfde weekdag als wanneer je opdracht 1 hebt gedaan (dus was dat een dinsdag, dan valt deze opdracht ook weer op dinsdag).
4. Na deze laatste opdracht kun je alles bij elkaar leggen zodat ik het kan ophalen op het moment dat we hebben afgesproken.
5. Als een opdracht onduidelijk is, doe hem dan gewoon zoals jij hem begrijpt. Mocht je desalniettemin tussendoor vragen hebben kun je mailen of bellen.
6. Alle opdrachten en de materialen die je voor de opdrachten gebruikt krijg je na afloop van het onderzoek uiteraard terug.

Nogmaals: heel erg bedankt voor je deelname.

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## Part A: Capture a day exercise

Instruction card about the exercise to capture “a day in the life of...”.



Een dag uit het leven van ... A

Datum:

Probeer vandaag je dag vast te leggen, voor jezelf, voor later. Leg de alledaagse dingen vast

Je mag zelf bepalen in welke vorm of vormen je dit wilt doen en welke materialen je daarbij gebruikt.

## Part B1: Everyday Memories

a. General instruction on part B



Herinneringen van het alledaagse B

Dit deel gaat over herinneringen van alledaagse dingen - het gaat dus niet over alledaagse dingen van nu, maar alledaagse dingen van het verleden. In de opdrachten wordt verwezen naar “herinneringen” of “vroeger”. Dit kan gaan over alle alledaagse dingen van het verleden. Het gaat niet alleen over lang geleden maar kan ook over recent verleden gaan.

Natuurlijk ben je vrij om te kiezen welke herinneringen je wil delen.

b. Notebook

For anything participants wanted to share, not captured in other exercises.



- c. Exercise on 'everyday rituals' (front and back)  
Describe or draw a 'mundane ritual'

Rituelen

Naast religieuze of bijzondere rituelen heeft iedereen ook kleine, persoonlijke rituelen. Herinner jij je een "alledaags ritueel" van vroeger? Omschrijf of teken dat ritueel zoals je dat ooit deed.

The slide features a background of colorful bokeh lights. Below the text is a white box containing three empty rectangular frames for drawing or writing.

- d. "The small things" (front, back is empty)  
Open question for valuable small mundane memories.

De kleine dingen...

Men zegt wel eens "de kleine dingen van het leven" de details of korte momenten. Aan welke kleine, alledaagse dingen heb jij herinneringen?

The slide shows a close-up of a person's finger holding a small, pink, folded paper flower. The background is blurred. A text box is overlaid on the bottom left of the image.

e. Exercise on 'repetition' (front and back)

Asks for habits that were done multiple times each day, once a day and once per week.



Toen ik ..... ging ik meerdere keren per dag....	Ik ging bijna elke dag...	Een keer per week...
<p>Welke aspecten (Het hoe? Wat? of waarom?) van deze situatie herinner je je nog goed?</p>	<p>Welke aspecten (Het hoe? Wat? of waarom?) van deze situatie herinner je je nog goed?</p>	<p>Welke aspecten (Het hoe? Wat? of waarom?) van deze situatie herinner je je nog goed?</p>
<p>Wanneer was dit?   geboren   nu  </p>	<p>Wanneer was dit?   geboren   nu  </p>	<p>Wanneer was dit?   geboren   nu  </p>

- f. Dictionary exercise (outside and inside, folded)  
 Asking for a definition of 'mundane' and characteristics.  
 Asking to name the opposite and provide a definition.



<p>Vul aan:</p> <p><b>al-le-'daags</b> (bijvoeglijk naamwoord) :</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>Maak eenzelfde woordenboek-item voor het tegenovergestelde van alledaags. Welk woord is dat en wat is er de definitie van volgens jou?</p> <p>(bijvoeglijk naamwoord) :</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Wat zijn de eigenschappen van "allegaags"?</p> <p>Wat maakt iets alledaags?</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>Waar ligt de grens tussen deze twee dingen?</p> <p>Kun je een voorbeeld geven van een "grensgeval"?</p> <p>_____</p> <p>_____</p> <p>_____</p>

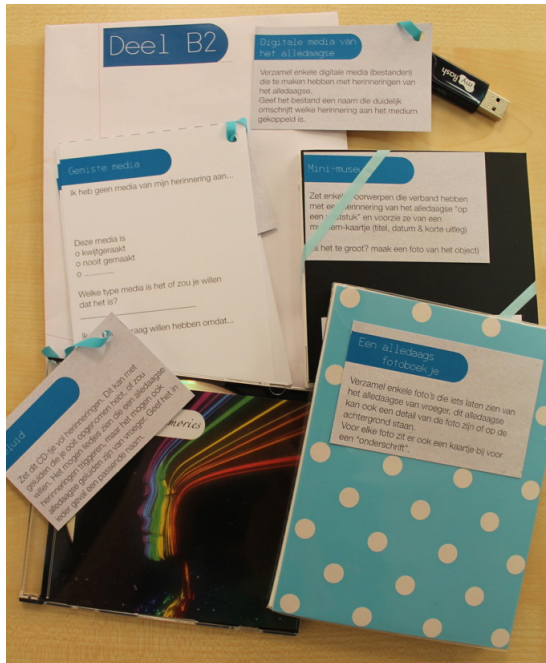
- g. Everyday people (front and back)  
Asking questions on people who played a small or large part in ones everyday life.



<p>..... heeft grote invloed op me gehad, door zijn of haar rol in m'n dagelijks leven, want .....</p> <p>.....</p> <p>.....</p> <p>Dit was in (jaar/tijd) .....</p>
<p>..... speelde een kleine rol in m'n alledaagse leven zo'n .... jaar geleden, ik herinner me hem/haar nog heel goed omdat .....</p> <p>.....</p> <p>.....</p>
<p>..... en ..... waren samen een deel van m'n dagelijks leven. Een typische eigenschap van hen was .....</p> <p>.....</p> <p>.....</p>
<p>.....</p>



## Part B2: Media of everyday memories



Instruction card for digital media of everyday life, attached to a USB stick (see overview top right).

### Digitale media van het alledaagse

Verzamel enkele digitale media (bestanden) die te maken hebben met herinneringen van het alledaagse.  
Geef het bestand een naam die duidelijk omschrijft welke herinnering aan het medium gekoppeld is.

Instruction card for a mini photo album of everyday life (see overview bottom right).

### Een alledaags fotoboekje

Verzamel enkele foto's die iets laten zien van het alledaagse van vroeger, dit alledaagse kan ook een detail van de foto zijn of op de achtergrond staan.  
Voor elke foto zit er ook een kaartje bij voor een "onderschrift".

Instruction card for 'mini museum' attached to a small "pedestal" to display objects of everyday life (see overview mid right).

### Mini-museum

Zet enkele voorwerpen die verband hebben met een herinnering van het alledaagse "op een voetstuk" en voorzie ze van een museum-kaartje (titel, datum & korte uitleg)

(Is het te groot? maak een foto van het object)

Instruction card about sounds of memories. Attached to an empty CD. On the CD cover there was room to give titles and explanations to each track (below).

### Geluid

Zet dit CD-tje vol herinneringen. Dit kan met geluiden die je ooit opgenomen hebt, of zou willen. Het mogen liedjes zijn die een alledaagse herinneringen triggeren, maar het mogen ook alledaagse geluiden zijn van vroeger. Geef het in ieder geval een passende naam.



1.	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

gebrand op deze CD  
heb ik analoog  
zou ik willen hebben

Instruction card on media that people miss. A number of cards with questions was added (right).

**Gemiste media**

Mensen leggen veel dingen vast, maar misschien heb je van sommige herinneringen van het alledaagse leven wel geen gerelateerde media. Van welke alledaagse herinneringen mis je de media? Vul daarover deze kaartjes in.

**Gemiste media**

Ik heb geen media van mijn herinnering aan...

Deze media is  
o kwijtgeraakt  
o nooit gemaakt  
o .....

Welke type media is het of zou je willen dat het is?  
\_\_\_\_\_

Ik zou deze graag willen hebben omdat...

### Part B3: The creation of everyday media

Package of cards with questions about how the media was created. Front of package with instructions (top) and a number of cards to fill in for each of the chosen media examples (bottom).



Type medium:	Ontstaan door:
<input type="checkbox"/> foto	<input type="checkbox"/> deze media bewust gecreeerd
<input type="checkbox"/> video	<input type="checkbox"/> als "bijproduct" van het vastleggen van iets anders
<input type="checkbox"/> audio	<input type="checkbox"/> "iets" bewaard (dus niet gecreeerd)
<input type="checkbox"/> tekst	<input type="checkbox"/> anders namelijk.....
<input type="checkbox"/> voorwerp	
<input type="checkbox"/> anders nl. ....	
Omschrijf de herinnering:	
Weet je door wie deze media gemaakt is? _____	
Kun je je nog herinneren dat dit vastgelegd werd? Hoe ging dat?	

## Part C: Capture your day exercise

Instruction card about the second exercise to capture "a day in the life of..."

Een dag uit het leven van ... C

Datum:

Na het vorige deel over het verleden, gaat dit laatste deel weer over het nu: Leg vandaag weer je dag vast, voor jezelf, voor later. Leg de alledaagse dingen vast.

Je mag zelf bepalen in welke vorm of vormen je dit wilt doen en welke materialen je daarbij gebruikt.

Belangrijk is dat je doet alsof de opdracht van deel A niet heeft bestaan, dus ga er vanuit dat je die dingen niet hebt vastgelegd.

## Appendix 2: Chapter 4

### Interview questions of Ritual Camera

#### **Pre-Interview - Dutch** *(English translation below)*

1. Kun je jouw vastleg-gedrag omschrijven? (m.b.t. foto's, souvenirs, dagboeken etc)
2. Op wat voor momenten leg je vooral dingen vast?

In dit onderzoek kijken we naar het vastleggen van de ervaring van avondeten.

3. Kun je omschrijven hoe, over het algemeen het avondeten bij jullie verloopt?

#### **Pre-Interview - English Translation**

1. Can you describe your capturing behaviour? (Concerning photo's, souvenirs, diaries etcetera).
2. At what kind of moments do you mainly capture your experiences?

In this research, we focus on capturing the experience of home dinners.

3. Can you describe how, in general, your home dinners usually happen?

#### **On Pick-up**

No specific questions were asked – some first responses were saved.

#### **Final interview - Dutch** *(English translation below)*

A. Het avondeten:

1. Kun je (nog een keer) omschrijven hoe, over het algemeen, het avondeten bij jullie verloopt?
2. En hoe ging het de afgelopen twee weken?  
Waren het "gemiddelde weken"?  
Hebben er bijzondere situaties of uitzonderingen plaatsgevonden?
3. Hoe zou jij willen dat het avondeten gepresenteerd wordt?

B. De aanwezigheid van de camera

4. Wat vond je er van om de camera in huis te hebben?  
Zijn er dingen mee gebeurd? (verzet, omgestoten, etc)
5. Heb je er aan gedacht? Tijdens welke momenten?  
Hoe heeft het gedachten beïnvloed?
6. Is de camera ter sprake gekomen? Met wie? Wat besproken?
7. Heb je iets gedaan of gelaten omdat de camera er was?

### C. Omschrijvingen van het gecreëerde materiaal

Rank-order-task op basis van omschrijvingen van visuals.

8. Op de volgende kaartjes staan omschrijvingen van mogelijke visualisaties, kun je ze voor de volgende omschrijving op volgorde leggen:  
o heeft het meeste waarde - heeft het minste waarde

Een visualisatie die benadrukt wat altijd hetzelfde is.	Een visualisatie die de mensen weergeeft.	Een visualisatie die de uitzonderingen weergeeft.
Een visualisatie die het ritme van wekelijkse herhalingen vastlegt.	Een visualisatie die de gemiddeld situatie abstract weergeeft.	Een visualisatie die kleine gewoontes benadrukt.
Een visualisatie die de handelingen en houdingen van mensen benadrukt.	Een visualisatie die alle individuele dagen laat zien.	

### D. Het gecreëerde materiaal

Ik heb 9 representaties gemaakt van de foto's die de camera heeft gemaakt, ik zal die nu ven op de tafel uitspreiden.

Even de tijd geven ze te bekijken

9. Wat is je eerste indruk? (mogelijkheid om prangende gedachtes te delen)  
Wat zijn je gedachten? (mogelijk inzichten "toch vaker alleen dan ik dacht")
10. Ik heb een aantal labels en ik wil je steeds vragen de foto's te sorteren op die schaal, van A tot B. En daarna uit te leggen waarom.
- heeft het meeste waarde - heeft het minste waarde
  - helpt het minst om te herinneren - helpt het meest

Uitleg op basis waarvan visuals gemaakt zijn.

- zet aan tot nadenken - zet niet aan tot nadenken

#### E. Potentie van het concept

11. Wanneer lijkt het je leuk deze terug te zien?
12. En andersom: Van welke periode zou je dit nu wel willen zien?  
Heb je van die periode iets? Wat zou je willen hebben?

Stel dit is een product:

13. Waarvoor zou je het dan gebruiken? (locatie, situatie, periode)
14. Wie zou dit willen hebben?  
En waarvoor zouden zij het denk je gebruiken?
15. Wat zou je veranderen om het beter te laten passen bij wat je zou willen?
16. Alleen beeld of ook andere modaliteiten?
17. Als we alledaagse events willen vastleggen: heb je dan tips voor ons?

### **Final Interview - English Translation**

#### A. Dinner

1. Can you describe (again) how, in general, your home dinners usually happen?
2. And how were your dinners the past two weeks?  
Can these be considered average weeks?  
Were there any special occasions or exceptions?
3. How would you like your home dinners to be represented / captured?

#### B. The presence of the camera

5. Did you think about it? At what times? During what moments?  
Did it influence your thoughts?
6. Did you talk about the camera? With whom? What did you talk about?
7. Did the camera influence your behaviour? Did you do or not-do something because the camera was there?

#### C. The created material

Rank-order-task based on visual descriptions

8. On the following cards are descriptions of potential visuals, could you rank these for the following descriptions?  
- Has most value – has least value

#### D. Visuals

I have made X visuals based on the photos that the camera made, I will now spread them out on the table. [give participants time to review]

9. What is your first impression? (possibility to express first thoughts)  
What are your thoughts? (collect potential insights)
10. I have a number of labels, and what to ask you to rank the visuals each time on a scale from A to B. And explain later why.
  - has most value - has least value
  - least supportive or remembering – most supportive of remembering

Explain what the basis for visuals is

- makes me think – does not make me think

E: Potential of the concept

Now you've seen this, what do you think?

11. At what times would it be interesting to see these?
12. The other way around: from which period would it be interesting to see these visuals?  
Do you have visual material from that period? What would you like to have?

Imagine this is a product

13. What would you use it for? (location, situation, period)
14. Who do you think would like to have this? And why?
15. What would you change to make it more suitable for what you would like to do?
16. Is still images enough, or would you prefer other modalities.
17. In general, to capture everyday experiences – do you have any suggestions?



# Appendix 3 – Chapter 5

## Full overview of questionnaire questions

### Information sheet and consent form online survey

Materialising Memories (UTS HREC 2012000570)

The research project Materialising Memories is doing research on media, memory and everyday life. The aim of the current study is to gain insight in people's thought processes in everyday life.

By continuing to complete this questionnaire you agree to be part of the research. Research data gathered from this survey may be published in a form that does not identify you.

If you have concerns or questions about the research that you think the researchers can help you with, please feel free to contact Ine Mols on [i.mols@tue.nl](mailto:i.mols@tue.nl) or contact the project supervisor Elise van den Hoven at [e.v.d.hoven@tue.nl](mailto:e.v.d.hoven@tue.nl).

Are you willing to participate in this research?

- Yes, I give my informed consent for participation in this research. I am aware that the research data gathered from this project may be published in a form that does not identify me in any way.

If you do not want to consent to this research, just close the browser tab or window. To retract from the research, you can also close this window any time before completing the questionnaire, in which case data will not be saved.

#### NOTE:

This Human Research Ethics Committee of the University of Technology, Sydney has approved this study. If you have any complaints or reservations about any aspect of your participation in this research, which you cannot resolve with the researcher, you may contact the following independent persons, who will treat your complaint or reservation in confidence, investigate it fully and inform you of the outcome.

The researcher's primary affiliation is with the Eindhoven University of Technology, you can contact: the Project Officer of the Industrial Design department at the Eindhoven University of Technology (ir. Karen Luijten-Hoffman, phone: +31 40 xxx xxxx, e-mail: [k.luijten.hoffman@tue.nl](mailto:k.luijten.hoffman@tue.nl)). Please quote the names of the project and researchers.

## Part 1 (SRIS)

Please rate the following statements from strongly disagree to strongly agree

It is important for me to evaluate the things that I do

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

I don't often think about my thoughts

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

I am not really interested in analyzing my behaviour

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

I am very interested in examining what I think about

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

I rarely spend time in self reflection

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

I frequently examine my feelings

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

It is important to me to try to understand what my feelings mean

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

I don't really think about why I behave in the way that I do

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

I have a definite need to understand the way my mind works

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

I frequently take time to reflect on my thoughts

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

It is important to me to be able to understand how my thoughts arise

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

I often think about the way I feel about things

Strongly disagree	disagree	neutral	agree	strongly agree
0	0	0	0	0

## Part 2

The following questions all relate to reflection.

With reflection we refer to “thinking about your thought, feelings, actions or experiences”. We do not refer only to elaborate or “hard thinking” but about small moments of considering.

How often do you have a moment of reflection in your everyday life?

- several times a day
- once a day
- several times a week
- once a week
- several times a month
- once a month or less
- I don't know

Are you satisfied with this frequency:

- I would prefer to reflect more often
- I am satisfied with frequency
- I would prefer to reflect less often
- I don't know

Has there been a certain period in your life when you experienced a higher need for reflection?  
When and why?

What are the causes for reflection? Which things trigger you to reflect?

Mark any that apply regularly:

- my feelings
- my actions
- something that happens to me
- something that is said to me
- I have a fixed moment for reflection
- other internal event, please specify ....
- other external event, please specify ....
- other please specify ....

Choose:

- I consciously choose to reflect
- Reflection just ‘happens’ to me

When does reflection most often occur:

- Morning
- afternoon
- evening
- nighttime

Can you explain a common scenario for reflection?

E.g. where are you? When? for instance: In the car on the way back home after work.

Can you explain another scenario, different from the one before?

Do you reflect individually or with others? (mark any that applies regularly)

- alone
- with partner
- with a friend
- with a group of friends
- with a family member

Which of the following applies to you:

- I write when I reflect (in a diary, a booklet, digitally or just a note)
- I put on music to reflect
- I go for a walk / run / bike-ride to reflect
- I have a specific place in my house to reflect
- I go to a specific location outside of my house to reflect
- I reflect in conversation with others
- I have another routine / strategy when I reflect, please specify ....

After having considered these different activities that involve reflection, how often do you consider

you have a moment of reflection in your everyday life?

- several times a day
- once a day
- several times a week
- once a week
- several times a month
- once a month or less
- I don't know

### Part 3

The aim of this research is to create an overview of current practices and challenges regarding reflection in everyday life. These insights will be used to inform the design of products and systems that can support reflection.

In what way do you think a product or system could support you in reflection?

Is there anything else you would like to mention regarding this research?

In the future, we will be looking for participants to evaluate new concepts to support reflection. If you are interested in being informed on these developments or you might be interested in evaluating one of these systems in the future, please enter your e-mail address.

Your e-mail address will be stored separately from the collected research data.

# Appendix 4: Chapter 5

## Coding steps for analysing the scenarios

Based on Braun & Clarke (2006).

### ***Step 1: Familiarising & initial notes***

Before starting specific coding, the researchers familiarize themselves with the data, From the 65 respondents, three did not provide any answer to the scenario question. Most respondents described two or three, some up to seven different scenarios. Responses were split into smaller units of analysis, of which each related to only one scenario, resulting in 142 extracts to be analysed.

### ***Step 2: Generating initial codes***

As a second step, preliminary codes are generated. Based on our first reading of the data, we coded the segments primarily for location, but this turned out to be too limited. Other aspects such as timing, subject and activity were added as codes.

### ***Step 3: Searching for themes***

Based on our codes, we created a thematic grouping of potential scenarios, resulting in eight initial categories.

### ***Step 4: Reviewing themes***

These initial themes were reviewed in two ways, first individually and second by involving a second independent coder who clustered all segments. In the discussion of clusters, we paid special attention to internal homogeneity (similarities within a cluster) and external heterogeneity (differences between clusters) (Braun & Clarke, 2006). This resulted in a fine-tuning of several of the existing categories and the creation of three new ones. Additionally, a few categories were considered to be on a different level as they did not cluster scenarios but other aspects of the data, which are therefore discussed separately in the discussion section.

### ***Step 5: Defining and naming themes***

After this, a discussion amongst the primary researchers concerned the final defining and naming of themes, resulting in the 14 categories as described in this chapter. In this step, the essence of each theme was defined and the core characteristics listed. During this step, the categories were also split in two groups, as will be explained below.

### ***Step 6: Writing up***

The final step focusses on producing the report, describing the themes both individual and grouped, as described in Chapter 4. The number of scenarios in each cluster should only be seen as an indication of the data. As the data is derived from an open question, a small number of scenarios in a category does not necessarily mean that it is a rare scenario in the population as a whole. Rather, only few people mentioned it.

# Appendix 5: Chapter 5

## Statistical Analysis

### T-test results for differences in gender

<b>Engagement with Reflection</b>		
t-Test: Two-Sample Assuming Equal Variances		
	<i>Female</i>	<i>Male</i>
Mean	4,038085714	3,759259259
Variance	0,356330434	0,458024276
Observations	35	27
Pooled Variance	0,400397765	
Hypothesized Mean Diff	0	
df	60	
t Stat	1,720315943	
P(T<=t) one-tail	0,045264604	
t Critical one-tail	1,670648865	
P(T<=t) two-tail	0,090529208	
t Critical two-tail	2,000297822	

<b>Need for Engagement</b>		
t-Test: Two-Sample Assuming Unequal Variances		
	<i>Female</i>	<i>Male</i>
Mean	4,142857143	3,734518519
Variance	0,211024361	0,566761875
Observations	35	27
Hypothesized Mean Diff	0	
df	41	
t Stat	2,48412925	
P(T<=t) one-tail	0,008581853	
t Critical one-tail	1,682878002	
P(T<=t) two-tail	0,017163706	
t Critical two-tail	2,01954097	

## Anova for differences in age

Need for Reflection				
SUMMARY				
Groups	Count	Sum	Average	Variance
Age 18-25	10	37,667	3,767	0,168
Age 26-35	13	53,000	4,077	0,308
Age 36-45	13	52,000	4,000	0,301
Age 46-55	11	43,833	3,985	0,325
Age >55	14	58,167	4,155	0,267

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0,952	4	0,23798106	0,85754584	0,4951322	2,53657939
Within Groups	15,54	56	0,2775141			
Total	16,49	60				

Engagement with Reflection				
SUMMARY				
Groups	Count	Sum	Average	Variance
Age 18-25	10	36,667	3,667	0,617
Age 26-35	13	51,667	3,974	0,212
Age 36-45	13	50,500	3,885	0,335
Age 46-55	11	43,333	3,939	0,329
Age >55	14	58,667	4,190	0,337

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1,677	4	0,41917145	1,18566635	0,32712062	2,53657939
Within Groups	19,8	56	0,35353238			
Total	21,47	60				



## Anova for differences in education

Need for Reflection				
SUMMARY				
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Academic Higher Education (University)	27	110,000	4,074	0,291
Higher Professional Education (HBO)	24	95,667	3,986	0,251
Secondary Education or Senior Covational Education (MBO)	11	41,333	3,758	0,513

ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0,78311339	2	0,3915567	1,25019893	0,29392434	3,15312326
Within Groups	18,4785354	59	0,31319551			
Total	19,2616487	61				

Engagement with Reflection				
SUMMARY				
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Academic Higher Education (University)	27	106,000	3,926	0,590
Higher Professional Education (HBO)	24	95,000	3,958	0,158
Secondary Education or Senior Covational Education (MBO)	11	42,667	3,879	0,367

ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0,04856359	2	0,0242818	0,06325459	0,93876803	3,15312326
Within Groups	22,648569	59	0,38387405			
Total	22,6971326	61				

# Appendix 6: Chapter 7

## Exploratory sketches on scenarios

### “Rethinking commuter” scenario with sketch overlay.

**Pausing the day**  
4-6 personality characteristics

*dynamic artwork to inspire reflection*  
↓  
*automatic based on phone photos (at that time)*

*allow to capture changes to continue later.*

“Bye, I hope you win!” Peter grumps and closes the backdoor, off to his soccer match. I clean up the breakfast dishes and make myself a cappuccino while a cappuccino

Sitting at the kitchen table, I stare outside, where Peter left the garden gate open. This morning’s discussion lingers in my mind, he wanted to quit soccer. The third sport this year he wants to quit.

Should I be more strict, or is this just the age? He’s so different from Jenny. I glance at the newspaper on the table - <maybe some ginger herbs>

My thoughts are interrupted by Jenny, calling out from the top of the stairs: “She can’t find her laptop charger, again! It’s here!” I call out, already getting up to bring it to her.

*relief in table*  
*cat-fables! conversations*

*something to “fiddle” with → semi action*

*side of table*

*decision reflection ... pros/cons*

*when holding long....*

*condem*

### Reflective Conversation scenario, with sketch overlay.

**Rethinking Commuter**  
Fulltime job // high educated // family life // fast paced life

*aperture*  
*record audio*  
*share photos*

*keychain*  
*select color for today*

It’s 17:30. I walk out the office and cross the parking lot. I can’t find my keys. I wonder if I left them in the car.

Traffic is slow as usual. While I stare at the red light, my mind wanders to this morning’s meeting. Why did Peter react so strongly? Was the suggestion to quit soccer really that bad?

< - > Maybe his comment struck me more than I thought. I had troubles being productive after that meeting. Kept coming up in the back of my mind. Maybe there are things I could do differently.

Before I know it I turn around the corner into our street, the 30 minutes drive home is over. I take the key out of the ignition and sigh. Walk in today the hallway was greeted by a happy “hello”

*select based on increases heart rate.*

*listen in car.*

*connected to from work.*

*at coming home hallway*

# “Pausing the Day” scenario with sketch overlay.

**Conversational Partner**  
4-5 personality characteristics

Hi honey! As she drops her bag in the corner she stands behind me, kisses my cheek, as I am gathering dinner stuff on the kitchen counter. How was yesterday?

While I cut the vegetables, she sets the table, we continue talking. The meeting, her boss, my project, the effort and constant pressure. Just bringing into words why I was irritated already brings relief.

While I stare into the pot of rice, her questions strike me. Why was the previous project so much more fun than this one. Why was it so much easier to stay motivated? It reminded me of the project she and I did together.

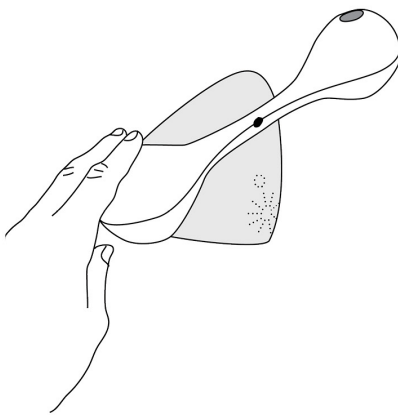
We reminisce of the great project, the fun meetings and late nights with pizza. I realize the team spirit, the common goals is what makes such projects successful.

# Appendix 7: Chapter 7

## Instruction material on prototypes

### Balance

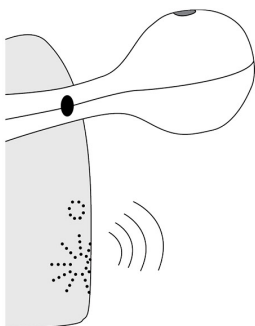
Met Balance kun je korte audio-berichten opnemen. De twee zijdes staan voor twee tegengestelden. Dit kan je zelf bedenken, bijvoorbeeld "positief en negatief" of "werk en prive".



Om op te nemen geef je een "tik" bovenop een van de zijdes, de Balance zal dan eerst naar een nieuwe positie bewegen. Hoe harder je tikt hoe meer "gewicht" er aan je boodschap wordt meegegeven.

Daarna start de opname, dit is te zien aan het rode lampje.

De Balance neemt 10 sec. op, het lampje knippert 2x net voor de opname stopt.



Als je berichten wilt terugluisteren moet je eerst de speaker even aanzetten middels het schuifje aan de voorkant. Je kunt vervolgens een willekeurig bericht van een van de kanten terugluisteren door de zijkant van de bol aan te raken.

## Opnieuw opstarten:

Bij de meeste problemen (hieronder beschreven, of anderen) kan opnieuw opstarten helpen. Doe daarvoor het volgende:

1. Trek de stekker met het framboos-logotje uit het stopcontact.
2. Zorg dat je de balance zelf niet aanraakt tijdens het opstarten, opstarten duurt 2-3 minuten duren.  
Let op, bij het opnieuw opstarten kan de Balance plotseling bewegen om opnieuw in het midden te komen.
3. Steek de stekker er opnieuw in. Na 2-3 minuten is de balance weer opgestart en kun je het opnieuw proberen.

## De Balance reageert niet als ik op de sensor tik om iets op te nemen.

1. Probeer het nogmaals, let erop dat je zo goed mogelijk het midden van de sensor raakt. Je kunt niet opnemen tijdens het afspelen of direct na een vorige opname.
2. Mocht de Balance nog steeds niet reageren, start hem opnieuw op.

## De Balance blijft zoemen na een opname.

1. Controleer of de speaker uitstaat (schuifje voorop naar links).
2. Wiebel voorzichtig aan de balans bij het draaipunt. Mogelijk houdt het zoemen hiermee op.
3. Een opname toevoegen kan eventueel ook helpen.
4. Mocht dit niet helpen en het zoemen vervelend zijn, start hem opnieuw op.

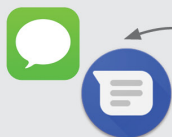
## De Balance speelt niks af als ik de zijkant aanraak.

1. Controleer of je de speaker hebt aangezet, het schuifje moet naar links staan.
2. Wacht een seconde of 20, en probeer het dan nogmaals. Met name als je net iets opgenomen hebt kan het nodig zijn even te wachten.
2. Mocht de Balance nog steeds niet reageren, start hem opnieuw op. Let erop dat je de Balance niet aanraakt tijdens het opstarten, wacht voor de zekerheid 2-3 minuten, zodat hij zeker volledig is opgestart.

**Contact gegevens:** Ine Mols ..... i.mols@tue.nl

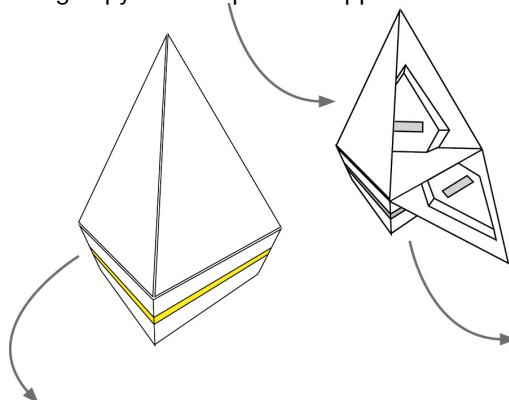
Met vragen, opmerkingen of problemen met betrekking tot dit onderzoek kun je altijd contact met me opnemen. Mochten er toch vragen of klachten zijn die u liever niet direct met mij bespreekt, dan kunt u contact opnemen met mijn supervisor Elise van de Hoven op e.v.d.hoven@tue.nl of met de project officer ir. Karen Luitjen-Hoffman op 040-

# Cogito



Verstuur een bericht naar 'Cogito'  
met de normale sms app op je telefoon.

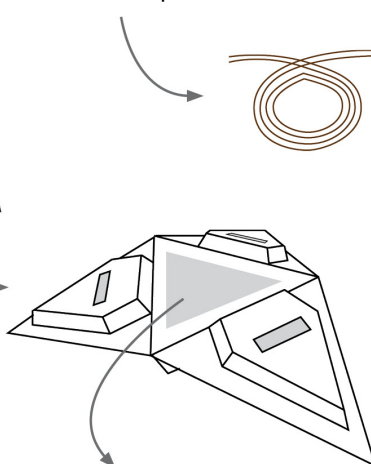
Je kunt berichten lezen door de  
Cogito pyramide open te klappen.



Het licht in de onderste rand geeft de  
status van Cogito aan:

- licht constant aan:  
geen bijzonderheden
- licht langzaam gloeiend:  
heeft al lang geen bericht  
ontvangen
- licht knipperend:  
er zijn veel ongelezen berichten

Je kunt per scherm  
kiezen om een ander  
bericht te zien door op  
deze plek aan te raken.



Je kunt het schrijfblokje  
gebruiken voor het maken  
van verbindingen, uitleg,  
gedachtes of wat je wil.

# Cogito Wat als....

## Opnieuw opstarten:

Bij de meeste problemen (hieronder beschreven, of anderen) kan opnieuw opstarten helpen. Doe daarvoor het volgende:

1. Klap de cogito pyramide open.
2. Haal de stekker eruit en wacht enkele seconde.
3. Doe de stekker er opnieuw in. Het duurt enkele minuten voordat Cogito opgestart is, raak in die tijd het object niet aan (in verband met het instellen van de sensoren).
4. Na enkele minuten moet Cogito opgestart zijn en is het probleem hopelijk verholpen. Mocht dit niet zo zijn of het probleem terugkeren, neem contact met me op.

## Als ik de Cogito pyramide openklap, gaan de schermen niet aan.

1. De pyramide registreerd dat hij open is op basis van licht. Controleer of er voldoende licht is. Probeer eventueel de pyramide een beetje te draaien, dit kan helpen.
2. Mocht dit niet helpen, start opnieuw op (zie boven).

## De 'knop' om een ander bericht op een scherm te krijgen werkt niet. of Een van de schermen blijft continue van bericht wisselen.

1. Probeer eventueel eerst een aanraakpunt bij een van de andere schermen.
2. Helpt dat niet, start dan opnieuw op (zie boven), let erop dat de pyramide opengeklapt licht tijdens het opstarten en je hem in die tijd niet aaraakt.

## Op een van de schermen staat "Unable to get messages"

1. Er is een probleem met internet of de berichtenservice. Controleer of je wifi-netwerk het gewoon doet (via computer of telefoon).
2. Start Cogito opnieuw (zie boven)
3. Mocht dit bericht blijven terugkomen, neem dan contact met me op

**Contact gegevens:** Ine Mols

[i.mols@tue.nl](mailto:i.mols@tue.nl)

Met vragen, opmerkingen of problemen met betrekking tot dit onderzoek kun je altijd contact met me opnemen. Mochten er toch vragen of klachten zijn die u liever niet direct met mij bespreekt, dan kunt u contact opnemen met mijn supervisor Elise van de Hoven op [e.v.d.hoven@tue.nl](mailto:e.v.d.hoven@tue.nl) of met de project officer ir. Karen Luitjen-Hoffman op 040-

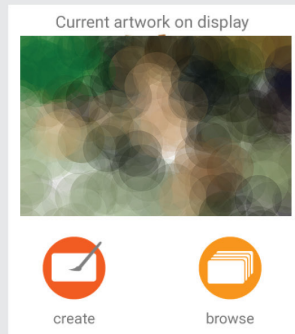
# Dott



Start de app door op dit symbooltje te klikken.

Bovenaan, staat je meest recente beeld.

Om een visual te maken klik op create.



Kies bovenaan 1, 2 of 3 foto's.

Klik op 'create' om een beeld te maken.

Je kunt de visualisatie aanpassen met de schuifjes.

Klik opnieuw op create om het resultaat te zien.

Klik op 'save & upload'. Pas dan wordt de afbeelding bewaard en komt hij op de fotolijst.



Op de fotolijst staat altijd het meest recente beeld.

In de app kun je via browse terugkijken naar oudere beelden.



# Dott Wat als....

## **Gebruik van de Dott app:**

### **De app sluit zichzelf af ("De applicatie Dott is gestopt")**

1. Controleer of je de app toegang hebt gegeven tot het intern geheugen van de telefoon.  
Ga naar Instellingen --> Apps --> Dott --> Toestemmingen en controleer of het schuifje op 'aan' staat.
2. Start de applicatie opnieuw op.
3. Blijft de app vastlopen? Neem dan contact met me op.

### **De app geeft de foutmelding "error uploading, check if device is online"**

1. Controleer of de telefoon internetverbinding heeft.
2. Start de app opnieuw op.
3. De vorige visual is wel opgeslagen, maar niet verstuurd.  
Maak een nieuwe visual om deze naar de fotolijst te versturen.

## **De Dott Fotolijst:**

### **De fotolijst blijft zwart of laat iets anders dan de Dott applicatie zien.**

1. Haal de stroom eruit en doe hem er opnieuw in.  
De foto applicatie start dan vanzelf op.  
Mogelijk laat deze eerst een andere visual zien, maar hij zou binnen enkele minuten je laatste visual moeten tonen.
2. Mocht hij een rood batterijte aangeven, controleer de oplader en zorg dan dat hij eerst opgeladen is.  
Houd daarna linksboven de powerknop in tot hij een trilsignaal geeft. Als de tablet is opgestart, haal de stroom er even uit en doe hem er weer in om de applicatie op te starten.

### **Ik heb een nieuwe visual gemaakt maar deze verschijnt niet.**

1. Pas net gemaakt? Wacht even een paar minuten, het kan tot 10 minuten duren voordat de lijst geupdate is.
2. Haal de stekker eruit en doe deze er weer in.  
De foto applicatie start opnieuw op.  
Mogelijk laat deze eerst een andere visual zien, maar hij zou binnen enkele minuten je laatste visual moeten tonen.

**Contact gegevens:** Ine Mols

[i.mols@tue.nl](mailto:i.mols@tue.nl)

Met vragen, opmerkingen of problemen met betrekking tot dit onderzoek kun je altijd contact met me opnemen. Mochten er toch vragen of klachten zijn die u liever niet direct met mij bespreekt, dan kunt u contact opnemen met mijn supervisor Elise van de Hoven op [e.v.d.hoven@tue.nl](mailto:e.v.d.hoven@tue.nl) of met de project officer ir. Karen Luijten-Hoffman op 040-

# Appendix 8: Chapter 7

## Interview Questions

### Overview:

Pre-interview (Dutch)  
Concept interviews (Dutch)  
Final Interview (Dutch)

Pre-interview (English translation)  
Concept interviews (English translation)  
Final Interview (English translation)

### Pre-Interview (Dutch)

Het onderzoek gaat dus over reflectie.

1. Waar denk jij aan bij reflectie of wat versta je onder reflectie?

Mijn insteek voor reflectie is: nadenken over gevoelens acties en ervaringen en hiermee verwijzen we niet alleen naar, niet alleen naar hele uitgebreid en diep nadenken maar ook de wat kortere momenten.

2. Hoe vaak heb je moment van reflectie in je dagelijks leven?
3. Ben je daar tevreden mee of zou je juist vaker of minder vaak of op een andere manier willen doen?
4. Kun je een voorbeeld noemen van een moment van reflectie, een typische wanneer, waar of met wie?  
Heb je er een vaste gewoonte voor of een moment dat het vaak gebeurt?
5. Zijn er bepaalde producten of methoden die je ooit gebruikt hebt om te reflecteren (bijvoorbeeld, dagboek, app, etc.).
6. We hebben het al kort over de concepten gehad. Heb je daar bepaalde verwachten van of ideeën over?

Introductie scenario's van hoe mensen in hun dagelijks leven reflecteren, op basis van vragenlijst studie. Dat gebeurt vaak ook op vergelijkbare manieren. Ik wil er drie bespreken, het gaat niet om de inhoud maar de waar en wanneer, de omstandigheden waarin reflectie plaatsvindt.

## Woon-Werk-Verkeer Reflectie

reflecteren van- of naar het werk, al lopend, fietsend of rijdend

*Het is half zes, ik loop het kantoor uit en steek de parkeerplaats over. Ik zet m'n tas op de passagiersstoel en start de auto. Het verkeer is weer eens traag, terwijl ik zit te staren naar een rood licht dwalen m'n gedachten af naar de vergadering van vanochtend. Waarom reageerde Paul zo fel? Was mijn suggestie brutaal? Had ik het anders moeten verwoorden. Het licht springt op groen en ik rijd verder.*

*Al rijdend over de snelweg blijf ik erover nadenken. Misschien raakte zijn opmerking me meer dan ik dacht. Het lukte niet goed productief te zijn na de meeting. Misschien had ik het anders kunnen aanpakken.*

*Voor ik het weet draai ik onze straat in, de half uur durende rit is weer zo voorbijgegaan. Ik pak de sleutel en zucht eens diep, loop het huis in en laat m'n werkspullen in de gang.*

7. Herken je dit scenario?

## De dag pauzeren

reflecteren tijdens een momentje "niks" - even zitten nadenken

*"Doei! Ik hoop dat je wint!" Peter, mijn zoon, mompelt wat en trekt de achterdeur dicht, op naar z'n voetbalwedstrijd. Ik begin de ontbijtspullen op te ruimen en zet een cappuccino. Terwijl ik aan de keukentafel zit, staar ik wat naar buiten. Peter heeft de tuinpoort weer eens open laten staan. De discussie van vanochtend blijft nog hangen in m'n hoofd, hij wil stoppen met voetbal. Al de derde sport dit jaar waar hij mee wil stoppen.*

*Moeten we strenger zijn? Of is het gewoon de leeftijd. Hij is zo anders dan Loes, z'n zus. Ik staar wat naar de krant en neem nog een slok cappuccino. M'n gedachten worden onderbroken door Loes, ze roept vanaf boven, ze is haar oplader weer eens kwijt. "Ligt hier" roep ik, terwijl ik opsta om hem te brengen*

8. Herken je dit scenario?

## Reflectief gesprek

In gesprek met iemand, het gesprek wordt gaandeweg meer reflectief

*"Hoi schat" Ze zet haar tas in de hoek, geeft me een vluchtige kus en hangt haar jas op. Ik zet de spullen voor het eten vast klaar op het aanrecht. "hoe was je dag?" "Muah" antwoord ik, "het ging niet zo lekker".*

*Terwijl ik de groente snijd, dekt ze de tafel en praten we verder. Over mijn bespreking, het project, de moeite die het kost en de stress. M'n irritatie verwoordden brengt al enige opluchting.*

*"Je bent toch hier gaan werken omdat je de drukte juist zo leuk vindt?" Ik roer wat in de rijst, ze slaat de spijker op de kop. Maar waarom was het vorige project zo veel leuker dan deze? Ons gesprek doet me denken aan hoe we tijdens de studie nog samen projecten oppakten. Terwijl we gaan zitten om te eten halen we wat herinneringen op aan onze studieprojecten. De gezellige meetings, de late avonden met pizza's. Dat groepsgevoel, het gezamenlijke doel en er echt voor gaan. Dat maakte die projecten zo succesvol, en dat mis ik nu. Misschien kan ik er morgen wat van zeggen.*

9. Herken je dit scenario?

Uitleg en installatie van het eerste concept.

## Concept-Interview (Dutch)

### Algemeen gebruik:

1. Hoe vond je het om dit concept te gebruiken?
2. Hoe vaak gebruikte je het concept om iets te maken?
  - a. Wat was daarop van invloed?  
(Welke elementen bepaalde om het wel/niet te gebruiken?)
  - b. Was dit op een vast moment of heel verschillend?  
Cogito / Dott: was dit op een vaste plek of ook onderweg?
3. Hoe vaak heb je iets teruggelezen / bekeken / beluisterd?
  - a. Bekeek / luisterde je dan meerdere berichten?
  - b. Balance:  
Willekeurig – hoe vind je dat?
  - c. Cogito:  
je ziet 3 berichten tegelijk, deed je daar iets mee?  
Heb je iets met het schrijfblokje gedaan?
  - d. Dott:  
Terugzien is natuurlijk minder expliciet, hoe is het om het zichtbaar in kamer te hebben?  
Heb je teruggekeken op je mobiel naar oudere berichten?
4. Was het makkelijk het concept regelmatig te gebruiken? Of moeilijk??
5. Herinner je je nog met welk scenario ik dit concept geïntroduceerd heb? Past dit bij hoe jij het gebruikt hebt?
  - a. Hoe komt dit?
  - b. Wat had je liever anders gehad?
6. In het algemeen, heb je het met mensen erover gehad? Ook de inhoud?

### Reflectie:

7. Zette het gebruik aan tot nadenken? Op welke manier?
  - a. Op het moment van maken of juist bij terugzien/horen?
  - b. Wat is het verschil tussen die momenten?
8. Zette het gebruik aan tot terugdenken?
9. Vind je dat dit product reflecteren stimuleert?
  - a. Op welke manier?

### Voorbeelden

Ik zou graag enkele voorbeelden van interactie met het product met je willen bespreken.

Op basis van de gemaakte media.

Hier kun je de bestanden gemaakt met dit concept doorkijken (luisteren).

Zou je er een willen kiezen die jij een goed voorbeeld vindt van hoe je dit product gebruikt hebt? Als je wil mag je het bestand (visual, bericht, opname) ook met me delen / aan me laten zien, maar dit hoeft niet.

1. Waar ging deze reflectie over?
  - a. Onderwerp (thuis, werk, persoonlijk)
  - b. Wat was gebeurd, was gezegd, mijn gevoel
  - c. Verleden / heden / toekomst?
2. Kun je uitleggen wanneer en hoe je dit bestand (visual, berichten, opname) gemaakt hebt?
  - a. Wat was de aanleiding voor gebruik? (zichtbaarheid, status)
3. Hoe besloot je wat je maakte / opnam?
  - a. Waarover?
  - b. Hoe besloot je over representatie (visual) of woordkeuze?
    - Dett: meerder foto's of niet? Wat met schuifjes gedaan?
    - Balance: gewicht aan meegegeven?
    - Cogito: lang over nagedacht? Herschreven?
4. Maakte je op hetzelfde moment meerdere reflecties (visuals, opnames, berichten), waarom?
5. Heb je dit bestand gedurende de gebruikperiode ook al eens teruggezien (gelezen / geluisterd)?

Hoe was dat?

Vond er toen reflectie plaats?
6. Kun je nog een voorbeeld delen, een die je zelf interessant vindt?

## Final Interview (Dutch):

1. Hoe vond je het gebruik van de concepten? Hoe kijk je erop terug?
2. Wat waren de verschillen tussen de concepten voor jou?
3. Hoe was het reflecteren anders tussen de concepten?
4. Welk concept ondersteunde voor jou reflectie het beste? Waarom?

En welke het minst? Waarom?

Reflecteren kan gaan over het verleden, het heden of de toekomst.

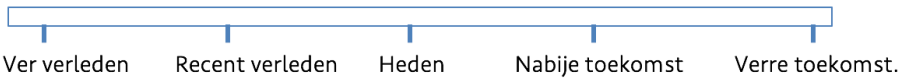
5. Kun je op de volgende tijdlijnen voor elk concept aangeven, welk soort reflectie het vooral ondersteunt?

6. Wil je op de onderste tijdlijn ook aangeven hoe je persoonlijk meestal reflecteert?
7. Een andere vergelijking, niet tussen de concepten met t.o.v. wat je normaal doet. Wat was er anders aan deze periode t.o.v. je normale reflectie?

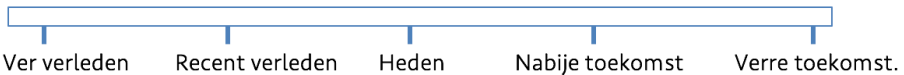
Concept: Dott



Concept: Cogito



Concept: Balance



Persoonlijk:



Een aantal beschrijvende woorden / schalen om in te vullen. 3 voor de concepten, 3 over de media die je ermee maakt.

(Onderstaande iconen werden uitgeknipt gebruikt om de schalen in te vullen)



**Reflectie met dit concept is**

\_\_\_\_\_

individueel sociaal

Met dit concept had ik vooral

\_\_\_\_\_

eenmalige reflecties doorlopende reflecties

Reflectie met dit concept is vooral

---

luchtig

diepgaand

**Deze media is**

---

subjectief

objectief

In deze media legde ik vooral vast

---

gedachten

gevoelens

Ik maakte de media

---

voor reflectie

tijdens reflectie

na reflectie

Ik wil graag nog wat verder verbreden en het hebben over de waarde van de media die je kan maken met dit soort concepten. De periode was nu vrij kort, dus (mogelijk) heb je weinig teruggekeken / geluisterd. Er kan ook juist reflectie plaatsvinden tijdens het terugkijken en teruglezen.

8. Wat is de waarde van deze media voor reflectie in de toekomst?

Tijdlijn /scale: wanneer het meest geschikt om terug te zien:

nabije toekomst, verre toekomst

9. Wat zou de media meer waardevol maken voor toekomstige reflectie?

Naast reflectie gebruiken we (andere) media ook vaak om herinneringen op te halen.

10. Wat is de waarde van deze media voor herinneren in de toekomst?

11. Wat zou de media meer waardevol maken voor herinneren?

Afsluitende vragen:

12. In het algemeen, geloof je dat dit soort media technologie een bijdrage kan leveren aan reflectie?

13. Welke van de concepten zou je het liefst verder uit ontwikkeld zien en waarom?

## Pre-Interview English Translation

The research concerns reflection.

1. What is your personal understanding of reflection? What do you think about when you hear the term?

In my perspective reflection concerns: thinking about feelings, actions and/or experiences. With this definition we do not only refer to very elaborate and deep thought but also include shorter moments.

2. How often do you have a moment of reflection in your everyday life?
3. Are you satisfied with this frequency or would you like to reflect more often or less or in a different way?
4. Can you explain an example of a moment of reflection? A typical situation (when, where and with whom).
5. Are there certain products or methods that you have ever used to reflect (for example a diary, an app etc).
6. We have briefly discussed the concepts. Do you have any expectations or ideas?

Introduce scenarios of how most people reflect in their everyday life, based on questionnaire study. We saw that this often happened in similar ways. I want to discuss three of such examples, the focus is not on the content of the reflection, but the where and when, the circumstances under which reflection occurs.

### Commuter scenario

Reflection on the way to or from work, either while walking, cycling or driving.

*It's 5:30 PM, I walk out of the office and cross the parking lot. I put my bag on the passenger seat and start the car. Traffic is slow, as usual, and while I'm staring at a red traffic light my mind wanders to this morning's meeting. Why did Paul respond to harshly? Was my suggestion rude? Should I have phrased it differently? The light turns green and I continue driving.*

*While I drive on the highway I keep thinking about it. Maybe his comment struck me more than I thought. I haven't really been productive anymore after the meeting. Maybe I could have done it differently.*

*Before I realise I turn the corner of our street, the half hour drive has passed in a split-second. I grab my keys and sigh, I walk into my house and drop my bag in the hallway.*

7. Do you recognise this scenario?

### Pausing the day

Reflection during a moment of 'nothing' just sitting down and thinking.

*'Bye! I hope you win' I shout as Peter, my son, mumbles something in return and shuts the backdoor behind him, off to his soccer match. I start cleaning up the breakfast table and make myself a cappuccino. While I sit at the table I stare into the garden. Peter left the garden gate upon again. This morning's discussion keeps lingering in my mind, he wants to quit soccer. It's the third sport this year he wants to quit. Should we be more strict? Or is it just his age? He is so different from Loes, his sister. I stare at the newspaper and take another sip of my drink. My thoughts are interrupted*



by Loes, shouting from upstairs, she's lost her charger. "It's here" I call out, while I'm already getting up to bring it to her.

8. Do you recognise this scenario?

### Reflective Conversation

In conversation with someone, the conversation turns more reflective along the way. 'Hi honey' She puts her bag down in the corner, gives me a quick kiss and puts away her coat. I put our food for dinner out on the kitchen counter, 'how was your day' 'Hmmm' I answer 'It didn't go so well'

While I'm cutting the vegetables, se sets the table and we continue talking. About my meeting, the project, the effort it all takes and the stress. Putting my annoyance into words already brings some relief.

'But you started working here because you like this buzz so much' I stir the rice, she nails it. But why was the previous project so much more fun? Our conversation reminds me of how we used to do project together during college. The fun meeting, the late nights with pizza. The feeling of being part of a team, a common purpose and really going for it, that's what I miss now. Maybe I could say something about it tomorrow.

9. Do you recognise this scenario?

Explanation and installation of first concept.

## Concept Interview (English Translation)

General usage:

1. How did you experience using this concept?
2. How often have you used this concept to create something?
  - a. What factors influenced that?  
(What elements of the concepts influence (not) using it?
  - b. Did you use it at a fixed moment or very different moments?  
Cogito/Dott: did you use it at a fixed place or on the go as well?
3. How often have you read / watched / listened to (on of) your media?
  - a. Did you read / listen to multiple messages at a time?
  - b. Balance: How did you experience the random replay?
  - c. Cogito: How did you experience seeing three messages at the same time?
  - d. Cogito: Did you write anything on the notepad?
  - e. Dott: Seeing media is less explicit, what was it like to have it visible in the room?
  - f. Dott: did you look back at older visuals on your phone?
4. Was it easy to use this concept regularly? Or hard? Why?
5. Do you remember the scenario I shared that this concept is based on? Does this fit the way you used to concept?
  - a. Can you explain what caused this?
  - b. What would you prefer to be different?

6. In general, did you talk about it with people? And about the content of the reflections?

Reflection:

7. Did the usage make you reflect? In what way?
  - a. At the moment of creation or when retrieving the media?
  - b. What is the difference between those moments?
8. Did the usage trigger remembering?
9. Do you think this concept supports reflection?
  - a. In what way?

### Examples

I would like to discuss a few examples of how you interacted with this concept, based on the media you created. Here you can see the files you created.

Could you please pick one that you think is a good example of how you used this concept? If you want you can share the file (visual, message, recording) with me, (show it to me), but you don't have to.

1. What was the topic of this reflection?
  - a. Topic (home, work, personal life)
  - b. What happened, was said, or was felt?
  - c. Past, present or future?
2. Can you explain when and how you created this file (visual, message, recording)?
  - a. What was the trigger to use the concept? (e.g. visibility, status light).
3. How did you decide on what to create / record?
  - a. About what?
  - b. How did you decide on the representation (visual) or wording?
    - Dott: did you use multiple photo? How did you use the settings?
    - Balance: did you add a certain weight to it?
    - Cogito: did you think about it long? Did you rewrite the message?
4. Did you create multiple files / reflections at that same moment? Why?
5. Have you seen/heard/read this reflection during the last period? What was that like? Did you reflect at that moment?

Can you share another example, that you think is interesting?

### Final Interview (English Translation)

1. How did you experience using the concept? How do you look back on it?
2. What were the biggest differences between the concepts for you?
3. How was reflection different between the concepts?
4. Which concept support reflection best, for you? Why?
  - a. And which one the least? Why?

Reflection can concern the past, present or future.

5. Can you indicate on the following timelines what kind of reflection each concept

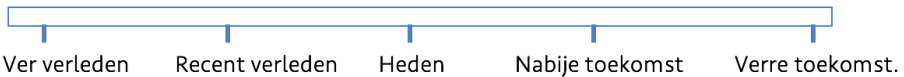
supported most?

6. Can you indicate on the bottom timeline what your personal reflection normally focusses on?
7. What was the difference between how you reflect normally and how you reflected with these concepts?

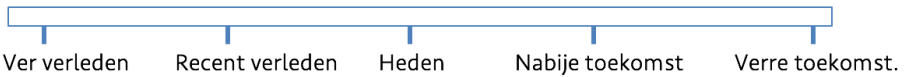
Concept: Dott



Concept: Cogito



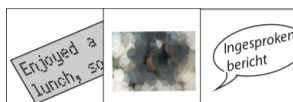
Concept: Balance



Persoonlijk:



I have a number of scales to fill in, three about the concepts and three about the media you created. (the icons below were cut out to be used as answers on the scales)



Reflection with this concept is

individual

social

With this concept, reflections were primarily

Singular

connected with each other

Reflection with the concept is mainly

Light-hearted

deep

This type of media is

subjective

objective

In this type of media I primarily captured

thoughts

feelings

I created this type of media

before reflection

during reflection

after reflection

I would like to zoom out a bit more and discuss the value of the kind of media you can create with these kinds of concepts. The period of use was pretty short now, so (potentially) you have not reviewed / listened back a lot of media. Reflection can also occur when looking back over longer time.

8. What would be the value of these types of media for reflection in the future?
9. What could make the media more valuable for future reflection?

Instead of for reflection, we often use (different types of) media for remembering and reminiscing.

10. What would be the value of these types of media for remembering in the future?
11. What could make the media more valuable for remembering?

Final questions

12. In general, do you believe these types of media technologies can contribute to reflection?
13. Which of these concepts do you prefer to be further developed and why?

# Design for Everyday Life Reflection

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## Summary

In everyday life, most people reflect frequently. It is a way of thinking to process experiences, to come up with potential solutions to problems and to gain a better understanding. Everyday life reflection serves many purposes, such as creating and maintaining personal identity and supporting behavior change. Yet reflection can also be challenging, as it requires time, effort and attention. We observe a trend that moments of everyday life reflection might be fading, as more and more of our time is filled with action and distraction. We identify an opportunity for interaction design to support everyday life reflection by creating new reflective habits.

In this thesis, we have explored design for everyday life reflection by adopting a research-through-design approach. The first chapter introduced our scope by defining the intersection of three core themes: reflection, everyday life and media interaction (Chapter 1). Our work is guided by a design challenge on the intersection of these themes: focused on how to design media creation systems that support reflection in and on everyday life. The research-through-design approach that we adopt is characterized by building on theory, involving people, and creating prototypes with a focus on open-ended designs.

We laid the groundwork for our design explorations by discussing our understanding of everyday life reflection with a variety of concepts and models from the literature on remembering and reflecting (Chapter 2). These theories shaped our scope, defining everyday life reflection as a type of reflection that serves different functions, occurs throughout the life-span, focusses on everyday aspects, has a certain level of depth and does not follow a strict process. To inform what everyday aspects would be worthwhile to reflect upon, we conducted a probes study exploring what experiences of everyday life are considered

valuable and how such value develops over time (Chapter 3). Reflection plays an important role in such value changes and the study turned out to be a form of guided reflection. The study also brought forward four specific design directions for media creation of everyday life: creating mementos in retrospect, repurposing mementos, selecting experiences in the present and creating media for repeated events.

In our first design exploration (Chapter 4), we explore this last opportunity, using abstract media to capture a frequently repeated event. With our design Ritual Camera, we captured everyday home dinners and discussed a number of abstract visualizations with the family members. We have found that different forms of abstract media were valued differently, depending on their envisioned use. Reflection occurred primarily through media exploration during the interviews and was influenced by the researcher's questions. To inform how to design for reflection, we wanted to know more about current practices of reflection in everyday life, without the involvement of extra probes or concepts. We, therefore, studied the occurrence of reflective practices with a questionnaire study (Chapter 5). The results showed that reflection occurs frequently and in many different forms. Specifically, the study brought forward a range of reflective scenarios that inspired our further design explorations.

In parallel to the empirical exploration of current practices, we explored the opportunities to design for reflection in a broad conceptual way. By developing a range of concepts for reflection and discussing their characteristics described a design space (Chapter 6). The design space is shaped by two dimensions: representing reflection strategies and system roles. We found that systems cannot just trigger to reflect, but adopt a supporting or capturing role as well. The design space brought forward a number of important aspects to support everyday life reflection, including holistic reflection, open-ended design, and integration into everyday life, which we explored in our third and final design exploration (Chapter 7). For this, we developed three concepts, Balance, Cogito and Dott, which were implemented into prototypes to be explored in-the-wild. The evaluation gave insight into how media creation and exploration can support reflection and how such habits can be integrated into everyday life. With these concepts, people primarily reflected during media creation and their reflections were often present- or future-focused. We found that people reflected on different levels of depth, primarily on a descriptive or dialogic level. Finally, the integration of reflective habits into everyday life patterns did not happen at a fixed moment but relied on good opportunity and triggers.

In the final two chapters of this thesis, we review our work, through discussion and generalization. Based on our design iterations and our theoretical and empirical understanding of reflection, we presented seven considerations for the design for everyday life reflection

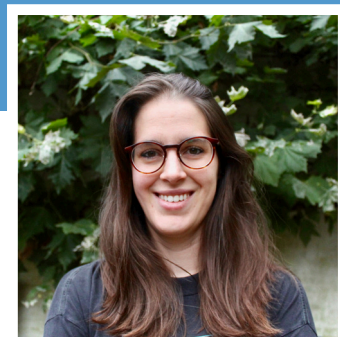
(Chapter 8). These considerations translate our understanding of everyday life reflection as an open and flexible process to implications for design. We propose considering the potential of everyday life reflection to support appreciation and to direct everyday life. In addition to considerations concerning the process of reflection, we present four considerations concerning the use of media for reflection. These consider how we can design for triggers and opportunity, for media creation and exploration and for human effort and automation. Finally, we present our insights on how to design for different levels of depth in reflection.

This thesis is concluded with a discussion of our results from different perspectives, including a critical review of our scope of everyday life reflection, a generalization to the three broader related themes (reflection, media interaction and everyday life) and opportunities for future research (Chapter 9). The research concludes that media interaction can indeed support everyday life reflection, both during media creation and media exploration. Design for open-ended reflection allows for flexible use and holistic reflection but requires specific motivation from its users. Our insights contribute to the understanding of everyday life reflection and how designers can support this process.



# C

## urriculum Vitae



Ine Mols was born on the 21st of July 1989 in Helmond. In 2007 she completed her VWO (pre-university education) at Commanderij College in Gemert, after which she started studying Industrial Design at the Eindhoven University of Technology. Between her Bachelor and Master's degree, she took a year off from studying to be a board member for the study association of Industrial Design, Lucid. Her master's research project explored stimulating reflective writing. The resulting 'Dear Diary' study was published at Persuasive Technology 2012, where Ine presented her work. In 2013, she graduated with an excellence verdict for her design 'Summary Wall', stimulating classroom interaction in secondary schools.

Following her Master, she started a PhD-project within the Materialising Memories research group, of which the results are presented in this theses. The research was part of a joint-PhD program between Eindhoven University of Technology (TU/e) and University of Technology Sydney (UTS). As part of this collaboration, she visited Sydney several times to work with colleagues within the Materialising Memories group, as well as other experts at UTS.

At the TU/e, Ine was involved as a coach in student design and research projects related to her interests in memories and media. She co-organised the TEI conference in Eindhoven in 2016 as a local venue chair. Between 2015 and 2018 she was a member of the university's PhD-council and initiated the formation of a departmental PhD-council within Industrial Design.

During her PhD, Ine and her partner Freek became parents to their two daughters, Lina (2016) and Rove (2018). Since 2018, she is working at Avans Hogeschool in Den Bosch, where she is a teacher at Business Innovation and a researcher within the Sustainable Strategy and Innovation lectorate.

# P ublications

## Presented in this thesis:

### Peer-Reviewed Journal Article

**Mols, I.,** van den Hoven, E., & Eggen, B. (2016). Ritual Camera: Exploring Domestic Technology to Remember Everyday Life. *IEEE Pervasive Computing*, 15(2), 48-58.

### Peer-Reviewed Conference Articles

**Mols, I.,** van den Hoven, E., & Eggen, B. (2016, February). Technologies for Everyday Life Reflection: Illustrating a Design Space. In *Proceedings of the TEI'16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction* (pp. 53-61). ACM.

**Mols, I.,** van den Hoven, E., & Eggen, B. (2016, October). Informing Design for Reflection: an Overview of Current Everyday Practices. In *Proceedings of the 9th Nordic Conference on Human-Computer Interaction* (Article 21, 10 pages). ACM.

**Mols, I.,** Hoven, E. V. D., & Eggen, B. (2014, October). Making memories: a cultural probe study into the remembering of everyday life. In *Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational* (pp. 256-265). ACM.

### Short Peer-Reviewed Conference Article

**Mols, I.,** van den Hoven, E., & Eggen, B. (2017, March). Balance, Cogito and Dott: Exploring Media Modalities for Everyday-life Reflection. In *Proceedings of the Tenth International Conference on Tangible, Embedded, and Embodied Interaction* (pp. 427-433). ACM.

# Not presented in this thesis:

## Book Chapter

van den Hoven, E., Broekhuijsen, M., & **Mols, I.** (2017). Design Applications for Social Remembering. In Collaborative Remembering: Theories, Research, and Applications. Oxford University Press.

## Peer-Reviewed Conference Article

Arslan, Y., **Mols, I.** & Hummels, C. (2018, June) Tegelen: supporting individual and group reflection through a dynamic, structured and tangible tool. In Proceedings of Design Research Society Conference 2018 (pp. 2061-2074). Design Research Society.

## Short peer-reviewed Conference Articles

Broekhuijsen, M., **Mols, I.**, & van den Hoven, E. (2016, November). A holistic design perspective on media capturing and reliving. In Proceedings of the 28th Australian Conference on Computer-Human Interaction (pp. 180-184). ACM.

**Mols, I.**, Broekhuijsen, M., van den Hoven, E., Markopoulos, P., & Eggen, B. (2015, December). Do we ruin the moment? Exploring the design of novel capturing technologies. In Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction (pp. 653-661). ACM.

**Mols, I.**, & Markopoulos, P. (2012). Dear Diary: A Design Exploration on Motivating Reflective Diary Writing. In Persuasive Technology: Design for Health and Safety; The 7th International Conference on Persuasive Technology; PERSUASIVE 2012; Linköping; Sweden; June 6-8; Adjunct Proceedings (No. 068, pp. 29-32). Linköping University Electronic Press.

## Other Publications

**Mols, I.**, F., Rooijackers Increasing (un)certainly: becoming parents in the digital age. (2016) NordiChi'16 – in Workshop 'HCI and Sensitive Life Transitions'.

**Mols, I.**, van den Hoven, E., & Eggen, B. (2014) Interacting with Meaningful Memory Objects in the Home Context. Presentation and paper in online proceedings of the NordiCHI'14 workshop Ubicomp beyond devices: People, Objects, Space and Meaning <http://www.meaningofspace.org/Papers.html>

**Mols, I.** Designing for Reflective Remembering. (2014) Doctoral Consortium Paper – NordiChi'14

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