

# CHALMERS



## Designing for Reflection

*Master's Thesis in Interaction Design and Technologies*

PÉTER KUN

Department of Applied IT  
CHALMERS UNIVERSITY OF TECHNOLOGY  
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## **Designing for Reflection**

PÉTER KUN

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Examiner: Sus Lundgren

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Department of Applied Information Technology

Division of Interaction Design

Chalmers University of Technology

SE-412 96 Göteborg

Telephone: + 46 (0)31-772 1000

Gothenburg, Sweden 2013.

## Abstract

Researching designing for reflection has been a niche interest of few interaction designers in the past. Reflection, as an individual and informal mental activity is a complicated experience to design for, and no appropriate design method has so far been developed.

The thesis summarize the main views on reflection, and the history of reflection in interaction design. Afterwards, the Reflection Design Method is introduced, which can potentially be used during the design process to imbue a design with qualities that motivate reflection. The method consists of two parts: (a) a guiding framework for designers to expand their design processes by providing guidance how to introduce reflective qualities into conceptual designs; (b) a collection of reflective design patterns, which help designers to look for inspiration in their own ideation processes.

The final outcome was reached by following a research through design approach. The starting point of the process was an investigation of earlier studies on reflection, based on which a preliminary framework was created. This framework was then complemented with the outcomes of a qualitative questionnaire, resulting in the first version of the Reflection Design Method. The next iterations of the method integrated the user feedback and the observations from two conducted workshops, and the final iteration was concluded with an expert review.

The Reflection Design Method provides an applied approach to help designers to tackle this otherwise abstract area. The design method can potentially provide alternatives for other, similar design focus areas, such as designing for sustainability or behavioral change.

**Keywords:** interaction design, design research, reflection, reflective design, reflection-in-action, experiential learning, critical thinking, design tools



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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Introducing the thesis . . . . .	1
1.2	Describing the problem area . . . . .	2
1.3	Why to design for reflection . . . . .	4
1.4	Raising the research problem . . . . .	6
1.5	Defining the thesis scope . . . . .	6
1.6	Outlining the thesis . . . . .	7
<b>2</b>	<b>Theoretical background</b>	<b>9</b>
2.1	Defining reflection . . . . .	9
2.2	Reflection-in-action . . . . .	12
2.3	Reflection in learning . . . . .	13
2.4	Designer tools . . . . .	14
<b>3</b>	<b>Related work</b>	<b>16</b>
3.1	Slow Technology . . . . .	16
3.2	Critical Design . . . . .	17
3.3	Reflection on everyday experience . . . . .	19
3.4	Reflective design . . . . .	22
<b>4</b>	<b>Methodology</b>	<b>24</b>
4.1	Framework . . . . .	24
4.2	Methods . . . . .	26
<b>5</b>	<b>Concept development</b>	<b>30</b>
5.1	Developing a model for reflection . . . . .	31
5.2	Questionnaire . . . . .	36
5.3	Card deck . . . . .	43
5.4	Workshops . . . . .	48
5.5	Final review . . . . .	57

<b>6</b>	<b>Reflection Design Method</b>	<b>59</b>
6.1	Framework overview . . . . .	59
6.2	Using the Reflective Design Method . . . . .	61
6.3	Reflection intent . . . . .	61
6.4	Experience data . . . . .	64
6.5	Reflective qualities . . . . .	70
6.6	Action . . . . .	82
6.7	Context, situations, environments . . . . .	87
<b>7</b>	<b>Discussion</b>	<b>93</b>
7.1	Findings . . . . .	93
7.2	Evaluation . . . . .	95
7.3	Future opportunities . . . . .	96
<b>8</b>	<b>Conclusions</b>	<b>98</b>
	<b>Bibliography</b>	<b>102</b>
	<b>Appendix</b>	<b>103</b>

# 1

## Introduction

*“He who has a why to live for can bear almost any how.”* - Friedrich Nietzsche

### 1.1 Introducing the thesis

This master thesis is the product of my intersecting interests; in the educational field (the niche aspect of self-education, reflection) and the design field (the niche aspect of interaction design and design methods). This thesis was carried out in conjunction with for the master program of *Interaction Design and Technologies* at Chalmers University of Technology (Gothenburg, Sweden), however the project was conducted during an exchange semester at the Industrial Design Engineering faculty of Delft University of Technology (The Netherlands).

The combination of these two, rather different approaches to (interaction) design gave two different views to synthesize within this work.

Prior to starting my master’s education, I spent several years with non-formal education (e.g. teaching teamwork skills in a training setting). During that time I built a strong interest in how people can extract more knowledge from their own earlier experiences just by looking at them retrospectively through different lenses, hence reflecting and learning new things.

*“Historia est magistra vitae”* (*history is life’s teacher*) as the latin proverb goes, however without the actual, conscious thinking about how we think about our experiences, new learning does not happen.

One of the first courses I had in connection with the *Interaction Design and Technologies* master’s was with Johan Redström; his teaching on design methodology had influenced my thoughts greatly about being a reflective practitioner (or a reflective designer, in this case), and established my first thoughts how could we design for reflection more directly. This interest remained in the background for some time, leaving space for new learning during other courses.

Fortunately, the following courses had numerous design projects, and exams which required reflection about the designs and projects. Probably most of what I learnt at Chalmers was during the times spent writing my home exams. This made an extra push to go for a master thesis which is regarding reflection.

This thesis was largely influenced by doing my work at the Industrial Design Engineering faculty of TU Delft. The environment in the StudioLab was very influential; being exposed to the many design research projects, this thesis ended up much more balanced between abstract and applied than I could have imagined at the beginning.

## 1.2 Describing the problem area

In the recent decade, the field of interaction design has been exposed to the rise of personalized technology [51] and the emerging design research on designing for experiences. As such, it has become increasingly interesting to investigate how could personalized technology contribute to personal experiences.

Personal needs have been described by Maslow's famous "*Hierarchy of needs*" theory [37]. Based on his work we can safely assume, that what generally people need does not really change along the years. We witness that technology has created solutions for problems we never really had before living with technology itself, it brought us benefits such as rapid and unlimited access to information or the instant connectivity to others, to name a few. Such technologies are answering what Maslow names higher-level needs, e.g. "need for aesthetic and beauty".

On the other hand, technology has not been that successful in creating solutions to some other, lower level personal needs, such as reflecting on our daily life, evaluating our experiences and by these maintaining a healthy habit of learning from every phenomenon surrounding us. These fall into Maslow's "Knowledge and understanding needs".

Designing reflection has been on the interaction design agenda on some level for more than a decade now, however the limited access to personalized technology in the past was a barrier to gain traction. Furthermore the nature of designing something so personal is a challenge on its own. With these limitations until now, designing for reflection has been mainly tackled by the artistic approaches of critical design. This has retained reflection in interaction design marginalized as something interesting and thought-provoking, but overlooked in the designing of everyday artifacts.

The next sections elaborate on these precursors.

### 1.2.1 Personal technology

With the coming of laptops, tablets and smartphones, designers have a new design space consisting of digital objects carried around with ourselves during the whole day. These personalized devices bring new opportunities for designers to initiate and support personal reflection. Some hobbyists and nerds have already started to extensively extract their personal data for later analysis, or hacking their physical surrounding to get ad-

ditional data. The former has resulted in Quantified Self <sup>1</sup> and the latter in Internet of Things <sup>2</sup>, showing a possible future where we are going to be more conscious about our life via technology (and data) than ever before. Consciousness about our actions and experiences is a cornerstone to start reflecting on them, as later on will be discussed within this thesis.

New upcoming technologies (such as Google Glass and other wearables) are aiming to blur the borders between technology and daily life. These are pushing the design space even further, tackling such domains as social acceptance, confronting people what contribution technology may provide to everyday life.

### 1.2.2 Designing for experience

People have successfully reflected on their life before an extensive access to their personal data, and this shows that technology on its own cannot be the solution to trigger reflection, and this is where the design aspects come into the picture.

It is surprising to think about how few products of our everyday life are with the purpose to reflect more. This has been researched by artist-designers through critical design earlier; the use of provocation was found very effective for raising awareness on important issues of our society, but seemed like a dead-end for the designing of everyday products, those everyday products which are actually *used* by people and have a chance to be used for reflection.

How designers can design for specific experiences have been in the focus of design research in the recent past, and designing for experiences opening up new paths to walk within design; these new paths could mean the replacement of the art practice of critical design to the *design practice of experience design as new triggers for evoking reflection*.

### 1.2.3 Educating designers on reflection

Designing for specific experiences are considerably easier when those experiences are not unknown to the designers; there are many human-centered design methods to overcome such lack of knowledge during the design process itself. Regarding designing for experience, the knowledge base is increasing as more and more design tools appear for designing for adjacent experiences (for instance emotions). These similar experiences have already established research lines in the scientific and industrial practice, and as a consequence the terminology has been formulated to describe these experiences.

As for designing for reflection, it needs to increase its presence in the research and industrial practice, so common terminology and methods can be created, hopefully with

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<sup>1</sup>Quantified Self (QS) is a movement to gather (sensorial) data about an individual's daily activities to gain additional insights. These insights often regard health or performance. There is a community of QS hobbyists to be found here: <http://quantifiedself.com>

<sup>2</sup>Internet of Things (IoT) is a paradigm, where "the pervasive presence around us of a variety of "things" or "objects", such as RFID, sensors, actuators, mobile phones, which, through unique addressing schemes, are able to interact with each other and cooperate with their neighboring "smart" components to reach common goals." [22]

the results of both educating designers to design for reflection, and to advocate the need for these personal and hidden, but important user activities.

As much as a master thesis can influence, my aim with this work is to expand the research done on designing for experiences towards reflection. I believe that by having designer tools for reflection (the tangible outcome of this thesis), the overall awareness of designing for reflection can increase, and with that the amount of reflective products in our everyday life.

## 1.3 Why to design for reflection

Every designer is aware of the extent how much the surrounding products are designed to influence our feelings, to lead our consumer behavior to buy things, or pay for services with questionable needs. Such designer intents can be easily emphasized by triggering certain emotions, for example by simply choosing a specific color or visual style.

Moreover, other design strategies such as gamification or engaging social interactions can be used in order to influence behavioral change for example to loose weight, to exercise more or to learn a new language. Such methods influence through motivation and persuasion.

Now, designing for reflection is different from both of the above mentioned; it regards the rational mind instead of the irrational (i.e. influencing emotions), and influences behavioral change via conscious actions, instead of changing the context around the influenced behavior, like gamification does.

Although these characteristics make it more complicated to “sell” reflection to designers (as there are already established practices to achieve such designer intents), there are some other different perspectives, where designing for reflection can contribute to a designer’s practice. These are elaborated in this section.

### 1.3.1 Sustainability

Designing for sustainability is ever-increasing in design; firstly it started with the efficient use of materials for product design, while taking into consideration the limitations of resources and their effect on the environment. When it comes to interactive products, designing for sustainability goes beyond the traditional understanding of being thoughtful regarding the used resources; that was the main concern for physical objects, but not as much applicable for software. Interactive products can influence sustainability by influencing the users’ behavior for rational use of resources, evaluating their consumer choices and making sound decisions with sustainable living in mind. The STATIC! research program [3] showed how reflection and interaction design can create awareness of energy consumption, showing an evidence that reflection can effectively contribute to sustainable design.

### 1.3.2 Behavioral change

Behavioral change through interaction design is a complex matter, and has been mostly explored by persuading to pursue a certain behavior (Persuasive Technology, 2002 [20]) and motivating to maintain that behavior (by gamification, for example). Besides the underlining mechanics of persuasion (like conditioning or cognitive dissonance), behavioral change has also been gaining research focus through emotional design [38].

These leave further design space to explore in what alternative ways could behavioral change be achieved; by the rational mind, where the change mechanics are based on reflection. Reflection for behavioral change can be supported with personal behavioral data. The action of data collection can be used to provide personal awareness to the user about her behavior, and trigger reflection in order to influence this behavior.

### 1.3.3 Reflecting on experience

When it comes to “*consuming*” art, it is trivial that people are very differently educated on how to experience (and appreciate) art pieces. This may result in a lack of interests in visiting museums, or going there only because of social pressure, but without much individual benefit from the experience. A similar problem area is the tasting of food or drinks; people often pay for wine-tasting courses to learn how to taste wine, and learn to appreciate the nuances of experiences for all the senses. Watching these from reflection design lenses, a wine-tasting course could be seen as a way to elaborately explain how to enjoy the experience of tasting a wine, and the same way a typical museum could provide more guidance on how to experience art.

At the same time, there are also numerous cases when reflecting on experience is actually helping consumer decisions; for example, at the case of buying a high quality headphone, it is very useful to *listen* to the headphone before making a decision. Furthermore, the tryout moment of listening can be augmented with careful experience design; for example by subtly training the listener what to listen for (e.g. “*listen to the crispiness of the brass at this moment*”, or “*you can even hear the singer breathing*”). Although marketing and branding suggests differently, but not all decisions are made entirely based on emotions, and people also often use rational thinking to make important decisions.

### 1.3.4 Learning

Learning from past experiences is an important part of non-formal education, and – for instance – at the workplace it provides a lifelong way of growing knowledge. In these cases, reflection is the main part of revisiting the experiences from the past and conclude learnings from them.

Reflection has mainly been researched within the educational theory field, and as such already be able to providing its findings as analogies for the other mentioned design problems. However, within design and technology learning has mostly been approached by other means than reflection (such as prompting practice), hence leaving a design space only partially explored for designing for reflective learning.

## 1.4 Raising the research problem

Designing for reflection is a very vague topic proposal for a master thesis, as reflection is not a well-rounded experience (as to be seen in later chapters), and can take place in various ways, triggered by equally numerous factors. This thesis aims to explore one perspective on designing for reflection, where reflection is understood in the *literal, pragmatical* way, and evoked not by artistic design interventions, but by the very design intent of designing for the reflective experience.

This thesis investigates (1) what kind of strategies a designer can choose in order to design for reflection, and (2) what kind of reflective qualities a product may have which can evoke personal reflection. These two points reflect on the initial research questions from the thesis proposal, namely:

1. *How to use design as a reflection-motivator?*
2. *How to design entities (artifacts, interactions, services, etc.) to evoke reflection as a mental activity?*

Such questions are hard to answer when researched by the classical, scientific inquiry. Reflection is a very personal experience, which is hard to be evaluated. Reflection has different meaning for different people, and yet a very common term in the scientific language, the meaning of reflection is often overlooked, or vaguely defined. Also, this thesis partially aims to advocate reflection design, built on the belief that reflection is an activity contributing to someone's subjective well-being.

Having all these considered, designing for reflection can be considered as a *wicked problem* [42], and hence any research done on it should contribute to finding solutions for the above mentioned research questions.

## 1.5 Defining the thesis scope

This thesis targets design practitioners, and likely be an interesting read for design-interested educators as well. The thesis does not focus on the elaboration of the general interaction design process, but discusses the aspects of designing tools for designers themselves, and also provides a theoretical overview on the important theories regarding reflection.

With the deeper exploration of reflection, and different approaches of reflection in design, the thesis scope needed to be limited, due to the timely limitations of a master thesis. The two main limitations raised were to (1) solely target designers, and (2) provide them practical tools to design for reflection.

1. Focusing on designers enabled to work with a user group which I am rather familiar with, as being a design student. This made it somewhat simpler to conduct user studies.
2. After working with the theoretical approach of reflection for months, the thesis direction was much towards abstract. To balance this, the direction turned into the creation of actual tangible objects, which would not have been possible with some conceptual prototypes.

The thesis' investigation is carried out in the format of developing a design method (**Reflection Design Method**), and this method is prototyped through several iterations, which are documented in the thesis.

Due to the focus on supporting designers, this thesis does not feature well-developed conceptual prototypes, only small examples of how reflection design could be approached by redesigning everyday objects. These are more helpful in supporting designers, than high-fidelity prototypes of a few concepts.

The constraint of time heavily limited the research scope; the problem area of this thesis is a new approach to research reflection in design, and could be the beginning of further, broader and deeper studies. In case of continuing the research towards reflection design, this thesis can be considered as the first research cycle, an exploration of what would be viable to research later on.

## 1.6 Outlining the thesis

In the *Introduction (chapter 1)* the thesis is placed into the context of interaction design, by explaining the background and framed design area. Based on these, the research of designing for reflection is motivated, and a limitation is set to scope the specific target of designers. The chapter is closed with outlining the entire thesis.

In the *Theoretical background (chapter 2)* first a definition of reflection is attempted. Afterwards the main theories of reflection are explained, especially by Schön and Dewey. After these, experiential learning is outlined, and also a theoretical background on designing designer tools.

In the *Related work (chapter 3)* the seminal works on connecting reflection and interaction design are shown, by showing product and reflective design examples and inquiries from critical design, slow technology, designing for experience, and reflective design. Also, a small summary of the state of the art is given.

In the *Methodology (chapter 4)* the used design methodologies are summarized for the thesis' research, both the framework of the general approach and also the specific design methods used.

Then, in the *Concept development (chapter 5)* the complete followed design process is described; showing the different iterations, how were they conducted and what were the findings from them. This chapter explains the complete way until the final outcome.

The *Reflection Design Method* (chapter 6) is the main outcome of this thesis, a design method for designers to design for reflection. This chapter summarizes both the framework and the reflective design patterns collected as a card deck.

In the *Discussion* (chapter 7) the results are analysed, and collects the reflections on the design process itself. It then continues with how reflection design could be more utilized within interaction design. As being a research thesis, this chapter leaves suggestions for future work, what could be followed upon regarding researching reflection design.

As closure, in the *Conclusions* (chapter 8) the master thesis is summarized, and the *References* chapter lists the references.

# 2

## Theoretical background

This chapter discusses what is reflection, and explains the leading theories which contributed significantly to the development of this thesis.

Furthermore, this chapter also elaborates on the *design of design tools*, as this forms a background for the Concept development (chapter 5), and explaining the rationale behind the design decisions for the final outcome of the Reflection Design Method (chapter 6).

### 2.1 Defining reflection

In order to effectively discuss reflection in interaction design, it is important to characterize and frame reflection itself. This section gives an overview of how reflection can be seen from theoretical and practical perspectives.

#### 2.1.1 The complex problem of defining reflection

Defining *reflection* is as complicated as defining *design*. Moreover, the attempts to define reflection can easily lead to such philosophical discussions as defining design has lead to, during designers' attempts to conclude whether design is a stand-alone discipline and whether it can be characterized as a field of science.

When defining reflection, the scholarly works on defining design are helpful as an inspiration – as they deal with parallel problems – , and give an example of what kind of problems may arise during the attempt to find a definition. One of these is that design stands between multiple fields. Similarly, reflection may relate to cognition, psychology, learning, art, experience, and probably many other fields; and potentially also combinations of any of them.

In spite of this complexity, my approach for definition was to synthesize the theoretical and practical interpretation of reflection, with certain openness in mind. This loose method may not appear entirely scientific, but it will be shown that over-formulation to produce a well-rounded, hundred percent precise definition would be virtually impossible.

### 2.1.2 Theoretical approach

The earlier comparison between reflection and design stands firm when it comes to theoretical definition. For instance, Rodgers [43] attempted to define reflection based on John Dewey's work. Rodgers' approach may seem strange first, as Dewey's work dates back to the beginning of the 1900's, yet his work needed to be revisited, as – Rodgers argues – in the recent past reflection's definition became even more vague. Rodgers summarizes 4 problems regarding the lack of definition on reflection (based on Dewey):

- It is unclear how systematic reflection is different from other types of thought
- The assessment of a skill that is vaguely defined is problematic
- It is difficult to talk about something, which lacks common language
- Without a clear understanding on what we mean as reflection, it is complicated to research the effects of reflection (in the learning practice, and beyond)

Although Rodgers' article is written in the domain of learning and educational theory, it is valid to base the theoretical definition of reflection on this specific field; theorists on reflection mainly come from education.

Maintaining this parallelism with the problems of defining design, it is interesting to study how design is defined in the seminal book on design methodology. Christopher Jones offers ten, entirely different definitions in *Design Methods* [29], avoiding the problem of defining design himself. In fact, he concludes from a different perspective: *“the effect of designing is to initiate change in man-made things”*.

Following Jones' approach, instead of giving a precise theoretical definition on what reflection is, I follow Rodgers' concise summary on the four criteria that characterize Dewey's concept of reflection (ibid. p. 845):

1. *“Reflection is a meaning-making process that moves a learner from one experience into the next with deeper understanding of its relationships with and connections to other experiences and ideas. It is the thread that makes continuity of learning possible, and ensures the progress of the individual and, ultimately, society. It is a means to essentially moral ends.*
2. *Reflection is a systematic, rigorous, disciplined way of thinking, with its roots in scientific inquiry.*
3. *Reflection needs to happen in community, in interaction with others.*
4. *Reflection requires attitudes that value the personal and intellectual growth of oneself and of others.”*

The reason of using someone else's summary for definition lies in the fact that Dewey's language is complicated. However, here are two definitions of reflective thought and reflective thinking, from *How We Think* [13]:

- “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” (ibid. p. 6 – Reflective thought defined)
- “Reflective thinking, in short, means judgement suspended during further inquiry; and suspense is likely to be somewhat painful.” (ibid. p. 9)

### 2.1.3 Practical approach

The earlier theory-based definitions are helpful to frame reflection (especially in deciding whether a thought is reflection or not), but not entirely usable for designers, especially in the case of designing practical tools for designers (which this thesis targets).

In order to find a practical way to describe reflection, a recent article by Fleck [19] used The Oxford Dictionary [49] to define reflection, which says “*a serious thought or consideration*”. Based on this definition, reflection can be equally seen as a thought, so if someone reflects, she thinks. This might appear as an over-simplification first, but it is rather an imposed limitation to be clear what kind of reflection is under analysis (e.g. not physics and the reflection of beams). Having the vague constraints that *reflection is thinking* enables to opening up this term, and define different kinds of reflections.

For a user study, I conducted an analysis on the taxonomy of “*reflection*”, “*thinking*” and “*realization*” words, with the aim to shortlist the most common words used to describe reflection (on contrary to give a precise definition).

Following Fleck’s approach, here are some definitions of reflection-related words, which describe reflection through the lens of language, meaning adjacent things, yet having different definitions [49]:

- **reflection** (*noun*) : serious thought or consideration
- **realize** (*verb*) : become fully aware of a fact
- **reflective** (*adjective*) : deeply or seriously thoughtful
- **meditative** (*adjective*) : absorbed in considered thought
- **rumination** (*noun*) : think deeply about something
- **introspection** (*noun*) : the examination or observation of one’s own mental and emotional processes

A more complete list can be found in Taxonomy analysis (subsection 5.2.2).

### 2.1.4 Summary

The previous theoretical **definition** and practical **description** on reflection sum up a usable, well-rounded explanation for the rest of the thesis. This is a common characteristic of the field of design, and looking for more than one perspective on the same matter usually gives more benefit than a single-minded definition, which is common for hard sciences. Such loose definition is important when it comes to incorporating a variety of understandings of reflection; as seen in the later chapters, this loose definition allowed further clarity in communicating reflection, when this term could bend from “*a learning*” to “*a realization*”, or from “*a serendipity*” to “*just a thought*”.

## 2.2 Reflection-in-action

Donald Schön’s Reflective Practitioner [45] is a seminal book when it comes to reflection and different professions, including scientific research, nursing or architecture. Schön managed to reformulate Dewey’s theories into a much digestible format, whilst expanding those works towards a learning model, which can be applied for basically any profession, hence in the interest of many different practitioners.

Schön based his model on *tacit knowledge* [40], as a knowledge for which there is no need to focus our consciousness on it or have it written down, stored and formulated; we use tacit knowledge when doing activities automatically and intuitively. Everybody uses tacit knowledge during daily activities and at work situations. For example someone might unconsciously choose a different route when sensing a jam on the road, however she would not be able to reason why a different route was taken. This is **knowing-in-action** according to Schön, when our intuitive knowledge is utilized.

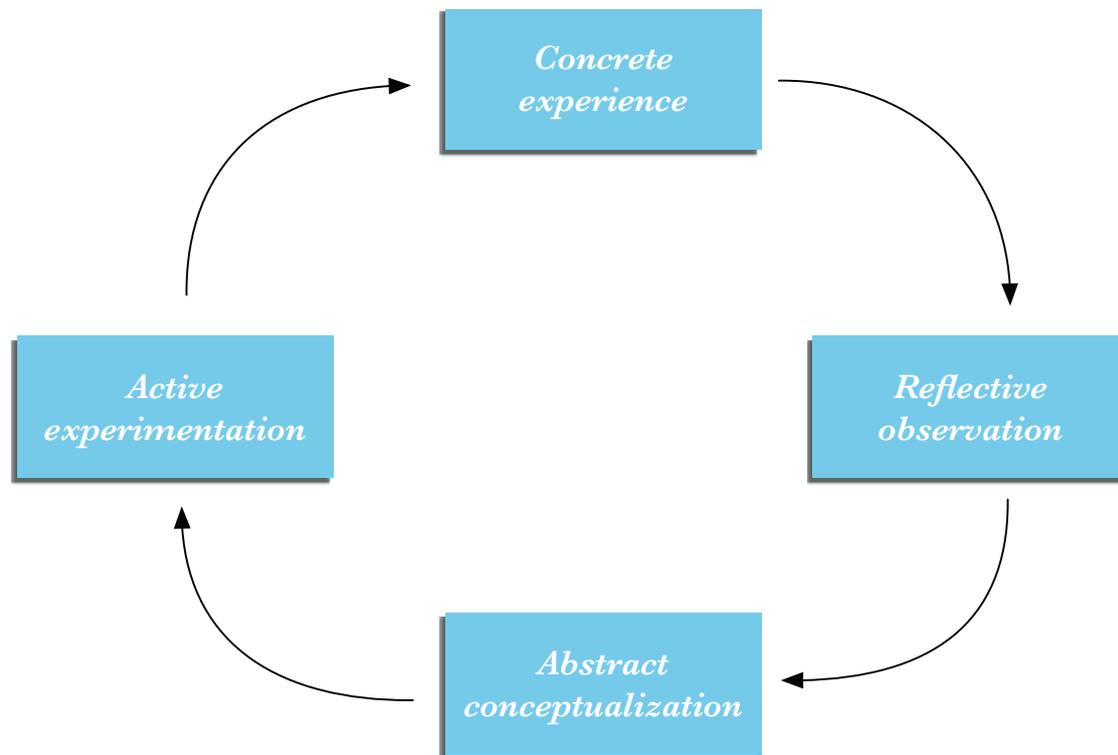
**Reflection-in-action** happens when our exemplary person consciously notices the thinking pattern during taking actions, consciously evaluating the situation and make continuous changes in the activity on the go. Formulating this continuous reflection during an activity made Schön’s work remarkable on the learning field, and he expanded this idea even further within the Reflective Practitioner and following works.

Another reason why Reflection-in-action is even more important for designers is because Schön based much of his observations at a design studio; he describes the design process as a “*reflective conversation with the situation*”, where designers conduct reflection-in-action by continuously exploring design decisions and design opportunities, evaluating and building on their intermediary findings.

Reflection-in-action can be combined with **reflection-on-action**, which happens afterwards. People can take notes on their activity, discuss it with others or watch a recording of it (depending on the nature of the activity); reflection-on-action let people take their time to explore why they acted like they did, or apply new perspectives on earlier activities.

## 2.3 Reflection in learning

Kolb's *Experiential learning* theory describes the mental process how a learning happens from an experience [30]. This process uses reflection for meaning making from the experience. The reflection continues with conceptualization and experimentation of the reflection (trying it out), which creates a looping process, where - by the end - new knowledge is generated. The loop closes, as when the learner attempts the experience once again, it will be experienced through the lenses of the adapted knowledge. Because experiential learning directly involves someone into the learning process, it is more effective than e.g. learning from a book.



**Figure 2.1:** Kolb's Experiential learning cycle.

Experiential learning suggests that every learning happens by attending all these below described four modes of the process (ibid. p.30). There is a tension in the model, that these modes are complete opposites of each other (action vs reflection, concrete vs abstract), and the learner needs to switch between the modes.

In the most optimal learning situations, the learner uses all modes in a balance, otherwise the learning will be incomplete (e.g. someone would not be really able to learn to ride the bicycle only by watching others riding it and reading the literature about how it is. Trying it out (active experimentation) is also an essential part of the learning of

this skill). However, as Kolb’s research points out, learners have their preferred modes (ibid. p.68), and these learning preferences well-describe the general experience of the modes:

1. **Concrete experience:** a focus on experiences and immerse human situations in a personal way. This mode “*emphasizes feeling as opposed to thinking, a concern with the uniqueness of present reality as opposed to theories and generalizations*”.
2. **Reflective observation:** a focus on the understanding of the meaning behind ideas and situations. This mode “*emphasizes understanding as opposed to practical application; a concern with what is true or how things happen as opposed to what will work*”.
3. **Abstract conceptualization:** a focus on the use of logic, ideas and concepts. This mode “*emphasizes thinking as opposed to feeling; a concern with building general theories as opposed to intuitively understanding unique, specific areas*”.
4. **Active experimentation:** a focus on the change of situations or influencing people. This mode “*emphasizes practical applications as opposed to reflective understanding; a pragmatic concern with what works as opposed to what is absolute truth*”.

## 2.4 Designer tools

The general design process cannot be just described with a step-by-step flowchart, as a linear way of reaching a final result. Different design methods exist for any stage of the design processes, and these are summarized for instance in Design Methods [29]. Although methods exist for all the design process stages, when it comes to tangible design tools, those are most often supporting the design work by (a) supporting the thinking about the conceptualization, or by (b) being cognitive helpers to tackle re-occurring problems during the development of design concepts.

- (a) **Conceptualization tools** According to Preece et al. [41], conceptualization is the step, when – based on the gathered requirements – the first prototype of an artifact is created. Their perspective is rooted in interaction design practice, but can be matched to the more general design practice as well. Conceptualization is typical during the ideation phase, when – based on the design brief – problem solutions get sketched down. Later on, these sketches (ideas, concepts) should be saturated and then evaluated to conclude in the design.
- (b) **Development tools** The main purpose of concepts is to evaluate different alternatives, select the best one, and then move on with the process. The next step, the development phase is when the designers need different tools than the ones supporting ideation. These development tools are to support doing precise, detailed design craftsmanship. A good example of these tools are **pattern libraries**.

Such collections are not unfamiliar for designers. In architecture, Alexander introduced “design patterns” [2], which collects timeless approaches to resolve similar design problems. Considering the field of usability and interaction design, pattern libraries are common, such as social interface patterns, usability, and so on. These patterns can simplify the dealing with typical problems (the task is just to find the most suitable pattern), and leave space to work on more genuine matters.

In Human-Computer Interaction, design patterns have been investigated in great depth; much of the focus regarding patterns was to develop the common vocabulary to describe timeless problems, hence mostly approach patterns as defining abstract solutions to abstract problems, so they can be applied in the greatest width of context and situation. On the contrary, Welie et al. [50] compares design patterns to design guidelines. In their view, guidelines are great tools to capture design knowledge, even on the expense that they might contradict each other, and that *“their validity and appropriateness always depends on the context”*.

When it comes to physical tools, many designers use only pen and paper (or their whiteboard - marker equivalent), sticky notes and similar simple tools for generating ideas. A common characteristic of such objects, that they are tangible, and leaving space for a wide-open usage, without imposing any limitations what can be done with them. The prolonged preference of such analog tools on digital tools shows that designers usually seek for simple tools over complex, and have a fascination of tangible tools rather than technology-heavy alternatives.

For this thesis, the main focus of design tools are card decks. As a card deck is one of the main outcomes of this thesis, there is a comparison and analysis of three different approaches in Card deck (section 5.3), which were conducted in order to understand (*“reverse engineer”*) how these artifacts should be designed.

# 3

## Related work

There have been earlier attempts to intertwine reflection with interaction design, however most of these previous attempts were rooted in art practice (where there can be confusion between design and art), rather than the attention being on creating human-centered or user-centered products. The focus of this thesis is on the latter, advocating the design of everyday products with reflective qualities. It is important to explore these earlier attempts to propose new approaches to researching reflection design, and it is important to know what is understood by reflection.

Interaction design – as Löwgren and Stolterman describes it – is the process, that with certain constraints, creates, forms and decides the structural, functional, ethical and aesthetic properties of a digital artifact [34]. Furthermore, Cooper et al. [8] add on that interaction design “*focuses on something that traditional design disciplines do not often explore: the design of behavior*”. These holistic definitions involve a lot of other things than just the outlook and the functional properties of an artifact, hence leaves a lot of properties for interaction designers to modify in order to evoke reflection. As it will be shown in the rest of the chapter, several reflective designs operate with ethical, functional or aesthetic properties of an artifact, which shows that reflection can be evoked in various ways.

### 3.1 Slow Technology

Hallnäs and Redström’s [23] Slow Technology article is one of the most important seminal works on reflective design in the field of Human-Computer Interaction. The authors notice the emerging patterns of information technology, where IT products are becoming ubiquitous items of everyday use, and how these products are set to go beyond being only limited functional products.

According to Hallnäs and Redström, the design considerations of using time as a designed dimension can lead to enabling the users of new technology to reflect, and to advocate mental rest in the fast-paced environment that daily IT products are creating.

Instead of having a world that is becoming faster, they propose “*slow technology*”, a design program more similar in nature to environmental design (such as architecture), but realized within interaction design. What they define as slow can be understood by taking the analogy of fast food and slow food; whilst fast food is all about efficiency and immediate consumption, slow food is all about the enjoyment of eating, and celebrating the art of cooking.

Explaining their design philosophy for slowness, Hallnäs and Redström emphasize that the use of a slow object “should not be time-consuming but time productive”; slowness stands for immersing oneself in the use of the object by learning and understanding it, and providing space and time for reflection on the experience.

Within slow technology, the authors propose three different approaches to achieving reflective design:

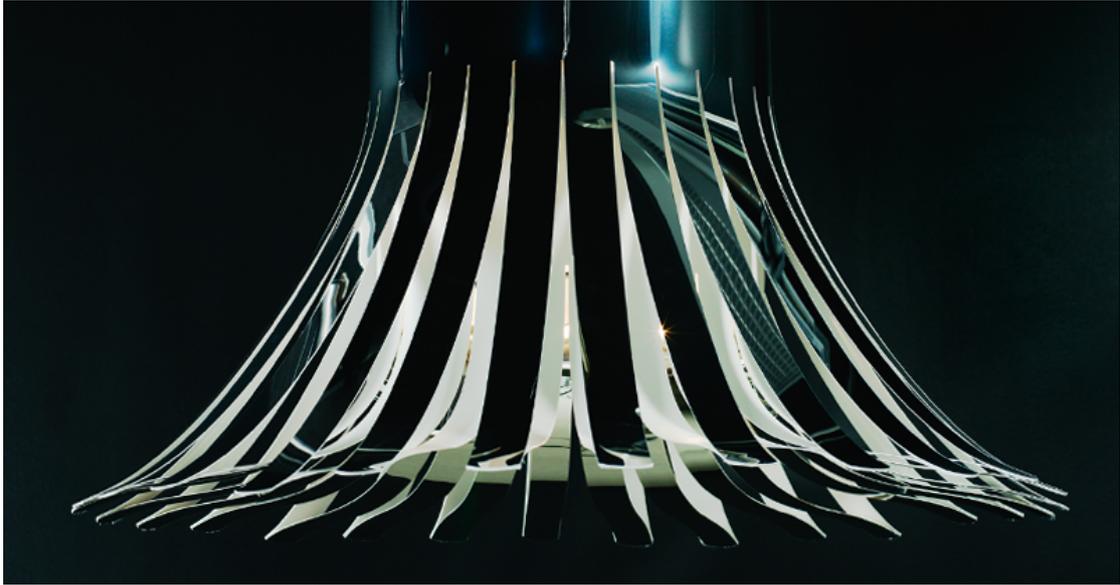
1. **Reflective technology:** to design technology critically, so that the designed piece’s basic expression leads to reflection and questions its being simply a piece of technology.
2. **Time technology:** to design technology which magnifies the presence of time, twisting the understanding of time.
3. **Amplified environments:** to design technology which changes the expressions of a given environment by operating with space and/or time.

The authors explain the use of these themes through several projects, all of which re-interpret the understanding of time, space or technology. Considering these novel approaches of interactive objects, Hallnäs and Redström explain a special problem, raised during the evaluation of slow technology. The novel design of slow objects may resemble works of art, without intending to become works of art. They argue that a good design of any slow technology is all about the inner logic and aesthetics of the object, and that these should be evaluated by techniques similar to art critique.

The collision of art, design and technology is natural in such design philosophies as slow technology. As a closing remark, Hallnäs and Redström claim that slowness should not be seen as an invitation for artistic impressions in information technology, but rather as an attempt to change the perspective on basic interface design problems. Through this shift, future design methodologies will come to consider IT products as part of a complex designed and inhabited environment, instead of “just” functional tools.

## 3.2 Critical Design

The term “*Critical design*” was coined by Anthony Dunne and Fiona Raby in *Hertzian Tales* [14], and later further developed in *Design Noir* [15]. The authors coined this term to describe their work: a sort of conceptual design, focused on “*making people think, raising awareness, exposing assumptions, provoking action, sparking debate, even entertaining in an intellectual sort of way*” [16].



**Figure 3.1:** Flower lamp. The lamp’s aesthetic lies in how it works: it opens up only if its household has been low on energy usage, rewarding them for their sustainable consumption. Picture credits: The Interactive Institute.

Critical design started out at the Royal College of Art in London, but throughout the years many other designers and design research groups have taken over its practice. A remarkable notion here is The Interactive Institute in Sweden, who ran a major design research program, *STATIC!* [3], which incorporated critical design to raise awareness on energy consumption and sustainability.

Most of the projects from critical design are “*dark*”; they incorporate a negative narrative how bad the future would turn, if things are going in the direction of today’s. On contrary, some objects from *STATIC!* are exemplary showing ways how to do critical design without being shockingly provocative.

### 3.2.1 Why is it connected to reflection?

Critical design projects may appear first as artistic interventions. As Dunne and Raby phrase it in the *Critical Design FAQ* [16], critical design does borrow from art in the terms of different methods and approaches, but it stops there; they expect art to be shocking and extreme. As the consumption of art is a reflective experience, making someone thoughtful and triggered, it is easy to find critical design works similar, in its ways to evoke reflection. Furthermore, critical design usually operates with everyday objects; everyday objects are man-designed, often mass-produced artifacts, nothing like art. This “*everydayness*” makes critical design much more closer to the users in the ways of relating to it by their everyday lives.

“If it is regarded as art it is easier to deal with, but if it remains as design it is more disturbing, it suggests that the everyday as we know it could be different, that things could change.”



**Figure 3.2:** Life counter, by Ippei Matsumoto (2001). You choose how many years you would like to or expect to live for and start the counter. After activation, it counts down the selected time span on four different rates (years, days, hours, seconds).

#### 3.2.2 How is it connected to reflection?

As written in *Design Noir* (ibid p. 58): “*Critical design, or design that asks carefully crafted questions and makes us think, is just as difficult and just as important as design that solves problems or finds answers.*” The triggers for reflection are very often found in questions, which wrap a whole different perspective on an experience.

Many designers deal with mass-produced products, however there is a very big design area also for installations and other design projects, where design is not used to resolve societal problems, but used for something else. Following the quote from *Design Noir*: “*Being provocative and challenging might seem like an obvious role for art, but art is far too removed from the world of mass consumption and electronic consumer products to be effective in this context. . .*”

Many critical design projects operate with an existential theme (ibid. p. 48), disturbing the user, instead of comforting: “*even just thinking about them raises many important issues.*” This triggered thinking is where the connection to reflection lies.

### 3.3 Reflection on everyday experience

With many of the constantly coming new mobile applications, designers are seeking novel ways to make the users record their everyday experiences, checking-in to locations (e.g. Foursquare), taking and sharing pictures of life (e.g. Instagram), posting short thoughts (e.g. Twitter) and so on. These recordings are mainly to inform the users’ peers about each others activity, however with applications such as RunKeeper or Nike+, mobile technology is used to log and track individual fitness record, along with motivating healthy behavior. These technologies create a foundation for applications, which are going to aim triggering individual reflection, with the help of technology itself.



**Figure 3.3:** Facebook’s year review function, which appears around every New Years’ Eve. Picture credits: Ronald Barba

### 3.3.1 Lifelogging



**Figure 3.4:** Microsoft SenseCam, a research project focused on lifelogging.

The digital augmentation of reflection on everyday experiences is very often by the means of “lifelogging”; Harper et al. [24] presents SenseCam, which is a memory prosthesis, “a resource for digital narratives”. In their study, the authors found, that the recording of one’s life is not deeply connected with the lived (and therefore, recorded)

experiences, claiming a distinction between the captured, the seen, and the evoked. For reflection design, this latter is especially interesting. The study participants reported that by every moments being captured, they gained new insights on their life, feeling strange, “*like in a silent movie*”. This strange feeling was also combined with the unique view the camera recorded; through fisheye lenses, and at a different spot than where the eyes are.

This strange and unique way of looking back the past evoked a lot of reflection in the participants: they had realizations about their lives, which otherwise would have been unnoticed. A major reported finding was how much mundane moments throughout the days. Hence, a conclusion from a participant was to put the SenseCam on for a week, and it is going to make someone rethinks life, like a therapy.

#### 3.3.2 Recording of personal data



**Figure 3.5:** Nike has developed a complete ecosystem to motivate people to do more exercise: shoes with sensors, wristbands, mobile apps with GPS, all these to capture the user’s personal data and show insights based on that. Picture source: <http://runsistersrun.com>

The above mentioned lifelogging as-how-life-happens is one way of gaining increased awareness of the experiences someone is exposed to. But this can be achieved by the logging of different bodily measures as well, similarly to how Quantified Self often works. Lindström et al. [32] reports an affective diary, which records sensor data and captures some physical and bodily aspects of experiences and emotions. One of the authors’ main interests was to research how would it be possible to combine (broadly understood) multiple media in a personal diary; a digital diary, which enables expressing private thoughts, and personal reflections on daily experiences.

### 3.4 Reflective design

Sengers et al. [47] introduced the term ‘*reflective design*’ in their respectively named article. Their findings are based on critical theory; a Western tradition to approach critical reflection. However, they note down the Eastern reflective traditions, e.g. buddhism or mindfulness as a different approach for reflection, which is much less discovered by HCI and interaction design.

Based on critical theory, the authors define reflection as “*bringing unconscious aspects of experience to conscious awareness, thereby making them available for conscious choice*”. This seemingly rigid definition expands with another point: “*reflection is not a purely cognitive activity, but is folded into all our ways of seeing and experiencing the world*”. This point makes reflection an open-ended activity in a holistic context, which is in-line with the reflection definition discussed in the section Defining Reflection (section 2.1).

Sengers et al. base their findings on other design approaches, pointing out the shortcomings for each, and how they do balance the shortcomings for each to the aim of create reflective designs. These foundations include Critical Design (section 3.2) and Reflection-in-Action (section 2.2), which appear in this thesis as well. As the authors conclude, Reflective design is an attempt to synthesize its different foundations, but not with the aims of replacement; these foundations are rich approaches, with ongoing researches on their own traditions.

An example the authors bring for discussion is about the integration of reflective design in an art museum. This example is especially interesting for this thesis, as it tackles a largely undesigned area of the art consumption experience, about the reflection on the experience. The augmented museum experience relies on the use of peers (more on Peer feedback (section 6.5.3) in Reflection Design Framework) for creating awareness both of the visitors and the curators.

The proposed reflective design framework by the authors consists of six principles and six strategies for reflection design. The principles are basically a statement from the authors how designers should use their own critical reflection for inspiration to question cultural norms, explore the limitations of the design practice, and that technology should support the critical skepticism about its own working. For this thesis, the six strategies are more interesting:

1. **Provide for interpretive flexibility:** let the meaning-making upon the users. This reflects on Open-ended functionalities (section 6.5.5) pattern.
2. **Give users license to participate:** to combine the unfamiliar pieces (to evoke reflection) with familiar notions in the design, in this way let the users participate with some comfort.
3. **Provide dynamic feedback to users:** the creation of awareness by providing feedback to the users. This feedback should stimulate reflection, for example by providing a new perspective on the environment. (This reflects on the Experience data (section 6.4))

4. **Inspire rich feedback from users:** let the users evaluate the experience, and make this evaluation designed in an inviting way, so it is not about the evaluation but inspiring reflection.
5. **Build technology as a probe:** use “*built systems analogous to the way a social scientist uses an experiment*”.
6. **Invert metaphors and cross boundaries:** use metaphors in order to find new design spaces. This means challenging common assumptions and looking for “un-designed” things for inspiration.

# 4

## Methodology

Many of the used methods in the concept development are essential, basic knowledge for designers. However, as I used these methods highly tailored to my process and needs, they should be listed for referencing purposes as well as for elaborating on the alternatives I could have chosen.

### 4.1 Framework

#### 4.1.1 Research Through Design

Zimmerman et al. [53] developed a model of Research through Design, explaining the role of the researcher interaction designer and how the designer acts like a facilitator between different disciplines, generating HCI research.

Research through Design is however not a design methodology on its own, but more of a designer-researcher statement, explicitly claiming that these two disciplines intertwined generate new knowledge which cannot just be categorized into restrictively either one of them. The way Stappers [48] summarized this: “*[a design] project draws in new knowledge from adjacent disciplines and may likewise return insights to those disciplines*”.

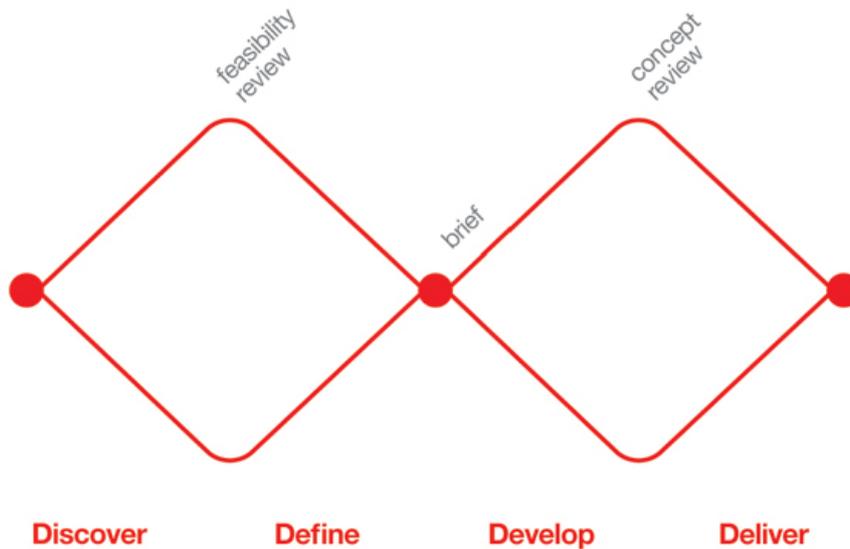
#### 4.1.2 Design inclusive research

At the practice of TU Delft, “*Design Inclusive Research*” is a widely used methodology for Research through Design. According to Horváth [27], the objective of design inclusive research (DIR) is “*to provide a sound theoretical foundation and a robust methodology for designerly inquiry to meet scientific rigor*”. This means, DIR enables the combination of research and design, to use research as a scientific inquiry and design as a knowledge synthesis, based on the findings of research.

During DIR, the design process looks like a typical one: phases of exploration, ideation and confirmation. Following DIR, these phases should contain scientifically grounded methods to ensure that the outcomes of the design process are meeting certain research criteria. To support the methods available for DIR, a designer may look for research methods from the social sciences; questionnaires, storyboards, workshops, etc. Such methods cannot be found in fundamental sciences or engineering, yet are established and well-fitting for design research.

### 4.1.3 Iterative prototyping

Iterative design breaks up an available timeline into smaller chunks of steps, usually by the use of prototypes. The designer tackles hypotheses with every iteration, continuously refining the design with the newer steps. The advantage of iterative prototyping is firstly to divide the timeline into smaller units, creating specific focus for each step, where research, ideation, decision-making, development steps are following each other.



**Figure 4.1:** The double diamond design process model. Source: Design Council.

A good representation of an iterative prototyping design process is the double diamond formula [9], where the first diamond is about framing the design problem (problem finding), and the second diamond is about creating a solution to resolve the framed problem.

An opposite approach would be a model based on the waterfall model in software engineering, which dictates similar cyclical model for the design of artifacts based on a design brief.

#### 4.1.4 Human-centered design

Human-centered design relies on users' input for the design process, at any of its stage; designers involve users in framing problems [44], prototyping (participatory design) and evaluating designs (usability testing). Human-centered design is an overhead of activity, and it requires extra efforts from the designer, especially time-wise. Yet, human-centered methods are giving a structured way to effectively design *for* the users' needs.

## 4.2 Methods

### 4.2.1 Literature review

Jones' [29] design method on literature searching, states as an aim: "*To find published information that can favourably influence the designers' output and that can be obtained without unacceptable cost and delay.*"

Literature review is a (semi-)structured way of exploring relevant literature regarding the design problem. Structured process, at least in the sense that it should be pursued with specific goals, however the actual procedure can be tailored, adapting to the findings and the given design problem.

Systematic quantitative literature review is the most strategical, most scientific rigorous method, based on keyword inquiries in the major publication databases, and then coding the results by quantitative measures, for statistical purposes [39].

However, to use literature as part of the design process, a semi-structured exploration of literature can provide qualitative input in the beginning of the design process; one way of proceeding is to check literature, and continue the process with references found in the earlier literature (often called the "berrypicking technique" [4]). This way, the literature is explored in a tailored way, adapting to the design problem.

Comparing the semi- and fully structured literature review methods, a crucial problem where these methods' difference is important; in cases, where the linguistic phrasing of a design problem is important (such as there is no common terminology, or the inquired topic can be explained in various ways, often through different disciplines). Then, a keyword-based rigorous method will lead partial results only, which results in misleading results.

### 4.2.2 Questionnaire

Unlike the traditional setup of using a questionnaire as a survey to gather quantitative data, questionnaires can be used for qualitative research as well. It must be emphasized that this is not too common, and most of the literature considers questionnaires as a technique to gather information from large population [29].

In Jones' Design Methods, questionnaires are outlined similarly to other design methods:

1. In the beginning, the designer needs to identify the design decisions, which are going to be influenced by the outcomes. This step is essential for designing the questionnaire; basically a design brief of a smaller design process (of the questionnaire).
2. Having the planned questions, questionnaire content outlined, the designer needs to prototype the questionnaire, and craft its questions and additional sensitizing content.
3. The “*questionnaire prototype*” should be evaluated as a pilot session, with a small amount of respondents. These respondents are later asked for feedback on the questionnaire. This pilot session should test the flow of the questionnaire, the insight it may reveal, and other criteria the designer is interested in.
4. Depending on the outcomes of the pilot study (3), the designer can choose how much she needs to adapt the content of the questionnaire; the feedback to be implemented.
5. Distribution of the questionnaire.
6. Evaluation of the questionnaire.

### 4.2.3 Prototyping

Prototyping is a vital part of almost every interaction design process; Preece et al. [41], Buxton [7] argue that the basic deliveries of an iterative design process are prototypes; these are the tools to manifest design decisions, to show to users for evaluation, to clarify further requirements, and so forth.

Prototyping can vary a lot depending on the project. For interactive artifacts, we distinguish two major types:

1. **Paper prototypes** (low-fidelity prototyping) enables fast, rapid, dirty and cheap prototyping, when the prototypes serve to be a strong visual/tangible support of the design process. Typically paper prototypes are utilizing sketching, basically simply drawn objects on paper, which are communicating the rough idea of the design. These sketches can be analysed in depth by iterations, before more expensive further developments happen. Drawbacks of paper prototypes, that due to their simplicity, they require a facilitator (typically the designer) to be present and to explain what is actually being seen. Another drawback, that testing participants often find it bothering that these prototypes look and feel is far from developed objects, and that can bias the feedback towards low quality information, regarding the poor look of the prototype.

2. **High-fidelity prototypes** are used in the testing of more detailed interactions, robust user interface solutions and so on; these are often coded software, or sketched hardware with prototyping tools, but can also be more thoroughly drawn sketches, based on the earlier low-fidelity prototypes. High-fidelity prototypes are complete in some sense, thus can be user tested. The expense is that high-fidelity prototypes are much more time-consuming to develop.

#### 4.2.4 Interviewing

Interviews are a simple, yet effective way to gather qualitative data and insights about people. Typically, interviews are a conversational form, where the conversation is focused on a specific research inquiry. Preece et al. [41] distinguish four types of interviews:

- open-ended or unstructured;
- semi-structured;
- structured;
- group.

Out of these four, the first three are differentiated based on the predetermination of the questions; as an interview is a conversation, it has the ability to be highly tailored as the discussion is going. The more it is following the predetermined set of questions, the less open-ended it becomes.

An **open-ended interview** is useful for explorative needs, when the design space needs further focus or constraints. During an open-ended interview, the interviewer can inquire in depth of interesting points from the respondent, but also easily refocus the discussion on another topic. A main benefit of open-ended, unstructured interviews that they generate rich data; it potentially leads to broader findings, however with the price of increased time spent on the data analysis, as rich data is typically messy and unstructured.

A **semi-structured interview** is to be followed, when the designer needs to explore a targeted area, such as the evaluation of a prototype. Also important to note, that if a designer team is conducting interviews in parallel, then those should follow the same set of – standardized – questions, otherwise the gained data will be corrupted.

**Structured interviews** resemble a lot with surveys; they are following a script of pre-defined questions, which are usually closed questions, requiring a precise answer. In contrast, semi-structured interviews have a predetermined area of questions, but keep the inquiry open for the interviewer; the questions can be formulated and discussed in a way which comes with the most sense based on the flow of the interview.

**Group interviews** are facilitated discussions with multiple people at the same time. The typical size of a group is 3–10 people; a gain of involving multiple participants, that the group can be composed of multiple stakeholders, experience level of users, genders, etc.; factors which may lead to broader, more diverse insights regarding the topic. Group

interview allow the researcher to use the group's support of bringing up sensitive topics. As a group interview is facilitated by the researcher, thus her own responsibility and challenge to ensure balance in the group; to let the shy participants talk and moderate the extroverted ones from not taking over the group's opinion.

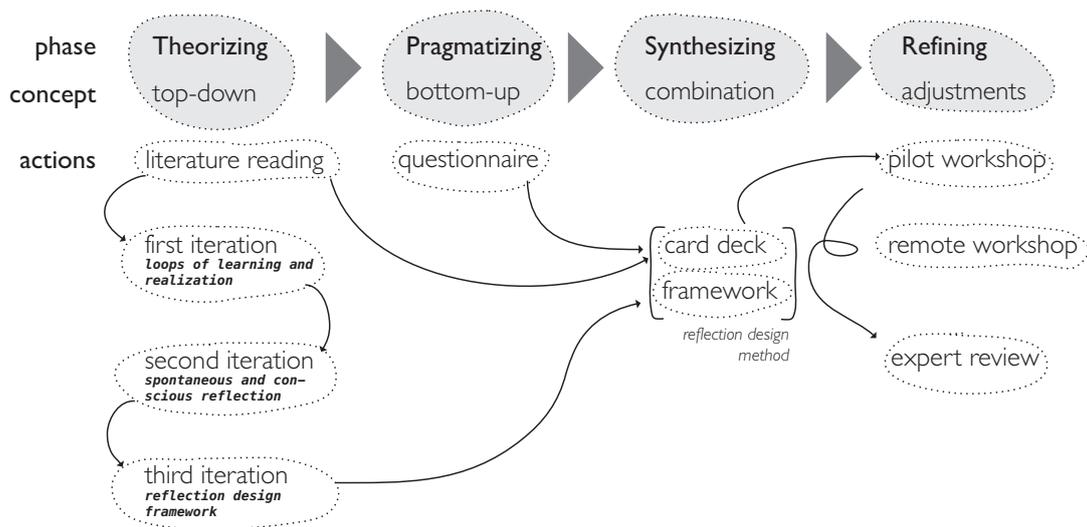
#### 4.2.5 Evaluations

In interaction design, evaluation methods come to the process when it is essential to assess if a prototype is succeeding in resolving the users' needs. As Preece et al. [41] formulate, "*evaluation is driven by questions about how well the design or particular aspects of it satisfy users' needs.*" They describe four different evaluation "paradigms" (methods/techniques), all tailored for different stages in the design process.

1. **"Quick and dirty" evaluation:** this is an informal practice for designers to collect feedback from users or consultants, as a validation that the ideas are on the right way of answering user needs. The power of quick and dirty evaluations lies in that they can be applied at any stage of the design process to get fast input, on the expense of extensive documentation (which is especially a problem when such documentation is needed for scientific output).
2. **Usability testing:** this is a method based on quantifiable measurements to analyze the users' typical performance. Usability testing usually tests average use, and in what percent the users are able to perform, thus measuring the rate of error, and the time used for performing the tasks. Compared to the quick and dirty evaluations, usability tests are performed in a strongly controlled environment.
3. **Field studies:** the combination of different qualitative tools are used, when it is important to observe the users in a natural settings, for an increased understanding how the designed prototype impacts their work. Field studies can be composed by interviews, observations, ethnography, depending on the context and the kind of observation they are required for.
4. **Predictive evaluation:** this method is used with experts, who "*apply their knowledge of typical users*". A predictive evaluation is for example an **expert review**, where one or more experts step through tasks using the prototype, and pinpointing problems of the design, with suggestions how could it be improved. In this setting, users are not involved, but represented by the expert's abstract knowledge regarding them.

# 5

## Concept development



**Figure 5.1:** The overview of the concept development from the beginning until the final outcome.

The overall process followed an iterative, human-centered, design inclusive research process. This approach was found particularly well-fitting for such an explorative design research process, essentially enabling the change of research directions after each iterations. It enables to combine iterative prototyping and human-centered design methods by backing them with scientifically sound findings, which characteristic was found crucial for a master thesis work.

As Design Inclusive Research operates within research cycles (represented as *phases* on the figure), these cycles could easily overlap with the iterations for the prototyping process, thus were used extensively during the project. Human-centered tools were used during the cycles to gather qualitative data about the users, especially at the final stage of evaluating the prototype.

## 5.1 Developing a model for reflection

While discussing my research on reflection with others, a major communication problem I faced was knowing how to be clear and concise. The problem is, that although reflection is very embedded and commonly used in academic language, it lacks a clear definition that is understood. During my research studies, I experienced this vagueness every time I sought new input.

When this pattern was realized, I developed different conscious strategies to enhance my communication. This realization helped to just consciously let my conversational partners immerse themselves in thinking about reflection in the first minutes of the conversation. Having this sensitizing period as a warm-up phase, turned the conversation into something beneficiary later on.

Furthermore I started to develop visual support materials to explain my thoughts and eliminate the communication problem. In this way the shallow definition of reflection was overcome by simply placing the word in a different perspective. As reflection is a very abstract topic to discuss, tangible tools, such as a simple drawing were found to be useful in creating pragmatic understanding as well.

As stated above, reflection has various meanings and interpretations for everybody (at least within the academic world), however it is not so common to seriously read deeper into the matter of reflection theory and reflective practices. These different “superficial” and random understandings were revealed with every informal discussion I had; some people came to understand mindfulness, some the provocation of critical design, and so on. These aspects of reflection are considerably different to the view I started with: experiential learning and introspective reflection on experiences.

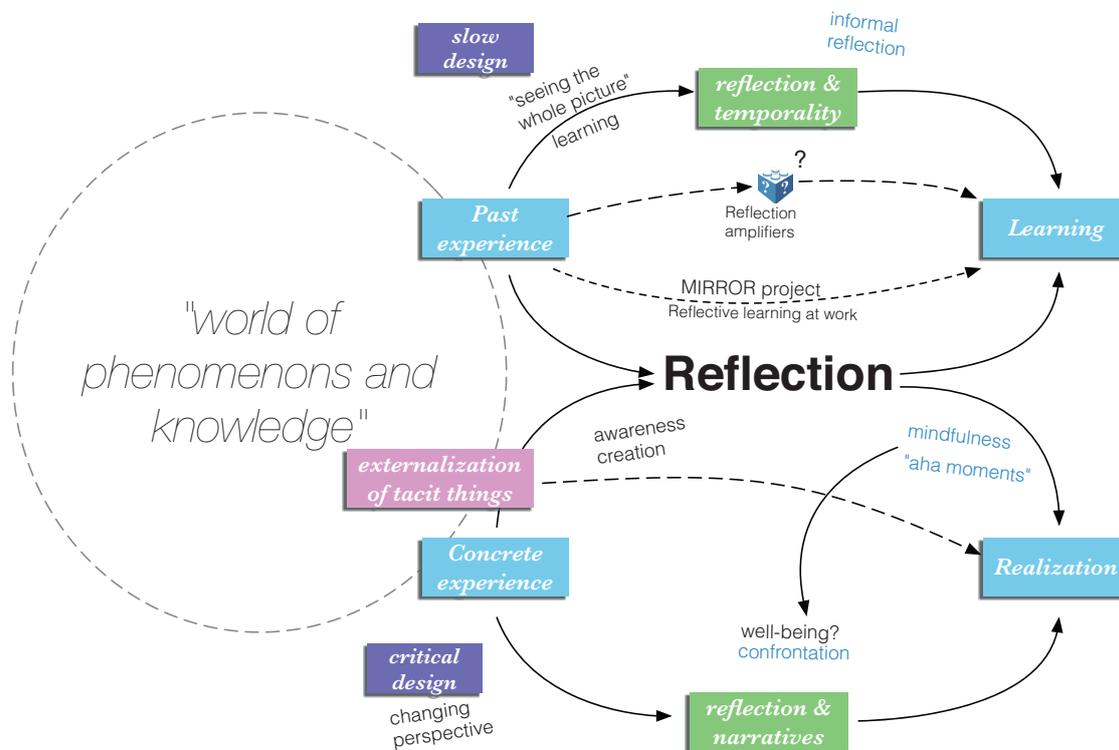
It is important to note, that my approach to developing the framework was very reminiscent of human-centered design processes, especially in the iterative development and human-centeredness aspect. Although the prototypes are simply visual representations of abstract things, the underlying design decisions and the way they are utilized justifies this perspective.

To begin with, the first iteration was established to support my communication regarding the issue of talking about reflection; to bridge all the different views my discussion partners may have. Through the iterations, the model turned out to be a continuation, concluding my literature studies and my discussions and thoughts about reflection. In this way it started to gain weight in terms of my thesis work. This is the reason why I ended up having the third iteration as the basis to the method card prototypes, and in this way evolved from something abstract to something practical.

### 5.1.1 First iteration

The main aim of the first iteration was to create a communicational prototype, which could support my learning and help in the discussion of reflections with others. With these criteria in mind, it was quite a natural choice to opt for a visual representation of the area; so that it could be a summary of all the literature research that had taken place in the early steps of my thesis project, as well as indicating my conclusions and reflections based on my reading. Besides concluding my reading on reflection theory, this first iteration also correctly situates the “ad-hoc” reflections from the informal discussions.

## Loops of learning and realization



**Figure 5.2:** Loops of learning and realization, the main pillars of the first iteration of the reflection design framework.

The initial model was inspired by the *Experiential learning* model [30], which explains how learning is based on experience. This was the basis for the *loop of learning* in the model. To keep the model consistent, this loop was mirrored for in cases where the outcome of reflection is not learning, but rather a *realization* of something based on an experience (the loop of realization). The inspiration came from the STATIC! Project [3], where reflection was influenced by making the user aware of her energy consumption in various ways, but without placing emphasis on learning or on drawing bigger conclusions.

The most important finding at this stage of development was the formulation of realization as a “*kind of reflection*”, which happens not for learning purposes, but for more ad-hoc, less controlled, or less deep reasons. Having this defined helped to also place all the ad-hoc, uncategorized reflection types in the same framework. In this way, many diverse views became unified within the same model.

This iteration features a separation between *past experience* and *concrete experience*; this separation was found to be poor after having used the model. Later on these were perceived as ‘*individual phenomena*’, which is a better description, still retaining the characteristics that they may differ in relation to past or actual time.

However, having temporal separation of phenomena helped to place *reflection and temporality* and *reflection of narratives* on the same model. These are related techniques which lead to reflection, but could not have been fitted into learning and realization separation.

Having these together as a framework for reflection formed a model to elaborate my view and incorporate other perspectives. Since this is a graphical representation with entities and arrows, it became a natural step-forward to integrate more related terms. In this way, everything appeared to be the same as on a *mental map*, summarizing all the different other views which cannot be placed within the learning and realization loops. When this framework is considered as a prototype, having such shortcomings seems to be an effective way of incorporating them only after iterating the concept.

### 5.1.2 Second iteration

The first iteration of the model was an effective visual representation of a broad problem area, but it also featured a couple of inconsistent or just simply not-rationalized parts.

The main design organization for the second iteration was to distinguish between spontaneous and conscious reflections. This perspective made a lot of sense, considering the complex nature of reflection, which is something that naturally happens in a rather informal way, whilst in learning situations it is often “forced” by assignments, project reports, etc., without being constrained to one thing or another.

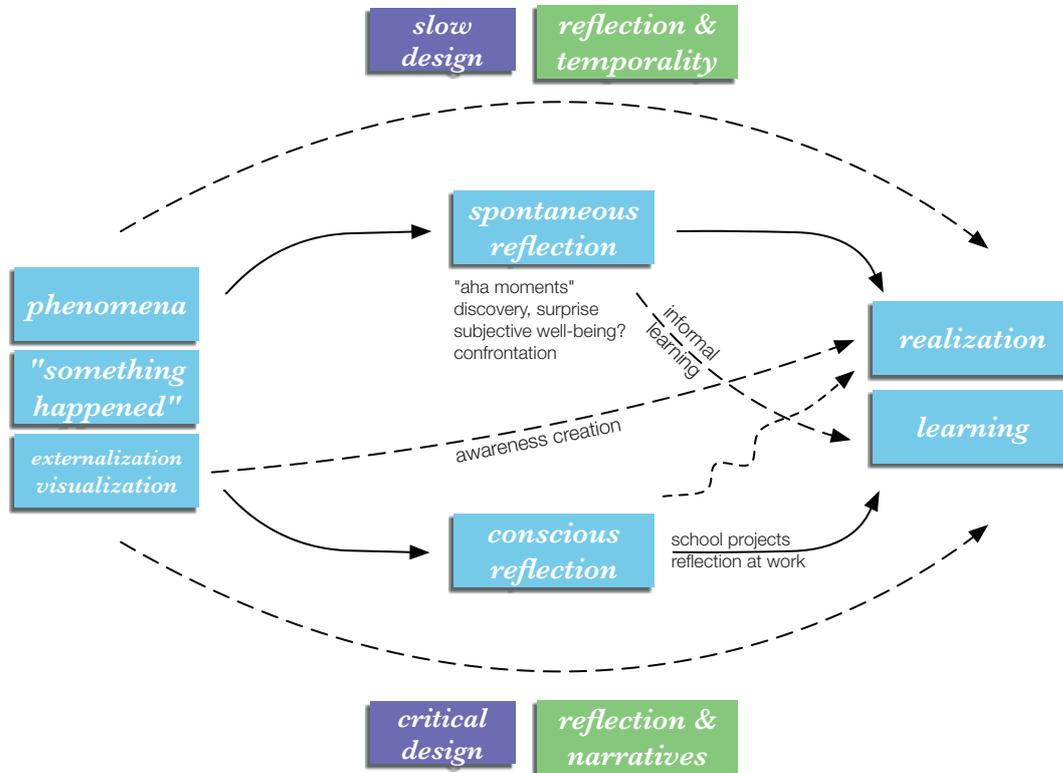
With the organizational dimension incorporating spontaneous and conscious reflections, this second iteration features simplification at both ends of the model.

On the phenomena sides, the earlier version of past and current experiences was replaced with a cluster of

- Phenomena
- “*Something that happened*” (inspiration from Kolb)
- Externalization/visualization.

These all are better representations than the previous versions, and their phrasings more effectively communicate the idea of how broadly phenomenon can be understood.

# Spontaneous and conscious reflection



**Figure 5.3:** Spontaneous and conscious reflection. The second iteration of the reflection design framework.

The outputs on the end side of the model also became a cluster, more precisely indicating that reflection and realization are intertwined and that it is up to the designer to choose which one is applicable or realistic for her purposes.

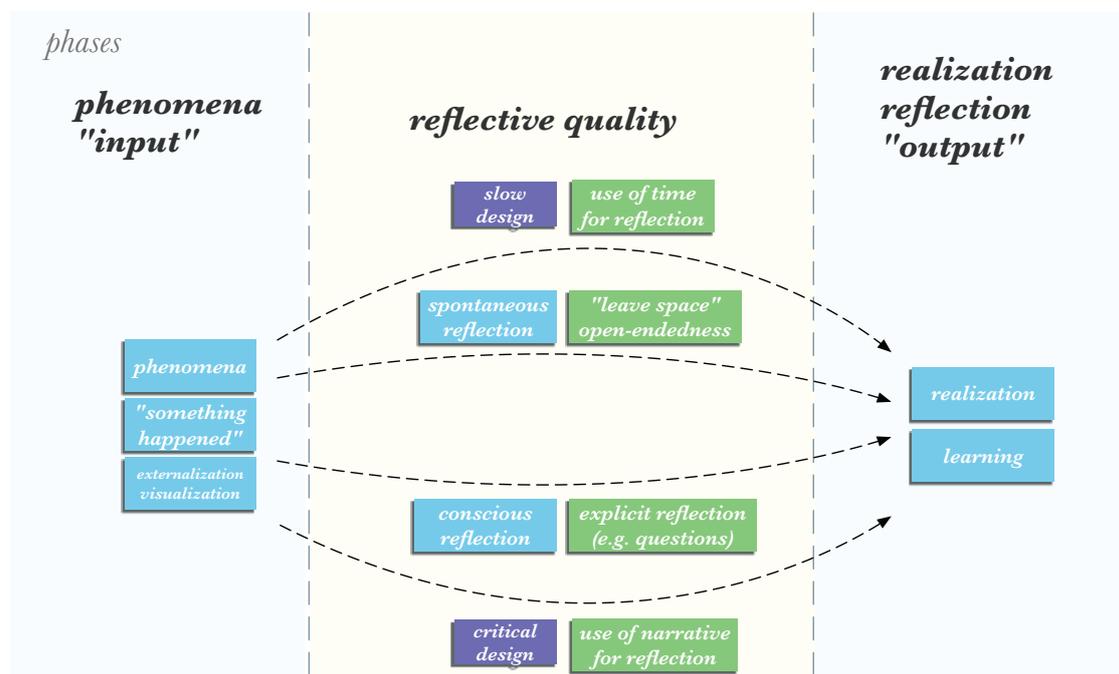
The spontaneous and conscious reflection division also helped to divide the supportive (ad-hoc types of reflection) components of the model. Temporality and slow design was placed on the spontaneous reflection side, which well represents how these design techniques approach reflection; in a subtle, relaxed way, literally by “*taking their time*”. The obtrusiveness of critical design acts very harshly on reflection, and how it works by basically shouting at people that they must stop and start to think. This leads to much obvious reflection, which relates to conscious reflection.

### 5.1.3 Third iteration

For the third iteration of the model, the main intention shifted from the communicational prototypes to the actual framework, which could be the basis to the design methods prototyped for this thesis.

In previous iterations, the supportive parts were ad-hoc or semi-justified, however they were always somewhat inconsistent or imperfect. In the end, these are alternative methods next to evoking spontaneous or conscious reflection, and so therefore their representation should be equal within the model.

## Reflection design framework



**Figure 5.4:** Reflection in three phases, the third iteration of the framework.

With the design method prototype as a future output for this iteration, the main idea behind the different phases of the model became that of being general enough, for it to be an umbrella of techniques, with endless combinations and extendability.

Therefore, the earlier clusters of phenomena and realization/reflection became phases of input and output. In this way input and output phases also gained visibility, as with this solution, so that any number and kind of methods could be considered to achieve the intention of the phases.

The middle phase became an umbrella for all the different design techniques related to reflection. In this way, there was no forced categorization to divide reflective design, it intended to trigger clarity with regard to earlier steps. This umbrella characteristic enables to expand the framework with new inventions of reflection design later on.

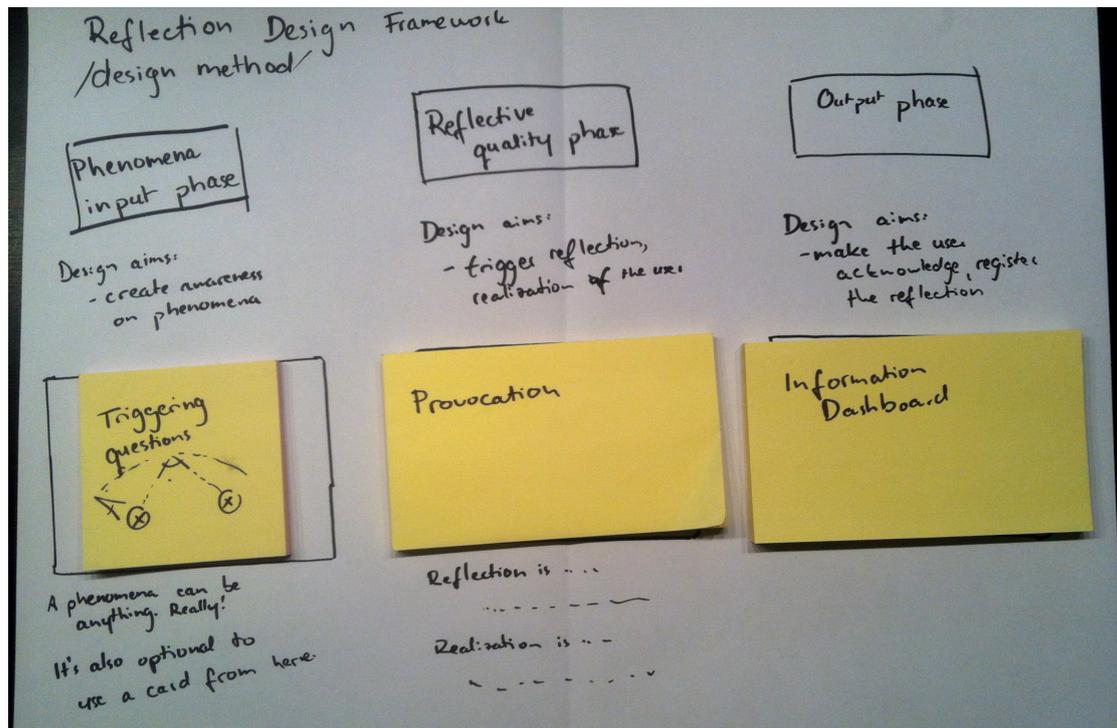


Figure 5.5: An early sketch of the framework prototype with cards.

The model of this third iteration was used extensively during the conducted workshops. However, it is not the final version; the final version is presented in *Reflection Design Method* (chapter 6).

## 5.2 Questionnaire

“If you want to go fast, go alone, If you want to go far, go together” - Old African Proverb

The developed framework is a good indicator of how far someone can get by summarizing and concluding the theory and work of others, pushing it further into one’s own thoughts and views. However, a clear shortcoming of this method is the large distance between reality and the users’ perspective.

Navigating through the reflection space, designers can easily develop a fixation to approach a “*designing for reflection*” problem through artistic critical design, which will definitely make people think, at least for once.

As my intention was always to investigate reflection design by summarizing what is out there, and look further than the shortcuts such as critical design, a broader study was needed.

The literature showed me how designers attempt to implement reflection design, but it lacked the important aspect of what users find reflective. Turning this into a research problem, after investigating reflective design from the theoretical - top down - perspective, a very practical – bottom up – view was needed, to complement my findings.

There are various ways to gather such insight; one may choose to conduct a series of interviews or one can opt to ask a group of people for auto-ethnographical diary keeping. I chose to create a qualitative questionnaire.

Using a questionnaire to gather qualitative data might appear uncommon, because the real value of qualitative data lies ‘between the lines’, and involves gathering tacit knowledge; that is often revealed by interviews, workshops and such formats.

The reason why I chose the questionnaire method for my data gathering was mainly due to the fact that reflection is a very personal activity and people usually need to notice their own thinking patterns to understand how they reflect. This can be largely biased within a workshop, where the discussion takes place within a group and personal views get lost between arguments.

Moreover, according to my experience, meaningful discussion on reflection starts after a sensitizing period, when people have accommodated some preliminary thinking about it. A time-bounded workshop or interview lacks the possibility to leave space and time for respondents, whilst a questionnaire gives the opportunity to return to it within a given time frame.

In an optimal case, I could choose to conduct interviews and workshops, as they also have their advantages: if time had been available, a sensitizing activity would have been possible to do, to eliminate the problem of “*warming up*”. During the interviews and workshops, I could do more in-depth questioning to reach a better understanding of how the respondents actually reflect. With the questionnaires, this depth was uncontrolled, and it was left to the respondents to be lengthy or brief whilst writing answers to the questions.

The considerations behind deciding on a research method were time, the people approached, the respondent rate and the quality of the data gathered.

The quality of the gathered data is hard to assess scientifically. I considered that people really need some time to think about reflection; after being asked about it, most people prefer to spend some immersion time, to notice and realize these introspective moments. Online questionnaire softwares are able to support this with browser cookies (so the respondents may return to the questionnaire at another time), so there is no technical barrier.

Another approach to gathering higher quality data would have been to hold workshops, with a preliminary sensitizing period, so that participants could arrive with a diary or thoughts or realizations at the workshop. In this case, the workshop format could have allowed a discussion between them, and instead of having textual output, their views would have been collected as interview transcripts.

Workshops are excellent ways of gathering deeper insights, but touching on such a personal area as reflection, I did not see the added value of gathering people in the same room and letting them to discuss. Habits of introspection really differ, and this was the safer choice not to exclude the input of more introverted, more reflective people.

### 5.2.1 Questionnaire design

The main focus of the questionnaire was to understand what products make people reflect and realize, and what are the possible product qualities that may play a role in all of this.

#### Sensitizing

As explained in previous chapters, I found discussing reflection particularly complicated both with laymen and designers. Therefore, sensitizing became an important part in designing the questionnaire, both as a static landing text, and as “*warm up*” questions.

The landing page text explains the general, survey-related matters, with expanded focus on reflection, technology, my motives and what I am trying to resolve. The reason for this was to be as concise as possible, and also to put it into the context of what kind of outcomes could be achieved from my research; perhaps if some people have interest in this, they might find themselves more eager to provide higher quality input.

#### Thank you for participating in this study!

I'm Peter Kun, an interaction design student from Chalmers University of Technology (Gothenburg, Sweden), and I'm doing my master graduation project at TU Delft (The Netherlands).

In my master project, I'm investigating a special slice of the so-called "user experience" field. I'm curious how can products be designed so that they make their users' think about their interaction with the product, or help people to reflect on the experiences they are engaged in.

In these days, most of our products are designed to be to used as easily and intuitively as possible, which is a good thing; they shouldn't be overcomplicated or confusing. However, with the expansion of mobile devices and computerization, we have come to face times when technology has literally started to overtake all our private times, and claim its existence in every single activity we pursue. Following this pattern, we are devoting more and more time in activities which were designed not to use our minds to their full capacity.

I believe our minds should be triggered, and we should claim back more of our time; to spend consciously with thinking about things; ourselves, life, the very activity we happen to be doing.

With my research I'm investigating how can be our everyday technology utilized in this, how can our products be designed in a way that they make us to think on meaningful things, or how can products assist in our pursuit of thinking consciously about things surrounding us.

This calls for different design strategies than aiming for usability and efficiency of the tools we use, intuitive interactions we engage in.

With this questionnaire I would like to discover what are the product qualities which makes people think, and what kind of strategies a designer can take to evoke reflective behavior.

Next to the questions I placed some relevant words, synonyms. Feel free to use them as trigger, and it might be helpful to check their meaning in your native language to avoid bias by using English.

Filling up the questionnaire takes approximately 20-30 minutes, thank you in advance for that! I hope, by thinking through the questions you reach some pleasant realization about your thinking habits as well and find some learning during the process!

If you have any questions regarding my research, you may reach me at [p.kun\[at\]tudelft.nl](mailto:p.kun@tudelft.nl) or [peterku\[at\]student.chalmers.se](mailto:peterku@student.chalmers.se)!



Figure 5.6: Sensitizing warm-up text from the questionnaire.

## Questions

What describes the usual situation

when you need to think deeply about something meaningful?

Take a minute to recall a recent experience, when you needed to think hard about something. What did you do, where did you go?

Some connected words or synonyms:

**meditative** (adjective) - absorbed in considered thought

**speculate** (verb) - firming a theory about a subject without firm evidence

**focus on** (verb) - pay particular attention to

**consideration** (noun) - careful thought, typically over a period of time

**concentrate** (verb) - focus one's attention or mental effort on a particular object or activity

**Figure 5.7:** Example question from the questionnaire.

As reflection is generally an ambiguous term, I focused to craft the questions carefully, through several iterations, to achieve the best possible responses for them. Every question featured a small thesaurus, explaining relevant terms (such as pondering, rumination, meditative, etc.).

The complete set of questions can be found in the appendix.

### 5.2.2 Taxonomy analysis

Having complications with defining reflection in a concise way, I chose to analyze the taxonomy of words connected to reflection in a thesaurus. The aim was to discover the vocabulary describing reflective processes, and based on this vocabulary design the questionnaire in a way, that the possible linguistic confusions will be minimized.

The motivation came from my native language; in Hungarian - although it exists in the language - “*reflection*” is barely known and used besides academical context. In training or psychological context, reflection appears as mirror-translated from English, usually.

It also contributed to focus on this, that knowingly in advance, the respondents to the questionnaire very likely not going to be native English speakers, but design and education practitioners and students.

Re-visiting the definition of reflection from the Oxford Dictionary [49] as “*a serious thought or consideration*”, the considered words were based around “*thinking*”, “*realization*” and “*reflection*”.

This search resulted in an overly long list of synonyms; words with very similar meanings, where the differences can only be noticed by native speakers of English. Knowing that the questionnaire is going to be responded by an international group of people (mainly English as a second language), there were two main considerations:

1. The shortlisted words should be relatively known in English, and not requiring a dictionary to understand them with upper-average language skills,
2. The small nuance differences between similar words should be not emphasized.

This rationale resulted in the questionnaire exemplified here: Questions (section 5.2.1). The complete questionnaire can be found in Appendix.



**Figure 5.8:** The taxonomy used for the questionnaire.

### 5.2.3 Questionnaire findings

The questionnaire was analyzed by coding the data with NVivo, a robust software for qualitative data analysis.

#### Statistics

The questionnaire was filled in by 85 people, but: it was not compulsory to respond to all the questions, which resulted in 45 people responding for the complete questionnaire, and some questions which had more responses than that.

- **Gender distribution:** 66% male, 34% female
- **Average age:** 27.5 years (standard deviation: 5.4 years, median: 26 years)
- **Respondents' countries:** Swedish(11), Dutch(10), Greek(8), Hungarian(8), Slovenian(6), Estonian(4), Romanian(4), Latvian(3), Polish(3), Portuguese(2), Russian(2), French(2), Italian(2), Belgian(2), Colombian(2), Danish(2), Chinese(2), Algerian, Argentine, Austrian, Bangladesh, Cypriot, Dominican Republic, German, Mexican, Serbian, Spanish, Ukrainian

Distribution of profession: 38 respondents are design student/practitioner. The rest of the respondents are mostly educators with engineering education.

As the gained input from these questions were rich data, the analysis process could have gone for a long time. I chose to cut this period short, and focus on the data which is directly applicable for the next iteration. I found this acceptable considering that many of the insight gained from the questionnaire is explorative; user data on widely open questions, varying in quality and depth.

### **Reflection-driver product qualities**

A main aim of the questionnaire was, to seek for products, product qualities which make people reflective, introspective. These on one hand served as validation for the patterns already externalized by that time, and on the other hand served as a source for new patterns.

The interpretation of the results for qualities happened in comparison of the already existing prototype of the cards; in this way, most of the study was a validation of patterns, but also resulted in new patterns described.

An example was the “*Open-ended functionalities*” card, which resulted from the respondents, who described e.g. Skype (a product which contributed to make the world smaller, by connecting relatives and friends from all over the world). Similarly, “*Conscious mental technique*” was inspired by another respondent, who always tries to overcome thoughtful times by forcing himself to think in different perspectives and etc.

Based on the responses, a strong evidence was that none reported products, which were designed to be reflective; this is a validation that, when the typical designer approach for reflection is critical design, that rarely finds the users in their everyday in the end.

Another general conclusion is, that almost any product can evoke reflection; the various responds included thermos bottle, broken umbrella, computer games, internet, laptop, phone, Gmail, and so on. This is an evidence that reflection can be triggered by virtually anything; even if reflective qualities were among the intents of the designers, users seldom evaluate a product reflective, if the reflective elements are subtle.

### Reflective situations

Besides product qualities, the questionnaire also focused on understanding reflection from the users' perspective; how it happens, how does the environment influence it and what are the possible user strategies to trigger reflection.

- **Conscious mental technique** (1): People uses mental techniques to generate ideas, such as 5 Why?-s, brainwriting, etc.
- **Cut distractions** (4): The users of modern technology admit that smartphones, laptops are big distractive factors in their life, so they choose to get away from them to be there for their thoughts.
- **Dilemma** (2): When being in a dilemma (i.e. making big decisions) or people facing hard times, people tend to be more reflective.
- **Externalization - pen and paper** (19): To enhance their thinking, people takes pen and paper to doodle their problems, walk around the topic by drawing, or enforcing themselves to externalize it in a way.
- **Externalization - peers** (1): People choose to talk with their peers to get feedback on their situation or problem, to gather new insights on the same issues.
- **Meditation** (16): People choose to meditate when facing hard times, and they practice mindfulness to fully attend their thoughts. This can help them identifying the core of problems, or for stress relief.
- **Waiting for inspiration** (1): People consciously look for new experiences, from which they expect to get inspiration; this can be to seek analogies of their problems, or just get fascinated with refreshing new thoughts.
- **Random activity** (2): People pursue different, random activities to disconnect from their thoughts, with the conscious hope to get inspiration out of the blue.
- **Taking a walk** (13): People choose to take a walk, sit in the nature, feed birds, etc., pursue such disconnecting activities. During doing this, they are left alone with their thoughts, which gives place for thinking.

### Evaluation of the method

To gather such rich data, the questionnaire proved itself to be appropriate; the amount of respondents reached a fairly high number, with insights which would have been uncomfortable or too hard to gather, because of the topic being too personal.

I think that based on the questionnaire findings, another, more survey-alike questionnaire could be done to gather quantitative data on e.g. the clustered reflective environments, as a validation of the theorizing.

Otherwise, this questionnaire could not be more effectively conducted on reasonable expense; at the point in the process, an explorative study was needed, and although the findings did not result in big discoveries, it probed the research area well, opening the space for future, more specified studies.

### 5.3 Card deck

The constant designed-minded iterations to turn my thesis findings into explicitly designed outcomes was an important drive to continuously seek for the next steps. An important, prototyped outcome was the reflection design framework, and that admittedly had its shortcomings, especially due to its abstractness. Driven by this observation, I wanted to shape this prototype into something practical, what designers can directly apply in their research process.

An early idea was to formulate my findings into a tangible format, in order to make practical sense of all the abstract knowledge gained during the earlier parts of the thesis work. Along the development of the reflection design framework, it became clear that designers have chosen various ways to evoke reflection, and that users' reflection is evoked by many unexpected, ad-hoc things, that is often beyond the designers' initial intention. Because of the wide selection of possible methods, the design process cannot just contain a flowchart with steps following each other. Designer methods (and tools) are most often supporting the designer's thoughts for conceptualizing or developing the design, as discussed earlier in Designer tools (section 2.4). Thus, I found it important to tackle both of these categories, supporting *conceptualization* by the Reflection Design Framework, and *development* with the collected patterns as a card deck.

After the decision was made that the thesis is going to be targeted to designers, the idea of making a card deck with reflective design patterns came quite naturally; card decks for collecting design methods [28] or design patterns [17] are not uncommon for designers, and generally found interesting and appealing to use.

Beyond these first appeals, cards have further benefits as design helpers:

- Cards are **open-ended**; the design process on its own is a rather fuzzy process, and it is significantly harder to control the design process, instead of just aiming to support it. With the use of cards, designers can find their own way of using them.
- Cards are **well-known** for designers. Designing for reflection on its own is a novel area for designers; it would have been too heavy to aim for a novel topic *and* a novel toolset as well.
- Cards are **ideal for collecting patterns**; it is easy to expand the card deck, or change their content by fast iterations (at least during the prototyping stage).

Alternatives design tools would have been:

1. A workshop format: a workshop format imposes that the patterns would be utilized by some facilitated method. This way the outcomes are more predictable (dependent on the skills of the facilitator), however increases the human factor in the use of the Reflection Design Method, creating a hard-to-fulfill need for the future. Prototyping a workshop is also very needy regarding resources (participants, logistics, evaluation method), and it was not feasible within this thesis.

2. A wiki-based pattern library: one step for creating cards is to aggregate reflective design patterns. For aggregation, a wiki is a common and well-fitting place, as it enables easy editing by anyone, with ease of structural changes on the higher level (such as clustering). For patterns, providing examples is very important, and that is where most of user contribution may matter. If sharing and collaborative editing had been main criteria for the development of the cards, a pattern wiki would have been created for storage. Since it was based on individual work, I chose to collect and maintain the library on my own. However storing the patterns on wiki is a legit alternative for the future, as it can exist in parallel of the card deck.

### 5.3.1 Design considerations

The design of the cards imposed design problems interaction designers rarely face in their work; designing cards are a complex matter of leveraging tangibility (physical appearance, interaction (how will the users use them), information design (what are the most important information to be placed on the cards)).

**Tangibility** Typically tangible things are found more appealing than virtual objects; this was proven when I had the first prototypes printed and cut, people just found them **interesting**. This was a great benefit to raise interest in the design tool, but also tangible cards basically require a printer and a slicer (or scissors, alternatively), thus are rather easy to prototype. This was an important consideration for the development.

**Interaction** Usually it is undesigned how such design tools are used; card decks utilize the open-ended design, and the tendency that designers tend to think outside the box. It is better (and unnecessary) to design every aspect of the interaction, and rather let designers find their ways to use the cards. The main function of the cards is to aggregate patterns. The card decks should enable the users to review multiple cards at the same time, to freely combine them, expand the deck if needed, and should support group interactions in a group setting also.

**Information** Cards are relatively a small format to contain much information, so there must be constraints what is going to be visualized. Based on the analysis of other cards (and common sense), the most important information to show was: pattern name, an example (preferably with a small explanation), and a description of the pattern. The cards should also connect with the Reflection Design framework with color-coding. As some categories have multiple clusters, a small indicator of the cluster field was included as well.

Comparison of similar card decks:

- IDEO method cards<sup>1</sup>
  - **Tangibility:** The IDEO cards are a deck of separate cards, and it also exists as a mobile app alternative. One side of the card contains an example picture without any text, and the other side contains the actual useful content.
  - **Interaction:** The cards are divided into four categories (learn, look, ask, try). Based on the design problem, the designers can choose methods from the cards, openly combine them, or wonder around the deck for inspiration. It is in-line with Human-Centered Design method of IDEO.
  - **Information:** The information side of the cards contain the categories (indicating into which the card belongs to), the name of the method, and text on *how* and *why* to use this method. The cards also store a small story from IDEO itself, how this method was used in their practice.

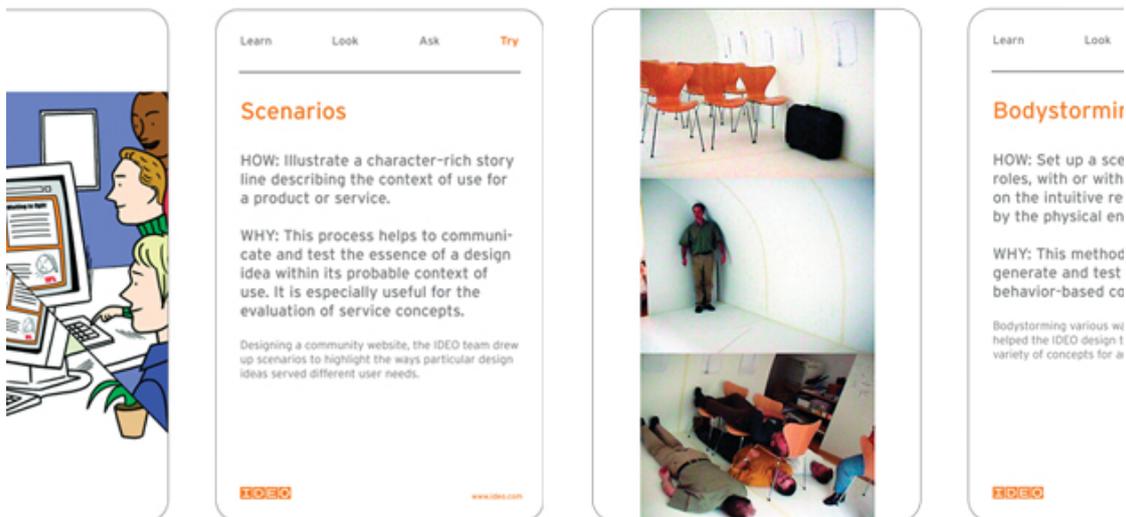


Figure 5.9: IDEO method cards. Picture credits: IDEO.

<sup>1</sup>IDEO method cards [28] is a deck of 51 cards for human-centered design, consisting diverse methods mainly for design research.

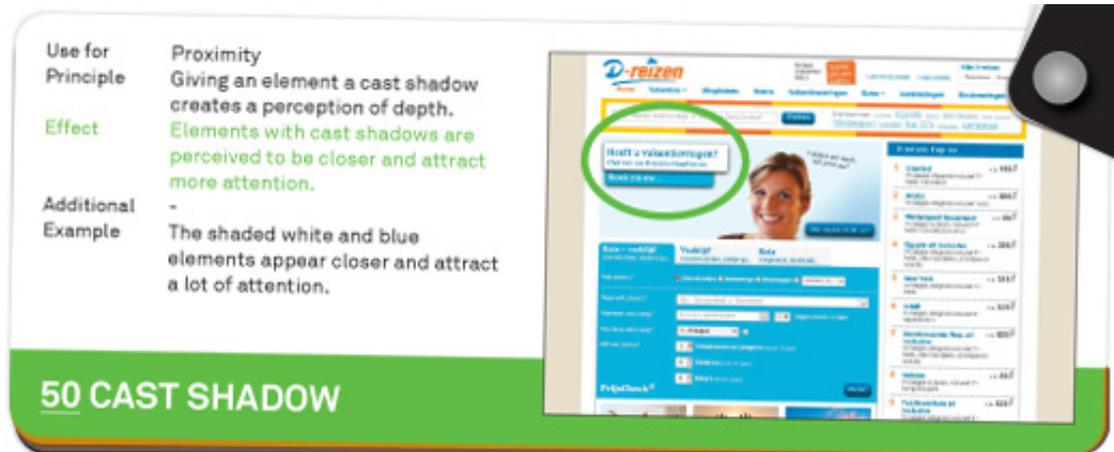


Figure 5.10: Fabrique inSights. Picture credits: Fabrique.

- Fabrique inSights<sup>2</sup>
  - **Tangibility:** The design tool looks like a color swatch. It supports the search of a pattern either by *principle* (the actual patterns), either by *category*, by choosing left or right direction to start saturating the cards. The other sides of the cards contain the actual information.
  - **Interaction:** The cards are divided into color-coded categories (higher level design aims), practically enabling a single card shown at a single time. Based on the design problem, the category can be chosen, and the different principles can be scrolled through easily, as they are physically attached to each other.
  - **Information:** The cards contain very practical examples from websites (this tool is the most pragmatic of all the three), supported with a one-liner description of the principle, the effect it creates and the example explained.
- Design with Intent<sup>3</sup>
  - **Tangibility:** The cards are available either as separate cards, either as a workshop sheet, but there is no difference content-wise. (Separate cards feature an extra card regarding the lens - the cluster of the card -, while this information is part of the workshop sheet).
  - **Interaction:** The card deck is a very extensive collection, hence wondering around the different cards is encouraged. The cards offer multiple perspectives on a design, and the categories are complementing each other; combination of cards is possible, but undesigned.

<sup>2</sup>inSights by Fabrique [17] is a design tool for persuasive web design. Instead of a card deck it looks like a color swatch, emphasizing that it is collecting visual design patterns.

<sup>3</sup>The Design with Intent toolkit is a result of a PhD work [33] on influencing behavior through design. It is a card deck of 101 patterns divided into 8 clusters.

- **Information:** The cards contain the lens (with color code), the name of the pattern, and an example with short description. For this thesis the most interesting aspect, the cards have a big headline with a rhetorical question, which makes the designer reflect about that pattern regarding her design.

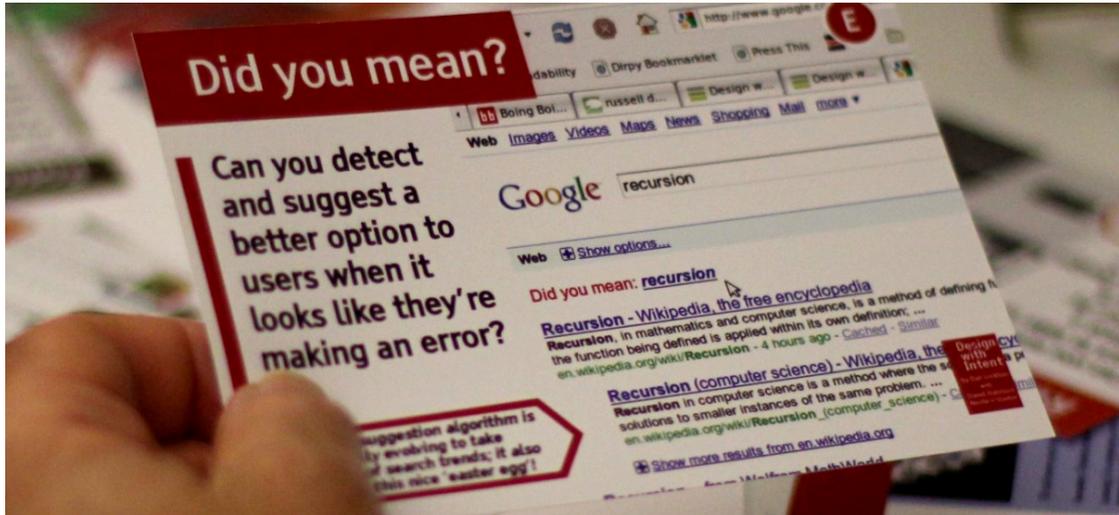


Figure 5.11: Design with Intent cards. Picture credits: Autodesk.

### 5.3.2 Prototyping

The cards were iterated in different rounds, continuously increasing the fidelity.

1. **Collecting patterns on paper:** The most early attempt (not on the figure) to externalize the patterns found from the different literature and questionnaire responses were put on paper. This was a collection, and a basic attempt to cluster the patterns; these clusters were based on the reflection design framework iterations.
2. **Sticky notes versions:** To move the cards towards tangible versions, the second iteration was to move the patterns onto sticky notes. In this way, clustering became much easier (as shuffling became very simple), and also it forced to stick to a limited physical space for a description of the patterns.
3. **First version for pilot workshop:** This card deck was the first digital version. The cards were fast prototyped to A4 paper sheets (so a size which is definitely oversized considering the end aims), and got examples with pictures and descriptions. The examples were much inspired from the questionnaire, expanded with findings from literature.

4. **Draft version for remote workshop:** This card deck was a significant increase in the visual quality; the cards received a facelift with aesthetic visual style, including proper sizing, and color coding to be integrated with the Reflection Design framework A3 sheet. The “*Reflective situations*” cluster got included into the deck.
5. **Fine-tuning:** With the increased integration of the A3 sheet and the card deck, it became harder to work with them separately, hence this iteration handled both of them together. Some cards were removed from the deck, and the clustering was affected between the remote workshop and the final version; these changes got implemented.

## 5.4 Workshops

### 5.4.1 Pilot workshop

*“Everybody has a plan until they get punched in the mouth.” - Mike Tyson*

The earlier steps to develop the Reflection Design Method were aiming to turn an abstract piece into something applied, without any actual application to test it. With the completion of the first versions of the reflective pattern card decks, the natural next step was to conduct a field study (Evaluations (subsection 4.2.5)), where the method can be seen in action for the first time.

For this first time, the pilot study, I wanted a safe group where the participants have knowledge on reflection and some awareness regarding the design process. That is why in the end the main evaluation point should have been to see if reflection is seamlessly implemented from abstract into applied, leaving the evaluation of the design tool itself for the focus of a later study.

#### Workshop outline

The pilot workshop happened with 5 participants, who are all youth educators, from diverse backgrounds: Human-Computer Interaction, Innovation Management, Computer Science and Economics. Their design experience is limited to training and educational design (hence their improved expertise in reflection), and to the concept design of an online platform, developing together for over a year.

Although the participants background was a compromise - them not being designers - , I did not find this crucial for the pilot. The tested tools should have aimed to support the ideation process, and that part of the design process is perhaps the most “*accessible*” for anyone to contribute equally. I also need to emphasize, that their previous experience with evoking reflection in training circumstances gave advantage on other aspects during the evaluation. And it was a safe environment for a pilot, since they are good friends and colleagues of mine.

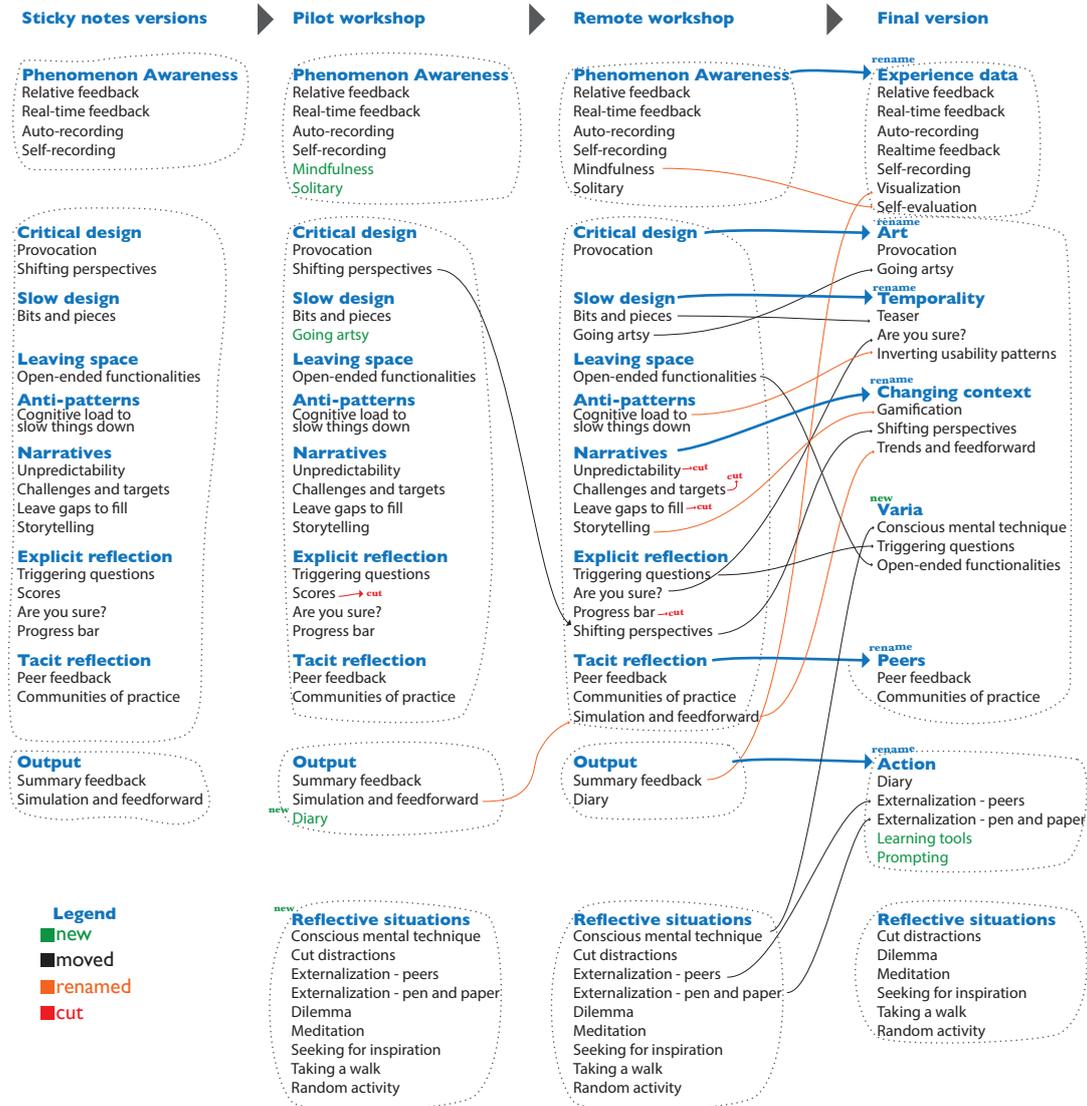


Figure 5.12: Development process of the card deck



**Figure 5.13:** Pilot workshop, introducing the pattern cards.

The workshop took 90 minutes. The rationale behind was to have some time to do sensitizing as an introduction, but not to make it lengthy; it should be just the important basics, and the focus should be on the actual, ideation work done. The ideation part should be intense and compressed in time; having shorter amount of time means cutting debates on idea evaluation and validation, and a focus on idea generation.

**1, Sensitizing** The beginning of the workshop was aimed to “warm up” reflection as the matter of upcoming discussion and work.

This sensitizing was planned to be done by presenting “*What is reflection?*” and “*What is realization?*”, however the participants asked directly these questions in the beginning, which made it smoother to shortcut the introduction. I redirected the discussion to learning from a phenomenon happening right on the spot (a participant playing with the sticky notes’ piles, building a card structure), and how to create reflection from that.

Continuing this block, I shortly explained Kolb’s experiential learning model and Rolfe’s reflection model <sup>4</sup> (all the workshop participants were educators, so these were only recaps), and then went on to explain the reflection design framework.

<sup>4</sup>Rolfe’s reflection model [21] based on three simple stages: 1, What?; 2, So what?; 3, What next? These three catchy questions catches the essence of externalizing an experience, evaluating it and then formulate what was concluded from it.

**2, Individual ideation** The participants were asked to come up with product, service ideas which would evoke reflections. They received a bunch of sticky notes and 5 minutes to individually write the ideas down. Afterwards, they were asked to present their ideas and put them on a whiteboard.

This step was the warm-up for creating some tangible outcomes, not just listening to the facilitator talking about reflection; therefore a bridge between the previous sensitizing and the actual work. It was also useful for me to validate whether the previous step was actually something meaningful.

The individual ideation resulted in a handful of ideas on the whiteboard.



**Figure 5.14:** The participants of the pilot workshop reading the pattern cards.

**3, Introducing the reflective pattern cards** After the sharing of ideas at the end of the individual ideation, I introduced the pattern cards' first prototypes; they were dirty-made low-fidelity prototypes printed in A4 size, with a simple structure and content, with the intent to communicate their idea only.

The cards were saturated on the tables, and the participants started to wonder around and to read all of them. Some mess time was needed for the reading, so I did not carry on with the facilitated ideation for a while.

**4, Ideation with reflective pattern cards** As the actual user testing session of the prototypes, this part took the most of the time from the whole workshop. The participants were asked to generate as many ideas as possible, by utilizing the cards. To have a framework around this, the ideation happened around different topics, which were served as design constraints. The topics were:

- Based on the earlier ideation, work out these ideas more in detail
- Redesigning Facebook for reflection
- Augmenting an online platform for educators for reflection tools

### **Workshop evaluation**

The workshop was an important milestone, as being the first, applied session of the earlier abstract work. Furthermore, the cards were prototyped for the first time. The workshop did not result in very productive outcomes, however this was not expected from a pilot; the main aims were to evaluate the tool itself, and investigate if the workshop format is something to use.

The participants' feedback and my personal observations are summarized as the following:

- The sensitizing was found very useful; it framed reflection effectively, by the means that the term was well-explained and exemplified through facilitated discussion.
- The Reflection Design Framework was included in the sensitizing part, and that was a problem; the participants did not make the connection that they will need to work with the framework for the complete session. Also, the cards did not connect effectively to the framework. The participants requested more guidance on how to use the cards.
- The reflection design pattern cards were found too big (A4), absolutely not card-like. This did not encourage active experimentation with them. The patterns depicted on cards varied from very conceptual design patterns to small interface gimmicks; these differences in scaling were found disturbing, and questioned.
- The clustering of the cards (especially reflective quality) were not explained; the participants found this extra data confusing on the cards, and were puzzled how to utilize that further information.
- The goals of the ideation exercises were unclear in the sense of what level of fidelity is expected beyond writing down an idea on a sticky note.
- The exercise of redesigning Facebook and other social networks turned out to be rather dividing, and went into problems of personal dislike of them.
- There should be more explanation and proposals on how to use the cards, but keep it also open-ended.

Based on these observations and feedback, the following changes were made:

1. Instead of focusing on facilitated workshops, it is more realistic to expect the study participants not following a strict agenda, and use the tool on their own found way. This means a non-facilitated workshop format.
2. The content of the sensitizing phase was filtered from learning theory and the rest was moved to an extra material, an A3-sized paper sheet, which also consists of the reflection design framework. This sheet contains practical know-how how to use/read the different phases and what are they for.
3. The group effect was not really utilized, hence the focus moved to create individual tools, which are neutral regarding group interaction.
4. The cards were iterated into proper sizes (6.5cm x 9 cm), filtered, and improved.

### 5.4.2 Remote workshop

One of the main conclusion of the pilot workshop was, that the facilitated ideation as workshop format is not realistic considering the vision of the design tool (as a stand-alone design method, designers can freely access and use when facing a design problem with reflection). Therefore, a main pillar of the second field study was to simulate as much as possible the vision, mostly in the sense of cutting the facilitation, yet keeping the study in a controlled environment.



**Figure 5.15:** Snapshot from the video recording of the remote workshop.

The simplest solution for this rationale was **not to be present** at the workshop, but have it conducted via instructions, and recorded for analysis. As I was located in Delft at this time, it was handy to make this workshop happen at Chalmers. The workshop was video recorded, and the participants had no real-time communication with me, therefore everything I evaluated later on was based on the video recordings I received from the participants.

There were three participants in this study, all of them final year interaction design students from Chalmers (male, background in computer science). The three participants received two physical copies of the A3 sheet and the card deck.

The aims of the workshop were to fundamentally validate the concept; to see in action if it can be used as a standalone design tool, or facilitation is crucial to use it. This remained unclear from the pilot workshop, where the participants came from educational background (thus more familiar with reflection itself than design), and the question of facilitation needed to be investigated with designers (who are possibly less conscious about – evoking – reflection).

The rest of the investigation was focusing on detailed elements of the whole experience, and discussed in the evaluation.

### Instructions

As sensitizing, the participants received an email containing an excessive document containing the following information:

1. **Sensitizing:** A general description about reflection, and its relations to design. This partly contained a condensed version of the motifs of the thesis and an overall background of reflection, with focus on why to design for it. Compared to the pilot, the sensitizing was not covering learning theory. To make an experiential connection to reflection, there was a small thought experiment included.
2. **Toolkit description:** A couple of paragraphs explained the categories of the framework, using a simple example of a simple reflective design concept. This text was to elaborate further the descriptions from the A3 sheets.
3. **Tasks:** Although the aim was to leave the study upon the participants, just to impose some design constraints, the email suggested a couple of design areas for consideration. These were including:
  - Re-design of social networking sites (e.g. Facebook/Instagram/Twitter for reflection);
  - Design intervention for interaction designer students to be more reflective on their general work;
  - Mobile technology and ubiquitous computing for reflection;
  - Behavioral change problems (like design a tool which helps making decisions).
4. **Questions for evaluation:** An excessive list of questions were composed for evaluation; this was put into the same email, so the participants can optionally check it during the process, to see what aspects are interesting for the study.

## Feedback

Generally, the participants were confused for long time during the process; it was too much information at once, with imposed rules (such as orderliness in the framework), which were found rather unnecessary.

The participants did not read thoroughly the email or the A3 sheet, but discovered everything along the ideation process. This was probably more close to the expected real-life usage, than what the instructions suggested.

- **How to use the cards?:** The participants generally lacked more direct guidance about how to use the cards.
  - They proposed to put more information about this on the A3 sheet. Although, this was contradicting with another comment: *“Too much text on A3 sheets. I’m expecting the cards to tell me what to do.”*
  - Instructions, suggesting ways of using the cards should be included somewhere.
- **A3 sheet (Reflection Design Framework):** The sheet was more seen as a container of information than a framework for the cards.
  - The hints written on the cards’ placeholders were found useful information, however their placement was criticized; if the user puts the cards over them before reading/noticing the extra text, these information would remain hidden for long.
  - An alternative comment was, that the cards could be just the card deck only (without the A3) and make the cards telling the instructions; therefore the structure imposed by the framework is unnecessary.
- **Cards:** Among the evaluation questions, an important area was to see what cards did they find useful, or what could be removed from the deck.
  - They noted that some cards in different categories are similar (such as *Peer feedback* and *Externalization - peers*), and that *Cognitive load* is confusing (however, intentionally: it was an anti-pattern).
  - The different clusters of reflective qualities were not found useful.
  - On the question if the varying levels of design depth (between conceptual to interface design) should be scaled only towards conceptual design, they requested to keep the “easier” cards; they argued that those are more concrete solutions, and keeping it only abstract will not cover all sort of users.
- **Reflective situations:** There was a bigger discussion and analysis regarding this category; they were found hard to squeeze into the framework, however also found very useful as a collection of reflective situations.

- **Usage observations:** The participants did not try out different approaches to use the cards.
  - The participants preferred to pick single cards in the hand for consideration, and try out combinations one by one, instead of saturating a lot of card in the hand, and trying to compare. Possibly the ability to compare comes with gained practice with the cards.
  - For ideating together, a single set of cards is enough for a three people group.
  - The participants did not follow the orderliness of the three phases, and claimed to remove the arrows suggesting that, to result a framework which is only a canvas.

A general observation from watching the participants' session and later on their evaluation discussion, that they revealed new depths of the framework and the cards during the evaluation period, while they were reflecting on it.

For example they discovered only during the evaluation that cards can intertwine together (can be combined), but noticed that some cards do not fit together: the combinability was my envisioned use of the deck, and it was not an aim to have every card matching any other card. Probably such depth of the cards only gets discovered after longer usage.

## Evaluation

The workshop was a validation that it is possible to use the framework after minor guidance, and from this aspect considered as a success. However, a proper validation study should contain a control group of participants who did not receive the design method, and then the results evaluated by an expert. Such validation study is out of the scope of this thesis.

The work done on the cards since the pilot workshop was in the right way; there were no critique on the cards outlook, or reporting fundamental problems. The feedback was more on the actual content of the cards and A3 sheet (with the Reflection Design Framework), as practicalities to improve.

After this workshop, I approached simplification of the deck by removing some cards from the reflective qualities phase; although the participants opposed to remove such interface design cards as *Progress bar*, they did not belong to the vision of the deck. The removal was also to limit the number of reflective qualities, and have the remaining ones more developed.

From the received feedback, it became clear that working with reflection is still found quite confusing. This study did not contain enough input on how to tackle this, however the final review in the upcoming chapter contains improvements on this.

## 5.5 Final review

As the final iteration for developing the reflection design framework, it was reviewed (more on expert review in: Evaluations (subsection 4.2.5)) by a design professor, who provided extensive feedback on the concept.

A major problem with the framework at this point was the poor usability; both workshops reported different levels of confusion during the use of the framework, which only got clearer through the time of using it. This observation was clearly pointed out during this session, when an expert with a beginners mind looked at the tool.

The confusion was due to that framework was developed based on critical theory (philosophy) and educational theory (experiential learning, reflection-in-action), thus not with a designers' perspective. Based on this observation, the framework was reviewed:

1. Previously, the reflection process was based on a phenomenon (and creating awareness on this phenomena by the design). But, designers start with a final intent, and for that a different starting point is needed. This starting point became the **reflection intent** itself to be clarified by the designers, with the focus on finding what to trigger with the design. This intent is integrated in the process, and can be influenced by the available data, reflective quality or possible actions; so it may change iteratively during the design process.
2. The phase which previously was called *Phenomenon awareness* needed to be renamed; although it is an appropriate naming for the included patterns, the problem is that "*phenomena*" is a very broad term; too broad to easily work with it. Therefore, this phase got renamed into "*experience data*". Considering that all the included patterns in this phase are related to creating data of experience (like uploading a picture to Instagram), or receiving sensor feedbacks (e.g. actual speed for running), this is the phase which brings IT (and this way a strong connection to *interaction* design) into the process.
3. As stated in the 'Defining reflection' chapter, reflection lacks a common vocabulary. The above mentioned renaming of phases were aiming to make the language of the tool closer to the mental model of designers (than to educators, philosophers), however the final version is still not perfect.

In the most common cases, the framework can be effectively used to *redesign* an artifact for reflective qualities; this means that the designer should "*arrive*" with a problem statement to the tool, or use the tool to get inspired what should be the reflected experience from the users. This scenario is well-supported with giving a separate phase of finding the reflection intent (point 1).

Some things left unattended, however admitted as a valid feedback for the future:

1. Working with reflection found to be complicated for every participants from the studies. I believe this is because of the topic itself: it is a very pragmatical approach for reflection, thus rather unusual. Designing for other experiences (such as

emotion) has proven that abstract design intents can be tackled in practical ways as well, so probably if designing for reflection would gain traction, it could become less unusual to work with than currently.

2. The onboarding experience, when someone first sees the tool; there is a lot of reading, a lot of cards to review, it is overwhelming. Also, a lot of practical information is dropped here and there, and people often overlook them. Scrolling through so many different cards simply takes time, this could not be influenced by simple design changes. The amount of information at first glance remained like this, because more studies would have been needed to generate more practical knowledge regarding the use of the tool (for practical tips to include regarding the usage), but more studies are out of the scope of this thesis due to the time limitations.

# 6

## Reflection Design Method

The Reflection Design Method is a design tool for designers, with the aims to help designers approaching the creation of the kind of designs, which trigger reflection for the users. The method consists of a *framework*, which is underpinning a theoretical perspective on the design of reflective experiences, and a *card deck*, which is a collection of reflective patterns to be applied during the the design process.

The upcoming sections introduce one-by-one each category of the framework, and the related cards of that specific framework category (with their pattern).

The framework and the cards can be found in the Appendix in their normal size.

### 6.1 Framework overview

The framework consists of 5 different categories (or phases), which focuses on different aspects of reflection, and the supportive design activities. Considering that the design process is generally fuzzy, there is no strong orderliness how the categories should be considered, and therefore it would be a harsh statement to name them different phases. The different categories are listed below, and expanded during the chapter.

- **Reflection intent:** reflection can happen out of the blue, however it is usually triggered by something (it may happen that this trigger remain hidden and the reflection appear serendipitously). To influence reflection as a designer, the designer needs to choose what is the reflection to be evoked, to search for appropriate triggers for that.
- **Experience data:** with IT products, there is an increasing amount of data available about the user's activity. How to use the recorded data about her activity for triggering reflection is something the designer need to find as well. However, the data is often already available, and the designer wants to use it somehow to trigger reflection, reversing the order of inquiry.

## Reflection design framework

*a design method for reflection*

Péter Kun  
 peterku@student.chalmers.se  
 p.kun@tudelft.nl



CHALMERS TU Delft TU Delft University of Technology

Figure 6.1: Final version of the Reflection Design framework

- **Reflective quality:** to make an artifact reflective, there must be a quality of it which can trigger reflection, even if this quality was not designed as such. When designing for reflection, choosing a reflective quality to integrate into the artifact is essential, at least to consciously design for reflection. This phase is a big collection of different patterns for reflective qualities.
- **Action:** to “control” reflection and *make it stick*, further actions can be designed beyond the basic interactions with the product. Adding additional actions may overwhelm the user and create confrontation rather than motivation. At the same time, supporting taking action can increase the achievable depth, which is sometimes needed.
- **Situations, environments:** what people do to seek introspection (and by that reflection) varies person to person. There are general patterns collected here, all of which are typical situations someone would choose to go for reflecting. It is hard to design these situations or environments, however: by design, the user can be motivated to change her surrounding for something more reflective.

## 6.2 Using the Reflective Design Method

Although the Reflection Design Method is accessible from the appendix of this thesis digitally, it was designed to be printed and used as a tangible tool. To start using the it, the designer should lay the sheet of the framework down the table, and place the cards on top of their respective areas. The cards are color-coded with the different categories, and are expected to be used in parallel with the framework.

The expected starting point of using the framework is the bottom-left corner (Reflection Intent), and from then the designer is expected to follow a clockwise direction to go through the other, different phases. Following such an order, the designer makes sure that all the different aspects are considered for the specific design case, like a “checklist”. To begin the process somehow, the user can put all cards saturated on a table, and pick one from each phase. There are different strategies to follow from this point on:

- Not every pattern fits the given product, those mismatching cards may be replaced with other cards from their respective decks. The designer can shuffle the cards until she finds a somewhat “interesting” combination for the design.
- The designer can create forced associations by randomly combining different cards to see what kind of reflective designs would those combinations result in.
- Analyze one category at a time, by keeping the used cards in other phases fixed. In this way the designer creates constraints for herself, which can be triggering for ideation.
- Removing cards or ignoring categories are also triggering for the designer to see what is the minimum reflective quality which cannot be removed from the conceptualization.

An important remark here, that the usage of the cards were only lightly investigated in this thesis, and it was also left intentionally “undecided” to see what would be intuitive use by designers. Thus, besides the above mentioned strategies, there are probably further ways to utilize the cards, and active experimentation is heavily suggested.

## 6.3 Reflection intent

Choosing the appropriate reflection intent may appear obvious for various artifacts, and reveal itself very slowly for many others. This phase is about the searching process to find the right questions to trigger reflection, and by this search identify the design focus in order to trigger reflection. Compared to the other phases, there are no patterns collected for reflection intent, but rather approaches offered to find the right questions.

Basic questions to find the triggers for reflection, finding the artifacts problem statement:

- What is the artifact?
- What do people do with this artifact?
- What is the most common function of the artifact?
  - Are the users overdoing that?
- What are the other, less frequently used functions?

Having such questions clarified and in hand, the designer can see appropriate ways of making data out of experiences (move to *Experience data* phase), or start seeking a reflective quality, which would fit the artifact and the problem to make the artifact reflective.

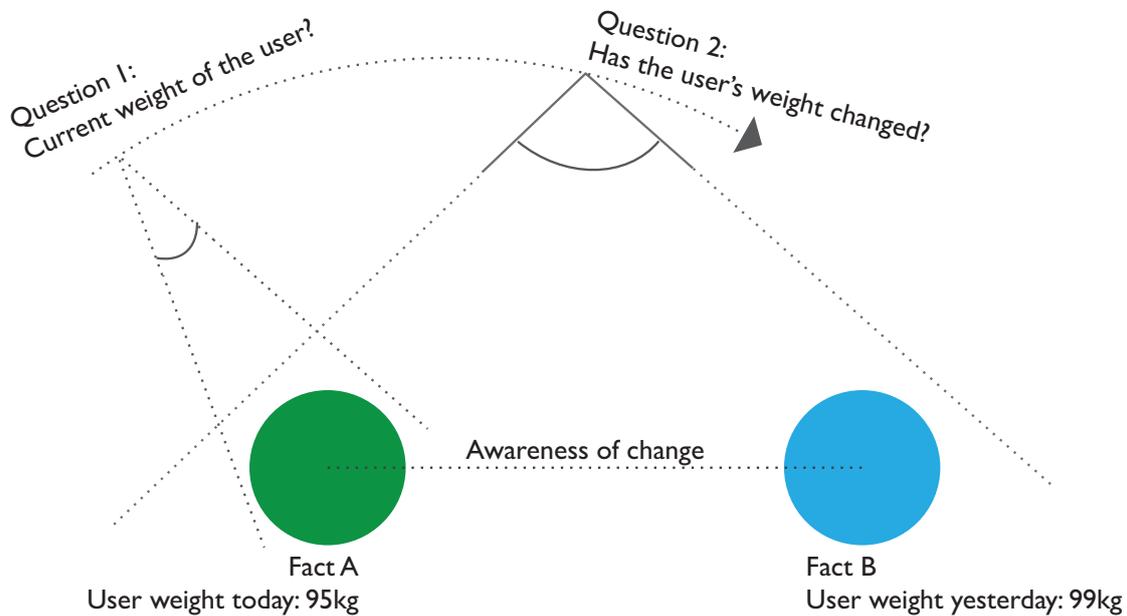
If it is still unclear what the user should reflect on, the questions should go deeper. For this, the upcoming section offers a design metaphor to use for construction.

### 6.3.1 Triggering questions

*“Designers create solutions – the products and services that propel us forward. But artists create questions — the deep probing of purpose and meaning that sometimes takes us backward and sideways to reveal which way “forward” actually is. The questions that artists make are often enigmatic, answering a why with another why. Because of this, understanding art is difficult: I like to say that if you’re having difficulty “getting” art, then it’s doing its job.”* - John Maeda [36]

Asking the user triggering questions to recall earlier experiences is a long-proven reflection tool in education. This can be applied to analyze a certain activity (“*How did it go?*” or “*What have you learnt from doing this?*”) concerning what has happened during the educational process. Questions can also be used to reveal new, unexpected connections, serendipity between different experiences.

One way to think about reflection is to use the analogy of the perspectives of cameras. In this illustration, there are two facts; common phenomenon from daily life. Simple bathroom scales can answer one question: What is the current weight of the user? To give a reflective quality for the bathroom scales, the main function must be changed to put the user’s weight into a context, a perspective. This could be achieved for example by changing the question to the more dynamic “How has the user’s weight changed?”, and thus having a functionality (like a memory), to indicate a trend. This trend could be indicated by just a small up/down arrow (with green and red colors), giving an easy-access contextualization for the user.



**Figure 6.2:** Camera movement as a metaphor for reflection.

If *triggering questions* are used to achieve phenomenon awareness, an important design consideration to keep in mind is that it takes time for the user to recall an experience as an answer. If a *triggering question* is in a textual format, there is the danger that the question will only be skimmed through, as people tend not to read thoroughly, especially on the internet [35].

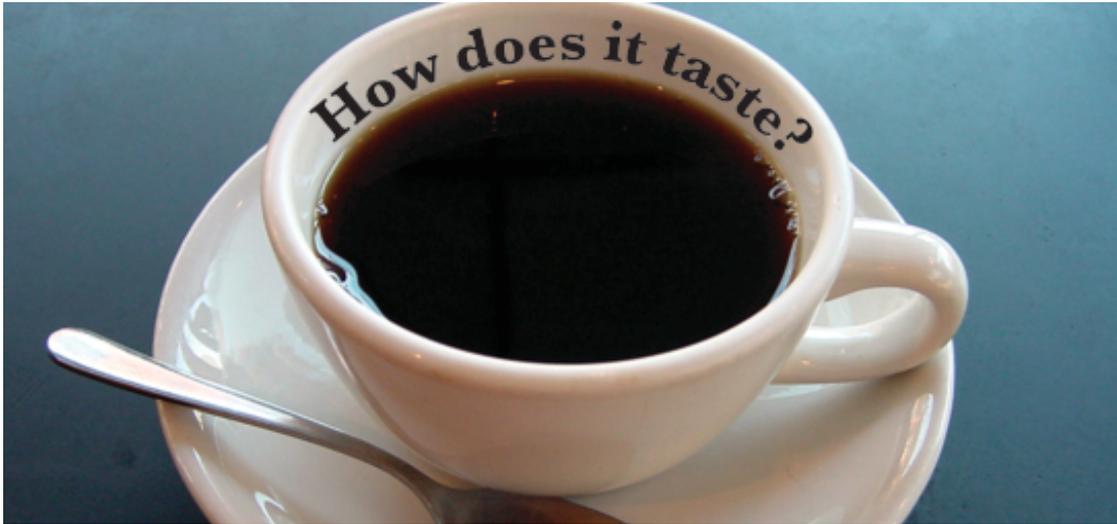
A designer can choose workarounds to eliminate this problem by finding solutions, all of which somehow “deconstruct” the question and ask for the same information by means of interface design tricks. For instance, in surveys, it is common to see pre-composed lists as answers to questions to facilitate easier selection, rather than having to fill in answers in text boxes.



**Figure 6.3:** Status update text box of Facebook. A typical example of a triggering question, which became a static part of the interface, instead of actually triggering.

Even if a question is part of the interface, having it there as a static object will make people develop a blindness to it. Therefore a proposed design guideline here is to keep the triggering questions somewhat interesting, dynamic, and not too obtrusive; no one wants to receive pop-ups with questions which are really hard to answer.

For example, to achieve mindful awareness on food/beverage consumption, triggering questions could be placed all over our plates, cups and so forth. This would be interesting at a first glance, but in everyday life, they would become ignored in a short space of



**Figure 6.4:** Triggering coffee cup. The consumer is asked explicitly to reflect on the taste experience, provoking mindful consumption.

time. That is, however, still a good design opportunity for such occasions, where these plates, cups, etc. are used in unique situations. For example eating out rarely happens, and a restaurant or café would benefit from bringing some novelty to enjoying the meal or coffee.

### 6.3.2 Blended triggers

People get triggered not only by being asked specific questions to reveal certain things, but also by what they perceive in everyday life. Their perception can be triggered by a piece of art, a book, or by seeing poverty on the street, and so on. These triggers may be designed artifacts or the products of nature. They may vary if the intention was to trigger or it is a by-product of coincidences. The questionnaire used for this thesis featured several responses, where reflection was triggered by unintended, ad-hoc (random) events.

This prompts the designer to seek subtle, blended ways to make the users aware of experiences; the core goal can still be summarized as a triggering question, but the design solution might be more novel or aesthetically appropriate with the object or media.

## 6.4 Experience data

Daily human life is a constant process of perceiving the surrounding environment. Cognitive efforts are made to perceive what is happening, or to understand and resolve actual matters, such as navigating from a map, riding a bicycle, cooking, or programming the computer [25]. All of these are different kinds of mental efforts, varying from sense-

making to problem solving. These efforts make use of long and short term memory to repetitive, well-learnt physical actions.

It requires extra effort to expand our activities by adding another layer of thinking concerning the activity itself. This was described by Schön (Reflection-in-Action [45]), and his work also laid down principles to educate people to reflect on performed activities.

To work with these experiences as materials for interaction design, there must be an intermediate step when they become externalized in the digital world. Luckily for designers, the social internet has introduced various novel ways for the users to track their experiences and share it with the world (or keep it for themselves).

### 6.4.1 Auto-recording

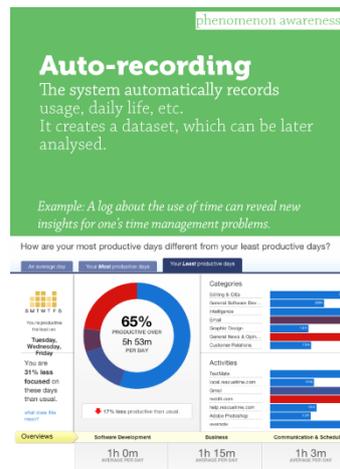
Example: Imagine the shared toilet at your workplace. You use a certain number of paper towels to dry your hands. A sensor could be installed to count how many sheets you are using, and this numerical information could be shown.

It is just a first, but inevitable and crucial step to use this data for reflection design. One can put this data into context, by, for instance, comparing your paper towel consumption with your average sheet consumption, or by putting it into the context of how much others consume. These would lead to triggering some realization, hopefully to the consuming of less paper towel.

Sidenote: (Sustainability - although a trendy word today - is more and more pervasive in design, and all design opportunities to create sustainable solutions are welcomed, be they technological or persuasive. This thesis features examples of the latter; behavioral change has a lot to do with reflection.)

From a system design perspective, experience data can be significantly augmented by means of modern technology; existing sensor technology can digitally quantize human actions, or actions regarding the built environment people interact with. These days sensor-driven technologies present two big movements, the Internet of Things and Quantified Self. The sensor-enhanced paper towel dispenser resembles with Internet of Things. IoT is all about connecting every electronic appliance online, since such sensor data can be collected, analyzed, and tinkered around with. This may be combined with Open Data (open access public information from governments) and macro-measures, concerning data collected at city scale and in city blocks.

Quantified Self appeared along with the hastened personalization of technology: Quantified Self is a movement to gather data about the self in every level of detail: it ranges from the commercial products of e.g. running sensors (Nike+), to a japanese toilet which analyze its input and shows details about the health level [10]. QS practitioners basically measure everything in their life, and this is achieved by sensor data of smartphones, and simple DIY electronics hacking; Arduino and similar platforms gave a leap forward to help people measuring everything, as easily and accessibly as possible.



**Figure 6.5:** Auto-recording card. Text: *The system automatically records usage, daily life, etc. It creates a dataset, which can be later analysed.*

Why is this data gathering important in the end?

Although collecting data still sounds technocratic and soulless even in the 21st century, it can be performed in a subtle way. Technological devices are going to become even smaller and even more ubiquitous, so incorporating these technology-savvy solutions into motivating reflective behavior is generally a better approach than ignoring the benefits of hectic technological expansion. Working with such collected data opens up a design space, so that the users' behavior can be tracked and recorded.

Example: Recall the last morning, when you were very late, while you were following your usual morning routine. What took too much time? Compare this with what a smartphone could tell you: your alarm went off at 9:15, you got out of the bed at 9:23. Took a shower for 12 minutes, and then spent 9 minutes on getting dressed.

Awareness of an experience increases greatly if it is not recalled from the user's memory, but rather on the basis of evidence, which is recorded by a system. This leads to a two-way lane for designers; either creating the system in the way that it will record itself, or making the user record things for herself.

### 6.4.2 Self-recording

The user's self-recording is actually the design intent behind Twitter, Instagram, Facebook and similar websites suggesting – extensive sharing of daily life, to achieve tighter social connectedness. Sharing one's activities on these sites creates a subjective and filtered view of what is happening momentarily with someone, but subjectivity is not an excluding characteristic when trying to achieve reflection. In the pre-digital world, this was normally achieved with daily logs, writing a diary, taking photographs of important life moments, and so on.



**Figure 6.6:** Self-recording card. Text: *The system enables or encourages of the recording of daily activities, or some main functionality. This is for to keep an archive of happenings for later use-inquiry.*

Documenting life onwards and backwards has been the intention behind Timeline in Facebook. The present design is, however, questionable, since it neither features a curated way to review the past nor a way to trigger the reflection of the user. I think these are missed design opportunities, and they are also an indication of how unimportant it is to consider creating reflective opportunities for users.

The main design pattern for social networks is to provide a snapshot of what other people do, and not what the user did some time ago. Introspection might seem anti-social, however being anti-social generally represents socially destructive behavior, whilst introspection and reflection are all about peace and harmony. This dual feature is definitely a bottleneck when it comes to having reflective designs spreading wider on the internet. What is interesting to note here is that Facebook has a “Year review” functionality around every Christmas and New Years’ Eve (see [facebookyear](#)<sup>1</sup>); at this period it is generally common for people to reflect on the last year and introspect, and a year review somewhat supports this.

Creating a log/evidence from the user’s activities is one effective way of resolving the problem of creating experience data. What other ways are there to achieve this?

### 6.4.3 Feedbacks

Auto- and self-recording was focused on *capturing* of personal data based on the users’ experience. However capturing is not the only interesting aspect of experience data, it is also a rather important area how this data is *shown* to the users. In HCI, the feedback loop of the user and the interface is very common, where feedbacks are important ways to inform the user regarding their actions. Similarly, in reflection, different feedbacks can

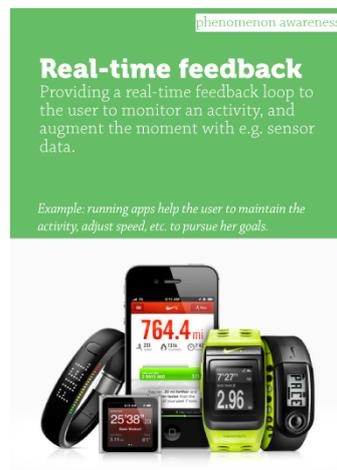
<sup>1</sup>[pictures/facebookyear.png](#)

show the evidence of behavior and experience to the user, and this evidenced behavior can be the basis of further reflections through reflective qualities and so on.

There are two different feedbacks listed here, **relative feedback** and **real-time feedback**.

### Real-time feedback

Real-time feedback concerns the tight feedback loop, when the user is performing an activity. In this case, if there is sensor data available, it can be directly shown to the user, informing her with input for Reflection-in-action.



**Figure 6.7:** Real-time feedback card. Text: *Providing a real-time feedback loop to the user to monitor an activity, and augment the moment with e.g. sensor data.*

This real-time feedback is especially important for such fitness applications as RunKeeper or Nike+, where the user is informed through audible sense about her performance; this can often be motivating not to stop while exercising, or continuously state new goals, thus pushing the personal limits because of the real-time feedback gained.

This pattern is inspired by the Design with Intent method from Lockton [33], whose reflective question on real-time feedback is: *“Can you let users know how what they’re doing is affecting the system?”*<sup>2</sup>

### Relative feedback

Relative feedback places a data about an experience into a relevant context; this is important for artifacts where the object informs the user about a single piece of data (like the user’s weight), but this data remains as a numerical entity, until it is placed into context (such as showing a trend of the user’s weight changes compared to the previous day).

<sup>2</sup>Real-time feedback: [http://danlockton.com/dwi/Real-time\\_feedback](http://danlockton.com/dwi/Real-time_feedback)



**Figure 6.8:** Relative feedback card. Text: *Showing a simplified pattern, trend how are things going.*

The inspiration of Relative feedback is coming from the so-called “*DIKW pyramid*” [1], which uses a pyramid structure to describe how knowledge can be constructed in a hierarchical way:

1. **Data:** raw values, such as numbers, words (e.g. “38”)
2. **Information:** such data, which has been given meaning. (e.g. “38°C”)
3. **Knowledge:** pieces of information in a relational connection (e.g. “38°C is warm for humans”)
4. **Wisdom:** extrapolated knowledge, which leads to a new level of understanding

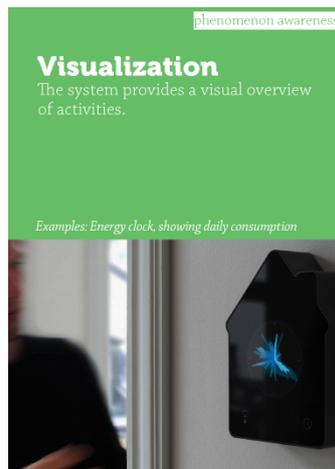
With using relative feedback, users can be informed of data beyond raw values, augmenting those with contextual information.

#### 6.4.4 Visualization

Experience data is often represented by visualizations; these were quite remarkable designs in the STATIC! project [3], such as the Energy Aware Clock, or the ceiling lamp which opens up when energy is consumed in a sustainable way.

On the card: Energy AWARE Clock. The clock visualize the energy consumption of a household along the hours of a day, and also indicating how were the consumptions in the past days.

Visualization of data is nothing new; it has been around for a long time; one need only to think about the cockpit of an airplane, the different instruments are there to provide simple access awareness to important phenomena involving the performed action (the flying of the aircraft).



**Figure 6.9:** Visualization card. Text: *The system provides a visual overview of activities.*

Today visualization (which is often a by-product of auto-recording) has evolved to become the first thought to “do something with data”. There are numerous statistical tools available, such as chart libraries in spreadsheet software, open APIs to exciting data and so on. Gaining first insights through visualization is a good way to create more in-depth reflective products.

#### 6.4.5 Self-evaluation

Self-evaluation is the type of realization when someone comes to a realization of – previously unformulated – personal values, which may help and be the basis for bigger decisions.

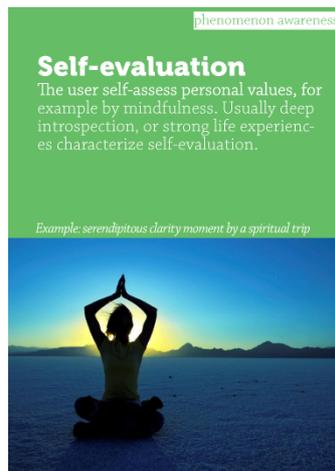
Compared to the previous approaches, self-evaluation is not experience data *per se*, hence a harder material to work with for the designer. Despite that no data is capturing this experience by a system, this evaluation can be triggered by the design, and the design can also support recording it by indirect ways.

There have been previous studies in HCI on how values can be supported by designing systems [18], and those studies was the source for Self-evaluation pattern.

### 6.5 Reflective qualities

Under reflective qualities, I define such artifact qualities, which evoke reflection. These can be a surprising product quality (like unexpected choice of texture), serendipity by functionalities, telling the user explicitly to reflect and so on. Reflective quality can be such product property, functionality, which triggers the user to reflect on an experience.

The designers’ aim to add to an artifact a reflective quality is to evoke reflection, thinking or realization. A product without a reflective quality can easily be only a “piece of functionality”.



**Figure 6.10:** Self-evaluation card. Text: *The user self-assess personal values, for example by mindfulness. Usually deep introspection, or strong life experiences characterize self-evaluation.*

For example, a coffee mug enables the user to safely consume a coffee at an enjoyable temperature. To augment the coffee mug with a reflective quality, it could somehow educate the consumer on how to fully enjoy the taste of the coffee (learning/reflection), provide a counter how much coffee the user consumes (realization), or inform the consumer how many human workhours did it take to make this cup available for her (reflection).

From this example it is clear that the designer intention is heavily influencing what kind of reflective quality should be chosen. Furthermore, it is also influenced by the phenomena itself, and what kind of problem the artifact solves. Choosing a reflective quality for the designed artifact is a complex matter; design decisions for concept development are hard when dealing with such personal and individual activity as reflecting on a phenomena.

An easy escape route for designers is to opt for evoking reflection by artistic ways; provocation and critical design are providing a rich history how can reflection be achieved in museums or similar environments. However, when it comes to designing everyday objects which are expected to evoke reflection, a designer may face a blurry design space, not knowing what kind of strategies and techniques may work.

In choosing reflective qualities, an important separation between artifacts is the regularity of use.

- **Installations:** If the artifact is going to be exhibited in a museum, there are many inspirational sources a designer can look for to evoke reflection. Art has a strong tradition of provoking reflection by choice of topic, format, materials, message, and so on.
- **Everyday objects:** If the artifact is actually going to be a mass-produced product, or a software, provocative critical design is not feasible as reflective quality.

### 6.5.1 Temporality

Hallnäs and Redström [23] laid down the foundations to use time in interaction design, and their “slow technology” design program does feature such design principles which can be used in the design for everyday objects with a reflective quality.

#### Teaser

Hallnäs and Redström’s doorbell showed only a small friction of a melody, encouraging the user to come back and ring the bell often to “construct” the complete tune. They operated with giving only a teaser; a small bit of something bigger. Dalsgaard [12] shows the concept of peepholes. His design also operates with a teaser; the user only perceives a very small part of a complete whole, and such teasing engages the user to keep using the product to discover more.



**Figure 6.11:** Teaser card. Text: *By doing its function, the product leaves notions of small parts of some- thing bigger.*

Teasers operate with the temporality by giving only frictions at a time; in this way immense use cannot cover everything regarding the artifact, leaving time for the user to think about the experience. A teaser quality can maintain the users engaged and interested, giving bits and pieces of the artifact at a single time. This is however rather annoying if there are tasks to be completed in fast pace; a teaser becomes annoying when it holds back functionalities.

#### “Are you sure?”

A different approach for temporality is to pause the user’s flow to make her reflect on her activity. For example operating systems asks for confirmation before deleting files (hence the name of the quality), but you can find similar solutions with the doors of moving vehicles: for example a train window, which can only be open fully from the outside, or the door of a moving car where you need to pull the lever twice to open it.



**Figure 6.12:** Are you sure? card. Text: *Pause the users' flow of action to have reflection/realization moment before going on. This is to create awareness on the weight of the action.*

In software design “Are you sure?” often comes as modal feedback, and as stated in *About Face 3* [8], modal feedback (and the excise casted by them) generally should be avoided.

### Inverting usability patterns

An interesting aspect to mention here is to see usability patterns as “patterns to create time-efficient interactions”. Earlier iterations of the Reflection Design Framework featured such inverse-patterns, which were basically turning usability patterns upside-down; instead of making interaction a time-saver, intentionally design for tedious and complicated user flow, slowing the user down for reflection.

This is a provocative approach for temporality, and definitely undesired. However, when a user flow can be simplified, often there is some time won by this; earlier the procedure took more time, and with the simplification it takes significantly less. Such “won time” could be utilized with reflective qualities.

The inspiration for this pattern came from Krug’s seminal work on web usability, “*Don’t make me think!*” [31]. The idea for the pattern was to invert this into “*Do make me think!*”, as an inspirational, good sounding statement.

### 6.5.2 Art

Art has a strong tradition of provoking reflection by the choice of topic, format, materials, message, and so on. Interaction design intertwine with new media at many occasions, hence comes the blurry borderline of some design works which are also interpreted as artistic creations. This is one of the reasons why many designers consider some *artistic* reflective qualities as a way to augment their designs for reflection.



**Figure 6.13:** Inverting usability patterns card. Text: *Doing the opposite of what would create an intuitive interface, the user is forced to be thoughtful with her actions.*

Furthermore, critical design had also much influence on interaction design since the famous works of Dunne and Raby [14]. Their criticism focused on the over-technologized mankind at the times when technology started to be designed by interaction designers.

### Provocation

Critical design often operates with provocation to evoke critical reflection; let it be on overconsumption, caducity, technology, and so on. An artifact with provocative reflective quality is likely not going to be a mass-produced product; this reflective quality is more expected for installations and similar one-time experiences with the object. The reflective quality “hits” once, but then it hits hard. This punchiness of provocation would be found annoying, boring, cumbersome for an everyday object.

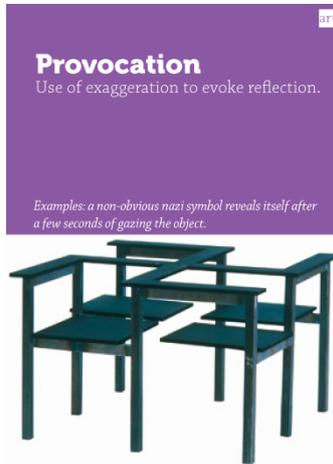
### Going artsy

Not all artistic approach operate with provocation; artistic quality can make an artifact or interaction into a beautiful, remarkable experience, which moves the user. For example an artistic reflective quality can do something with the aesthetics of the artifact, having it crafted around a matter, which triggers the user on the phenomenon.

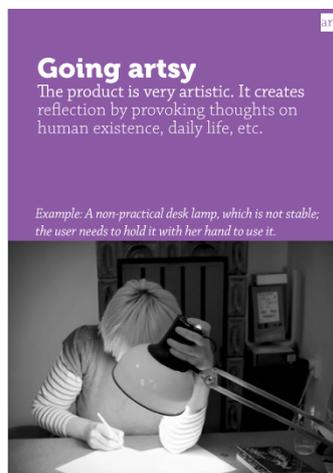
A common characteristic of provocation and artistic reflective qualities is that often they raise awareness on a phenomenon as well, which may be connected to the main message of the artifact, the statement of the artist, or the interaction it forces the user into. Therefore these reflective qualities are also usable for phenomenon awareness.

### 6.5.3 Peers

Reflection is an individual and rather personal activity, but people often share their reflections with others, for knowledge sharing, new perspectives and other reasons.



**Figure 6.14:** Provocation card. Text: *Use of exaggeration to evoke reflection.*



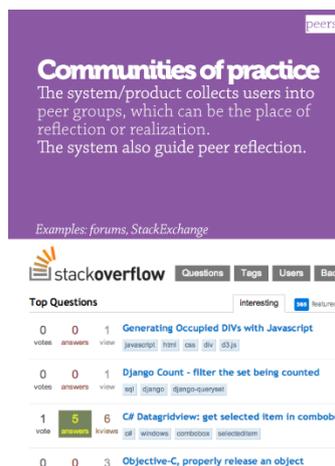
**Figure 6.15:** Going artsy card. Text: *The product is very artistic. It creates reflection by provoking thoughts on human existence, daily life, etc.*

For Schön’s reflection-in-action and reflection-on-action, peers are important pillars in the process. Peers are ones who bounce thoughts back, and in this process share knowledge and experience. Discussing an experience with others also creates further awareness on a phenomenon, because of the extra aspects and time spent on the analysis of it.

Reflective qualities involving peers are often happening in different learning management systems; such systems are supporting informal learning at workplace and work experience, by supporting the externalization of experiences and sharing them with colleagues.

### Communities of practice

Communities of Practice as a reflective quality can be used if the user can be connected to other users involved in similar endeavors. In these cases reflection typically happens by externalizing the user’s analyzed phenomenon and asking the community for their input on it.

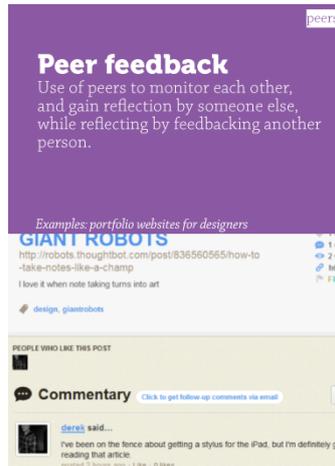


**Figure 6.16:** Communities of Practice card. Text: *The system/product collects users into peer groups, which can be the place of reflection or realization. The system also guide peer reflection.*

How Wenger defines: *“Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.”* [52] Learning is a key activity here, thus the connection to reflection.

### Peer feedback

Peer feedback quality “delegates” the reflection to a peer, and ask the user to reflect on someone else’s phenomenon. Typical examples of this are e-portfolio websites (for example Behance for designers), where users can publish their works and receive feedback on them, while giving feedback to others.



**Figure 6.17:** Peer feedback card. Text: *Use of peers to monitor each other, and gain reflection by someone else, while reflecting by feedbacking another person.*

The inspiration of this pattern comes from the Design with Intent method from Lockton [33], whose reflective question regarding Peer feedback is: “*Can you give users feedback on their behaviour from other users of the system, equal in status to themselves?*”<sup>3</sup>

#### 6.5.4 Changing context

When using an artifact or attending an experience, the analyzed phenomena and the context it happens are tightly connected. Sometimes it is easier, more feasible to influence the context itself, use it as a designed dimension to change the user’s perception of the artifact.

#### Gamification

Games most often operate with fictional context, where fictional phenomenon happens. Studies reported [46] that hardcore gaming does contribute to one’s skills development, especially on the soft skills side, such as leadership skills development from World of Warcraft and so on. This is an evidence that experiential learning can be sourced from absolutely fictional situations as well, and the learning can be created by reflecting on the phenomenon.

Designing a complete fictional world is though a big overhead, and cannot be applied to the regular cases of interaction design. This does not mean that playfulness cannot be achieved with products linked to the “real world”: gamification has been ever-growing in the recent years to motivate behavior of users with IT artifacts. Gamification operates with affecting the context around a phenomenon; such as gratifying the user with a badge,

<sup>3</sup>Peer feedback: [http://danlockton.com/dwi/Peer\\_feedback](http://danlockton.com/dwi/Peer_feedback)



**Figure 6.18:** Gamification card. Text: *The system incorporates a playful narrative which changes the context around the main functionality. This way, reflection can be achieved by doing a “more appealing” task instead, or by using the story to shift perspectives.*

if she does something “good”. This is quite far-fetched from real life, where an experience of receiving a badge may happen only during situations like sport competitions and alike.

### Shifting perspectives

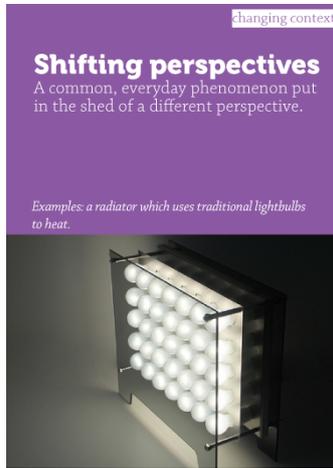
The STATIC! project involved a lot of objects from everyday life. The reflecting quality of these re-interpreted everyday things were rooted in the witty ways of changing the context around the functions of the objects. For example, the lightbulb radiator does its heat radiating function as well as a regular radiator, keeping the perceived phenomenon of heat remained. However, the lightbulbs need to light up for generating heat, and that inevitably visualizes the energy consumption.

Shifting perspective as a reflective quality enables novelty for solving a problem, but always with the threat that during longer usage the novelty fades into everyday regularity.

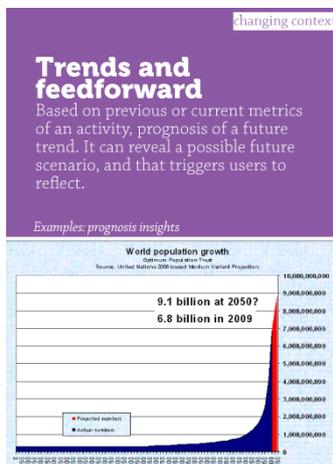
The inspiration of this pattern came from looking at the mechanics of critical design (deconstructing critical design to provocation, to art and to the shift of perspectives), but this element more belonging to changing the context around the artifact rather than artistic approaches.

### Trends and feedforward

A more traditional approach for changing context is to predict what the future is going to look like, if the phenomenon continues in the way as in the present. In applications for weight-loss (a really typical behavioral change matter for designers), there are trendlines predicting the user’s weight based on the dynamics of the weight-change.



**Figure 6.19:** Shifting perspectives card. Text: *A common, everyday phenomenon put in the shed of a different perspective.*



**Figure 6.20:** Trends and feedforward card. Text: *Based on previous or current metrics of an activity, prognosis of a future trend. It can reveal a possible future scenario, and that triggers users to reflect.*

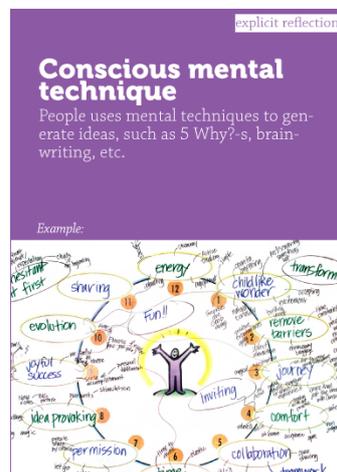
The inspiration of this pattern came from the Design with Intent method [33], where the reflective question of “Simulation and feedforward” is: “*Can you give users a preview or simulation of the results of different actions or choices?*”<sup>4</sup>

### 6.5.5 Varia

These patterns did not fit into the other reflective quality clusters, but found important to keep, even as individual patterns.

#### Conscious mental technique

Mental techniques such as the 5 Whys?, brainwriting, etc are forcing the person’s thinking into unexplored, unexpected domains, often to generate new ideas. Such techniques are nicely summarized in the IDEO method cards, where different methods are collected to stretch the designers’ perspective in the analysis of a design problem.



**Figure 6.21:** Conscious mental technique card. Text: *People use mental techniques to generate ideas, such as 5 Why?-s, brainwriting, etc.*

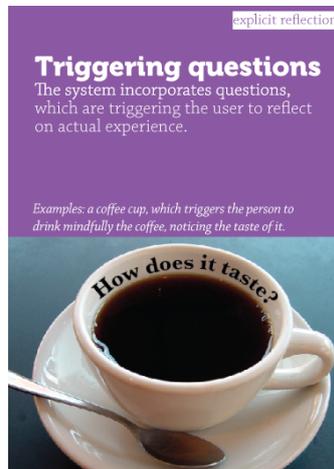
These techniques work as a reflective quality in cases the user wants to look for inspiration or self-conducted procedures to look further and further into a phenomena. A great example is the 5 Whys technique, which provides a simple but very effective framework for looking deeply into a phenomenon.

The source of this pattern was from a questionnaire respondent, who reported the use of mental techniques (forceful ways to seek new perspectives) as a way of becoming reflective.

<sup>4</sup>[http://danlockton.com/dwi/Simulation\\_%26\\_feedforward](http://danlockton.com/dwi/Simulation_%26_feedforward)

### Triggering questions

Asking an explicit question for reflecting on the experience is not an original way to evoke reflection, yet very effective.



**Figure 6.22:** Triggering questions card. Text: *The system incorporates questions, which are triggering the user to reflect on actual experience.*

The pattern of triggering questions is strongly connected to the reflection intent phase Triggering questions (section 6.5.5).

### Open-ended functionalities

Reflection often comes through serendipity, triggered by unexpected experiences and phenomenon. This is largely coming from “undesigned” parts of the artifact. For example in the questionnaire, respondents reported Skype as a product which triggered reflection (as making the world smaller by remotely connect to distant family, peers); or sticky notes, which makes ideas and thoughts tangible and provides plasticity, enabling mind-triggering new associations, and combinations with very low efforts; a car, which just surprisingly doing its job very well; or boxes used for moving, which naturally triggers the person’s memory when she is collecting and boxing her stuff.

In these cases, the reflective quality is the plasticity of functionalities, when the user can define for herself the use and the interpretation of the artifact. This relates to art pieces, where the interpretation is largely left for the person, moderately influenced by the curator and learned or guided ways of reading art.

The pattern of Open-ended functionalities was inspired from questionnaire respondents, who reported the examples above (such as Skype or sticky notes).



**Figure 6.23:** Open-ended functionalities card. Text: *The system’s main functionality is extremely open-ended, and as such it becomes such an enabler of “new” experiences, that without it the users’ life would be “less”.*

## 6.6 Action

After reflection, realization, thinking happens, people variously implement their new findings into their life or knowledge: the triggering artifact could help in this by providing additional functionalities, or hinting possible actions. The role of the action phase is to orientate this open space, and design how the findings make their way into implementation.

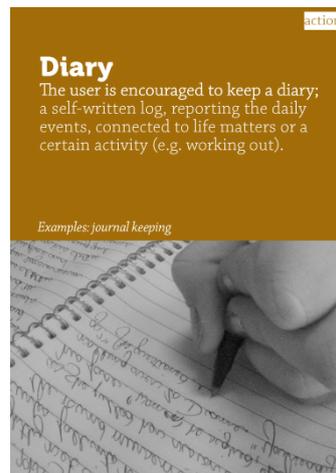
There is always a conflict between forcing the user to take action and letting the user to decide what to do with the gained reflection; this is the usual problem of experience design; designing *an* experience is impossible aim, but designing *for* an experience is feasible. Therefore whatever is the designed action, it can be further emphasized by using principles from persuasive design.

Having action this much open-ended does not help in the evaluation of designs; reflection is hard to assess, and the users may not realize that their reflection was triggered intentionally by the artifact. However, obtrusive designs to incorporate actions are more of a burden in the user experience than something pleasant, so a suggestion is to consider well if it worth it to ensure that the user does the action step too.

The designer should aim for motivating a habit creation with taking action after reflection, but motivating habitual change is out of the scope of this thesis.

### 6.6.1 Diary

Journal keeping is one researched and proven way of enhancing reflection for students [26]. Keeping written notes is very user habit dependent, but it is one effective way to create rigorous reflection habit for the user. Blogs are often used for having a “flush” for users to externalize their thoughts, and social networks are partly used for this as well (in crafting content sense, not sharing information).



**Figure 6.24:** Diary card. Text: *The user is encouraged to keep a diary; a self-written log, reporting the daily events, connected to life matters or a certain activity (e.g. working out).*

A diary suggests a personal documentation, which was definitely the case for the analogue world before the internet. Today keeping a diary is optionally shared with the world in no time, and that is something people often take granted, hence not motivated to keep reflective thoughts.

But a reflective diary can be taken less literal as well; for example sites such as Foursquare enables the user to check-in to a location, post a photo, leave a comment. These activities are looping back to phenomenon awareness, but gradually enhance reflection. An evidence is going to be created of an experience, and that is something to be revisited at the other parts of the design.

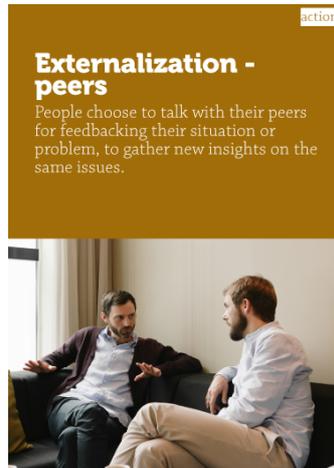
### 6.6.2 Externalization - peers

The externalization of tacit knowledge [40] is a core activity in knowledge management and learning from experiences; in these cases reflection can be seen as the activity converting tacit knowledge into explicit knowledge.

This externalization can happen by the user alone, or by involving peers. With peers, externalization is usually taking place as a discussion, either online, either as a spoken conversation.

When designing IT artifacts, the most common ways are to influence the user to have reflections written down (and this has the benefits to create discussions not entirely real-time and scaling the participation to the online public), so it is more likely that a designer opts for creating a such technology-heavy outcome. However, as reflection often comes in serendipitous and informal ways, designing for ad-hoc discussions should be also among the designers' intents.

The pattern of Peer externalization is inspired from Schön's Reflection-in-Action Reflection-in-Action (section 2.2) [45], who describes several situations when learning is happening through a reflective conversation with others.



**Figure 6.25:** Externalization - peers card. Text: *People choose to talk with their peers for feedbacking their situation or problem, to gather new insights on the same issues.*

### 6.6.3 Externalization - pen and paper



**Figure 6.26:** Externalization - pen and paper card. Text: *To enhance their thinking, people take pen and paper to doodle their problems, walk around the topic by drawing, or enforcing themselves to externalize it in a way.*

To enhance their reflection, many people reported in the user studies that they often go for pen and paper to externalize their thoughts, write things down as text, mindmap or random doodle.

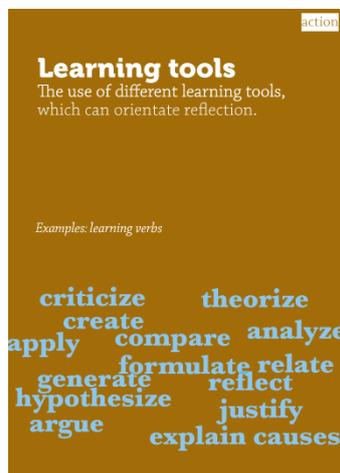
The main characteristics of “pen and paper” externalization is its simplicity regarding involved tools (no technology!), the open-endedness that the user can write text, draw, doodle; externalize reflection by her most comfortable way. This action can be used also in peer settings, such as group thinking with sticky notes in a design studio, or simple

paper prototyping of concepts during the design process. The importance lies here to motivate the user to externalize her reflection in a way, because by this action a new level of clarity will be reached.

The inspiration of Pen and paper externalization is coming from the questionnaire outcomes, where a mass amount of respondents reported the use of these very simple tools to approach reflective situations.

#### 6.6.4 Learning tools

Conscious and planned reflection is often triggered, enforced by learning situations; in academia it is common to evaluate a project by reflecting on it. Schön's reflection-in-action often involves a teacher, someone who "opens up" the eyes of the student how to reflect on a situation, and by teaching this reflective skill guiding the student of self-evaluation and learning from experiences.



**Figure 6.27:** Learning tools card. Text: *The use of different learning tools, which can orientate reflection.*

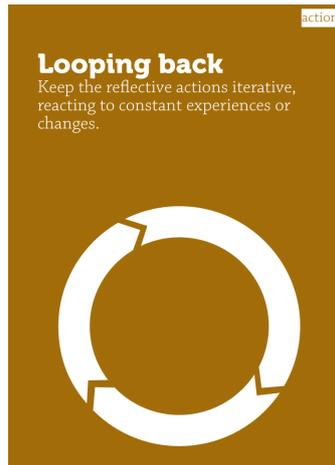
Taking learning action has been formulated in various taxonomies to help educators in the design of curricula; the focus of these taxonomies is usually the evaluation of the student's knowledge. Evaluation of knowledge is not in the scope of reflection, however these taxonomies can be a great help to grasp those words used for learning, which can create reflective action on an experience.

The SOLO taxonomy from Biggs and Collis [6] collects verbs for gradually increasing levels of competence. These verbs can be used also as triggering words for reflection, for example as an exercise to externalize thoughts.

Such verbs: (based on Biggs [5]) *create, formulate, generate, hypothesize, reflect, theorize, analyze, apply, argue, compare/contrast, criticize, explain causes, relate, justify*

### 6.6.5 Looping back

The Reflection Design Framework features a holistic approach for reflection through the different categories/phases. These phases can be followed in an order, however they have blurry borderlines between each steps, and working with either of them influence the rest, thus the designer may need to go back and forth in loops, to reach a final outcome.



**Figure 6.28:** Looping back card. Text: *Keep the reflective actions iterative, reacting to constant experiences or changes.*

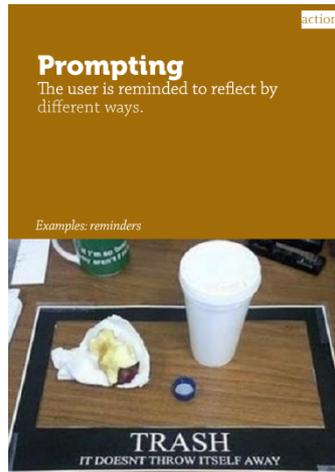
Many times acting on a reflection results in a new phenomenon, experience (especially in learning), and then the reflective process starts from the beginning. Therefore many times the designed actions should be for the aim of repetition; repeating activities builds good - reflective - habits, and secondarily helps the designer to evaluate if the design works. A re-occurring issue with reflection is that people simply forget to do it consciously; such repetition can work as prompting, reminding the user on the importance of reflection.

This pattern is inspired by user-centered design, human-centered design and experiential learning; these processes are absolutely iterative, and constantly adapting during the process.

### 6.6.6 Prompting

Much of the designer’s task is to find good ways to remind the user to reflect; as reflection often happens informally or triggered by random events to reflect on something distant in time, prompting is important so that these reflections are not lost and considered consciously by the user.

The inspiration for prompting comes from Fleck [19], who describes “Technology to prompt explanation” as a support for reflective descriptions of earlier experiences. On Fleck’s terms, this is a way of triggering low-level reflection, which does not lead to deep findings.



**Figure 6.29:** Prompting card. Text: *The user is reminded to reflect by different ways.*

When using prompting as reflective quality, it is important to notice, that when the user knows what to do (to reflect), she should not be stopped by tedious use of the tools (or lack of tools), thus prompting should be subtly integrated in the design, as a support rather than a compulsory action.

## 6.7 Context, situations, environments

The context surrounding an experience, phenomenon is strongly intertwined with the phenomena itself. If we are considering a phenomenon which actually happened, the context “*wraps up*” the phenomenon linking it to a specific situation. When a fictional phenomena considered (an idea, for example), we normally consider the context to be *ceteris paribus* - remaining the same.

Relating this to reflection, modifying the context around two - otherwise unconcerned - phenomena is another approach to create realization between them. Building on the earlier example of “changing perspectives”, changing context would mean essentially a change in the third dimension between two phenomena, something which puts those two into an entirely new shed of light.

Consider Christmas and New Years’ Eve. Usually people gather with their families and very often send greetings to their friends wishing merry times and a happy upcoming year. But, it is also a high time for someone to retrospect on the last year, and reflect what happened, what should change (often in the format of new year resolutions). With the coming of such holidays, nothing changes in life circumstances, but the context around is changing, and it is triggering reflection.

These patterns are entirely based on user studies conducted for this thesis. More on this in Questionnaire findings (subsection 5.2.3).

### 6.7.1 Seeking for inspiration

When facing a complicated life or work situation requiring deep and focused thinking respondents reported to consciously seek for inspiration during their daily routine. Such inspiration-seeking is a way for someone to force her mind to look for free associations regarding the problem, and consciously waiting for serendipity moments.



**Figure 6.30:** Seeking for inspiration card. Text: *People consciously look for new experiences, from which they expect to get inspiration; this can be to seek analogies of their problems, or just get fascinated with refreshing new thoughts.*

### 6.7.2 Solitude

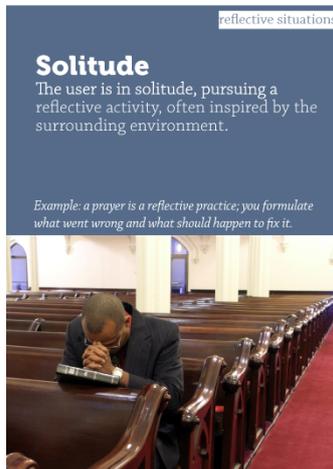
There are certain environments and situations which connect to solitude and reflection. A particular example is visiting the church for a prayer. A prayer is basically a reflective situation, when experiences get formulated (externalization), and a change is “ordered”. Such “order” is a wishful thought from the person, containing a wish, which could be already acted upon by the person.

An example of solitude is a prayer in the church; the person summarize earlier happenings and experiences in the prayer (therefore externalize phenomenon at least for herself), and “orders” actions what should happen.

### 6.7.3 Meditation and mindfulness

Meditation and mindfulness are very tight-knot with reflection, and people often get confused making a differentiation between these. Meditation is a learned technique used for stress relief and mental health. Mindfulness is the practice of closing off the world and attend thoughts with focus.

These situations may enhance raising awareness on a phenomenon, by providing space and time to attend thoughts. However, meditation and mindfulness are a process to reveal personal values and this revelation is the core of phenomenon awareness in these cases.



**Figure 6.31:** Solitude card. Text: *The user is in solitude, pursuing a reflective activity, often inspired by the surrounding environment.*



**Figure 6.32:** Meditation and mindfulness card. Text: *People choose to meditate when facing hard times, and they practice mindfulness to fully attend their thoughts. This can help them identifying the core of problems, or for stress relief.*

#### 6.7.4 Random activity

People often pursue random activities to disconnect from a problem, and make their mind busy with something entirely different (or something simple, like a repetitive task). Respondents reported that they seek for gardening, washing the dishes and similar activities, to calm their mind from a hard topic, and let different thoughts sail in. Many people who does individual sports often use it for mental recreation as well; this provides design opportunities for augmenting sporting applications with reflective qualities.



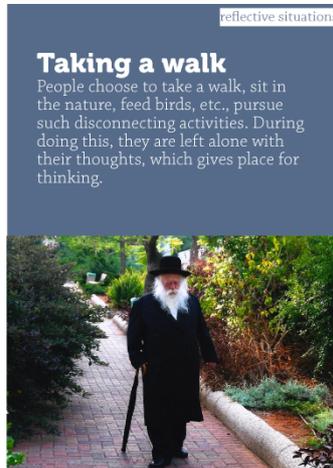
**Figure 6.33:** Random activity card. Text: *People pursue different, random activities to disconnect from their thoughts, with the conscious hope to get inspiration out of the blue.*

#### 6.7.5 Taking a walk

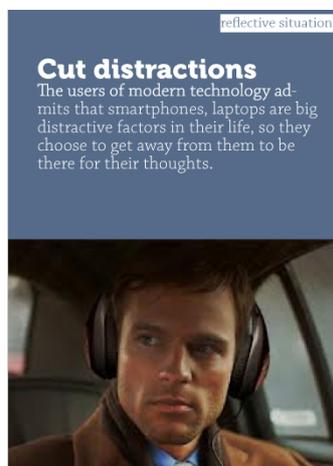
Similarly to random activities, respondents often reported taking a walk for introspection; this is often triggered by the desire to get out to the world and disconnect from the problems of daily routine. Taking a walk in the city is meaningful for people who does not want to be alone, but appreciate some pointless wandering; such walks often also combines with inspirational walks, using the tired mind to notice interesting experiences all around. Another way is to seek nature and going for the waterside or to a forest, sit down to feed the birds and so on. These people often seek for calm situations, when quietness is highly valued.

#### 6.7.6 Cut distractions

Many respondents reported that one way of consciously planning for an introspective situation is to turn off technology, such as computers, smartphones, TV and so forth; they cannot stop checking the news, Facebook, etc and do seek distractions. Therefore a crucial way is to cut back from these, and seek for reflection by getting away from these.



**Figure 6.34:** Taking a walk card. Text: *People choose to take a walk, sit in the nature, feed birds, etc., pursue such disconnecting activities. During doing this, they are left alone with their thoughts, which gives place for thinking.*

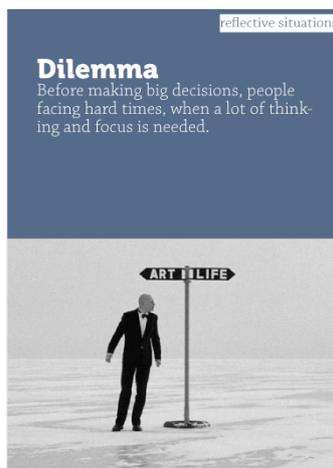


**Figure 6.35:** Cut distractions card. Text: *The users of modern technology admits that smartphones, laptops are big distractive factors in their life, so they choose to get away from them to be there for their thoughts.*

A slightly different way of seeking for reflection is when people “wire in” with headphones or earplugs, closing off the noise of the external world. Listening to music can both be distractive or helping to focus.

### 6.7.7 Dilemma

A very common life situation which triggers reflection is facing a dilemma; times when important decisions need to be made often call for a lot of analysis of the problem and as such reflection. Several questionnaire respondents reported dilemma as a reflective situation.



**Figure 6.36:** Dilemma card. Text: *Before making big decisions, people facing hard times, when a lot of thinking and focus is needed.*

# 7

## Discussion

*“There are no facts, only interpretations.” - Friedrich Nietzsche*

Writing a thesis about reflection, it was beyond average how much reflection has piled up in my mind during the process. This chapter builds on these reflections, concluding them as findings and an evaluation of the overall work, moreover proposing future research opportunities regarding them.

### 7.1 Findings

The research started with this thesis did not really finish with ending the project about it, rather just reached a point when it was time to finish. This means, that it cannot be considered entirely complete, especially as its research could easily span years time rather than the 8 months spent on it. Thus, what findings have been reached within the frames of the thesis should be seen as work-in-progress, an exploration of something bigger, with admitted failures and minor wins along the way.

A general aim of the thesis and the project was to advocate reflection for designers, as an important experience to trigger it through design. This advocacy led to approach this area through creating tangible tools for designers, and rather directly “teach them to fish”. This approach blinded me to notice early enough, that designing for designers is a complicated matter. During the concept development, it became clear that designing for designers is basically “terra incognita” in the scientific literature; there are articles analyzing and discussing this meta aspect of design, but there is a lack of textbooks or seminal works, which summarize this area of design (this is understandable; how designers think leads to the foundations of describing the cognitive processes of design, and as the design process is usually “fuzzy”, it leads to even further complexity). With designing for designers there is a trap of focusing on such areas where there are no problems (and overdo such design process support activity by design, when there are no

problems found in the process). However, it is also rather overlooked how to validate the efficiency of design tools; the lack of measurements from validation may easily suggest lack of the lack of focus on these matters as well.

One of the most important outcomes is definitely the applied perspective on triggering reflection through interaction design; this applied, pragmatical approach was not in the focus of research earlier. I state this in the comparison of my Reflection Design method with other, recent works on designing for reflection, such as Fleck's [19] or Dalsgaard's [11]: Fleck has similar theoretical underpinnings from learning theory (which focuses on the depth of reflection and how can technology support reflection on the different levels) , but she focuses on *generating design knowledge*; whilst Dalsgaard also focuses on Dewey's work, but he *analyzes designs*, instead of generating practical tools.

Comparing my work with other attempts of reflection and design, it is clear that there are not many other theories which could have been considered and used; every work is somehow relating to Dewey's and Schön's work in a way. Possibly further looking towards critical theory (another philosophical theory) could have provided different perspectives to evoke *critical thinking*, which has relations to reflective thoughts. Similarly, my work was mainly grounded with philosophical and educational aspects of reflection, simply because the terminology somewhat existent in these fields. However, cognitive science could have provided – likely scientifically more grounded – concepts related to reflection; *sense-making, problem solving, decision making* to name a few.

A possible shortcoming of the outcomes is regarding the development of a too specific design tool, when there should be design tools created for a broader area. What I mean here is that “designing for reflection” can be seen as a niche subfield of “designing for experience”. Developing a design tool, which aims on a very specific field of experiences (i.e. reflection), whilst there is a gap of (or well-spread, popular) general design tools for the designing of experiences. In some sense, it would have been probably a better approach to tackle the design tool creation for reflection **after** design tools exist for designing for – broadly understood – experiences.

Although I focused on interaction design, my outcomes are possibly well-applicable for other design areas as well; many of the examples I use to explain experience data are IT products with complete services behind, hence *service designers* can likely use my outcomes in their concept development processes. A lot of the collected patterns are connected to interactive products and systems, and I think this cannot help much industrial designers; their inspiration to trigger reflection probably lies in the visual aesthetic, which is more connected to artistic methods (which connects to reflection through critical design). *Architects* are likely able to use the situations and environments cluster from the patterns, as those patterns are directly dealing with spaces architects design. Besides the designer professions, my outcomes can be found useful by *educators* and *learning designers*; such conscious use of general design process is not common in the non-formal education field, and a work like this provides a glimpse how can the learners' reflection be approached and designed in a systematic way.

## 7.2 Evaluation

### 7.2.1 Evaluating the design process

The design process during the concept development was something different than the usual: although it followed iterative, human-centered design, the general approach synthesized theoretical (even philosophical) knowledge and applied, practical observations. The combination of these top-down and bottom-up perspectives effectively summarized all the literature study I did, combining it with the user research through questionnaires (and many informal input), which gave a good overview of how people actually reflect. Afterwards, the concept development turned into more traditional designing, with the loops of sketching, designing, evaluating until the final outcome was reached.

I already stated above that the first part of the concept development was found successful; I have more mixed feelings regarding the second part: should I have known that designing for designers is going to be complicated, I had chosen prototyping concepts utilizing reflective triggers. The reason for this conclusion is mostly because of this work being a master thesis; the format of a thesis is more aligned for design projects than conducting explorative design research on broad problems.

The other reason why I am questioning the success of the second part is, that during all the workshops, the participants found the tool confusing. With a longitudinal research about reflection (i.e. more time available), a better sensitizing would have been possible to help the users' onboarding experience, and avoid the confusions from the first moments of using the tool. The other use of extra time could have been to conduct a decent validation study, to evaluate in a – scientifically more – sound way the success of the designed tool.

### 7.2.2 Evaluating the results

Despite the questionable effectiveness of the Reflection Design Method (and the already pinpointed improvement points of the design), I am satisfied with the results. Everybody who has seen the prototypes noted that it looks very professionally and appealing, and fact that it was tangible and “real” contributed a lot to the positive experience. Reading the literature, it became clear that many of the design tools on the market lacks a transparent (scientifically documented) background research, thus questionable effectiveness. This might be because of design tools are often used to capture designer knowledge from industrial practice. If this is really the case, then the only way to tackle the effectiveness of my method to have it used in industrial settings and see how experts adapt the use of it in their practice.

If I consider the theoretical framework developed for the design method, I think it captures reflection in a usable way. As elaborated in the thesis, reflection is a complex experience to design for, and the framework should offer various perspectives to the design of this experience. Considering that the framework was initially based on well-proven learning theories, and later on adapted to the thinking of designers', it should combine the best practices of both professions.

### 7.2.3 Personal learnings

When looking at the personal learning from this project, there are various aspects, which could not really fit in elsewhere in this chapter.

Definitely one of the biggest learning was to *do* design research, and realize its mechanics. In the frames of this thesis, I needed to conduct qualitative research in various formats, and this made me look quite deep into the methodology of these. I find this very valuable for my designer knowledge; much of what designers learn is regarding the use of quantitative data (and reaching design decisions regarding that), and quantitative research definitely has much shortcomings.

I spent 8 months conducting this thesis, which is more than the approx. needed 5 months. I do not regret investing this much time considering the outcomes (which I am rather proud of), but it is generally a lot of time for one design project. Conducting this work alone, I often missed another person to discuss the progress with, and another person could have helped in balancing the workload also, considering the broad scope of the thesis. With this much time spent on the thesis, I regret a bit, that I neglected creating interactive prototypes; the prototypes I worked on led more to communication design than interaction design, and after months of reading and absorbing abstract knowledge, I was seriously waiting for some hacking and rapid prototyping of interactions.

The fact that I was conducting individual research at another university, physically distant from my supervisor was probably a deep water to start developing my research skills, especially in the middle of the process. This new environment was mostly fascinating in the beginning, but I also found myself lost at many times; the outcomes of the thesis would have been greatly influenced if I had stayed in Gothenburg, where everything is familiar. However, in Delft I managed to see how “applied” design research is conducted, and this environment influenced a lot my decision that I opted for creating tools for designers, instead of creating conceptual designs for prototypes.

At last, spending 8 months analyzing reflection is definitely hard on someone’s mental processes. I think I got significantly more conscious about my thinking and reflection because of the thesis, and I expect new, fascinating findings regarding my design process because of this.

## 7.3 Future opportunities

These days, we cannot assess yet whether Google Glass is going to be a success, but it definitely shows that wearable computing is going to grow only bigger than it is today, consequently increasing the ubiquity of personalized technology. With this technology-push, the need of exploring (and defining) the designing for personal experiences (such as reflection) needs to only grow.

With this in mind, I think the area this thesis is tackling will gain importance in the near future, therefore further research will be inevitable. As this thesis was mostly focused on contributing to the scientific knowledge on design, I intend to pinpoint several future research opportunities based on the outcomes.

The Reflection Design Method was not tested out in the actual creation of reflective products, only on the level of ideating such products. This observation shows that the actual, reflection-in-mind designed artifacts are missing; the design of such artifacts would provide important knowledge for designing for reflection, as well as observing the users using such a reflective product.

Similarly to the previously mentioned qualitative research, further studies could investigate the “borders” of designing for reflection; one of the highest quality finding of the questionnaire was the patterns for reflective environments, and this could be further investigated by looking into the role of the environment for reflection. Parallel to architects, it would be probably interesting to analyze more in detail, how artists approach triggering reflections; in the end, critical design is largely influenced by artistic methods, and used for triggering reflections. Understanding the mechanics of how artists approach reflection would provide an interesting aspect.

One of the areas where designing for reflection can contribute a lot is behavioral change; as there are already several methods used in this field, it would be useful to study these methods (e.g. emotional design, persuasive design, reflective design, etc.) comparatively, with the investigation which is the most efficient or appropriate for given situations.

Focusing on the research conducted during the concept development, I think the questionnaire could be the basis of another, (this time) quantitative survey, where the outcomes of the already conducted questionnaire are clustered into bigger categories (e.g. “How likely do you write down your reflections?”), with the possibility of generating a large number of responses. Another way would be to expand the conducted research by performing a longitudinal study, where participants keep a journal of reflection, and take time to carefully realize their own reflective thinking patterns.

# 8

## Conclusions

This master's thesis was focused on how can designers design for reflection, how can they imbue reflective qualities into interactive products.

As an outcome of the thesis, the Reflection Design Method <sup>1</sup> was created, a design tool to support designers in the creation of products, which potentially trigger reflection of users. This design tool provides an applied approach for designers to handle the abstract quality of invoking reflection. The method consists of two parts: (a) a framework, which summarizes different aspects designers can influence in designing for reflection; (b) a collection of reflective design patterns as a card deck, which provides practical help for designers on how to enrich their designs with different ways to evoke reflection.

In the first part of the thesis, the relevant theories of reflection are summarized, to inform designers about the essentials of this individual and informal mental activity. Afterwards, a research through design approach is described, which resulted in the Reflection Design Method: at first, earlier studies on reflection were reviewed, and concluded in a preliminary, theoretical framework. This framework was then complemented with qualitative studies on what kind of general product qualities make people reflective. As a continuation, the combination of the theoretical framework and the qualitative studies resulted in the first version of the Reflection Design Method. In the last part, the iterative design process of the design method is followed through, incorporating the description and the outcomes of two workshops and an expert review.

Besides user tests during the thesis, the Reflection Design Method was not exposed to a bigger group of users yet. Despite the infancy of the tool, it was positively welcomed by designers, which suggests further studies to validate the results and increment the design itself. Future research on designing for reflection is also motivated by an interest from such designers, who deal with designing for sustainability, behavioral change and similar experiences, where reflection is a key activity in the users' mental processes.

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<sup>1</sup>The Reflection Design Method can be found in A3 printable format in the Appendix.

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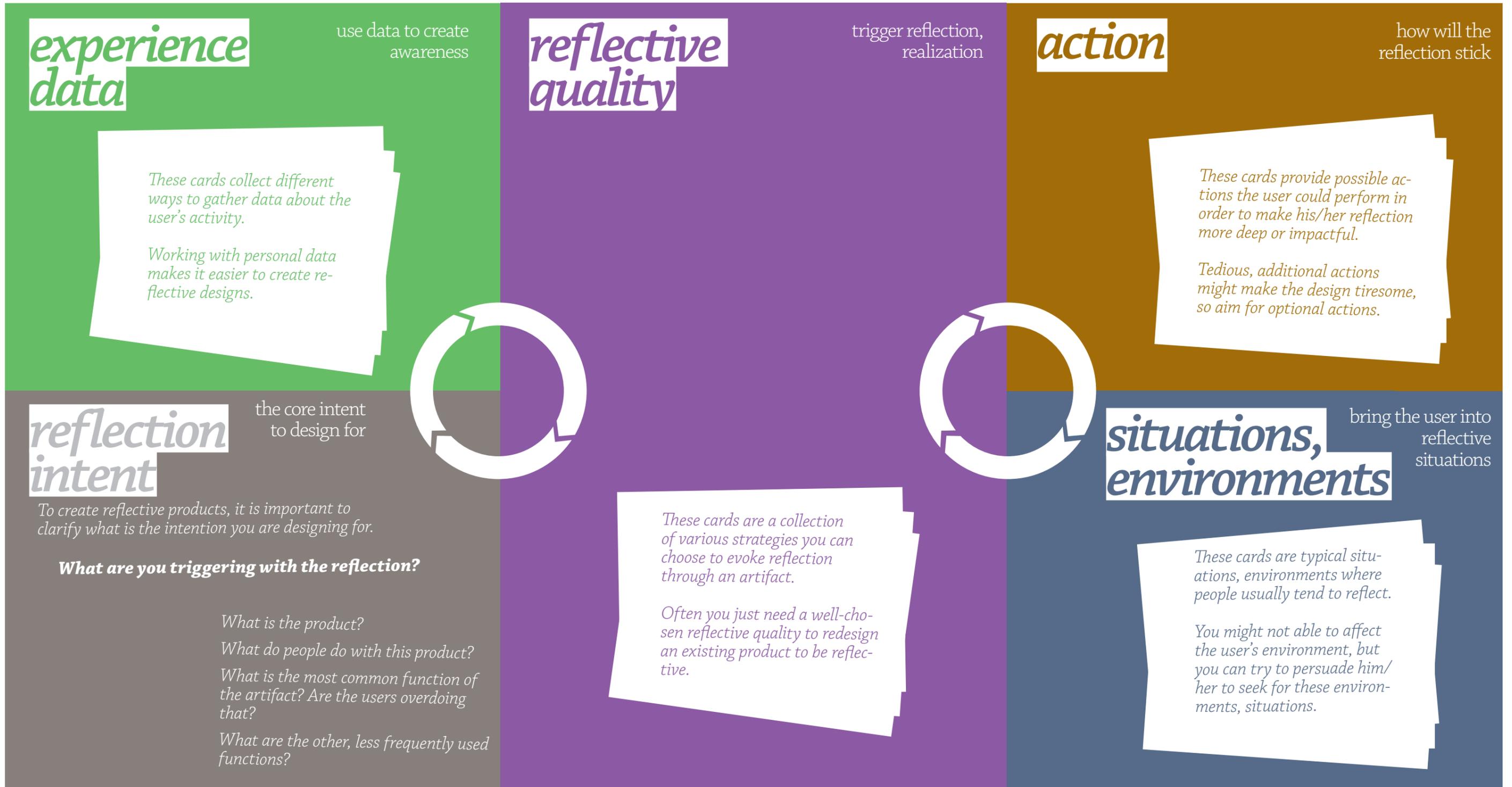
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# Reflection design framework

*a design method for reflection*

**Péter Kun**  
peterku@student.chalmers.se  
p.kun@tudelft.nl



**Auto-recording**  
 The system automatically records usage, daily life, etc. It creates a dataset, which can be later analysed.

*Example: A log about the use of time can reveal new insights for one's time management problems.*



**Relative feedback**  
 Showing a simplified pattern, trend how are things going.

*Example: putting context around body weight, to indicate a positive or negative trend for the user.*



**Real-time feedback**  
 Providing a real-time feedback loop to the user to monitor an activity, and augment the moment with e.g. sensor data.

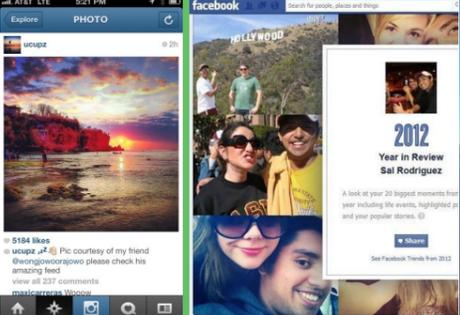
*Example: running apps help the user to maintain the activity, adjust speed, etc. to pursue her goals.*



**Self-recording**  
 The system enables or encourages of the recording of daily activities, or some main functionality.

This is for to keep an archive of happenings for later use-inquiry.

*Example: Twitter, Instagram, Facebook, ...*



**Self-evaluation**  
 The user self-assess personal values, for example by mindfulness. Usually deep introspection, or strong life experiences characterize self-evaluation.

*Example: serendipitous clarity moment by a spiritual trip*



**Visualization**  
 The system provides a visual overview of activities.

*Examples: Energy clock, showing daily consumption*



**"Are you sure?"**  
 Pause the users' flow of action to have reflection/realization moment before going on. This is to create awareness on the weight of the action.

*Example: File deletion*



**Teaser**  
 By doing it's function, the product leaves notions of small parts of something bigger.

*Example: In a science museum, children could raise virtual fishes and let them live in a virtual ocean. The 'Hydroscope' is the peephole to watch them live.*



**Inverting usability patterns**  
 Doing the opposite of what would create an intuitive interface, the user is forced to be thoughtful with her actions.



**Going artsy**  
 The product is very artistic. It creates reflection by provoking thoughts on human existence, daily life, etc.

*Example: A non-practical desk lamp, which is not stable; the user needs to hold it with her hand to use it.*



**Provocation**  
 Use of exaggeration to evoke reflection.

*Examples: a non-obvious nazi symbol reveals itself after a few seconds of gazing the object.*



**Triggering questions**  
 The system incorporates questions, which are triggering the user to reflect on actual experience.

*Examples: a coffee cup, which triggers the person to drink mindfully the coffee, noticing the taste of it.*



**Communities of practice**  
 The system/product collects users into peer groups, which can be the place of reflection or realization. The system also guide peer reflection.

*Examples: forums, StackExchange*



**Peer feedback**  
 Use of peers to monitor each other, and gain reflection by someone else, while reflecting by feedbacking another person.

*Examples: portfolio websites for designers*



**Gamification**  
 The system incorporates a playful narrative which changes the context around the main functionality. This way, reflection can be achieved by doing a "more appealing" task instead, or by using the story to shift perspectives.

*Examples: gamified web services*



**Shifting perspectives**  
 A common, everyday phenomenon put in the shed of a different perspective.

*Examples: a radiator which uses traditional lightbulbs to heat.*



**Trends and feedforward**  
 Based on previous or current metrics of an activity, prognosis of a future trend. It can reveal a possible future scenario, and that triggers users to reflect.

*Examples: prognosis insights*



**Open-ended functionalities**  
 The system's main functionality is extremely open-ended, and as such it becomes such an enabler of "new" experiences, that without it the users' life would be "less".

*Example: Post-its enables a completely new way of laying out ideas, and Skype makes the world smaller by connecting people remotely.*



**Diary**  
The user is encouraged to keep a diary; a self-written log, reporting the daily events, connected to life matters or a certain activity (e.g. working out).

*Examples: journal keeping*



**Learning tools**  
The use of different learning tools, which can orientate reflection.

*Examples: learning verbs*

criticize theorize  
create compare analyze  
apply formulate relate  
generate reflect  
hypothesize justify  
argue explain causes

**Meditation and mindfulness**  
People choose to meditate when facing hard times, and they practice mindfulness to fully attend their thoughts. This can help them identifying the core of problems, or for stress relief.



**Random activity**  
People pursue different, random activities to disconnect from their thoughts, with the conscious hope to get inspiration out of the blue.



**Cut distractions**  
The users of modern technology admits that smartphones, laptops are big distractive factors in their life, so they choose to get away from them to be there for their thoughts.



**Conscious mental technique**  
People uses mental techniques to generate ideas, such as 5 Why?-s, brainstorming, etc.

*Example:*



**Externalization - pen and paper**  
To enhance their thinking, people take pen and paper to doodle their problems, walk around the topic by drawing, or enforcing themselves to externalize it in a way.



**Externalization - peers**  
People choose to talk with their peers for feedbacking their situation or problem, to gather new insights on the same issues.



**Taking a walk**  
People choose to take a walk, sit in the nature, feed birds, etc., pursue such disconnecting activities. During doing this, they are left alone with their thoughts, which gives place for thinking.



**Dilemma**  
Before making big decisions, people facing hard times, when a lot of thinking and focus is needed.



**Looping back**  
Keep the reflective actions iterative, reacting to constant experiences or changes.



**Prompting**  
The user is reminded to reflect by different ways.

*Examples: reminders*



**Seeking for inspiration**  
People consciously look for new experiences, from which they expect to get inspiration; this can be to seek analogies of their problems, or just get fascinated with refreshing new thoughts.



**Solitude**  
The user is in solitude, pursuing a reflective activity, often inspired by the surrounding environment.

*Example: a prayer is a reflective practice; you formulate what went wrong and what should happen to fix it.*



**Picture credits**

Relative feedback	Credit: Withings
Auto-recording	Credit: RescueTime
Realtime feedback	Credit: Nike
Self recording	Credit: Instagram, Facebook
Visualization	Credit: The Interactive Institute
Self-evaluation	Credit: AGEACAC
Triggering questions	Credit: Dalje.com
Shifting perspectives	Credit: The Interactive Institute
Provocation	Credit: Richard Hutten
Communities of practice	Credit: StackOverflow
Peer feedback	Credit: Forrst
Trends & feedforward	Source: <a href="http://simplysuperbswans.blogspot.com/">http://simplysuperbswans.blogspot.com/</a>
Gamification	Credit: Duolingo
Unpredictability	Source: <a href="http://cheaponlinecasinoslot.com">http://cheaponlinecasinoslot.com</a>
Teaser	Credit: Peter Dalsgaard
Artsy	Credit: Monika Hoinkis
Open-ended funcs	Credit: BBC
Conscious mental technique	Source: <a href="http://www.funnytobe.com">http://www.funnytobe.com</a>
Are you sure?	Credit: Apple
Solitude	Source: <a href="http://www.opposingviews.com">http://www.opposingviews.com</a>
Cut distractions	Credit: Klipsch
Dilemma	Credit: Roi Vaara
Meditation and mindfulness	Source: <a href="http://epochtimes-romania.com">http://epochtimes-romania.com</a>
Seeking for inspiration	Source: <a href="http://packagingworld.blogspot.com">http://packagingworld.blogspot.com</a>
Taking a walk	Source: <a href="http://www.pishposhpaints.com">http://www.pishposhpaints.com</a>
Random activity	Credit: The Telegraph
Diary	Source: <a href="http://todaysadmin.com">http://todaysadmin.com</a>
Externalization - pen and paper	Credit: Maris Eliass Skujins
Externalization - peers	Credit: Scandic Hotels
Prompting	Source: <a href="http://gagnamite.com">http://gagnamite.com</a>
Inverting usability patterns	Credit: Steve Krug