Practicing Storytelling in Design with Pitchify

A Tool to assist in Pitching Design Concepts

Qiong Peng
Doctoral Dissertation
Practicing Storytelling in Design with Pitchify

A Tool to Assist in Pitching Design Concepts

THESIS

ter verkrijging van de graad van doctor aan de Technische Universiteit Eindhoven, op gezag van de rector magnificus prof.dr.ir. F.P.T. Baaijens, voor een commissie aangewezen door het College voor Promoties, in het openbaar te verdedigen op dinsdag 10 mei 2022 om 13:00 uur

by

Qiong Peng

geboren te Sichuan, China

Het onderzoek of ontwerp dat in dit proefschrift wordt beschreven is uitgevoerd in overeenstemming met de TU/e Gedragscode Wetenschapsbeoefening.
Summary

Storytelling plays an important role in design, and especially in HCI, as evidenced by a substantial body of recent literature. As advocated by terms such as “design as storytelling” and “designers are storytellers”, stories are broadly applied in design in different domains and phases, and often visualized and shared in the form of storyboards. Storytelling is a promising way to assist designers in discussing human-related aspects, which explains the popularity of storytelling in design for experience. Prior studies on storytelling in design provide useful insights and references from various perspectives, but additional studies are advised as literature at large mostly highlights the values of storytelling but is empirically weak with regard to the actual design practice in relation to storytelling. The challenges and problems seem to be underestimated and are worthy to be investigated.

The research presented in this thesis is primarily an empirical exploration of the adoption of storytelling in design. It starts from the insights collected in an earlier research project on the StoryPly method which was developed within our research group with the aim to support designers to envision and discuss user experience through crafting and visualizing stories. A discrepancy between the slow acceptance of storytelling by students of industrial design and the theoretical claims on the benefits of storytelling was observed. Inspired by such insights, we were motivated to conduct research to understand how industrial design students adopt storytelling in their design practice, what problems they encounter, and what could be alternative approaches or solutions. One specific issue was how storytelling in design could be better supported by appropriate tools and methods. We specifically focused on the development of tools or methods to facilitate students’ adoption of storytelling in design pitching since storytelling is intrinsically required and happens naturally when pitching.

In this thesis, an investigation on the ideation, development, and evaluation of tools in support of planning stories for pitching design concepts is conducted. Guided by a research-through-design approach, a tool named Pitchify is defined, iteratively designed, and evaluated. It is a set of templates and cards that can guide design students through the process of planning a story for pitching a design concept. The tool has been tested and accepted as useful by participants such as industrial design students from diverse cultural backgrounds.

We conclude that the industrial design students’ acceptance and adoption of storytelling in their design practice can be enhanced and improved provided that this is facilitated by appropriate tools or methods. Two contributions are worth mentioning. First, the gap between the literature which predominantly highlights the benefits of story/storytelling, and the adoption of storytelling by industrial design students in their design practice is investigated, and the lack of accessible tools is identified as an important obstacle. Second, a tool specifically aimed at planning stories for pitching design concepts is iteratively designed and evaluated. Lessons are learned all along the whole process based on reflection and discussion.
Chapter 6 Supporting students to plan stories for pitching design concepts with Pitchify tool

6.1 Introduction
6.2 Related work
6.3 Methodology
6.4 Results
6.5 Discussion
6.6 Conclusion

Chapter 7 Conclusion

7.1 Introduction
7.2 Main research findings and contributions
7.3 Limitations and recommendations for future work
7.4 Concluding Remarks

Appendix

Appendix 1: A questionnaire for the claims on the values of storytelling in design (chapter 2)
Appendix 2: The questionnaire for the acceptance of storytelling templates (in chapter 2)
Appendix 3: The USE questionnaire (chapter 4)
Appendix 4: Evaluation on the pitches (chapter 4)
Appendix 5: The video introduction of the Pitchify tool

Acknowledgements

Curriculum Vitae

Published papers

List of Figures

1.1 The structure of the thesis
1.2 The tools mentioned in the online questionnaire and the percentage of participants who mentioned the tool
1.3 The top-10 tools with their recommendation percentages and some reasons for recommendation
1.4 The winning storyboard (picture-based) with the tool StoryboardThat
1.5 1D clusters derived from the retained 11 questions (or attributes) in the questionnaire, presented as vectors in a 2D plane.
1.6 Individual items from the questionnaire used in the internal storyboard contest are represented as vectors in a 2D plane. The vectors representing items in different clusters are coloured differently
1.7 Design space and direction of the storyboarding tools provided by the four tools
1.8 Some photos taken during the three successive studies
1.9 The prototype of a simple storytelling template applied in study 3
1.10 Medians and effect sizes (probability of agreeing) for the 21 claims about the positive role of storytelling in design
1.11 Students used storytelling during the design process
1.12 Examples of the templates using by the students in different groups
1.13 Medians and effect sizes for the 7 questions about perceived usefulness
1.14 Medians and effect sizes for the 7 questions about satisfaction
1.15 Medians and effect sizes for the 7 questions about perceived ease of use
1.16 The procedure of the experiment
1.17 The framework underlying the StoryPrea tool
1.18 The working context for the StoryPrea tool
1.19 Template 1 of StoryPrea tool
1.20 Template 2 of StoryPrea tool
1.21 Template 3 of StoryPrea tool
1.22 Template 4 of StoryPrea tool
1.23 Template 5 of StoryPrea tool
1.24 Template 6 of StoryPrea tool
1.25 Template 7 of StoryPrea tool
1.26 Template 8 of StoryPrea tool
1.27 Template 9 of StoryPrea tool
1.28 Template 10 of StoryPrea tool
1.29 Template 11 of StoryPrea tool
1.30 Guidelines of the StoryPrea tool
1.31 The inspiration cards
1.32 Instruction of using the tool
1.33 The participants using the tool in the test
1.34 Effect sizes (probability of agreement) for the claims on StoryPrea tool
1.35 Effect sizes (probability of higher score) for cultural difference
1.36 Effect size (probability of higher score) for the claims on StoryPrea tool between U1-U2
1.37 Effect size (probability of higher score) for the claims on StoryPrea tool between U1-U3
1.38 Effect size (probability of higher score) for the claims on StoryPrea tool between U2-U3
1.39 Some examples of the ways of filling in the blanks on templates
1.40 Examples of the cases in U2
5.1 The 7 templates included in the Pitchify tool  
5.2 The 10 cards included in the Pitchify tool  
5.3 The poster that was distributed throughout the department of Industrial Design to find students interested in participating in a study on the StoryPre tool  
5.4 Using the Pitchify tool to analyse the pitch made in a previous study  
5.5 Using Pitchify tool to analyse Hans Rosling’s talk  
5.6 Using Pitchify tool to plan a story for a new pitch  
5.7 Some pictures from the design pitching workshop  
6.1 The templates of the updated version of the Pitchify tool  
6.2 The inspiration cards in the updated version of the Pitchify tool  
6.3 An example of one of the inspiration cards 6.6  
6.4 The mid-term and final demo presentation settings  
6.5 Students using the Pitchify tool while preparing their final presentation  
6.6 An example of how the students in group 2 used the Pitchify tool to analyse their design concept and to plan a story for pitching  
6.7 The final design of the two groups shown in demo day  
6.8 Photos of the students’ final pitch

List of Tables

2.1 Comparison of the sketch-based tools and picture-based tools in terms of merits and defects  
3.1 A priori established topics for the focus group  
3.2 Examples of the claims for values of storytelling from papers published from 1996 to 2018  
3.3 Categories and examples of the 120 quotes in study 1 (focus group)  
4.1 Analysis of the similarity between crafting stories and designs  
4.2 Examples of the quotes in category 3—Ease of use  
4.3 Examples of the quotes in category 6—others  
4.4 F-test for the results  
4.5 T-test for the results  
4.6 Examples of quotes from analysing the reasons for pitch preference  
6.1 Insights collected from the co-design workshop with group 1  
6.2 Insights collected from the co-design workshop with group 2
Chapter

ONE

Introduction

1.1 Relevance and motivation

Storytelling plays an important role in design as evidenced by a substantial body of recent literature [1]. Generally, the similarities between design and storytelling, such as the importance of context-dependence and the ability to organize unstructured information [2], support the popularity of storytelling in design [1]. This is why statements that advocate “design as storytelling” [3, 4], and define “designers are storytellers” [5], have recently appeared. Moreover, storytelling is viewed as an important tool for design thinking [6,7], more specifically to assess the critical factors for the success of design processes and outcome [8]. Storytelling is used in diverse domains of design including user experience design [9–11], computer supported cooperative work (CSCW) [12], service design [13], interaction design [3,14], etc., playing different roles such as sharing design ideas and perspectives [15], conveying information, promoting communication [16,17], informing and inspiring design [18], as an inquiry to collect user stories [3], as a way to represent the subjective aspects of experience [19], and to trigger empathy [20]. Especially, storytelling is a promising way to support designers to discuss human-related aspects like emotions, motivation, desire, needs, etc., as a “common language” [21], because stories can clarify them and make them more concrete by incorporating them into accounts with vivid characters, rich descriptions of the context and human activities, all incorporated within a story that guides the audience into understanding the plot [14]. Stories are often visualized and shared in the form of storyboard [22].

While the huge body of prior studies on storytelling in design indeed provides useful insights and references from various perspectives, it seems still an insufficiently-tapped territory where additional studies are required as literature at large highlights the values of storytelling but is empirically weak with regard to the design practitioners’ practice of storytelling [1]. The challenges and problems seem to be underestimated, and also worthy to be investigated. Within this context, the research presented in this thesis is actually an empirical exploration of the adoption of storytelling in design. The research in this thesis starts from StoryPly, which is a method developed by our research group that aims to support designers in envisioning and discussing user experience through crafting and visualizing stories [23]. StoryPly is proposed as a method and/or tool in assistance to crafting stories based on classic theories such as Campbell’s work [24], Freytag’ Curve [25], and Field’s Paradigm [26], etc. It supports crafting and visualizing stories by providing templates which design practitioners need to fill in, and which guide them through the process. This is one instance where the design practice of storytelling is researched and also supported in the way of developing a method or tool for assistance. This is also an important instance which provides insights that there seems to exist a discrepancy between the slow acceptance of storytelling by design students, on the one hand, and the theoretical
claims on the benefits of storytelling [1], on the other hand. More specifically, observations of the application of the StoryPly method by industrial design students within our department revealed two obstacles for acceptance. First, storyboarding is perceived as a bottleneck in applying the storytelling method. Second, design students demonstrated relatively little interest in storytelling (the method itself) despite being encouraged by their tutors and being introduced to the benefits in favour of storytelling.

There issues with the StoryPly method invite further study, and we adopted them as starting points for our own research. More specifically, we wanted to figure out the reasons behind the observed phenomenon. We quickly discovered that the lack of empirical studies questioning the impact of storytelling could also be observed in a lot of the related literature. The research presented in this thesis primarily focuses on industrial design students within our design department since the implications only indicate a local problem as there may be different cases in other universities or design schools. Several exploratory studies are carried out to understand the students’ adoption of storytelling, guided by the three following research questions:

Q1: Why is storyboarding perceived as a bottleneck in applying storytelling methods, and how to the practice of storyboarding, be improved, especially from the perspective of tool assistance?
Q2: How do industrial design students adopt storytelling in their design practice? What are the problems that they encounter, and how can these problems be addressed?
Q3: How can storytelling in design be supported by appropriate tools and/or methods? What are the characteristics of such tools and/or methods?

1.2 Research Approach

Our research can be characterized as exploratory, based on real-life insights, and design-oriented. We thus position our research as a practical approach in design research, achieved by means of research-through-design [27]. On the one hand, as “design research is framed as research on a condition that arises from a number of phenomena in combination”[28], the research-through-design approach is quite suitable for practice-based exploratory research. On the other hand, this approach is also referred to as design-oriented approach [28] under which an artefact or prototype which is embedded with design knowledge and research hypothesis [29] is developed, and iteratively improved based on findings of the evaluation and the generation of knowledge, and ultimately become as an attempt to transform the world from the current to a preferred state [30]. In addition, design is a reflective practice [31], during which design knowledge and insights are obtained through both reflecting in and on the design actions. And these reflective actions are conducted through the whole research process, mainly relying on mixed research methods providing a greater depth and breadth of information [32]: the quantitative method, which features the collection and analysis of data by utilizing mathematically-based methods [32] such as surveys with questionnaires and user testing; and the qualitative method, which emphasizes exploring and understanding [32], and helps to describe details in specific contexts [33] for instance, conducting interviews or observations.

According to these points of view, the thesis consists of explorations which are reflected in the five body chapters. Specifically, in the initial phases (Chapter 2, 3 and 4), we make design propositions for how to facilitate the practice of storytelling and conduct empirical studies, guided by specific research questions, to develop a better understanding of the problems that design students encountered when trying to incorporate storytelling into their design practice. The insights gathered in these initial phases led us to focus on the development of tools that support one specific critical aspect of storytelling, i.e., planning stories for pitching new design concepts. The outcome of this iterative design approach is the Pitchify tool presented in Chapter 4. In the latter phases (Chapter 4, 5 and 6), we gathered feedback from participants using mixed methods, collecting both qualitative and quantitative data on aspects such as usefulness, ease of use, user acceptance, problems encountered and suggestions for improvements, etc. The tool development can be interpreted as an iterative-and-reflective-based design exploration.

1.3 Thesis Outline

This thesis consists of 7 chapters, and presents four explorations which are reflected in the five body chapters. Figure 1.1 summarizes the structure of this thesis, and gives a visual overview of the relations between theoretical background, research activities and concrete contributions.

Chapter 1

In chapter 1, we establish the research background of storytelling in design, and clarify the motivation, purpose, and research approach. The research questions are listed and the structure of the thesis is outlined.

Chapter 2

Chapter 2 describes exploration 1 on storyboarding tools to answer the first research question. This exploration is based on the insights collected from the
research with the StoryPly method, and concludes with a proposition of three design directions for future storyboarding tools.

**Chapter 3**
In Chapter 3, exploration 2 is presented to answer the second research question. In this exploration, the research focus is on the adoption of storytelling by industrial design students in their design practice based on insights that there exists a discrepancy between the slow acceptance of storytelling by industrial design students and the theoretical claims on the benefits of storytelling. An in-depth overview on literature of storytelling in design is conducted with the conclusions in classification for the related literature. And then Consequently, we decided to undertake an iterative design exploration into a tool aimed specifically at supporting storytelling for pitching design concepts.

**Chapter 4**
Chapter 4 introduces a preliminary design exploration which describes the development of the StoryPrea tool and the evaluation of its acceptance by industrial design students. One interesting aspect of this study is that it was conducted with students from different cultural backgrounds, which revealed some systematic differences in the feedback that they provided. The answer to the third research question is probed both in this chapter and the following two chapters.

**Chapter 5 and Chapter 6**
In these two chapters, we formalize the design that emerged from the design iterations and evaluate the final design prototype of the Pitchify tool.

**Chapter 7**
In chapter 7, the conclusions are summarized. Some important contributions are highlighted, and directions for future research are indicated.

---

**Figure 1. The structure of the thesis**
Chapter TWO

Requirements Gathering for Tools in Support of Storyboarding in User Experience Design

This chapter is based on


Abstract

Storytelling is an often-used method that supports communication in early User Experience (UX) design, and the resulting stories are frequently visualized in the form of storyboards. However, storyboarding, the creation of storyboards, has also been identified as an important obstacle in adopting storytelling in UX design. Most UX designers do not possess the drawing skills needed to produce professionally-looking storyboards. This problem can potentially be overcome (or at least ameliorated) by using alternative (digital) storyboarding tools. A study into the user acceptance of existing tools is described in this chapter. The results show that while traditional tools like pen and paper are still very much valued, digital tools are getting increasingly popular. The limitations of existing tools are identified and the requirements for future storyboarding tools are formulated as the outcomes of this study.

Keywords

Storyboarding, Design Tools, User Experience Design, Storytelling, Communication

2.1 INTRODUCTION

As evidenced by a considerable amount of literature, storytelling has been applied in the field of design for various purposes because of its multiple benefits such as its values as a design thinking tool [6] and as a way for sharing design ideas [12]. Especially in early phases of user experience design, storytelling supports communication, and the resulted stories are often shown as storyboards. This chapter introduces the first exploration in the research on storytelling in design in order to provide the answers to the first research question as outlined previously in Chapter 1. It was started from the StoryPly [34] method, which was developed for crafting stories to facilitate early user experience design as documented in the P.D. thesis of Berke Atasoy [34], and it was an important part of the research on storytelling within our research group. This chapter was based on observations made in about 20 workshops conducted with this Storyply method. Some of these workshops involved professional design teams, while others were conducted with teams of design students. These observations support the assumption that storytelling is a valued technique in the conceptual design of user experience (UX), especially if it is supported by a structured method such as StoryPly [34]. In order for the method to be effective, however, at least one team member (or the moderator) needs to be skilled in storyboarding, as the process of making storyboards is perceived by many participants, especially those who lack drawing skills, as the major bottleneck for adopting the Storyply method. Other
researchers also pointed out a similar phenomenon, i.e., that there are still challenges for design practitioners in the creation of storyboards [35], despite storyboarding being a common technique in design. Storyboarding is an important skill but seems difficult to apply effectively in practice [35]. While techniques for storyboarding are often suggested in literature, tools for storyboarding are instruments [36] which can play a prominent role in supporting design activities, and be especially beneficial for novice practitioners. In this chapter, we aim to understand the practice of storyboarding from the view of tool support within the field of UX design. An empirical investigation was executed to get an overview of existing storyboarding tools, namely which tools are currently available for supporting the creation of storyboards, especially for UX design practitioners with limited drawing skills, and how they are incorporated in current practice. The user acceptance of such tools was assessed, and the requirements for future storyboarding tools were identified.

The extant literature on tools for storyboarding predominantly focuses on tool development, more specifically on how to take advantage of new interaction technologies [26–30] such as multi-touch, Augmented Reality (AR) and Virtual Reality (VR). Very little effort has up to now been dedicated to studying whether or not such tools actually succeed in supporting designers in storyboarding, let alone that they answer the research question as to whether or not such tools could be used in the conceptual design of user experiences.

In this chapter, an explorative study into existing tools in support of storyboarding for early UX design is conducted. The purpose is twofold, i.e., to get an overview of tools currently in use for storyboarding in UX design as well as to better understand their usefulness for storyboarding in early UX design. Our three main research questions are the following:

Q1: Which tools do UX design practitioners (including both professionals and students) currently use for storyboarding, and what motivates them to use these specific tools? (what and why)

Q2: How do these tools support storyboarding and how well are the outcomes produced by such tools appreciated by UX design practitioners? (utility, usability and satisfaction)

Q3: What are the limitations of existing tools for storyboarding, and how to deal with these problems? (proposed improvements and future design requirements)

We first discuss our motivation for conducting this study in more detail. Next, we introduce the research methods and outline the process, after which we analyse the findings from our explorative study. Last but not least, we identify design requirements for future storyboarding tools. These requirements are used to identify concrete opportunities for improving existing tools.

2.2 BACKGROUND AND RELATED WORK

2.2.1 Story / Storytelling in Design

Story/storytelling has a long history in design. The proposal of “design as storytelling” [4] has attracted many designers and researchers. Theories of story often highlight the classic story structures such as Freytag’s pyramid [25] and Field’s Paradigm [26], etc. A story is thus typically defined with a plot that develops from a beginning, where the characters and context are introduced, through a middle, where conflicts are identified and developed, towards an end where the consequences of proposed actions and interventions are revealed [42].

Literature on story/storytelling in the design field also involves concepts such as narrative [43] scenario/persona [e.g. 12,44,45], design fiction [46], etc. With regard to story and narrative, Paul G.R. and Shirin E. analyse the concept of narrative and story or plot through drawing upon literary theory and film theory, etc., and note that a story is “a sequence of events in time and space” [43] like a route map, and the plot is a way to understand and interpret a story, while the narrative is “an account of the events of the plot” [43] which should take into account aspects such as narrative elements, narrative tense, point of view, etc.

Scenarios have been used before in the scenario-based engineering process [47] for the purpose of illustrating abstract information associated with a system. Typical definitions of scenarios are predominantly agreed scenarios or stories about people and their activities [48], captured in statements such as “descriptions of natural, constructed or imagined contexts for user-product interactions” [49], “a description of a set of users, a context and a set of tasks that users perform or want to perform” [50]. Typically, Rosson and Carroll describe four scenarios used in the development of software: (1) problem scenarios generated as part of the analysis phase in support of a user study or a field study; (2) activity scenarios in the design phase to introduce design ideas about how requirements can be met through new designed functionalities; (3) design information scenarios specifying the objects of a task and the actions that will help users to perceive and make sense of the proposed functionalities; and (4) interaction design scenarios specify how users interact with the software to perform activities [48]. However, human-related aspects are not very prominent in such scenarios. Scenarios thus are often used in combination with personas [51] in the field of HCI and UX design. Persona-based scenarios tell a story in which a main character has a
specific problem or goal, and reaches his/her goals [52] in a context with a concrete product / system. They replace the generic user by a particular person with emotions, actions and needs [52]. They lend theoretically support for our proposition that crafting stories is a core competency when describing and communicating user experience [53].

Going beyond the scenario, story/storytelling supports design in different phases within UXD and HCI, which is why storytelling has often been viewed as lying at the heart of the design practice [43]. Specifically, in the phase of user research, user stories are often collected, analysed, and refined to confirm the pain points or problems, and provide useful contextual information for discussions on user needs or goals [52, 54]. In the ideation phase, design practitioners make use of storytelling to create design ideas [45] and discuss user experience [e.g. 55]. Stories in this phase are predominantly persona-based scenarios that depict the details in the characters and their interaction with products/systems. Stories about design concepts are often visualized as storyboards for communication both internally within a design group in later design phases [e.g. 12], and externally to potential users and stakeholders when making a presentation or pitch. These stories used in the different design phases play similar roles as the four kinds of scenarios introduced by Rosson and Carroll.

In recent years, design fictions have become popular in HCI as a way to explore design requirements within a fictional scenario [46]. It is a story about the future where new technical applications are envisioned and their properties are communicated [46].

2.2.2 Storytelling in UX design

Stories gain details over time and add the human aspects of the products/services [56] so that many design practitioners considered unconsciously in their design practice. Several researchers have indicated that stories are key to understanding user experience (UX). Marc Hassenzahl points out that a user experience is subjective, context-dependent and dynamic over time [57]. He proposes that an experience is actually a story [31–33] we value sufficiently to share it with others. Glebas in turn believes that stories can convince in ways that logic cannot [60] which is one of the reasons why books, plays and films have a continued attraction on people. Queensbery and Brooks have proposed stories as media in user experience design. They connect product ideas to the people who will use such products [9]. Gruen et al. have similarly advocated the use of stories in user experience design [11]. McCarthy and Wright highlight that telling stories is a way of making sense of experiences [61]. H.Korhonen and his colleagues regard storytelling as an effective way to gain a holistic view on the targeted user experience [62]. Storytelling can help to deliver rich information as it provides details about the characters and the contexts in which products or services are expected to demonstrate their value. In short, a story is a well-established way of sharing and communicating emotional experiences. UX design is the design of a product, system or service to enhance positive appreciation [63] such as user satisfaction and/or pleasure. It forces designers to focus on the emotional impact of design ideas. Early UX design is a creative process which alternates between idea generation and problem solving. Communication of and reflection on ideas are the main activities in early UX design. Frequently-used methods for visualizing and communicating design ideas are through sketching, prototyping and/or storyboarding. Sketching is easy and fast but tends to focus on (static) product features. Moreover, it requires skills of hand drawing that many people may not possess, implying that they may think their sketches inappropriate for external communication with project stakeholders. Prototyping often requires a substantial effort and time investment, sometimes requiring assistance by technically skilled personnel, and may not be warranted at early conceptual stages. Storyboarding employs low-tech means to not only describe ideas for products, systems and services but to also make the context of use and the emotional impact on the users explicit. Storyboards not only help to visualize design ideas but also to create a common understanding about a particular problem and the targeted experience of the people involved.

Storyboarding is defined here as the creation of a storyboard that is a visual depiction of a story [35] by a series of sketches, photographs, animations or pictures [64], possibly accompanied by text, speech or audio. Storyboarding has a long tradition in the production of movies, cartoons and animations [65]. Although storyboarding has often been promoted within the area of UX design, there is obviously a bottleneck for design practitioners as observed in the workshops conducted with StoryPly. There is a lack of research on actual practice in literature. Novices experience difficulty when storyboarding, as they lack the tacit knowledge that experts get through substantial practice and experience [35]. Meanwhile, most of the literature either provides recommendation for storyboarding by analysing the elements of a storyboard [35] or stresses the usefulness of sketching and camera shot techniques [22, 34, 41–43], but fails to validate that such techniques match the skills and interests of existing UX designers. Next to the technical aspect of making storyboards, experts and novices alike also encounter problems when trying to apply storyboarding in UX design or facing new design tasks. In addition, storyboarding, to some extent, is the person-scenarios visualized with details of not only the context information like time and place, but also the character’s emotions, behaviours, and their reactions to the products/systems that they interact with, etc., should be introduced and depicted in the storyboards. All of this results it as a complex task...
to create a storyboard within a couple of minutes that not only presents a product idea (what it is) but also clarifies its impact (why it is relevant). This might be the underlying reason for the problem mentioned before that storyboarding is considered to be the main bottleneck for adopting storytelling in UX design. Improving tools that can support storyboarding is therefore a potential solution as tools are instruments [36] that can assist in decomposing complex design activities into steps that are more easily accomplished. Appropriate tools do not only have the potential to assist in the creation of storyboards but can also help to produce a more professionally-looking output that is considered more appropriate for sharing with stakeholders.

### 2.2.3 Storyboarding tools

Based on their physical form, existing tools for storyboarding can be divided into two main categories: (1) much-used traditional tools like pen and paper, and (2) digital tools that involve specialized software, on-line platforms and/or mobile apps. The digital tools can in turn be subdivided into professional tools and non-professional ones. Professional tools, such as Storyboard Pro, Storyboarder and ToonBoomStoryboard Pro, are frequently used by professional storyboarding artists in the production of films and animations. We will however focus on non-professional tools, including tools for storyboard sketching or animation, picture and video editing, as they are less expensive, more general purpose and a priori expected to be more likely candidates for adoption by designers (as will be confirmed by our first study).

A review paper on storyboarding tools by Salim et al. [68] describes and analyses 24 storyboarding tools, concepts and frameworks from the perspective of teaching storyboarding in e-learning environments. However, the paper does not go into the actual use of storyboarding tools, let alone from the specific perspective of UX design. The paper by Truong et al. [35] highlights important characteristics of storyboards as uses them to formulate guidelines for successful storyboarding. It does however not pay attention to the role of tools. There are some tools focusing on interface features for storyboarding either supporting sketching such as Silk [69] and EmoG [70], etc., or supporting interaction scenarios like DENIM [71]. Some recent publications focus on how to create storyboards by means of new digital technologies, such as augmented reality (AR) [40]. The AR Storyboard tool [38] is, for instance, helpful in scene composition and camera motion control. It seems fair to conclude that existing research studies offer only a limited perspective as they focus on facilitating storyboarding, largely ignoring the actual use and effectiveness of storyboards, especially for presenting and discussing UX concepts.

There is no formal definition of storyboarding tools specifically for UX design. Any tool that supports storyboarding by either sketching or by pictures, and even by video or animation, are usually viewed as storyboarding tools. There is hence a variety of tools that could support storyboarding in very different ways. In this chapter, we make an exploration of existing tools in an attempt to understand whether or not such tools facilitate storyboarding in an adequate way. The insights collected from this explorative study will subsequently be used to identify directions for improving existing tools and for developing alternative new ones.

### 2.3 METHODOLOGY

We conducted two separate studies. Firstly, in order to get to know how UX design practitioners view existing tools for storyboarding, an online questionnaire was distributed among both UX designers and design students. The questionnaire contained both closed and open questions, the latter ones addressing aspects such as: which tool(s) do you use and for what purpose. We also asked the participants to recommend one favourite tool and to share their arguments in favour of this choice.

All tools reported in the questionnaire were categorized and ranked, and a selection of representative tools was selected to be included in a follow-up study. This selection included both sketch-based and image-based techniques, as well as combinations of the two. The second study included both an online storyboarding contest and a workshop with students from our department of Industrial Design. Computers and iPads with the tools already installed were provided to the participants in the workshop, while the online users were provided with internet links with download instructions.

Participants in both the online contest and the locally conducted workshop were required to produce a storyboard based on a given UX design task. At the start, they were provided with a story script and had to choose one of the recommended tools. The difference between both conditions was that the participants in the online contest worked individually and separately (with unlimited time) while the participants in the workshop worked as a team in the same room on the same storyboarding task. A USE questionnaire (Usefulness, Satisfaction and Ease of use) [72] was filled in by all participants. In the USE questionnaire, statements had to be scored on a seven-point Likert scale ranging from 1 “Strongly disagree” to 7 “Strongly agree”. A semi-structured interview was conducted with the workshop participants individually after finishing the storyboarding task. In this interview, which lasted for 60 minutes, questions were asked about subjective
opinions on the tool, suggestions for improvements, as well as advice for alternative new tools.

2.4 RESULTS

2.4.1 Results of study 1

The online questionnaire was filled in by 60 participants mainly from the Netherlands (47%), China (40%), the USA (10%) and other countries (3%). The participants were either UX designers (58%) or students (42%) being trained in UX design. All of them had experience in storyboarding as a way to support communication in early UX design. We distinguished their storyboarding experience into expert (70%), in case they had more than one year of storyboarding experience, or novice (30%), in case the storyboarding experience was less than one year. Sketching only was preferred by 10% of the participants, while 15% indicated to use only pictures; 75% of the participants used a combination of both approaches.

The participants in the questionnaire proposed a range of different storyboarding tools. As Figure 2.1 shows, traditional pen and paper was mentioned by all participants, while the Adobe software programs Illustrator and Photoshop are in use by 40% and 30% of the participants respectively. PowerPoint and Keynote were also liked by a similar percentage (30%) of people, as were web-based platforms (such as StoryboardThat, Pixton) and mobile apps (such as Procreate and Paper 53). The professional tool Storyboard Pro was cited by only 5% of the participants.

Figure 2.1: The tools mentioned in the online questionnaire and the percentage of participants who mentioned the tool
The reasons provided for using specific tools for storyboarding in early UX design were analysed. UX design practitioners adopt tools like PowerPoint/Keynote, StoryboardThat, Photoshop etc. for describing and explaining design ideas to stakeholders. Tools like Procreate, Paper 53 and pen&paper were mainly used for exchanging and discussing ideas internally. The different tools were ranked in terms of frequency of occurrence and the top ten is listed in Figure 2.1, together with some of the reasons for why they were recommended.

The shortlist of tools in Figure 2.1 was used as the starting point for the follow-up study 2. The general-purpose tool of pen-and-paper, the two Adobe software programs (Illustrator and Photoshop), and the presentation software PowerPoint, were not in study 2, as the objective of this study was to collect more detailed information on digital tools which contained specific storyboarding functionality.

Four tools were selected to be used in study 2. Two of them were picture-based tools: StoryboardThat, a web-based tool for storyboarding with pictures, and Pixton, a storyboarding tool with pictures, available as both a web-based and an iPad app. The other two were sketch-based tools: Procreate, an iPad sketch app and 2013 Apple design award winner, and SketchBookExpress, an iPad sketch app.

2.4.2 Results of study 2

15 students participated in the storyboarding contest, consisting of a mixture of undergraduate students, master students and PhD students studying industrial design, all of them used to UX design projects. They rated their experience with storyboarding on a seven-point Likert scale, ranging from 1 (totally unfamiliar) to 7 (totally familiar). As mentioned before, students with more than one year experience in using storyboards were classified as experts (76.2%) while students with less than 1 year of experience were classified as novices (23.8%).

The participants were free to select the tool that most appealed to them, which resulted in the following selection across the 4 tools: StoryboardThat (42.9%), SketchBookExpress (28.6%), Pixton (19%) and Procreate (9.5%). A factor analysis revealed that gender, age, and level of experience of the participants did not have a significant effect on their tool choice.
The results of the USE questionnaire were analyzed with a new program for interactive statistics called ILLMO [73]. A difference between this program and more traditional statistical programs such as SPSS, is that ILLMO is very visually oriented, which makes it easier to learn for users who are relatively new to statistics. The most relevant feature of the ILLMO program for the current discussion is that it contains an advanced clustering algorithm, described in a recent CHI paper [74].

The 30 questions in the questionnaire were first analyzed individually in order to establish whether or not an individual question contains significant differences between at least two of the four tools being rated (Tool 1: StoryboardThat, Tool 2: Pixton, Tool 3: Procreate and Tool 4: SketchbookExpress). Questions that did not contain such significant differences between any pair of tools were obviously uninformative and were removed from the analysis. Only 11 of the 30 questions in the original questionnaire were retained after this pre-processing stage. A 1D clustering of these 11 questions was subsequently performed in order to find clusters of questions that behaved in a similar way. This resulted in 3 clusters.

Cluster 1 is labelled as “Useful” and contains 4 of the original questions (Q11: It helped me to be more productive, Q15: It saved me time when I used it, Q25: I didn’t notice any inconsistencies as I was using it (sub-activities were performed in a similar/consistent way) and Q29: I learned to use it quickly). The internal consistency between the questions in this cluster is also excellent, as expressed through a Cronbach’s alpha of 0.946 (and an average pairwise correlation of 0.814). Tool 2 receives the highest score for the questions in this cluster.

Cluster 2 is labelled as “Meet Expectation” and contains 6 of the original questions (Q17: It did everything I expected it to do, Q22: It was flexible, Q35: It was fun to use, Q37: It was wonderful, Q38: I feel I need to have it (I would use it again) and Q39: It was pleasant to use). The internal consistency between the questions in this cluster is also excellent, as expressed through a Cronbach’s alpha of 0.956 (and an average pairwise correlation of 0.791). As shown in the left graph of Figure 2.5, Tool 3 receives the highest average score for the questions in this cluster.

Cluster C3 contains only a single question, Q15: It was simple to use, as the corresponding pattern. It is significantly different from the answers on any of the other questions.

In order to understand the relationship between the different questions and clusters, 2D clustering was also performed. The result for the three 1D cluster patterns and for the original 11 questions are displayed in Figures 5 and Figure 6, respectively. The length of the vectors in these figures are proportional to the
squared correlation between the average cluster/question score and the projection onto the displayed 2D plane, where the dotted circle indicates perfect correlation.

In Figure 2.5, the clusters C1 and C2 have correlations that are almost equal to 1, implying that the 2D graphical representation adequately summarizes the average cluster scores. As the correlation for cluster C3 is substantially smaller than 1, the 2D graphical representation is however only an approximation of these average cluster scores. Geometrically, this means that the vector representing cluster C3 is not within the plane but points either towards or away from the viewer.

Figure 2.5: 1D clusters derived from the retained 11 questions (or attributes) in the questionnaire, presented as vectors in a 2D plane

Figure 2.6: Individual items from the questionnaire used in the internal storyboard contest are represented as vectors in a 2D plane. The vectors representing items in different clusters are coloured differently.

We can produce an alternative 2D clustering, shown in Figure 2.6, where the 11 retained items from the questionnaire are rendered individually. All 11 items are rendered simultaneously and the lengths of the black vectors are proportional to the squared correlation between the average scores on the different items and the predictions as derived from the 2D graph (i.e., these predictions are the orthogonal projections of the tools, represented by the points, onto the vectors representing the questionnaire items). From Figure 6 we can deduce that Tool 2 (Pixton) scores highest for items in Cluster 1 (which mostly contains items that have a relationship to usefulness) and Tool 3 (Procreate) score highest for items in Cluster 2 (which mostly contains items that confirm that the tool meets the expectations).

From the picture-based tools, Tool 1 (StoryboardThat) and Tool 2 (Pixton), the latter tool is clearly the preferred one (although it is not the one that is selected the most). From the sketch-based tools, Tool 3 (Procreate) and Tool 4 (Sketchbook Express), the former tool is the preferred one (again, it is not the one that is selected the most). Tools 2 and 3 are therefore the most likely candidates to start from when trying to develop improved tools. Tool 2 (Pixton) could be improved by increasing the score on items in Cluster 2 (meets expectations) in Figure 6, while Tool 3 (Procreate) could be improved by increasing the score on
items in Clusters 1 (useful) in Figure 2.6. Note that Tool 2 is also simpler to use than Tool 3.

2.4.3 Results of the interviews

The answers in the interviews were firstly transcribed verbatim and individual quotes were extracted and labelled. To guarantee the consistency of the coding process, 3 researchers, including the first author of the paper and 2 other researchers who are familiar with qualitative content analysis but not with the specific aims of the study, were involved in the coding process.

There were 321 quotes in total. We identified 27 quotes that were related to the need for new storyboarding tools; 88.8% of them confirmed the need for alternative tools. For instance, one participant believed that “It is necessary to have some better new tools” while another one stated “It is urgent to develop new tools which can better support storyboarding”. The remaining 11.2% quotes contained obscure remarks such as “I am not really sure” or “I have no idea”.

We identified 198 quotes related to strengths and weaknesses of the selected tool. 85 quotes identified positive aspects while the other 113 quotes provided more details about perceived weaknesses. The analysis of these negative judgements revealed four categories:

(1) Device limitations (6 quotes), for instance, “it is limited to be used only on iPad”, or “only a web app is so bad, because I mostly work with PC”;
(2) Functional limitations (43 quotes), examples are “I cannot edit my sketch”, “fewer Undo steps” and “too limited brushes for sketching”;
(3) Interface design (17 quotes), examples are “ugly interface design”, “the layout of the tools is too bad to find and use”;
(4) Communication limitations (19 quotes), for instance, quotes such as “I cannot export my sketches in different format like PDF or JPG picture” and “it does not provide immediate communication and file-sharing with others”.

The finding of the tools’ deficiencies indicated participants’ dissatisfaction with existing tools and helped to identify options for improvement.

The 96 quotes with concrete suggestions for improvements were divided into 5 categories: Functionality (37 quotes), Open-Resource (25 quotes), Compatibility (14 quotes), Help-Support (13 quotes), and Customization (7 quotes). These five categories were further divided into sub-categories to provide an overview of suggestions for improvements and desired (new) features in future tools.

The most prevalent quotes in the different categories are the following:

(1) Functionality: One quote said that “It should provide more tools for sketching”. Another one proposed “to combine the functionalities in both StoryboardThat and Procreate”;

(2) Open-Resource: Accessibility of external sources is important, for instance, one quote proposed “to upload and download the templates freely”, another stated that “It should provide online searching for necessary images”;

(3) Compatibility: The focus was on different platforms and media. The quotes highlighted aspects such as “to use the tool both on mobile devices and PC” and that “audio and visual resources to be used together”;

(4) About Help-Support: The quotes emphasized many different aspects such as “provide instruction especially for new beginners”, “sometimes need to ask my friends for help when storyboarding”, “sharing through different methods like email, social media”, and “storyboarding with team members together”;

(5) Customization: The quotes addressed the importance of meeting personal needs, for instance “The tool should provide different choices for different kind of users” and “It should provide the functionality for personal setting like setting favorite sketching brushes”.

2.5 DISCUSSION

The results from study 2 indicate that none of the recommended tools performed optimally on all relevant attributes. Hence, it is worthwhile discussing design directions for future storyboarding tools, either by improving existing tools or by design alternative tools.

Before entering into details, we should be aware that storyboarding is a form of creative expression, and that tools for storyboarding should possess features that have been identified as being important for all tools supporting creativity [29], such as supporting exploration, low threshold for both novices and experts, fun to use, etc. As designing storyboarding tools is in itself an example of UX design, different contexts of use and distinct user characteristics, such as novice vs expert, individual vs team, sketch-based vs picture-based, co-located vs remote cooperation, etc., will influence the prioritization of wanted functionalities.

The identified design directions for future storyboarding tools are as follows:
2.5.1 Design direction 1: Classification and optimization for functionalities

Tools for storyboarding can be sketch-based, picture-based or a combination of the two. No matter which style is adopted, it is important to comply with features that people have gotten used to from general-purpose programs such as Photoshop, Illustrator, PowerPoint, etc. Such features can be classified into different categories: drawing (brushes, colors, lines, eraser), image editing (move, add, delete, rotate, insert, resize, zoom in/out), image import/export, communication (chat, inviting, messages), collaboration (sharing, co-sketching, upload, download), organization (preview, overview, image files) and others like searching. They can be optimized per category, for instance, adding missing ones (like Undo, filter, layer) to image editing, or providing more brushes and colors to support drawing or making it more convenient for sharing by offering more options rather than only email.

Another option for optimization for functionalities is from the perspective of specific attributes. Based on Figure 2.6, we can conclude that Tool 2 (Pixton) and Tool 3 (Procreate) are superior to the other two (Tool 1: StoryboardThat and Tool 4: SketchbookExpress). It therefore makes sense to consider optimization starting from these two tools that users already like. We should however keep in mind that there is also one aspect, simple to use in Cluster 3 in Figure 2.6, for which inspiration can be drawn from another tool (Tool 1). In Figure 2.7, the two clusters (purple and orange) indicate the major design dimensions. Based on Tool 3 (Procreate) which scores best in terms of items in (the orange) Cluster 2 (meet expectations) in Figure 2.7, it could probably be improved on aspects such as efficiency (i.e., aspects such as saving time which are part of (the purple) Cluster 1 in Figure 2.7).

Since Tool 3, Procreate, is a sketch-based tool, users think it is flexible and fun to use. However, if users are not skilled in sketching, the possibility to include pictures (or sketches that are automatically derived by processing images) may be a valuable way to improve the visual quality of storyboards and/or may save substantial time. Hence, improvement in functionalities that are inspired by picture-based tools, such as easy input, output and editing of pictures, could be added to make Procreate more productive and suitable for the task of creating storyboards.

The feedback from participants indicates that Tool 2 (Pixton) provides efficient means for constructing storyboards, but produces an output that looks rather childish, which makes it less suited for professional applications, especially when considering presentations. The items in Cluster 1 in Figure 2.7 indicate that sketches seem to be much more acceptable. Providing opportunities for sketching on top of storyboards produced by Pixton, up to the point where the original storyboards are completely hidden, may be a way to successfully combine positive features of both tools.

2.5.2 Design direction 2: Hybrid storyboarding support and cross-device interaction

There is no single tool that meets all user needs. However, the four recommended tools each have their own attractive properties. The strengths and weaknesses of tools in both the sketch-based and picture-based categories are compared in Table 2.1.

![Figure 2.7: Design space and direction of the storyboarding tools provided by the four tools](image)

<table>
<thead>
<tr>
<th>Category</th>
<th>Merits</th>
<th>Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sketch-based</td>
<td>Freedom</td>
<td>Need drawing skills</td>
</tr>
<tr>
<td></td>
<td>Self-control</td>
<td>Output quality</td>
</tr>
<tr>
<td></td>
<td>Rapid</td>
<td>Personal style</td>
</tr>
<tr>
<td></td>
<td>Inspiring</td>
<td>Not easy to understand</td>
</tr>
</tbody>
</table>

Table 2.1: Comparison of the sketch-based tools and picture-based tools in terms of merits and defects
Picture-based tools are useful and productive because they are convenient, especially for users who are not skilled in drawing, as they use readily available pictures as building blocks. As sketch-based tools require drawing skills, they are mostly appreciated by users who favor the freedom of expression in storyboarding. According to the feedback received in the storyboard contest, 63% of the participants believed that the optimal storyboarding solution should combine sketches and pictures. In practice, many people use multiple tools for storyboarding. Hence, it makes sense to discuss hybrid tools that use pictures but that also support sketching. Users should be offered the freedom to use either or both of these two approaches. For example, if users don’t know how to draw by hand, they should be provided with the option to take photos, download or import pictures as templates and make modifications to such material rather than having to start from a blank canvas. This is sometimes called hybrid sketching [22], as it combines sketched elements with photos. Another example is where users can make storyboards with pictures or icons stored in the tools and then add more details such as dialogues, emotions and other necessary elements by means of sketching.

At this point, it is also important to point out that storyboards are not limited to be sketches or pictures. In UX design, animations [29] and videos may offer alternatives. Hence, there are also opportunities for new hybrid storyboarding tools that take full advantage of not only sketches and pictures, but also alternative media such as speech music, animations and videos.

Hybrid storyboarding can also be supported by improving the compatibility with existing tools. For instance, allowing designers to edit images in professional software like Photoshop for better visual effect and export them to tools which are more suitable for creating storyboards may be a way to combine the best of both worlds. It would also avoid the painful (and error-prone) process of copying (and debugging) well-established methods into a new storyboarding program.

Another feedback that we received is worthwhile to be highlighted here. It was implied that tools are likely to have more impact if they are supported on multiple platforms or devices. People are increasingly getting used to across-device interactions that combine traditional media such as pen on paper with digital devices such as mobile phones, tablets, PCs, big multi-touch screens, electronic whiteboards, and increasingly also augmented reality (e.g., based on Kinect), as these new technologies provide new means of creating and presenting content. This is also in accordance with recent literature stating that digital technology is an “excellent means of promotion and distribution” [40]. Such flexible combinations of diverse technologies within prototypes (sometimes called “hasing” in the field of design) are also ideally suited to support storyboarding in the context of UX design. For better communication (discussion and presentation of design ideas), the efficiency and effectiveness of content sharing and annotation should definitely be taken into consideration when judging the design of new tools.

2.5.3 Design direction 3: Open-resource supporting collaborative storyboarding

An insight gained both from the observations and the interviews in the storyboarding workshop is that it is not unusual to seek external support for storyboarding, as UX design nowadays is increasingly a team effort. Hence, the third design direction for storyboarding tools is looking towards crowdsourcing support (either online or within the local community) for collaborative storyboarding. This would mean that part of the project budget would be set aside to finance crowdsourcing competitions that can help in realizing the storyboards that are needed for the project. This means shifting emphasis from creating storyboards to specifying storyboards (e.g., through story scripts).

Members of a design team can potentially also play different roles in storyboard co-construction and modification, and may profit from alternative tools, provided of course that the storyboards can be easily transferred between such tools. Even in the context of co-located team work, open-resource tools can be beneficial for collaboration. StoryCrate [41] is a recent example of a system that supports collaboration on a storyboard (for film production) by creating a shared representation on a table-top with a tangible interface.

2.5.4 Limitations of the study

The number of participants in our studies was reasonable but still limited (60 participants in study 1 and 15 participants in study 2), so that the results are mostly useful for identifying interesting directions for improvement rather than for validation. In study 2, all the participants were design students from our department of Industrial Design (no professional UX designers were involved in

<table>
<thead>
<tr>
<th>Picture-based</th>
<th>Good quality</th>
<th>Time-consuming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to use</td>
<td>Limitation in supporting details</td>
<td></td>
</tr>
<tr>
<td>No sketch skill</td>
<td>Style-consistence</td>
<td></td>
</tr>
<tr>
<td>Free picture choices</td>
<td>Learn to use it first</td>
<td></td>
</tr>
</tbody>
</table>
study 2). The focus of the studies was also on creating storyboards, so that other aspects, such as facilitating communication and collaboration for storyboarding, have not yet been studied in depth.

We noticed that there was quite some overlap between the clustering obtained from the quantitative analysis and the coding and identification of categories in the qualitative analysis, which argues for a more integrated analysis of both types of data, such as using the categories identified in the qualitative analysis to identify a priori clusters of the items in the quantitative analysis, hence implying a priori boundary conditions on the quantitative clustering.

Our studies mainly focused on usability, usefulness and users’ subjective opinions on the four recommended tools. Observations of how people actually use their tools during the storyboarding process were not available in case of the storyboarding contest (given the context of a contest, we just gave participants the task, and it was not convenient to gather them for observation). Some important aspects may hence not be reported as people may not remember or judge as relevant some of the issues that occurred during the process when responding to the questions in the questionnaire or interview.

Key to UX is that an incomplete picture is bound to arise if we only study the usefulness and usability of tools and ignore the use context and user characteristics, such as the cognitive and behavioral abilities of the participants involved in a storyboarding process. For instance, in our study, an obvious confounding factor is that participants who are good at sketching mostly prefer sketch-based tools for storyboarding while participants who are not proficient in sketching prefer picture-based tools. The experience with existing tools and the expectations of the environment are other obvious factors that influence the preference for one tool or the other.

2.6 CONCLUSION

This chapter provides several distinct contributions. Firstly, it provides an overview of existing tools that are often used by UX designers for storyboarding. Secondly, it presents a study in which 4 existing tools for storyboarding were evaluated and the feedback on aspects such as usefulness, ease of use and satisfaction, etc. for these 4 tools was collected and analyzed. Thirdly, it identified design directions for future tools based on the results of the studies. As part of the research process, we showed how techniques such as cluster analyses of both qualitative and quantitative data can be used to help structure the large amount of gathered experimental data. Moreover, it is shown how a graphical model of the design space, such as in Figures 2.5, 2.6 and 2.7, can be used to identify directions in which to improve existing tools.

When facilitating storyboarding, tools should not be ignored, which is why we were interested in identifying design directions for storyboarding tools. We proposed three main directions for future storyboarding tools. The first one is to focus on the functionalities of the tools, and to draw inspiration from tools that are already widely adopted. The second direction is to develop hybrid storyboarding tools which can combine the advantages of sketch-based (such as Procreate) and picture-based (such as Pixton) tools and that support an easy transfer between digital and physical media. The third direction is to involve crowdsourcing into the storyboarding process, shifting the emphasis from making to specifying storyboards and using competitions to optimize results.
Chapter

THREE

Why (not) adopt storytelling in design?
— Identifying opportunities to enhance students’ acceptance of storytelling

This paper is based on


Abstract

Several methods and tools have been developed to support storytelling in design. While the benefits of storytelling have been argued extensively in literature, the willingness to adopt it in actual practice, especially in students’ design projects, has however been slow. The lack of empirical studies on actual adoption of storytelling calls for a deeper understanding of the considerations that influence design practitioners, especially design students, to adopt or reject storytelling in design. This chapter presents an exploratory study that aimed to identify the main obstacles that design students raise against using storytelling in their design process, and to explore ways to address such obstacles. The results imply that the main underlying reasons for poor adoption are the lack of perceived usefulness and the lack of tools that support the practical application. Based on the experimental observations, an opportunity for enhancing students’ acceptance of storytelling is identified.

Keywords

Storytelling, Design, User Acceptance, Tools, Design Pitching

3.1 Introduction

The suggestion to incorporate storytelling into the design process is not new, and has even inspired new design methods or tools. StoryPly [75] is an example of a recent method that has been developed by our research group. It is a method supporting designers to envision and discuss user experience through crafting and visualizing stories. Based on StoryPly, which was the starting point of my research, storyboarding (we explained it as visualizing stories by any approach) became the direction in my early research. The user tests of StoryPly implied that storyboarding was perceived as a bottleneck in applying storytelling methods [75]. Thus, in chapter 2, we conducted an exploration into tools that can support storyboarding [42]. While design students did participate in the studies, they were at the same time observed to show relatively little interest in storytelling (the method itself), despite being encouraged by their tutors and being introduced to the potential benefits in favor of storytelling as defined in literature. Specifically, students were confronted with the lack of argumentation for the relevance of their design concepts and how storytelling could potentially help them to take aspects of the context and the user better into account when arguing the value of their design concepts. Despite such arguments, students at large argued against the use of storytelling. For instance, one student complained that: “It’s useful, but I don’t want to use storytelling in my design” in our previous study. This discrepancy between the positive attitudes towards storytelling and the resistance to actually adopt it by design students in their design projects pushed me to change my research direction from storyboarding tools into design students’ adoption of storytelling.
Extant literature provides several arguments for the statement that designers are storytellers [5]. Advocates of incorporating storytelling into design have highlighted its value as an important design thinking tool [6], as an inquiry [4], to collect user stories, and as a method for communication [12] to share design ideas, convey information, etc. The benefits seem to be apparent, but a closer inspection of literature has not revealed any empirical studies that lend support to such theoretical considerations. In order to understand the conflict between theoretic claims and the observed reluctance in our design students to adopt the method in their own practice, in this chapter, we undertake an exploration with the aim to collect design students’ opinions on storytelling in design, defined here as any approach adopting story-crafting and/or storytelling in any form applied in design practice. Storytelling is related to narratives, personas as well as scenarios and stories are often visualized and shared in the form of storyboards [21].

More specifically, we aim to collect more detailed information on the following three main research questions in this chapter:

**Q1:** Do design students use storytelling in their design practice?
**Q2:** If (not) using storytelling, what are the reasons?
**Q3:** What are the problems that they encounter and do they have suggestions for how to deal with such problems?

The chapter is structured in three sections. We start with a literature review on storytelling within the context of design. Next, we discuss an empirical study including a focus group, a questionnaire and a field study. We conclude by identifying the main insights obtained and by proposing an alternative opportunity to incorporating storytelling into design.

### 3.2 Related work

Utilizing stories and storytelling in design has become popular, as evidenced by a substantial body of recent literature. On the one hand, the similarities shared by design and storytelling such as context-dependence, and organization of chaotic information, etc. [2] support the persuasiveness of storytelling in design. On the other hand, as the focus of industrial design shifts from creating artefacts towards designing for experience [23], experiential aspects such as emotions, motivation, desire, needs etc. become vital. While these aspects are usually too abstract to be interpreted easily, stories are concrete accounts with vivid characters, rich description of the context, human activities, and told based on a coherent and casual plot [14]. As a “common language” [21], storytelling hence is a promising way to support designers to discuss human-related aspects in design practice. Recent editions of the CHI conference also demonstrate an increased interest in “design stories”, “design futures” and “design fiction” [46], which all rely on storytelling as a way to inspire design.

Literature on storytelling in design can be characterized by three main directions: D1-highlighting values or benefits of storytelling in design; D2-integrating storytelling into the design practice; D3-designing for storytelling.

In D1, values and benefits of storytelling are being stressed. Early in 1996, Erick advocated that storytelling can be a strong power as communication catalyst and can be introduced throughout the design process as an element to initiate a dialogue between designers and users [3]. Peter Llyod et al. identified the role of storytelling in developing a common language within design teams [16], and in the development of design expertise [17]. As an essential part of design thinking [7], storytelling is viewed as a “critical success factor for design processes and outcomes” [8], to inform and inspire design [18], to share design perspectives [15], to trigger empathy [20], and to humanize the design [2].

In D2, the focus is on how storytelling is incorporated into different domains of design in various ways. It is important in interactive design [14,20], and CSCW (computer supported cooperative work) design [12], and broadly applied in user experience design [52,53], to represent the subjective aspects of experience [19], and to improve the quality of concepts [9]. Storytelling is also an efficient tool in service design [13] to improve the experience in service design [10].

Different types of stories can be distinguished, for instance, fictional stories and customer stories [11], as well as original stories, concept stories and usage stories [78]. In D3, there are some representative studies about designing for storytelling by developing method and tools. For instance, StoryPly [23] is a method for constructing concept stories that allow to explain and discuss the user experience and the end-user value of a design concept. The fictional inquiry method [79], instant card technique [80], as well as Storytelling Group [81], have also been developed to evoke ideas from users for future practice [82]. The UserX story template is designed as a tool for collecting usability requirement by writing stories [83].

To sum up, most literature (especially in D1 and D2) prefers to rationalize the role of storytelling in design. Apparently, literature is empirically weak with regard to the practitioners’ practice of storytelling. Researchers point out the difficulty to craft a good, coherent and design-oriented story without methodical support, and they also suggest to conduct empirical research on methods and guidelines to support it [45]. The observations in the previous studies in chapter 2 showed the same phenomenon in case of Industrial Design students who are neither trained nor experienced in looking into design from the perspective of...
storytelling. It seems a challenge for them to craft and tell a compelling story about their design concepts. Thus, a more in-depth understanding of ID students’ practice of storytelling is demanded in order to comprehend the underlying problems and the reasons for (not) adopting the method in their design practice.

### 3.3 Methodology

We specially focused on ID (Industrial Design) students within our industrial design department in our study primarily because they were observed to be reluctant to adopt storytelling in design, and also they were more readily available than professional designers for an in-depth study. On the other hand, design students are also expected to be early adopters of new design methods and/or tools, which implies that understanding their perspectives is important when developing and assessing the effectiveness of design curricula. An exploratory research was set up including three separate studies: Study 1 — a focus group study, Study 2 — a questionnaire survey, and Study 3 — a field study.

#### 3.3.1 Study 1 — A focus group study

A focus group was conducted with the aim to collect students’ thoughts on storytelling in their own design practice (as shown in the photos in Figure 3.1). 10 student volunteers from our Department of Industrial Design were recruited randomly to participate in this study, and the researcher acted as a moderator for the discussion which was centered around some topics that were established a priori (as shown in Table 3.1). The focus group lasted for 2 hours and was audio-recorded. For each of the questions, more than 80% of the participants shared their opinions either proactively or in response to being asked to give an answer.

#### Table 3.1 A priori established topics for the focus group.

<table>
<thead>
<tr>
<th>No.</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What is your definition of storytelling in the context of (industrial) design?</td>
</tr>
<tr>
<td>2</td>
<td>Did you ever adopt storytelling in your design practice?</td>
</tr>
<tr>
<td>3</td>
<td>If yes, when, why and how?</td>
</tr>
<tr>
<td>4</td>
<td>If not, what are the reasons that you don’t adopt storytelling?</td>
</tr>
<tr>
<td>5</td>
<td>Which problems did you encounter when adopting storytelling in (industrial) design?</td>
</tr>
<tr>
<td>6</td>
<td>Suggestions to promote practice of storytelling in design.</td>
</tr>
</tbody>
</table>

#### 3.3.2 Study 2 — A questionnaire survey

A questionnaire survey was conducted as the second study to understand ID students’ attitudes towards the values of storytelling claimed in the literature, and to identify values that were (not) recognized by students. 130 claims (examples as shown in Table 3.2) were collected from published papers in the period from 1996 to 2018. To match the design context, these claims were categorized into 5 groups by 3 researchers in a coding analysis according to the typical phases (summarized from the claims proposed in both the literature [60,61] and adapted by professionals in their industrial design practice in a process of product concept design: User Study (also defined as Empathy) — Design Analysis — Ideation — Prototyping — Presentation/Pitch. In the coding analysis, the 3 researchers first worked separately and then had a joint discussion to make the final selection of the claims. One researcher is the author of this thesis, and the other two researchers were fellow PhD students who were quite familiar with the coding method but not with the topic of the study. All three researchers categorized the claims based on their own understanding on both the claims and the 5 phases of industrial design process. In the end, 21 claims (specified in Appendix 1) were selected to be included in the questionnaire. They were the most representative ones in each category proposed by established researchers in the field, such as Thomas Erickson, Dan Gruen, Tim Brown, etc. In the questionnaire, the 21 claims were listed and scored on a seven-point Likert scale ranging from 1 “ Totally disagree” to 7 “ Totally agree”. The questionnaire was distributed within our Department Industrial Design, and 31 filled-in questionnaires were collected for analysis. The claims were ranked by the researcher based on the scores that were assigned to them, and the three claims that were most appreciated were discussed with ID students in order to establish opportunities for the practical usefulness of storytelling.

#### Table 3.2 Examples of the claims for values of storytelling from papers published from 1996 to 2018

<table>
<thead>
<tr>
<th>Year</th>
<th>Claim</th>
<th>Paper</th>
<th>Researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>Stories in Participatory work may be used as triggers for conversation, analysis or feedback.</td>
<td>Participatory design</td>
<td>Muller, M. J., &amp; Kalin, S.</td>
</tr>
</tbody>
</table>
3.3.3 Study 3 — A field study
A field study was conducted to understand aspects related to the acceptance of a specific storytelling tool. We observed the design practice of student-teams (including both master and bachelor students) over the course of an entire semester while they were executing their design project (specifically, in a design squad named Creative Design within our Department of Industrial Design). More specifically, this field study comprised three steps:

In step 1, a prototype of a simple tool that was intended to support students in telling stories about their design concepts was introduced to the students at the beginning of their design project. It is a physical template with five pages, where the different parts are entitled as Beginning, Development, Climax, Solution and Ending. It is based on Freytag’s five-act structure curve [86] and provides a basic framework for telling a story. Each page consists of a title, a short explanation and a blank area (shown in Figure 3.2) where students can provide content for their story in the form of text, drawings and/or images. The template was introduced to the students right at the beginning of their design project. An example was provided to make sure they could understand how to use the template. Then the students were encouraged to tell a story about their design concepts guided by this template, but its use was not enforced. They were free to use the template whenever they felt it suited their purpose. For instance, they could use it to show and share their ideas in the phase of ideation. Observations were made during weekly progress meetings of the design squad, and recorded in the form of notes, photos, etc. The observations were also semi-structured as the researcher closely worked with the students, for instance, participating in their discussion and presentation, to better see what they were doing, whether they were using the template or not, why or why not, and how they actually used it.

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>Stories reveal a user’s eye view of the landscape and provide an extremely effective way for getting people both designers and users involved and talking with one another. Design as storytelling Thomas Erickson</td>
</tr>
<tr>
<td>2000</td>
<td>Stories are particularly valuable for conveying the benefits. Stories and storytelling in the design of interactive systems</td>
</tr>
<tr>
<td>2000</td>
<td>Stories convey functionality of a proposed solution or service. Stories and storytelling in the design of interactive systems</td>
</tr>
<tr>
<td>2000</td>
<td>Stories serve as a common language, valuable for conveying the benefits of collaborative systems</td>
</tr>
<tr>
<td>2000</td>
<td>Storytelling introduces a narrative element into designing, a description of related events which link people over time. Storytelling and the development of discourse in the engineering design process Peter Lloyd</td>
</tr>
<tr>
<td>2002</td>
<td>Stories are useful in all phases of a software development project. The use of stories in user experience design Gruen, D., Rauch, T., Redpath, S., &amp; Ruettlinger, S.</td>
</tr>
<tr>
<td>2004</td>
<td>Storytelling is a critical success factor in design processes and outcomes. Storytelling as a critical success factor in design processes and outcomes Craig A. DeLarge</td>
</tr>
<tr>
<td>2006</td>
<td>Design stories are a communication tool that makes a design sufficiently tangible to allow judgement by others and provide guidance for the development team. Design as storytelling Patrick Parrish</td>
</tr>
<tr>
<td>2007</td>
<td>Storytelling can be a useful tool to establish an unbiased communication with user, since it allows professional to design not only focusing on concrete characteristics of products, but also on emotional aspects which can be difficult to obtain through a direct dialogue. Storytelling and repetitive narratives for design empathy: case Suomenlinna Fritsch, J., Judice, A., Soni, K., &amp; Tretten, P.</td>
</tr>
<tr>
<td>2008</td>
<td>Storytelling is part of the process in design and prototyping (or prototyping) interactive systems. Prototyping services with storytelling Bill Moggridge</td>
</tr>
<tr>
<td>2010</td>
<td>Storytelling approach can be applied during the whole design process to improve the quality of the developed concepts regarding UX, as well as to support designers in exploring and communicating their new concept idea. Storytelling for user experience design Quesenberry, W., &amp; Brooks, K.</td>
</tr>
<tr>
<td>2011</td>
<td>Stories put ideas into context and give them meaning, and are essential to design thinking. Change by design Tim Brown &amp; Barry Katz</td>
</tr>
<tr>
<td>2011</td>
<td>Stories have the advantage of working in time. Change by design Tim Brown &amp; Barry Katz</td>
</tr>
<tr>
<td>2015</td>
<td>Storytelling during a presentation is an excellent way to sell design ideas. Once upon a time: storytelling in the design process HUNSLUCKER, A. J., &amp; SIEGEL, M. A.</td>
</tr>
<tr>
<td>2017</td>
<td>Storytelling can significantly influence the impact on its audience when it is applied to pitching design concepts. Stimulating thinking at the design pitch. David Parkinson &amp; Laura Warwick</td>
</tr>
</tbody>
</table>

Fig. 3.2 The prototype of a simple storytelling template applied in study 3

In step 2, a USE questionnaire (detailed in Appendix 2) with 20 questions (Usefulness—7 questions: Q1—Q7, Satisfaction—6 questions: Q8—Q13, and Ease of use—7 questions: Q14—Q20) was filled in by the students, after they had used the template, to collect their viewpoints on it. In the USE questionnaire,
statements had to be scored on a seven-point Likert scale ranging from 1 “Strongly disagree” to 7 “Strongly agree”.

In step 3, several rounds of a semi-structured interview (as shown in the photos in Figure 3.1) were conducted with the students in different project groups, after they had filled in the questionnaire. In the interview, some questions related to the question in the questionnaire were asked to better understand their interpretation of the question and the reasons for their answer. Other questions aimed at collecting their opinions on the template, and on gathering suggestions for improvements. Each group interview lasted for 60 minutes and was audio recorded.

### 3.4 Results

#### 3.4.1 The results of study 1—a focus group study

10 students, 6 males and 4 females including 4 bachelor students, 4 master students and 2 PhD students participated in the focus group. They were recruited within our Department of Industrial Design, with 4 different nationalities: 4 Dutch, 4 Chinese, 1 Spanish and 1 Indian. The data collected from the audio records was firstly transcribed verbatim and individual quotes were extracted and labelled. The data analysis was followed by a thematic approach [87] which allowed the themes to develop based on prepared questions (as shown in Table 1) that were introduced in the focus group. To avoid the potential personal bias on interpretation and to guarantee the consistency of the coding process, 2 researchers worked together for the analysis. One researcher was the author, and another one was a post-doctoral researcher in our department. We identified 5 main categories in the collected 120 quotes. Only one first-year student had never used storytelling in his previous design work, while all other students could provide examples from past experience of how they used storytelling during oral presentations or when making storyboards. However, 60% of the students told us they didn’t like storytelling very much, for different reasons, against 30% of the students expressing that they did like it, while the remaining 10% of the participants had a more neutral attitude. Table 3 shows the identified categories and some example quotes.

<table>
<thead>
<tr>
<th>Main Categories</th>
<th>Sub-Categories</th>
<th>Quote No.</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>What is storytelling?</td>
<td>10</td>
<td>“Storytelling means to first build a story and then tell it to introduce your design concept to others. Designers can orally tell the story or use storyboards.”</td>
</tr>
<tr>
<td>Current status of storytelling adoption</td>
<td>Use and why</td>
<td>9</td>
<td>“Yes, storytelling/storyboards help to explain how my design concept works, how people interact with it.”</td>
</tr>
<tr>
<td>- Not used and why</td>
<td>1</td>
<td>“I never used storytelling in a design project because I think the sketches and prototypes are clear enough to show my design concepts. I don’t think I need it.”</td>
<td></td>
</tr>
<tr>
<td>When and how</td>
<td>20</td>
<td>“When we make presentations to introduce our design concept, a storyboard is often used, and we also orally told stories based on it.”</td>
<td></td>
</tr>
<tr>
<td>Preference</td>
<td>Like storytelling</td>
<td>3</td>
<td>“Yes. Storytelling makes it easy to show how a user will use the product.”</td>
</tr>
<tr>
<td>- Neutral attitude</td>
<td>1</td>
<td>“My attitude is neutral because I know it’s helpful, but it is not my first choice.”</td>
<td></td>
</tr>
<tr>
<td>- Do not like storytelling</td>
<td>6</td>
<td>“I don’t think so. I know it’s quite useful, but it takes much time and effort when storyboarding.”</td>
<td></td>
</tr>
<tr>
<td>- Other choices</td>
<td>10</td>
<td>“I never only orally tell stories because the audience must depend on their imagination of the story. Instead, I prefer using the sketches or prototypes to show my ideas because they are direct visuals. People can easily and quickly understand my ideas.”</td>
<td></td>
</tr>
<tr>
<td>- Other reasons</td>
<td>15</td>
<td>“We just tell stories in our own style. There is no training or guideline that can support us. We don’t know when should storytelling, and whether we tell the right story in the right way.”</td>
<td></td>
</tr>
<tr>
<td>Suggestions</td>
<td>Possible Solutions and suggestions</td>
<td>25</td>
<td>“If I believe that concrete guidelines or instructions for building a good story are in demand because I always do it in my own style and I don’t know whether it is right or not. There do not seem to be criteria or standards. “Appropriate tools or templates are definitely helpful.”</td>
</tr>
</tbody>
</table>

#### 3.4.2 The results of study 2 (the questionnaire survey)

The questionnaires were answered by 31 design students. The participant division was 54.8% male and 45.2% female, including 38.7% bachelor students, 38.7% master students and 22.6% PhD students. The median scores with 95% confidence intervals for the responses to the 21 claims (listed as the 21 statements
in the questionnaire) are shown in Figure 3.3(a), showing a median response that is significantly above the neutral score of 4 for all claims, except claim C9 — “Storytelling is a critical success factor in design processes and outcomes”. A more meaningful analysis is however to look at effect size. More specifically, in Figure 3.3(b) we show the estimated probability (with 95% confidence interval) that subjects agree with the claim, which corresponds to a score of 5 or higher. The three claims with the highest probability of agreement were related to the ability to convince others about the value of the proposed design: C20 — “Storytelling during a presentation is an excellent way to sell design ideas”; C12 — “Storytelling can deliver understanding when used in a design pitch”; and C16 — “Storytelling approach can be applied as user experience tool to collect insights about the underlying motivation and needs”. The three claims with the lowest probability of agreement refer to the positive role of storytelling in the design process itself: C9 — “Storytelling is a critical success factor in design processes and outcomes”, C5 — “Stories can be valuable at every stage of the product life-cycle” and C10 — “Stories convince people of the value of a proposed product in a real-world domain, and by analogy that it would be valuable in their own settings.”

3.4.3 The results of study 3 (a field study)

[1] Results of the observation (in Step 1 in study 3—a field study)
We involved 30 students within design projects in the field study. They were divided into 8 different project groups consisting of either bachelor or master students. The participant observation showed that 5 of the 8 groups, containing 20 of the 30 students, tried our proposed prototype for storytelling, while the other 3 groups, with 10 students, didn’t (and also didn’t use any other method of storytelling). For these 5 groups, storytelling occurred in different phases, as illustrated in figure 2. For instance, all of them told stories orally but also visually by using storyboards in their mid-term and final presentations. Three groups applied storytelling with the help of the templates to explore alternative solutions in early ideation phases. However, they tried it only once, in the sense that they completed only one set of story sheets in text or simple sketches. One group made storyboards based on the framework provided by the templates for the sake of feedback from peers (other students), while another group did it for the sake of internal reflection upon their design concept at the end of the ideation phase.

The students primarily used storyboards containing sketches or images as the way to present (or pitch) their design concept. The stories in these storyboards showed the influence of using the template, as they paid explicit attention to story elements such as people, scenarios, products, interaction, etc. They are however better characterized as flat narratives rather than true stories, as a story plot or dramatic conflict was not apparent.

Fig. 3.4 Students used storytelling during the design process
[2] Results of the USE questionnaire (in Step 2 in study 3—a field study)

The USE questionnaire was only filled in by the 20 students from the 5 groups that actually used the storytelling templates. They were 11 male and 9 female participants, divided over 14 bachelor and 6 master students. We separately analysed data for three categories of questions: Usefulness (Q1—Q7), Satisfaction (Q8—Q13), and Ease of Use (Q14—Q20). For many of the questions, the participants held views which were relatively close to a neutral attitude, corresponding to a median score close to a value of 4.

The median scores for the 7 questions on perceived usefulness of the storytelling templates are shown in Figure 3.6 (a), showing a significant positive average score for “Q3—useful” and a significant negative average score for “Q5—save time”. This is also reflected in the effect size shown in Figure 3.6(b) which is defined here as the estimated probability (with confidence interval) that subjects have a positive attitude to the usefulness attribute being questioned, which corresponds to a score of 4 or higher. The message conveyed by this analysis is that the provided templates for storytelling were considered useful but that the students were not convinced that using them saved time in their design process.

The median scores for the 6 questions on satisfaction with the storytelling templates are shown in Figure 3.7 (a), while the corresponding effect sizes are reported in Figure 3.7(b). A significant (positive) effect was only observed for Q13—I feel that I need it, while Q11—It’s wonderful was obviously least appreciated (marginally significant negative effect). The students were obviously divided in their judgements and their stance was mostly neutral.
The median scores for the 7 questions on perceived ease of use of the storytelling templates are shown in Figure 3.8(a), while the corresponding effect sizes are reported in Figure 3.8(b). In the section perceived ease of use, participants held positive attitudes to all the questions, except “Q18—effortless”, while the most positive effect was observed for the first 4 questions. This indicated that the templates were generally easy to use but did require an effort when actually using them (which is not surprising, as building a story is a non-trivial creative exercise.)

![Figure 3.8 Medians and effect sizes for the 7 questions about perceived ease of use](image)

[3] Results of the interview (in Step 3 in study3—a field study)
The data from the interviews was condensed into 197 quotes, and subsequently clustered into 4 main categories that can be explained as follows:

Category 1 contained 16 quotes from the interviews with the three student groups who decided not to include storytelling into their design process. Students in one of those three groups believed that “We don’t need storytelling because we are working on prototyping. Once people try the prototype, they can understand what it is and how it works. It’s not possible to only imagine it in a story.”

The other three categories contained quotes from the interviews with the students in the other 5 groups who did apply storytelling in their process; 121 quotes with both positive and negative aspects were collected.

Category 2 — the 54 positive quotes clarified the benefits and strengths of the storytelling templates. For instance, “The templates enhanced our awareness of storytelling as we actually didn’t care about it before, and they helped us to build a story.” And “The templates provided a basic structure for storytelling and promoted thinking about a background story for our design concepts.”

Category 3 — the 67 negative quotes provided more detail about the problems and concerns that the students encountered when they used the templates. These quotes revealed four sub-categories of concerns: (1) about the usefulness of the time and effort invested (19 quotes), for example: “It took both time and efforts. We used about one hour to use these templates to build a story.” (2) about the effort of creating stories (16 quotes) for example: “Storytelling is not simple. The templates helped to build a story, but also required much effort to do it.” (3) about satisfaction with the outcome (17 quotes), examples are: “I am not sure whether I need to use storytelling or not. It depends on the design project.” (4) other concerns (15 quotes), for instance, “I am not good at either storytelling or storyboarding. This is why storytelling is not my first choice.”

Category 4 — suggestions (60 quotes) for improvement of the story templates and the storytelling practice. 15% of quotes identified the need to develop appropriate tools to support and promote storytelling in the design practice. Another direction, supported by 25% of the collected quotes, was to target storytelling more to specific design phases. For instance, “If storytelling is used for a specific purpose in a specific time, for example in presentation, it could be easier to apply. And the tools should support this purpose.” “We mostly use storytelling when introducing or presenting our design to others. But we actually don’t know how to do it better. Support is necessary.” Another main direction, supported by 28.3% of the collected quotes, refers to improving the existing templates (and give them a more professional look and feel). “It needs better graphic design.” “to make the templates more professional with details, instructions and good visual design.” The remaining 21.7% quotes contained opinions that participants shared for how to improve the storytelling method. For instance, “It should be simple to start with and easy to use.” “Provide guidelines or instructions for users to follow.” “I think an appropriate storytelling tool should have two main functionalities: to tell us when we need storytelling, and to provide support for that specific purpose.”

3.5 Discussion

3.5.1 The reasons that students don’t adopt storytelling
The study reported in this paper provided more detailed insight into the current practice of storytelling by design students. It should be acknowledged that
storytelling can be expected to be more suitable for some design domains than for others, but the domain of user experience and service design practiced by the students in our study was assumed a priori to be a promising candidate. The lack of adoption of storytelling by our design students was seen as an example of poor user acceptance. According to the theory of use acceptance, perceived usefulness and perceived ease of use [88] can be expected to be major factors, and we discuss both aspects in more detail:

The perceived usefulness of storytelling is an important premise for acceptance. In the discipline of design, storytelling is believed valuable at all stages of the design process and the product life cycle [9,65] by informing product functionalities, exploring and communicating design ideas, conveying values and emotions, provoking comments and reactions, promoting innovation, etc. [4,14,66] However, only emphasizing the theoretical arguments in favor of the usefulness of storytelling is clearly not sufficient, as many students remain skeptical. The results of study 1 (the focus group) indicated that students often preferred other options such as sketches, prototypes, etc. over storytelling as the unique and practical usefulness of storytelling was (insufficiently) perceived. While unmatched values of storytelling, such as expressing emotions, demonstrating values, triggering empathy, managing information, etc., have been hypothesized, such arguments do not easily carry over to the design practice, and students do not easily comprehend when and how such values are essential in their design process. In study 2 (the questionnaire survey), the most agreed claims for values of storytelling indicated that the value of storytelling was only well recognized in case of design pitching/presenting. In study 3 (the field study), the 5 (out of 8) student groups who did apply the storytelling templates in their design practice provided useful directions for improving the storytelling method that we provided to them.

Ease of use is another aspect that influences user acceptance. The results of study 1 (the focus group) implies that the adopted definition of storytelling has an influence on actual practice and ease-of-use judgement. As storytelling was often perceived by students as being equivalent to storyboarding, the limited sketching (or photoshop) abilities of many students was perceived as a major obstacle [42]. Storyboarding hence tends to be viewed as a time-consuming and effort-requireing process by many (but not all) students. The results of study 1 (the focus group) confirmed that a lack of dedicated support for storytelling such as appropriate tools, guidelines, and instructions, etc. affect the perception of ease of use. In both study 1 (the focus group) and 3 (the field study), a demand for better support for storytelling was subscribed to by many students. In study 3 (the field study), the positive feedback on our templates, and the arguments in support of the positively valued “Q13-I feel I need it”, confirmed this necessity to develop methods or tools that better support storytelling.

3.5.2 A proposal to develop tools that support pitching design concepts in the form of stories

Based on the insights obtained from our empirical studies, we propose to develop a dedicated tool in support of one specific phase of the design process, i.e., design pitching. Three distinct considerations underlie this proposal:

Firstly, to enhance students’ acceptance of storytelling, we identified a design pitch as a good opportunity to show the practical values of storytelling. In study 2 (the questionnaire survey), two of the top three claims on the value of storytelling that students agreed with were related to the role in design presentation and design pitching. In study 3 (the field study), all student teams who adopted storytelling used it for their design presentation. Therefore, the unique and practical usefulness of storytelling seems to be most easily recognized when storytelling is used for a design presentation or a design pitch. We particularly focus on a design pitch rather than a design presentation because the former is more condensed and structured. Good pitches always use storytelling [67,68], since storytelling triggers empathy, promotes understanding, and invites feedback, as proposed in existing literature [15,18,20]. Empathy would easily occur when the audience watches or listens to a storytelling pitch and can connect a story to their own context or person. The feedback from the audience on such pitches can provide explicit evidence for students that storytelling is indeed useful.

Secondly, to avoid the influence of personal differences in a design pitch, we further propose to focus on preparing a design pitch using established methods from storytelling. Storytelling is analysis-oriented [4,17], as the available information (on product, context and user) needs to be analyzed and organized for story-crafting and storytelling. Preparing a design pitch with storytelling could help students to reflect upon, analyze and discuss their design concepts. It could enable students to view storytelling holistically by understanding its usefulness in information management, not only limiting its usefulness to communication with an audience.

Thirdly, to enhance students’ acceptance of storytelling, we propose to develop tools for storytelling on a higher professional standard (in terms of look-and-feel but also support) so that students may be more inclined to use them when preparing a design pitch. Storytelling is often too generic to be utilized in practice,
and appropriate tools could help. Tools are instruments which can extend the ability of people, facilitate design practice, and guide them toward solutions [36]. The studies demonstrated a need to support storytelling, and some concrete suggestions for improving the existing (research) tool were collected.

3.5.3 Limitation

There are three obvious limitations in the empirical study reported in this paper. First, we based our insights on the observation of the storytelling practice of industrial design students in our own design department, which is part of a Dutch university of technology. Students from e.g. art colleges were not involved in the study, and neither were students from other cultures. The argument in favor of our choice, next to convenience because of the easy access to participants, were that our students are very critical and used to conveying their criticism. Second, while we were able to extract more than 100 claims on the potential value of storytelling from literature, it was not practically feasible to collect participants' attitudes on all these claims. The selection of the claims for the questionnaire in study 2 (a questionnaire survey) was largely based on the researcher's own standards. Third, we only proposed a general direction for an approach to enhance the acceptance of storytelling as a tool for pitching, and developing and testing this proposal in more detail remains the topic of future research.

3.6 Conclusion

In this chapter, we presented an investigation into the current adoption of storytelling practice by students in the department of Industrial Design in our university. It was aimed at understanding the acceptance of storytelling in design as there seems to be a lack of related studies in literature. The results helped us to reflect upon ID students’ current practice of storytelling and to identify opportunities to enhance their acceptance by focusing on storytelling in design pitching, where the advantages would be most easy to perceive. Our future work will be to further explore this direction by developing a professional tool that should be both useful and easy to use for the ID students. Thus, it is necessary to make storytelling in design pitching more specific as both storytelling and design pitching refers to many aspects and includes several steps. To avoid possible negative influences due to personal differences in abilities and skills in storytelling and pitching, we choose to start with planning a story for pitching a design concept. In the next chapters, this objective is worked out in more detail.

Chapter FOUR

StoryPrea Tool Design and Evaluation

This chapter is based on


Abstract
Industrial design students often have difficulty in convincing their audience to subscribe to their design concepts when pitching. Many of these pitches lack a clear story which can help to appreciate the values or impact of their design concepts. This paper introduces an exploratory study of tools in support of planning stories for pitching product design concepts. A tool called StoryPrea is proposed and a user test is reported. Student participants (N=81) from three universities in two countries participated in the test. The results confirm a general acceptance of the StoryPrea tool and provide directions for the next design iteration.

Keywords
Storytelling; Design Pitching; Tool; Acceptance; Reflection.

4.1 Introduction
Incorporating storytelling into the design process has been promoted by many researchers and design practitioners. While the potential benefits of storytelling for design are highlighted in general terms [1–3], this literature does not clarify how to use stories for specific purposes in different stages of the design process. We found out in an earlier study in chapter 3 that, despite the theoretical argumentation in favor of it, the adoption of storytelling by industrial design (ID) students is not as straightforward as expected [1]. One of the identified problems was that practical tools/method that support storytelling within the design are hardly available. In Chapter 3, we also identified design pitching as an opportunity to enhance ID students’ acceptance of storytelling, and we proposed to develop tools to support storytelling for design-concept pitching [1]. As mentioned at the end of Chapter 3, this chapter presents a follow-up study to explore such tools and their user acceptance by the ID students. We explored alternative tools specifically supporting story-planning for pitching product design concepts, to find out features that are positively appreciated as well as problems that need to be remedied.

In this chapter, we not only developed a tool called StoryPrea, but also aimed to collect more detailed information about how ID students can use this tool. While processing their feedback we adopted an approach that kept the following four research questions in mind:
Q1: Does the StoryPrea tool support story planning for design pitching? (usefulness)
Q2: Is the tool easy to use? (ease of use)
Q3: What are the problems that students encounter when they use the tool StoryPrea for the purpose of design pitching? (problems)
Q4: What are the suggestions for solving the problems that they encounter? (insights for improvement)

The contributions of this chapter are twofold. First, it describes the development of a tool called StoryPrea as a practical approach to support story planning for design pitching. It is hence an attempt to fill in a gap observed in a previous study on how to specifically promote storytelling for design activities such as pitching. Second, an experiment is conducted to collect evidence that both the ID students’ awareness and their acceptance of storytelling can be enhanced through an appropriate tool such as StoryPrea.

The chapter starts with a literature review on existing tools that can support storytelling, particularly with a focus on the design context. Next, the tool StoryPrea is introduced as a concrete support for story planning for design pitching. Subsequently, a test of this tool is presented and the results are discussed. We conclude by identifying the main insights obtained from the test and by proposing future work such as problems that need to be addressed in a next design iteration.

4.2 Related work
4.2.1 Storytelling in Design

In the context of design, stories have been introduced as an effective approach for communication. Erickson has introduced stories as a communication catalyst to support the implementation of user information into prototypes [3]. Dan Gruen proposed to explain a design idea or product through telling stories as it serves as a common language to effectively communicate problems and values of new functionalities [12]. Peter Llyod and his colleagues identified the role of storytelling in developing a common language for communication within design teams [16]. Queeenbery and Brooks suggest applying storytelling to communicate design concepts regarding UX aspects [9]. Gausepohl et al. emphasize that stories help to understand the context of use as they involve user, task, and environment characteristics [93]. Designers are often regarded as storytellers as the authors of the book “the designer as a storyteller” proposed [5], more specifically as visual storytellers as design stories are often supported visually by means of storyboards with sketches and images [22]. Designers are supposed to share design ideas and convey information [12], at both ideation and
presentation phases. Successful pitches or presentations are claimed to tell stories [68, 71–73], because stories are rich in insights [96], easy to follow, and more likely to be remembered [97]. As one of the two possible modes of thought (the other being the logico-scientific mode) [98], stories are expected to be beneficial in fostering interest, engaging listeners’ attention [99], and creating a better understanding of emotional and psychological aspects [100]. Hence, they are claimed to be more powerful than a purely logical argument [98], for pitching or presentation. However, the actual practice of storytelling, such as in design pitching, seems to be largely neglected in favor of more theoretical considerations. It is an under-examined aspect in academic design research [101] with little relevant literature, which is one of the motivations for the study presented in this chapter.

4.2.2 Overview of Pitching

Pitching is an omnipresent practice in the world of innovation [102]. Pitch is a polysemic term [102] which has been used in diverse contexts. It first gains popularity in Hollywood where screenwriters used it to persuade movie producers for a film project [103, 104]. The TV reality show Shark Tank and the concept of an elevator pitch are examples that manifest the current pervasiveness of pitching. Pitching is more than a presentation transmitting information, but more like a conversation inviting the audience into envisioning “how the world would be if the new ideas being presented were realized” [105]. Especially an elevator pitch is a short and concise summary of a product/service and its value proposition [106]. An elevator pitch sells a compelling story which is a vision of how the world would be changed or how a problem would be solved if an innovative idea would be used [106]. The practice of pitching is predominantly shaped by literature on business communication or entrepreneurship, and most exiting studies have focused on the rhetoric aspects or techniques involved in speaking about instructional or procedural features [107]. Several articles propose methods to create and make an effective pitch [e.g. 103, 104, 108]. For instance, a checklist including purpose, focusing on customer, solving a problem, etc. is typically proposed [109]. A three-paragraph template to construct a sales pitch is introduced, in which each paragraph consists of 3–4 sentences [110]. New formats for pitching have been provided [111–113], and Daly and Davy specifically outline an 11-stage structural model for a pitch. They note the model can be used as a template to develop a pitch [113]. Moreover, Pitch gurus, such as Klaff [114] and Coughter [115], all offer recommendations for how to frame pitches. Guidelines for how to conduct a pitch [e.g. 109, 110, 114] often highlight the need to tell a story while pitching. Storytelling is recognized as the key to successful pitching [76–80]. To succeed for storytelling pitching, the preparation/plan of a story is vital [117]. Since stories inherently structure information, preparing or planning a story pitch seems similar to framing a pitch. Practical examples by some pitching experts like Duarte [26, 116, 118] are obvious. They all provide recommendations of storytelling and/or crafting stories for framing a pitch or presentation.

Despite the fact that these previous studies offer tips or guidelines for how to make a good pitch as well as craft a story [79, 81], such studies are not design-oriented. Furthermore, existing generic tools [84, 85], primarily aim at creating visual aids for presentations, such as PowerPoint and Keynote, or at rehearsing and collecting presentations, such as in the case of PitchPerfect [120], TalkZones [122], Prezi [123], etc. These tools are flexible, as they are intended to be used in many distinct presentation contexts, but are not specific enough to assist in the practice of planning stories for the sake of pitching design concepts. More specific tools that support storytelling in the context of design are not systemized [77], and designers, especially design students without experience, are likely to experience difficulties when applying them. Tools for storyboarding are generally deficient in supporting planning stories as they usually work by means of flexible sketching or editing of images without much attention to support analysis and discussion of the aspects related to both a design concept and a story. An interesting exception is a recently developed tool (method) StoryPly which supports the drafting of stories for the specific purpose of promoting discussions on user experience at early stages of UX design [75]. The storytelling approach-impact framework, while specifically exploring the use of storytelling in design pitching [101], doesn’t provide concrete tools that could be used by design students.

In summary, using storytelling for pitching is theoretically proposed and also empirically practiced. Specific support for storytelling for pitching a design concepts is scant in literature. Pitching is always an imperfect process for communicating creative ideas [104], and structured methods, guidelines and tools have the potential to help improve this process. As tools can have a substantial effect on design practices [124], design research has always had a strong interest in developing tools, both physical and digital [124], that can support design activities and in establishing their efficiency (i.e., in consuming time and other resources) and effectiveness (i.e., improving the quality of the outcome). We continue this tradition in this chapter, by developing a new design tool in support of planning stories for design pitching and studying its efficiency and effectiveness.
4.3 Methodology

We will discuss three separate studies in the exploration.

4.3.1 Study 1: an observational user study to collect requirements

Before performing the ideation towards developing a new tool, a user study in the form of an observation and an interview was conducted to collect design requirements. The researcher conducted observations while working together with design students in different stages of their design curriculum (including both bachelor and master students). The specific interest of the researcher was to develop a more in-depth understanding of how design students currently prepare for pitching design concepts. The observations were conducted within the context of two design courses which were part of the bachelor and master curriculum offered at our design department. In these two courses, students worked in groups on different design topics. The researcher participated in the later phase when the design projects were largely finished and the pitching of design concepts was being prepared. Through observations, interviews, and documentation with the help of photos and written notes, insights were collected on aspects such as the (lack of) practice in using stories, and in case they did indeed use stories, on how they planned such stories.

Several sessions of semi-structured interviews were conducted as part of the observation to collect students’ opinions. These interviews were guided by the following questions:

— How do you usually prepare for pitching a design concept?
— What information do you usually want to show in such a concept pitch?
— Do you plan a story when pitching a design concept? (Yes/No)
— If yes, how do you usually do it? If no, why do you not see the point in it?
— What are the problems when you try to plan a story for pitching?
— Which tools did you ever use to support you in the process?
— Which features do you think need to be included in a tool that aims at supporting story planning for pitching design concepts?

In the interview, students were encouraged to share their problems in both planning a story and pitching a design concept. Their suggestions for how this process could be supported by specific tools were particularly welcomed. All interview sessions were audio-recorded. The recorded data was translated into text and analysed by the researcher. The result indicated that there was support for an alternative tool, and helped to define requirements for it.

4.3.2 Study 2: a user test for the proposed StoryPrea tool

An experiment to test the user perspective of the proposed StoryPrea tool was conducted as the second study. The StoryPrea tool is an initial version of a tool that was developed to support the storytelling planning or preparation for pitching design concepts. It is a physical template with 11 pages, the details of which will be introduced in a later part of this chapter. Students majoring in Industrial Design from three universities in two countries (the Netherlands and China) participated in this study. The experiment was conducted according to the procedure outlined in the left part of Figure 4.1. We adopted a within-subject comparison, implying that participants were asked to create two versions of a design pitch (before and after using the proposed tool). Before the formal test, we conducted a small pilot test to check the feasibility of the proposed procedure for the experiment. The whole procedure of the experiment included two sessions:

• Session 1
Before the test, participants were required to prepare five one-page slides for pitching the concept of a design project that they had worked on previously. In step 1, Pitch A corresponds to participants pitching their design concepts within 3 minutes. In step 2, participants were instructed in groups on how to use the tool. In step 3, Pitch B corresponds to the same participants delivering the second pitch of their design concept within 3 minutes. All design pitches were recorded on video and audio, together with the slides used as part of the pitches. We made observations throughout the entire process. In step 4, a USE questionnaire (Usefulness, Satisfaction, and Ease of Use) [125], (shown in Appendix 3) was utilized to collect participants’ feedback on acceptance of the proposed tool. Statements had to be scored on a seven-point Likert scale ranging from -3 “strongly disagree” to 3 “strongly agree”. Finally, in step 5, several rounds of semi-structured interviews were conducted with the participants. In these interviews, we collected: (a) clarifications of the responses to the questions in the questionnaire, (b) explanations of observed activities, and (c) students’ understanding or opinion on the tool, as well as suggestions for possible improvements.
In session 2, 10 evaluators including students of Industrial design, design researchers, and professional designers were invited to help with assessing the design pitches. Each evaluation of the two versions (A and B) of a pitch addressing the same design concept lasted for about 15 mins. The evaluations were conducted according to the procedure outlined in the right part of Figure 4.1: watch design pitch A, evaluate it based on the questionnaire, watch design pitch B, evaluate it based on the questionnaire, compare the strengths and weaknesses of both pitches, and express a preference for one of the pitches. A questionnaire (shown in Appendix 4) with a seven-point Likert scale ranging from 1 “strongly disagree” to 7 “strongly agree” was used for evaluating the pitches. It includes questions about how understandable and convincing the design pitches are and questions for expressing the preference between both pitches.

4.4 StoryPrea tool

4.4.1 Design Requirements

By combining the results of the first user study with insights from the literature review, the design requirements for the tool were identified. Some requirements related to the type of tool, while others related to the required functionalities:

- **Type of tool**
  The initial design was based on several existing guidelines for creativity support tools [126]. The tool supporting ID students for story planning for design pitching should be simple to use with a low threshold because the target users are ID students who have limited experience in design and pitching, and who are not inclined to invest substantial time in learning new tools (especially not if they have a dedicated functionality). In the design field, physical tools like cards and canvases have always been popular because they are tangible as well as easy and simple to use [127]. Card-based tools can function as supplements as they are well suited to provide detailed information. Card-based tools have been proved effective in both inspiring and informing design efforts [128]. IDEO Cards [129], are an early example of how to improve the designers’ understanding of the people they are designing for. PLEX cards have been developed to communicate playful experiences [130]. DSD Cards provide information about children to support design for children of different ages [131]. Inspiration cards have been designed to facilitate designers’ reflective conversations [132]. Canvas-based tools often work as templates with which users, especially novices, feel comfortable to start with. A (physical) canvas on a wall or table is an environment that offers space for inspiration and collaboration by inviting engagement and discussion. The business model canvas [133], the Value Proposition canvas [134], and the StoryPly [75], canvas are representative examples. Post-it sticky notes can be ubiquitously combined with physical canvas-based tools due to their benefits such as regular shape, small size, flexible positioning, and re-positioning, etc. [135]. They make the canvases editable and extendable. Based on the above arguments and examples, we adopted it as the first design requirement: to develop a physical tool similar to existing card-based and/or template-based tools. Other forms of the tool, for instance, a digital tool will be postponed until the specific requirements for the physical tool had crystallized and been tested.

- **Main functionalities of the tool**
  First, the tool should support reflection upon the design concept which needs to be pitched. When a design concept needs to be pitched, the presenters (students) first need to reflect on it to extract the information that is essential and hence needs to be included in a pitch. To pitch a compelling story, except for the basic information, for instance, what the product concept is, how to use it, etc., other essential elements that influence the design concept such as the characteristics of the users and their needs, the context, the design brief, stakeholders’ concerns, etc., need to be addressed in the pitch. The tool should hence provide support for creating an integrated perspective on the design concept, as well as assist in analysing if all relevant elements are included.

Secondly, the tool should support making a connection between the design concept and a possible story that can assist in communicating this concept within
Last but not least, the tool should support the planning of a story for pitching. Herein we use story planning instead of storytelling since storytelling is dynamic and individual, and can be delivered through different media, but planning a story before pitching is the premise and it is feasible to be supported by tools. Many students told us that they often planned stories mentally and then pitched them orally, either with or without supporting visual material such as a storyboard.

Table 4.1 Analysis of the similarity between crafting stories and design

<table>
<thead>
<tr>
<th>Story Elements</th>
<th>Design Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who</td>
<td>Users, Stakeholders</td>
</tr>
<tr>
<td>When, Where</td>
<td>Time, Place, Environment</td>
</tr>
<tr>
<td>What, How</td>
<td>Behavior, Activity</td>
</tr>
<tr>
<td>Why</td>
<td>Design problem</td>
</tr>
<tr>
<td>What, How</td>
<td>Design solution</td>
</tr>
<tr>
<td>Why</td>
<td>What influence will the design have in terms of emotions, values, experience, etc.?</td>
</tr>
</tbody>
</table>

Because this was not explicitly supported, we assumed that the activity of mental story planning could be enhanced through externalizing both the process and the content, for instance by making the story elements tangible in the form of text or simple images, etc., so that they could be interacted with during a discussion or analysis. In this way, the likelihood of planning a good story could be expected to increase. The tool design should hence also take this aspect into account.

4.4.2 The conceptual framework of the tool

Based on the design requirements, a framework underlying the tool was derived.

Phase 1: How is it now?

— Activity 1 — Reflection

Reflection here means the tool supports a holistic review of a design concept. When preparing for pitching a design concept, stepping back to look at the design concept is necessary and important. Students of Industrial Design need to think about the related design elements such as design background, design problem, design solution, etc.

— Activity 2 — Analysis

Analysis here means a process where the design elements are analyzed in detail by discussing the 5Ws and 1H. For instance, the design background can be addressed with questions such as who, when, where, and what. This activity helps to remind the students of the information that is required to interpret a design concept clearly and logically.

Phase 2: How it could be?

— Activity 3 — Story-planning

This activity focuses on planning a story about a design concept through matching the design elements to the story elements, and by organizing these elements together into a story. The users of our tool potentially enjoy the freedom to create their own stories with different focuses by highlighting different story elements.
4.4.3 Introduction of StoryPrea Tool

[1] the overview of the StoryPrea Tool

The tool was designed with the above framework in mind, while the details were developed in several iterations. The three activities in the two phases of the framework are supported/guided by ready-made templates, inspiration cards, and instruction guidelines. The tool is proposed to be hung on the wall or laid flat on a table and filling in the templates is supported by the guidelines and cards (as shown in Figure 4.3).

[2] The composition of the StoryPrea tool

The StoryPrea tool includes 4 parts: 11 templates, guidelines, a set of 10 cards, and contextualized user instruction.

(1) The templates

There are 11 templates in total: 5 templates for Phase 1 that support the two activities of reflecting upon and analyzing a design concept and 6 templates for phase 2 in which the actual story planning is conducted. All the templates are A3-sized canvases with titles, sub-titles, 8 blank squares, and a page number. The titles explain the related design elements of a concept including who, when, and where, what happens, design problem, and design solution. The subtitles indicate five basic story elements: Character, Setting, Activity, Problem, and Solution. There are eight blank squares with dotted outlines on each template that encourage users to provide pieces of information. Users can write text or draw simple images on Post-it stickers to fill in these blank squares. Users also enjoy the freedom to add, delete, and reposition the Post-it stickers on the canvas. The design of 8 blank squares an A3-sized template was based on three considerations:
First, the observation and the students’ feedback on the storytelling prototype used in the study in chapter 3 implied that students hesitated to use a template. They told us that they didn’t know what to do with a big blank area on the template. If there were examples or some blanks to fill in, they were much more easily triggered.

Second, the consideration of only 8 squares on a A3-sized template was to match the size of the Post-it stickers with their normalized size of 75*75mm. Thus, only 8 squares could be contained in the template. Not all the blank squares were required to fill in. Students were free to add more than 8 Post-it stickers to a template if so desired.

Third, the template was designed in the same style as the StoryPly templates, as the StoryPly method was developed earlier in the same research group and acted as a starting point for this research.

Template 1 — “Who is in the story?” with a subtitle “Specify the character(s)” in grey color (shown in Figure 4.4). It urges students to reflect on their design concept by starting with the users.

Template 2 — “When and where does it happen?” with the subtitle “Specify the setting” in blue color (shown in Figure 4.5). It supports reflecting on the context in which the character(s) will interact with the design concepts by specifying the time and place.

Template 3 — “What goes on?” with the subtitle “Specify the related activity that people do” in yellow color (shown in Figure 4.6). It supports reflecting on the activities and behaviour that take place in the design concept.
Template 4 — “Why does it happen” with a subtitle “Specify the problems and reasons” in red colour (shown in Figure 4.7). It helps to identify the obstacle(s) that the character(s) encounter.

Template 5 — “Design Solution” with the subtitle “Specify your design concept” in green colour (shown in Figure 4.8). It helps to introduce a design concept.

In part 1, the concept is reflected as it is now, while in part 2, these 5 templates trigger students to think about how the presence of their concept can influence (some of) these elements. To make them template-styled, some keywords are included in the blank squares as tips.

T6 (Grey) — “Who is in the story?” with a subtitle “Specify the possible changed character(s)” (shown in Figure 4.9). It supports analysing the users by thinking about more details in the description of the character(s), for instance, not only the users but also the stakeholders could be analysed and discussed in this template. The features of the people involved should be considered.

T7 (Blue) — “When and where does it happen?” with a subtitle “Specify the possible changed setting” (shown in Figure 4.10). It supports analysing the background of the design by specifying the detailed time and place.
T8 (Yellow) — “What would go on?” with a subtitle “Specify the possible changed activities” (shown in Figure 4.11). It supports thinking about and analysing the activities and behaviour in more detail to make them more concrete than imagined before in part 1.

T9 (Red) — “Design problems” with a subtitle “Confirm the problem(s) and design direction” (shown in Figure 4.12). The design problem is the premise of a design concept and it is worthwhile analysing and discussing since it is often ill-defined.

T10 (Green) — “Design Solution” with a subtitle “Specify any new insights into the design solution(s)” (shown in Figure 4.13). Introducing a design solution (concept) to others convincingly is problematic if essential information is forgotten or neglected. This template supports thinking about new insights on how and where to apply the design solution.
T11(Purple) — “Impact of the design” with a subtitle “Specify the impact/influence of the design solution(s) on the character(s)” (shown in Figure 4.14).

(2) Guidelines
Guidelines in the form of provocative questions were provided to support users in filling in the blank spaces. They aimed to trigger users to think about different aspects or alternatives for specific story elements (as shown in Figure 4.15).

(3) Cards
The 10 inspirations cards have the same size of 75*75mm as the Post-It notes. They are two-sided and color-coded to match the templates that they relate to. The titles, explanations, image examples, and references provided in the cards aim to both inform and inspire students when they are trying to fill in the templates (figure 4.16). These cards are divided into 3 categories:

Category 1 — two cards: Character and Activity, to encourage students to think of more details about the character who is the main user of the design concept.

Category 2 — three cards: Place, Time, and Object. These three cards are related to the setting of a story. The explanations on these cards can assist students when specifying information about time and place and the environment.

Category 3 — Five cards with Needs, Emotions, Values, Goals, and Motivations. These five cards are developed to inspire students to think about subjective aspects such as the goal and the motivation which are related to people's behaviour and activities. The Needs card identifies 6 basic psychological needs summarized and ranked according to their importance as identified in earlier research: autonomy, competence, relatedness, popularity, stimulation, and security [138]. To fulfill different needs, alternative design concepts can be proposed. Emotions and values are important when thinking about personal experience, but they are often too generic to interpret and therefore easily neglected when presenting a design concept. The Emotions card and Values card is proposed to support them in this respect. In the Emotions card, some representative emotions which are related to design [e.g. 139, 140] are mentioned. The 5 common values that are included in the Values card are functional value, aesthetic value, emotional value, social value, and cultural value.
As already observed in the StoryPly method, an important benefit of templates is that they assist in dividing a complex task into more manageable sub-activities [31], especially if they are supported by guidelines and inspired by cards. All of the templates, cards, and guidelines are color-coded to make them more easily discernible from one another. The name of the tool “StoryPrea” was inspired by the stages distinguished in it: P—planning, r—reflection, e—externalization and a—analysis, and to highlight the aim of planning stories for pitching through reflecting upon a design concept, externalizing and analyzing elements.

(4) User Instruction
An extra document (see Figure 4.17) is included to explain how to use the StoryPrea tool. It distinguishes the following 5 steps:

- Step 1: Put templates 1-5 on the wall or the table.
- Step 2: Reflect upon your design concept and fill in the blanks on templates 1-5 with Post-it notes. You can either write text or sketch on the sticky notes.
- Step 3: Put template 6-11 on the wall or the table. Read the included guidelines carefully.
- Step 4: Fill in the blanks on template 6-11 with Post-it notes. Use the cards of the corresponding colour to the template to assist you in the process.
- Step 5: Plan a story for pitching your design concept based on the filled templates 6-11. You can re-organize the information freely within the story.

Figure 4.17 Instruction of using the tool
4.5 Results of study 2

4.5.1 The participants

81 participants from 7 nationalities were involved in the testing of the StoryPrea tool. They were bachelor (55.6%) and master (44.4%) students majoring in industrial design with a percentage of 55.6% female and 44.4% male. The participants came from three different universities: U1—TU/e, a Dutch university (U1 with 15% of the participants), U2—a Chinese university (U2 with 55% of the participants), and U3—an international university (U3 with 30% of the participants) in China with students of multiple nationalities such as Japanese, South Korean, Indian and American. The students were also classified in terms of coming from an Eastern (67.9%) and Western (32.1%) cultural background. Students joined individually or in groups of 2 to 4 students, depending on whether they were pitching an individual or group project. In the case of a group, they selected one member to deliver both design pitches. All students were required to fill in the questionnaire individually.

4.5.2 The collected design projects

27 design concepts with 54 design pitches were collected during the tests. These design concepts covered distinct design topics such as furniture (8 concepts), transportation (3 concepts), healthcare (6 concepts), etc. Most of the concepts were smart products design (23 concepts) for office, home, and public place, both physical and digital ones, service design (2 concepts), and the traditional furniture design (2 concepts) were also included.

4.5.3 Results of the USE questionnaire

The revised USE questionnaire included 20 claims in four categories: potential usefulness in reflection on a design concept (7 questions), potential usefulness in planning a story for pitching a design concept (7 questions), ease of use (5 questions), and the intention for use in the future (1 question). The data analysis was conducted with the ILLMO software [141].

[1] Agreement with the tool

The analysis of the estimated probability (with 95% confidence interval) of agreement with the claims in the questionnaire (as shown in Figure 4.19) showed that participants generally agreed with the claims on StoryPrea tool, which corresponds to a score of 2 or higher (the seven-point Likert scale ranging from -3 "strongly disagree" to 3 "strongly agree"). The claims with the highest probability of agreement were related to the perceived usefulness in planning a story for pitching a design concept: C8—“It has the potential to plan a story for pitching a design concept”; C11—“It can help me to identify critical aspects of planning a story for pitching”. The two claims with the lowest probability of agreement obviously referred to the aspect of working efficiency including C3—“It can help me to improve the efficiency of my reflection on a design concept”, and Claim18—“Using this tool requires a lot of mental effort”. There were also two claims with the same level of probability of agreement including C10—“It can help me to improve the efficiency of planning a story for pitching a design concept” and C19—“Overall, I find this tool easy to use”.

Figure 4.18 The participants using the tool in the test
[2] Cultural influences
The estimated probability of higher score (with 95% confidence interval) for the claims generally showed that participants from different cultural backgrounds held different opinions on the claims on the StoryPrea tool (as shown in Figure 4.20). There were 7 claims with a higher probability of higher score indicated that the participants with an Eastern cultural background were prone to give higher scores on these claims than the participants with a Western cultural background: C4—“It can help me to identify critical aspects of my design concept”, C8—“It has the potential to plan a story for pitching a design concept”, C9—“It can help me to gain more control over planning a story for pitching a design concept”, C15—“Learning to use this tool is easy for me”, C16—“I find it easy to get me to know what I want to do”, C17—“It is easy for me to remember how to use this tool”, C19—“Overall, I find this tool easy to use”. Two claims with the highest probability referred to C8—“It has the potential to plan a story for pitching a design concept” and C15—“Learning to use this tool is easy for me”. Meanwhile, 4 claims with the lowest probability of higher score including: C2—“It can help me to gain more control over my reflection”, C10—“It can help me to improve the efficiency of planning a story for pitching a design concept” and C15—“Learning to use this tool is easy for me”. Meanwhile, 4 claims with the lowest probability of higher score including: C2—“It can help me to gain more control over my reflection”, C10—“It can help me to improve the efficiency of planning a story for pitching a design concept” and C15—“Learning to use this tool is easy for me”.

The estimated probability of higher score (with 95% confidence interval) also revealed that the participants from the three different universities responded differently to some of the claims. When comparing U1 and U2 (shown in Figure 4.21), 4 claims with higher probability indicated that participants from U2 showed higher probability to give higher scores on these claims than the participants from U1: C10—“It can help me to improve the efficiency of planning a story for pitching a design concept”; C12—“It can help me to improve planning a story for pitching a design concept”; C13—“It’s easier to plan a story for pitching”; C14—“Overall, I find it useful for planning a story for pitching a design concept”. 3 claims with lowest probability of higher score included C4—“It can help me to identify critical aspects of my design concept”; C8—“It has the potential to plan a story for pitching a design concept”; C15—“Learning to use this tool is easy for me”.

Figure 4.19 Effect sizes (probability of agreement) for the claims on StoryPrea tool

Figure 4.20 Effect sizes (probability of higher score) for cultural difference
When comparing U1 and U3 (shown in Figure 4.22), there were more claims with higher probability of higher score indicated that participants from U3 generally showed higher probability to give higher scores on these claims than the participants from U1. The claims with the highest probability referred to C6—“It’s easier to reflect on a design concept”; C12—“It can help me to improve planning a story for pitching a design concept”; C13—“It’s easier to plan a story for pitching a design concept”. The claims with lowest probability of higher score included C4—“It can help me to identify critical aspects of my design concept”; C8—“It has the potential to plan a story for pitching a design concept”; C19—“Overall, I find this tool easy to use”.

When comparing U2 and U3 (shown in Figure 4.23), there were more claims with lower probability of higher score indicated that participants from U3 generally showed lower probability to give higher scores on these claims than the participants from U2. Only 5 claims with the highest probability: C15—“Learning to use this tool is easy for me.”; C16—“I find it easy to get me to know what I want to do.”; C17—“It is easy for me to remember how to use this tool”; C18—“Using this tool requires a lot of mental effort.”; C20—“I am likely to use this tool in my future work”.

Figure 4.21 Effect size (probability of higher score) for the claims on StoryPrea tool between U1-U2

Figure 4.22 Effect size (probability of higher score) for the claims on StoryPrea tool between U1-U3
4.5.4 Results of the observation

The observations during the tests provided information about how the participants used the tool that we couldn’t get directly from the questionnaire and interview. The observations were organized according to the following aspects:

(1) Where to start
Since we recommended participants to follow the steps in the written instruction, most of them were observed to first put templates 1-5 on the wall or the table in a sequence corresponding to the numbers on the templates, so that they could quickly obtain an overview of the method. 61.7% of the participants started from template 1- “Who is in the story”, while the rest started from either template 5 “Design solution” (21%), or template 4- “Why does it happen?”(13%). No one started from the other 2 templates.

(2) Ways of filling in the blanks
As observed, nearly 90% of the sticky notes were filled in by the participants with both text and sketches. A single sticky note contained either keywords, a simple sentence, or a sketch. Some participants only wrote the text on the sticky notes, for instance, with some simple keywords, or sentences either short or long. Figure 4.24 shows some examples.

(3) How the students deal with problems
There were three main ways in which the participants tried to resolve the problems that they encountered when using the StoryPrea tool. The students who participated individually preferred to think and check the guidelines and cards for help. The students who joined in groups combined discussions with checking the information on the guidelines and cards. Some participants asked the researcher directly for help.
(4) Where to spend your time
During the test, most of the participants were observed to spend more time on the two templates of “What goes on” and “Impact” than on other templates. Participants who joined in individuals took time to figure it out, and the participants who joined in groups preferred to discuss while working on these two templates. For most of the participants, filling in the templates “Why does it happen” and “Design solution” took substantially less time.

(5) Information provided
For templates 1-5, as the participants were encouraged to reflect upon their design concepts, they were inclined to provide as much information as possible. The number of sticky notes used varied substantially between templates. Especially on T5 - “Design solution”, most of the eight blanks were full of sticky notes for most of the time. The other two templates T1 - “Who is in the story” and T2 - “When and where does it happen” on average contained more sticky notes than T3 - “What goes on” and T4 - “Why does it happen”. For instance, in the test in U1 with 10 groups of 11 participants (the test in U1 was implemented in groups separately in a well-facilitated lab), all the groups filled in T5 - “Design solution” with at least 5 sticky notes by either text or sketches. However, there were only one or two sticky notes to fill in T3 - “What goes on” (examples as shown in Figure 4.25). Especially, 10 groups of participants in the test in U2 and U3 were observed to leave T3 - “What goes on” blank.

For templates 6-11, participants were invited to come up with more related information, inspired by the guidelines provided, but still not every template was filled in. Holistically viewed, almost the same amount of information was included in templates 6-10 and templates 1-5. Some templates, for instance, T7 - “When and where does it happen” were even left blank in some instances. T11 - Impact was the only new template in phase 2, and while many participants tried to include sticky notes on this template, they rarely exceeded one or two. For T6 - “Who is in the story” and T8 - “What goes on”, most of the participants did add sticky notes with complementary information that was inspired by the guidelines.

4.5.5 Results of the interviews
The data captured from interviews was analysed by clustering the 233 quotes into 6 categories, four of which provided interpretations of the answers obtained through the USE questionnaire.

Category 1: Usefulness in reflection on a design concept (53 quotes). Most participants didn’t directly mention the term sensemaking, but provided descriptions such as “It helped me to think about how to make sense of my concept.” “The impact analysis helped me to consider the aspects which can make my concept more convincing.” Some participants interpreted their understanding of sensemaking with other related words, for instance, “It is a process for reflection upon the concept, especially on its applicability, feasibility, etc.” “I know how to make my concept more acceptable through analysing these elements.”

Category 2: Usefulness in planning a story for pitching a design concept (25 quotes). The support for planning a story for pitching a design concept was recognized by most participants, as indicated by their positive opinions which directly expressed this. For instance, “It indeed gave some help when we were preparing the pitching, especially when planning a story.” “I can select useful information for my pitching.” “It provided a clear framework for planning a story.”

Category 3: Ease of use (62 quotes). The quotes about ease of use can be divided into positive (24.2%) and negative (75.8%) ones. Examples are shown in Table 2. The negative opinions primarily refer to the problems in efficiency and effectiveness. Details of the tool design were also mentioned in these quotes, for example, “I cannot understand the title ‘Activity’. What does it mean?” “Some subtitles for the blanks are confusing. What does ‘others’ mean? What should I fill in for this blank?” “The blanks in two rows are the same? Should I work horizontally or vertically?”
Table 4.2 Examples of the quotes in Category 3- Ease of use

<table>
<thead>
<tr>
<th>Sub-categories</th>
<th>Quote No.</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive attitudes</td>
<td>15</td>
<td>“The tool is simple to use. I can easily fill in the templates with stickers.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“It’s easy to use. We can just fill in the information after analysing our design concepts. We can either write down text or draw on the stickers. Simple to start with.”</td>
</tr>
<tr>
<td>Negative attitudes</td>
<td>47</td>
<td>“I didn’t understand some parts. For instance, what is the activity? Does it mean the behavior of the character?” More instruction or introduction is needed.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“I was a little lost when filling in the blanks because I don’t know how I should put the stickers on? From left to right or from top to the bottom?”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“too many templates to fill in. too much work. some might be unnecessary or just think in mind.”</td>
</tr>
</tbody>
</table>

Category 4: Intention for future use (15 quotes). 66.7% of quotes indicated an interest in using the tool in future work, 26.7% claimed to the opposite, and only 1 quote showed that the participant was not sure. Examples are “Yes, I will use it again. It is helpful.” “I am not sure if it is improved.” “No, I don’t think so. I don’t want to spend so much time to just fill in the blanks.”

Category 5: Suggestions for improvement (45 quotes). The suggestions mainly referred to aspects of visual design, an alternative design of digital tools, and usability. For instance, “Why not make it online so that it can solve the problem of documentation and sharing.” “You need to improve the visual and information design to make it much easier to understand.” “Think about improving the engagement.” “A digital tool can support collaboration. If I can use it with my team members, it could be more efficient.”

Category 6: Others. The remaining, unclassified, 33 quotes were put together in this category. It covered quotes about other benefits of this tool, quotes explaining details of use, and some other aspects. Examples are shown in Table 4.3.

<table>
<thead>
<tr>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The templates and cards are quite easy to use and take with you. We can use them individually or in groups when we discuss our design concepts or when we prepare for design pitching.”</td>
</tr>
<tr>
<td>“I want to make suggestion: how about making the tool like playing a game? It would be more interesting rather than only filling in the blanks.”</td>
</tr>
</tbody>
</table>

4.5.6 Results of the pitch evaluations

In the evaluation session, 3 design researchers respectively with a background in industrial design, computer science, and psychology were invited to evaluate the collected design pitches. Each design project with design pitches in two versions (version A is the pitch made at the beginning of the test, and version B is the pitch made after the participants used the StoryPrea tool) were provided for the evaluations. All the 3 evaluators were required to evaluate both of the two versions of pitches of each design concept based on a seven-point Likert scale ranging from 1 “Disagree” to 7 “Agree” and then express a preference for either pitch A (before) or pitch B (after). 81 results for evaluation were finally collected for the 27 design projects. We classified all the pitches in two versions into two groups for a hypothesis test (as the data shown in Table 4.4 and Table 4.5). The F-test showed that the deviation of the two groups was different and then the T-test verified a significant difference between the group of pitch B and the group of pitch A. Meanwhile, the results of pitch preference showed that 69 out of 81 times choosing Pitch B led to a percentage of $p=0.852$ with a 95% confidence interval of $[0.7, 0.9]$. This percentage indicated the evaluators mostly preferred pitch B. Thus, we concluded that the StoryPrea tool, played the role of supporting planning a story for pitching design concepts, since the pitches seemed to be changed positively in some aspects related to the items in the evaluation questionnaire (as shown in Appendix 4), for instance, they became easy to understand, they helped the evaluators to perceive the values of a design concept, and they raise the interest, etc.
The audio records provided insights into the reasons why a specific pitch was preferred. The comments could be clustered into three categories, based on a thematic analysis: Category 1---a story related, Category 2---content of the pitch, Category 3---persuasion effect. An overview of the quotes in different categories is provided in Table 4.6.

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-category</th>
<th>Quote No.</th>
<th>Example</th>
</tr>
</thead>
</table>
| Story related | | 37 | “There is a story in pitch B.”
| | | | “I felt that the presenter tried to tell a story in pitch B.” |
| Content of the pitch | Clear structure | 28 | “The structure in pitch B is clearer.” |
| | | | “He told a story which has a structure, and it made the whole pitch structured and logic.” |
| | Enough information | 23 | “Something is missing in pitch A, for example, the clear scenario in which I can use the product.” |
| Persuasion effect | Easy to understand | 35 | “I think pitch B is much easier to understand as I was a little confused in pitch A.” |
| | | | “Both pitches are understandable, but I prefer pitch B which is much better.” |
| | Easier to be convinced | 20 | “Yes, after watching pitch B, I am interested in that product.” |
| | | | “The reason why I prefer pitch B is that it convinced me to some extent. At least, I can imagine what benefit it can give me.” |

4.6 Reflection and Discussion

4.6.1 The usefulness of the StoryPrea tool

[1] providing support for planning a story for pitching a design concept

Tools are transfer vehicles of knowledge and experience. To pitch a design concept successfully is not easy for ID students. Planning a story can potentially increase the probability of success. With the help of an appropriate tool, planning a story for pitching a design concept could become easier and more effective. The overall opinion based on the questionnaire data and the interview feedback from the user tests showed that the potential usefulness of the StoryPrea tool for planning a story was recognized. The templates provided an environment in which ID students were urged to have a second look at their design concepts and to think about a variety of related aspects. The guidelines and the cards provided insights that ID students could use to become aware of missing information and on how to provide additional details. For instance, the detailed information about the people that they designed for, such as their expectations and/or their behaviour, made the characters more rich and vivid. This kind of additional information often helped when creating building blocks for planning a story for pitching.

[2] supporting reflection on and discussion of a design concept

The results also indicated that the tool supported reflection and discussion of a design concept as they were naturally embedded in the process of planning a story for pitching. Once students started to use the StoryPrea tool, this happened quite naturally. The tool helped them to formatively evaluate their design concept, think about the values of the concept, and guided them in taking perspectives that they would otherwise neglect for pitching. The StoryPrea canvases served as a physical reference and provided a common vocabulary when students engaged in the process of preparing for pitching a design concept. ID students often failed in convincing their audience to accept their design concepts as they were prone to focus on specific functional or interactive features of a concept of product, sometimes ignoring other important and relevant features as well as contextual and individual aspects. As design problems are usually ill-defined [51], the perfect solution also doesn’t exist. A design concept is only one example of a possible solution, but context and user characteristics play a role in assessing the quality (or value) of any specific proposal. Once a concept is interpreted within a story with concrete characters, scenarios, conflicts, and solutions, it was much easier for others to understand it and to identify or appreciate its values. By reflecting, analysing, and discussing a design concept in terms of concrete elements, essential but missing information is more easily revealed.
The StoryPrea tool was sufficiently flexible to be used both individually and in groups. It was useful to trigger both self-reflection and a group discussion on a design concept. The value for traditional product design, for instance, furniture design, was limited as other attributes like materials, technology for manufacturing, cost, were more important factors than the contextual and emotional values stressed by the tool. The design of smart products and the service design can profit substantially more from the StoryPrea tool. For such types of designs, consideration of the specific context, the scenarios of human-computer interaction, and user-experience related aspects like feelings, emotions can be incorporated quite naturally with the help of the StoryPrea tool.

4.6.2 Problems and Limitations

We reflected upon the whole study from the following five perspectives:

[1] Using the StoryPrea is time-consuming.
We acknowledge that the process of applying StoryPrea took longer than originally expected. Preparing for a good design pitch took time, and the process of planning a story was not effortless. For the students participating in our tests, it was difficult to strike a balance between finishing the tasks and controlling the time provided in the context of the user test. Our participants invested effort to finish all tasks by strictly following the steps for reflection and analysis of their design concepts but also recognized the benefits of this effort[4] for planning a story to pitch a design concept. There was space for improving the tool design in this respect. It is worthwhile to explore if a more concise and simpler version of the current tool can save time while preserving existing benefits. Moreover, as the inspiration cards were not used as extensively as expected (or hoped for) in the test, improvement of the design of the card or providing alternatives are also worth exploring further.

[2] Cultural differences
The results indicated that there were cultural differences that influenced how participants expressed (and possibly also formed) their opinions on a new tool. First, when filling in the USE questionnaire, students with a Western cultural background on average gave lower scores on the seven-point-Likert scales than students with an Eastern cultural background. It seems that Western students showed more objective and critical attitudes to this tool, while Eastern students were more positive and supportive. Second, in the interviews, Dutch students showed at least an awareness of the potential values of stories for pitching design concepts, while not much awareness was observed in the Eastern students. This might be influenced by different education approaches. Story pitching is probably more familiar for Dutch students. For the Eastern students, especially the Chinese students, both stories and pitching had not received much attention. They thus became more open to a tool supporting planning a story. It is hence safe to conclude that the cultural background of our participants did have a significant effect on the observations and judgments.

[3] The limited number of participants
For a test of acceptance, the literature indicates that a huge sample of participants is usually required to ensure external validity [142]. We only recruited a limited number of participants at three universities, especially only 12 in the Netherlands. Hence the study has only limited validity when comparing participants from different cultural backgrounds. It also indicates that, especially in the Netherlands, we failed partly in our design pitching as pitching to participants in the study was very similar to the objective of the StoryPrea tool itself. It is hence a big challenge for the future that we can demonstrate how we can use the StoryPrea tool ourselves to successfully pitch StoryPrea, as this could also serve as an example of using the StoryPrea tool for recruitment of participants or other future use. It is an important step in the development of StoryPrea that we simply cannot skip.

[4] The support for planning a story is still weak
We proposed a framework and a tool that included reflection, analysis and, planning stories to assist in planning a story for pitching a design concept, but we recognized that the current version in support of planning stories is still weak. Without explicit guidance for how to build a story plot professionally, the story elements provided by the tool remained unconnected. It has even been argued that an analysis such as the one that we propose could even diminish returns [4]. Through analysing and discussing different aspects, the total amount of information obtained increases, so that it could become more difficult to figure out exactly which information is essential for the story and the pitch. It might result in “analysis paralysis”, especially for novice designers such as ID students. It could be one of the reasons why using the StoryPrea tool to plan a story took longer than expected in the user tests. The support for planning a story is one of the aspects that need to be addressed in future work.

[5] The evaluators’ personal biases influence the pitch evaluation
The evaluators were specialists in different domains of design and with different perspectives on the field of design, which explained why they tended to pay attention to different aspects of the pitches they had to evaluate. A potential conflict between their expectations and the design aspects covered in the pitches could affect their evaluations. Our results indeed showed that story pitching seemed more suitable for design concepts that are based on user-centered design methodology, for instance, smart product design, service design, etc. In the of
more traditional product design, such as furniture design, including story elements even affected the judgment negatively.

### 4.6.3 Design considerations for future work

The results of the study have implications for further development of the StoryPrea tool. We propose three design requirements for the next design iteration, focusing on the following aspects:

**Design requirement 1—Enhancing the discussion of the design impact**

When personally reflecting on this study, we realized that the discussion of design impact is an important part of the framework and tool that we propose which should be supported more explicitly. There are multiple ways to argue this.

First, from the perspective of conceptual design. When reflecting on a design concept, it is necessary to think about its impact or values. This is why we make a design. According to the literature [143], the impact is related to aspects such as applicability, effectiveness, and appropriateness, which are the essential aspects that decide the quality of a design.

Second, from the perspective of pitching, the purpose is to demonstrate the impact or values of a design concept and to convince the audience to subscribe to these impacts or values. There are two complementary ways to convince people. One is the logico-scientific way with facts and data [144]. It works well once people have a clear understanding of the problem and can agree on key performance indicators [98]. Another way is stories which refer to problem-solving after a character experiences a journey. Impact usually needs to be described in a specific context as it cannot be explained generally, and is distinctive for different people.

Stories own significant advantages in making change and impact explicit in a specific context with clear characters, setting of time and place, and some other related information [9,73,79]. Thus, planning a story is essential for the interpretation of the impact of a design concept. The current version of the tool provides limited support (for instance, there were some provocative questions in the guidelines and a Values card). As the feedback of the participants indicated that it was not enough to support students to reflect on and discuss the impact of a design concept. More details and examples should be taken into consideration for the next design iteration.

**Design requirement 2—Enhancing the support for story crafting**

As discussed before, the support for story crafting is weak in the current version of the tool. Most students are not experts in story creation so that after analysing and discussing the story elements, the next step towards creating an actual story is still perceived as overly vague and generic. Support for crafting a story, for instance by providing a range of classic story structures, is one way of extending the tool that should be considered.

**Design requirement 3—Enhancing engagement**

To enhance the engagement when using the tool, both improvements to the tool itself and alternatives such as moving to a digital online platform are possible directions for further development.

The tested version relies exclusively on physical canvases and cards. Regarding aspects deemed important, improvements could be in visual design, for instance, titles are reinforced by using larger font size and appropriate colouring, fewer blank squares on canvas, improved English descriptions in guideline questions on canvases, etc. The participants’ requirement for lower cognitive load should also be considered when optimizing the structure design of the tool.

Concerning users’ feedback on the development of alternative digital versions, in the future, we would like to support the current physical version through an online platform. Such an online platform should provide all templates, cards, instructions so that interested professionals can try out the tool without an instructor is available. Digital tools could also provide richer human-computer interaction like editing, moving, adding, overview, preview, etc., and also offer benefits in supporting collaboration, documentation, and sharing, also when participants join from remote locations. Going digital has other potential advantages. External evaluation of design concepts could for instance be conducted on crowdsourcing platforms. The StoryPly method and website provide one example of how to migrate from paper templates to an online platform such as Miro [145].

**Design requirement 4—Promoting awareness**

Offering a tool is only a step towards support for pitching. To convince an audience to subscribe to a proposed design concept in a design pitch, stories help not only to capture the audiences’ attention but also to raise their interest through emotional connection. By planning stories for pitching, the changes in design pitches were noticed in the evaluation. However, we didn’t validate the effect or success of convincing an audience with the participants’ story-pitching in the evaluation session. Hence, a comparison of design pitches before and after should be supported. The extent of how convincing a design pitch it is for an audience should be identified more explicitly so that it could be provided as feedback to
the student pitchers, in the hope that they more clearly perceive the benefits of including more and richer story elements into pitches. External critical feedback may push students to be less easily satisfied with their design concepts and how they are pitched. Hence, another future direction for developing the platform would be to combine it with a service (e.g., through crowdsourcing) that integrates the generation and evaluation of pitches of new design concepts.

4.7 Conclusion
This chapter describes a study on the development and evaluation of a tool that is intended to help with improving design pitches. We made contribution by proposing a framework for tool development in support of story-planning for pitching design concepts and developed and tested a tool called StoryPrea. The user tests and pitch evaluations indicated a general acceptance of this tool, especially in the development of interactive products. We also identified some directions for future work and further improvement of the tool. We could only find very limited academic research on design pitching and hope that this chapter has contributed to recognizing some of the interesting challenges in this field. Developing effective tools in support of design pitching remains a challenge, but the tool proposed here can serve as an inspiration for others.

Chapter
FIVE
The Pitchify tool
An overview of changes with StoryPrea tool

This chapter is based on

Abstract
Planning stories for design pitching is important, but also difficult for many industrial design students. As there is a lack of appropriate tools that can support this task, a tool called StoryPrea was developed and tested by students in a previous study. It was later on improved based on the insights collected from that study. This chapter reports on a study with the updated tool that was renamed to Pitchify. To develop an in-depth first-person perspective, the researcher (also developer) of the tool used it by herself to plan a pitch for the tool itself. The insights collected from this exercise are used to explicitly identify three roles for the Pitchify tool. Obviously, the pitch created also provides an example that can be used in communications about the tool.

Keywords
Design pitching; Story-planning; analysis; Pitchify tool; design impact

5.1 Introduction
Making a successful design pitch is a challenge for designers at large, and even more so for students training to become designers. In order to convince an audience to subscribe to a design concept, a broadly supported view is that building a story around the design concept can be a key to success. Despite the fact that the use of stories has been broadly advocated in design research, the willingness of design students to adopt this in actual design practice, and especially in design pitching, was shown to be relatively low. Observing students within design practice, it became evident that their design pitches contained few story elements, and instead mostly focused on the features of the products or services that they designed. This is hardly surprising, as very few design students have followed specific training on design pitching. Both the awareness and the practice of story pitching could obviously be improved and appropriate methods and tools could play a key role in this. However, few methods and tools seem to be currently available for this particular purpose. In a previous study, we developed a specific tool entitled StoryPrea that supported story planning for design pitching, and conducted a user test with design students from both Eastern and Western cultures. The feedback from the students showed a general acceptance of the idea that design pitches, especially on interactive products, could be improved by including story elements and revealed a positive attitude towards the proposed tool. The results of the study also pushed us to reflect on the problems that the students encountered when trying to apply the tool in practice.

In this chapter, we report on a first-person exploration of the tool Pitchify that resulted from a redesign of the previous tool StoryPrea, taking into consideration of several of the lessons learned from the previous study. In order to make sure the problems that the students encountered in the test were appropriately solved, and both the functionalities and other features of the tool were improved in this updated version, the researcher applied the tool herself to develop an in-depth first-order perspective. Some of the considerations that led to this decision were the following.

Firstly, the researcher plays a double role as both the developer and user of the Pitchify tool. Before introducing a new tool to others in a convincing way, developing ample expertise with it, including being able to provide detailed examples, seems important and necessary. It is similar to conducting an expert review [146] in which the researcher uses a product or service to complete a specific task and makes a walkthrough through all the steps involved. Detailed insights can be collected in this way, for instance, identifying which part work well or not, and exploring both reasons for problems and possible solutions. It is also an opportunity to check whether the design direction or design requirements that have been proposed in an earlier stage have indeed been accomplished.

Secondly, the information collected in user tests is often primarily related to usability problems, while deep insights are not always easy to be extract from participants’ feedback. To understand all the problems that the users encounter during the process of using a tool, i.e., to develop an in-depth understanding of the issues that arise when applying the tool to plan a design pitch, positioning ourselves as the user seemed advisable. This is expected to provide complementary information to what can be collected in a user test (using the so-called third-person perspective).

Finally, the limited number of participants with Western cultural background that we were able to convince in the previous test indicated that pitching the StoryPrea tool was not very successful in the recruitment phase of this user test. To attract more students into using the Pitchify tool in future work, an improved pitch is required. Thus, it seemed necessary for the researcher to reflect on and analyse the existing pitch to understand its flaws, for instance, is there a convincing story or are key story elements missing. As the Pitchify tool has been developed for the explicit purpose of assisting pitching by planning a story, it was an obvious choice to try it out on a pitch for the tool itself.

Three research questions guided the first-person exploration reported here:
Q1: Does the updated tool Pitchify indeed support the analysis of a design pitch? (In our case, does it support the analysis of the existing pitch?)
Q2: Does it support planning a story for pitching a design concept? (In our case, does it support planning a story to pitch the Pitchify tool itself?)
Q3: How does using the tool change my first-person perspective on it?

This chapter is structured in four sections. We start with a literature review and subsequently introduce the updated version of the tool Pitchify. Next, a case study illustrates how I myself adopted the Pitchify tool for analysing earlier design pitches and for planning a story for a new pitch. Students’ feedback on this new pitch was collected and discussed. We conclude by identifying the main insights obtained from the study and by proposing future work.

5.2 Related work

Literature shows that there are primarily two strategies used for convincing: the logical approach by using conventional rhetoric with facts, statistics and quotes from authorities, and the emotional approach which relies on telling stories [137]. Seemingly, there is a common belief in literature that telling stories is ultimately the best way to convince [73, 76, 101]. People are not persuaded or convinced by reasoning alone, but naturally want to work through stories [137]. Stories not only provide rich data which can express people’s movement, interpret ideas [137], and describe detailed information to support explanation of the facts and data, but also deliver and arouse emotions with can in turn trigger empathy and imagination. McKee argues that “Stories fulfill a profound human need to grasp the patterns of living, not merely as an intellectual exercise, but within a very personal, emotional experience” [147]. The key to moving and convincing an audience thus seems to be in telling good stories [137].

For the presenter, no matter which strategy is used in a design pitch, both the information selected for the pitch and how it is communicated [143] affect the response of the audience. Completeness and clarity [143] are two important aspects that influence the results of convincing, and they can be measured by how successful they are in conveying the dimensions of what, who, when, where, why and how [143]. These dimensions are also the essential elements of a story [34, 68]. Hence, a story is undoubtedly an appropriate way to interpret a design concept, and a good story has the potential to lead to a more positive evaluation of such a design concept. People in the audience use their own perception and how they interpret the audience use their own perception and how they interpret how and why things happen [150]. The plot is the sequential arrangement of events which indicate what happens, with whom, in what order and with what chain of causality [149]. Structure and plot are used strategically to hook the audience and hold their attention [151]. The elements (content) such as characters, context, conflict, etc. are the building blocks. Scott King suggests to consider necessary elements such as character (with a specific point of view to interpret the world in the story), wants (the character’s needs and goals to achieve), conflict (obstacles to be overcome), etc., and mash them all together into a story pitch [92]. John B. Black believes that a story is the combination of these elements including setting (character, location and time), theme (event and goal), plot (goal, attempt and outcome) and resolution [150]. Quesenbery and Brook introduce ingredients of a story such as perspective, character, context (the environment, the what, when, where of the events in the story), imagery, etc. [9]. They particularly highlight the detailed elements, for instance defining traits of the character and specifying the context such as physical context, emotional context, sensory context, etc. in the story. There is a high degree of consensus about common structures that work for many stories. Examples are the Hero’s journey introduced by Campbell which provides a common structure for stories [24], and the Five-Act structure proposed by Freytag in which there are 5 main acts, namely exposition, rising action, climax, falling action and denouement [152]. Donna Lichaw discusses structures for story crafting from the perspective of a narrative arc or story arc including 7 elements: exposition, inciting incident or problem, rising action, crisis, climax or resolution, falling action or denouement, and end [78].

5.3 Methodology

In this study, we address the three research questions introduced earlier primarily through the method of a first-person perspective case study. It is a common and important method in qualitative research as it is an empirical inquiry to investigate an event or a phenomenon within a real context [153]. It helps to interpret how and why things happen [154] and is useful to gain a holistic view and understand particular problems or situations in greater depth [155]. Inspired by the strengths of this case study method, we involved aspects of three types of case studies, i.e., exploratory, descriptive and explanatory [155] into our study to concept. How to weave such aspects into a story is quite abstract, and tools that can assist in such a process are therefore potentially interesting and worthwhile.

Planning or crafting a story is not what design professionals are usually trained to do or think about doing [149]. A story can be crafted based on a structure or a framework or grammar which determines the order and fashion of the story [150].
investigate what we can learn from the use of the updated tool Pitchify. Using the tool Pitchify before introducing it to others was actually a pilot case study which was exploratory and helped to formulate the research questions. For instance, which features work well and which don’t? The description and explanation of how the tool was used by us is an attempt to describe what happened during the whole process and interpret the related information.

In line with the three research questions, three steps can be distinguished in our study:

- **Step 1** — The Pitchify tool was used to analyse an existing pitch that we used to recruit participants in our earlier study.
- **Step 2** — The Pitchify tool was used to plan a story for pitching the tool itself.
- **Step 3** — A workshop for design pitching was held and 20 ID students within our design department took part in it. We first pitched the design concept of the Pitchify tool in the workshop, and then collected student feedback on our pitch through interviewing. The interviews were audio recorded so that they could be analysed in more depth later.

### 5.3.1 The Pitchify tool

The Pitchify tool is derived from an iteration on the previous version called StoryPrea. In this iteration, we incorporated several insights collected in the study reported in the previous chapter. The name was changed into Pitchify to more clearly reflect its role in design pitching. Similarly, as in the case of StoryPrea, the Pitchify tool is comprised of two sets of materials: 7 templates for collecting information (shown in Figure 5.1) and 10 cards used for inspiration (shown in Figure 5.2). Compared to the previous version, Pitchify is improved in terms of functionalities and usability. All templates are A3 in size with titles, sub-titles, guideline questions and 8 blank squares. There were tips for how to fill in the squares and reminders to fill in related information. The guideline questions which have been improved in their formulation are included in each template so that users can take full advantage of them to support their activities such as reflection upon their design concepts, discussion of the design relevance, and planning stories for pitching.
### WHAT WOULD GO ON?
**Specify the activity**
- Which activities are the character(s) involved in?
- What are the functionalities of the activity/activities? Are these activities easy or difficult, frequent or exceptional, boring or interesting, imposed or voluntary, etc.? Explain them in details.
- Why does the character(s) take part in (or abstain from) the activity?
- What influence do these activities have on the character(s)?

<table>
<thead>
<tr>
<th>activity</th>
<th>motivation</th>
<th>influence</th>
<th>others</th>
</tr>
</thead>
</table>

### DESIGN PROBLEM(S)
**Confirm the design problem(s) and design direction**
- Describe the main character(s) and/or the supporting character(s) experience any problem(s)?
- Is there any tension between the activity actually taking place and the desired scenario?
- What is the core of the problem(s)? What are the reasons for the problem(s)?
- What influence do these problems have on the character(s)? Explain the problems in details.

<table>
<thead>
<tr>
<th>problem</th>
<th>response</th>
<th>influence</th>
<th>others</th>
</tr>
</thead>
</table>

### DESIGN SOLUTION
**Specify your design concepts**
- Introduce your design concept(s) with sketch, text, or images.
- What does your design (product) look like (shape, size, color, material, technology, interface, etc.)?
- What are the functionalities? How does it work? How do people interact with it?
- What influence will it have on the users? Whether it helps the character(s) to solve the problem(s) successfully or not?

<table>
<thead>
<tr>
<th>Design concept</th>
<th>Material/Features</th>
<th>Technologies</th>
<th>Interactions</th>
<th>Design concept</th>
</tr>
</thead>
</table>

### IMPACT OF THE DESIGN
**Establish the impact on the character**
- What is the likely impact in the short/medium/long run?
- Which basic needs (autonomy, competence, relatedness, stimulation, popularity, etc.) of the character(s) are met by this new product or service?
- What emotional(s) are triggered by this new product or service?
- What are the values of this new product or service to the character(s)?

<table>
<thead>
<tr>
<th>Impact</th>
<th>Needs</th>
<th>Emotional</th>
<th>Value</th>
</tr>
</thead>
</table>
5.3.2 How I use the Pitchify tool

[1] Step 1: using the Pitchify tool to analyse existing pitches

In our previous study, in order to introduce the StoryPrea tool to the students and recruit sufficient participants for the test, a design pitch was prepared. This included a textual pitch and a poster (shown in Figure 5.3) which were both displayed throughout the department building and delivered as well as hand-out to students. The StoryPrea tool was also pitched during a project meeting with some students. To ensure that the pitch could be delivered within limited time, the text of the pitch was limited to the following short description:

“Do you ever think about how to excellently pitch your design concept on the demo day? You may be frustrated in the past time. Yes, it is not so easy. If you still have problems in pitching, you are welcome to join us for a test in which you can try to use a tool called StoryPrea to help you for a good pitch with a story. There is also an opportunity for you to practice pitching and get feedback from the experts. You are always welcome to contact us for more information. Send an email for registration.”

The Pitchify tool was first used by the researcher to analyse the information contained in both the poster and the pitching text. As Figure 5.4 (1)-(6) shows, three templates were filled: Template 4 (identified the problem—students might have difficulty in successfully pitching their design concepts), Template 5 (identified the design solution—the tool Pitchify could help), and Template 6 (identified the impact—supported the students for making a good design pitch). While the other 3 templates were almost blank with very limited and vague information. In Template 1, the main character was identified as the ID students. In Template 2, the concrete information about the time and place was unclear. Template 3, the character’s activity was making a design pitch. It seemed that there was no story in that pitch and many essential elements were missing.
Figure 5.3 The poster that was distributed throughout the department of Industrial Design to find students interested in participating in a study on the StoryPre tool.
To get more insights into how useful different aspects of the Pitchify tool are when analysing pitches, the Pitchify tool was also used by the researcher to analyse some famous pitches or presentations such as TED talks, successful sales pitches, the iPhone introduction made by Jobs Steve in 2007, and Hans Rosling’s TED talk on the “Magic washing machine”. However, if defined strictly, most of the examples were presentations rather than pitches as they were made for different purposes and usually lasted at least for 15 mins. Therefore, an analysis of Hans Rosling’s talk is presented in this chapter. It is relatively short and much closer to pitching a product design than the other talks (shown in Figure 5.5 (1)-(2)).

The results of the pitch analysis showed that all the templates were used, and many of the blanks on template 1-6 were filled in with the sticky notes. It’s obvious that Rosling told a story in his talk as all the essential elements of a story were included:

1. In template 1, the characters were clear: his grandmother, his parents, and himself. More details about the characters such as their dialogue, thoughts, emotions and expectations were also introduced in the story.
(2) In template 2, the story setting was clear. The story happened at home on the day when they bought the washing machine.

(3) In template 3, characters’ behaviour and activities could be figured out from the narration of the details in the story.
In template 4, the conflict was easy to identify because in the beginning of the story the problem of washing clothes by hand was clearly introduced and highlighted in its severity.

In template 5, washing machines occurred as the solution. Just as the title of the talk indicated, it was the theme of this talk, and the solution to the conflict.

In template 6, the impact was also obvious. All the family members were happy. His grandmother was excited, and his mother had more time to read books to the children. Rosling himself benefited from such an environment.
deduced afterwards (shown in the paragraph with quotation marks below). The pitching was actually telling this planned story orally.

**WHO IS IN THE STORY?**

Specify the character(s) involved in the story

- Who is the main character(s)? Are there any supporting characters in the story?
- How would you characterize the people involved?
- Are there any possible changed character(s)? Specify the possible changed character(s)?
- Fill in the blank squares with text, sketch, or images to explain it (them) in details.

1. Sophie
   - a Dutch girl 20 years old
   - long yellow hair
   - typical Dutch
   - She and other 3 team members are working together for a design project in a design squad.

2. The other 3 team members
   - the team members are all Dutch
   - students of industrial design
   - teachers of ID
   - teachers coaching the design projects other peers

3. When and where does it happen?

Specify the setting

- When and where does the story take place?
- Which objects (or devices) are around?
- What are the contextual factors that have an influence on the character(s) or stakeholder(s)?
- If it is possible to change the setting, what would it be?

<table>
<thead>
<tr>
<th>Time</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:30-16:00</td>
<td>the open space for all the students a little noisy people pass by</td>
</tr>
<tr>
<td>Oct 3. 2018</td>
<td></td>
</tr>
</tbody>
</table>

4. What would go on?

Specify the activity

- When activities are the character(s) involved in?
- What are the functions (of the activities/actions)? Are these activities easy or difficult, frequent or exceptional, boring or interesting, imposed or voluntary, etc.? Explain them in details.
- Why do the character(s) take part in (or abstain from) the activity?
- What influence do these activities have on the character(s)?

- Sophie was finally checking the slides for pitching their design concept.
- All the students must pitch their design concepts in this midterm evaluation.
- Students should prepare for the pitching slides, sketches, etc. are allowed to use.
- They chose a design project which is related to combine crowdsourcing with medical images.
- They have proposed a design concept and developed before the pitching.

- They present their work so that they can get feedback from teachers and peers for improvement.
- The design concept is actually a mobile application called NeDe which combines crowdsourcing with gamification to support simple to annotate the medical imaging.

5. Design problem(s)

Confirm the design problem(s) and design direction

- Does the main character(s) and/or the supporting character(s) experience any problem(s)? i.e., is there any tension between the activity actually taking place and the desired scenario?
- What is the core of the problem(s)? What are the reasons for the problem(s)?
- What influence do these problems have on the character(s)? Explain the problems in details.

- They were argued by both the teachers and other peers after the pitching.
- The teacher seemed not to believe that concept would work because he asked some critical questions that was missing in their pitching.
- Sophie and the team members tried to interpret. However, it seemed that they failed in both the explanation and the pitching.

- For instance, the teacher asked for whom they design it and why they should use it.
- Another example: one student asked about the benefits of the design concept to the users.
- The teacher suggested that they need to think about how to clearly pitch their concept next time.

- Actually they spent much time on the work and supported by another coach who is an expert in crowdsourcing. The concept is a very good one.
The text for the pitch:

“Sophie is an undergraduate student majoring in Industrial design in TU/e. She is a typical Dutch girl who is positive, open and also hard-working. She is in the second year of her study and working with three other students in a group on a design project in a design squad in the department of Industrial Design. The project brief asks them to combine medical image annotation with crowdsourcing in a playful way, and there are two teachers coaching them. Halfway through the project there is a mid-term presentation at which every group is required to pitch their design concept.

In the afternoon of Oct. 03, 2018, the presentation is held in an open space in that LaPlace building on the TU campus. There are tables, chairs, and a projector and screen that can be used for the presentation. All the students and teachers came together. All student groups are required to pitch their concept(s). Sophie and her group members prepared slides for pitching their design concept and have agreed that Sophie will be the main person to pitch. She introduces the concept with sketches, images and text on the slides. However, after pitching, they are a lot of critical questions from one of the teachers who does not seem to believe that the concept will work. Some fellow students also voiced their concerns. Despite Sophie and the other group members trying to respond to the questions, they felt frustrated and awkward. It seemed that some essential information was missing in their pitch. For instance, what kind of user do they have in mind (which is one of the questions that the teacher asked). Or what is the value or reward that people get from using the product. The problem seems to be that they didn’t introduce these aspects clearly, and there was no narrative that provided this kind of information. One of the teachers strongly advised them to have a second look at their work and to think about how to pitch their concept in a way that the audience would more readily accept it. This might help them in their final presentation at the demo day. The teacher also advised them to join a pitching workshop which was offered within the department.

Sophie and her team-mates registered for the workshop on pitching. During the workshop, a tool called Pitchify is introduced, consisting of several templates to fill in and some cards used for inspiration. The instructor demonstrates the tool and introduces an example of how to use it step by step. It seems quite easy to learn to use the tool. They practice together, putting the templates on the wall and filling them with Post-it notes. They discuss and analyze the concept of their design project by sketching and writing text on the notes. They become aware of missing information such as users with details, the specific context of use and the values to the users as they progress with filling in the templates. Everything seems much clearer now and a story to pitch their concept starts to emerge from the
elements shown in the templates. Sophie and her team-mates smile as they feel more confident now to plan a new pitch based on the more extensive information that they have created."

In order to make sure the story is good enough for a formal pitch, a professor within our design department was invited as an expert for reviewing it. Based on his feedback and suggestions for improvement, the pitching story was finally identified as follows:

“Sophie was an undergraduate student majoring in Industrial design in TU/c. She was a typical Dutch girl who is positive, open-minded and also hard-working. She was in the second year of her study and was working with three other students as a group on a design project in the squad where other students work on related projects. The project was on making use of crowdsourcing to design an interface for annotation of medical images. There were two teachers coaching different student groups and providing feedback at the mid-term presentation, where all groups were required to pitch their design concepts for feedback by the teachers and fellow students.

In the afternoon of Oct. 03, 2018, the presentations were held in an open space at the LaPlace building on the TU campus. There were tables, chairs, a mobile poster board and a projector that can be used in the presentation. The students were required to pitch concepts in groups. Sophie and her group members had prepared slides for pitching their design concept, and Sophie would deliver the pitch. She used the slides to deliver the concept, successively explained it with sketches and storyboard. The design concept was a mobile application called NoDe which combined crowdsourcing with gamification to support people to use context of the design concept. Sophie and the other group members tried to use the context of the design concept and the values of the design concept to support people to use it. The users’ and the stakeholders’ needs were not clearly introduced in their pitch. The audiences could only develop a clear understanding of the proposed functionality but not on why the user would be motivated to use the application in the first place. One of the teachers advised them to have a second look at their presentation and to think about how to pitch their concept such that the audiences would accept the concept, which was what would be expected of them at the demo day and the final presentation. The teacher also suggested them to join a pitching workshop which would be organized shortly within the department and in which a tool would be introduced to help in preparing for a pitch.

Sophie and her team mates decided to register for this workshop. In the workshop, a tool called Pitchify tool was introduced and the instructor showed an example of how to fill in the templates with Post-it notes and how to use the cards that were part of this tool. They decided to try the Pitchify tool out by themselves. They discussed and analysed the concept of their project by simple sketching and writing text on Post-it notes. The missing information such as the users with details, the specific using context of their concept and the values of the design concept were identified more clearly as they filled in the templates. Everything seemed much clearer now and a story to pitch their concept emerged as all the story elements were identified. Sophie and her team-mates smiled as they were now more confident to put together a more consistent story for their next pitch.”

[3] Step 3: The workshop and interview
A workshop about design pitching was organized within our department, and 20 students (16 undergraduate students and 4 master students) participated in it (shown in Figure 5.7). The main purpose of this workshop was to collect feedback on the new pitch, so that we could check the results of the previous two steps and collect opinions on the usefulness of the Pitchify tool. Students were also invited to use the Pitchify tool in the workshop for planning stories to pitching their own design concepts. The workshop was organized as follows:

— Introduce the purpose and content of the workshop
— Pitch the Pitchify tool itself. The Pitchify tool was orally pitched to the students based on the story that was planned in step 2. The slides being used included the tool images and other related information that played a role in the pitch.
— Participants used the Pitchify tool to plan stories for pitching their own design concept (from a finished design project).
— Interviews with the students. The participants were interviewed in groups to share their opinions both on the pitch and on the Pitchify tool itself. The interviews were semi-structured and based on questions (see below) that related to these two aspects. The participants were urged to share their opinions objectively and impartially. The interviews were audio recorded and transcribed for the analysis reported below.
Some examples of the interview questions for the two different aspects being questioned:

- Referring to the pitch itself, what do you think about it? Is the information in the pitch clear and complete? Do you want to use the tool after hearing the pitch? Why or why not?
- Referring to your own use of the Pitchify tool, what do you think about it? Do you think it is useful? Can you explain how it is useful? Do you think it is easy to use? What are the problems when you use it? Do you have suggestions for how to solve your observed problems or, more generally, for how to improve the tool?

The results of the interview were qualitative, and revealed the following aspects:

### Responses to the pitch:

Of the 20 participants, 19 demonstrated positive attitudes to the pitch itself. For instance, one participant told us that:

“I think the pitch works because I have the same problem as what the character has in your pitch. I actually don’t know how to make a good design pitch. Usually I just do it in my own way: to introduce my design concept directly, paying little attention to tell a story. I didn’t care how the audiences think about it. There is no course or training especially for design pitching. I neither know some useful tools for it. I want to try to use it. Maybe I have been persuaded. I got its value.”

Another participant said: “The pitch is nice. Everything is clear and enough. Rather than explaining the design problem and introducing what the design is, it’s good to let me see my problems shown in a similar story. I like stories. However, I often forget to tell stories or I actually don’t know how to create a good story for pitching. From what the character does in the pitch, it seems that the Pitchify tool can not only remind us of using stories, but also support us to make a story before pitching. There is a tool and I see its usefulness, why not use it?”

Only 1 participant held a neutral or even negative attitude as he explained that: “I don’t think I have problems in pitching, so I don’t need to use any tool, at least until now. I just come for the workshop because I am curious about what it is as there is no such kind of workshop in our department before. I am not sure that the Pitchify tool would solve the pitch problem as I didn’t see the results. Actually, the audiences decide whether a pitch is successful or not. Pitching is complicated. Maybe I will have a try in the future.”

### Feedback after using the Pitchify tool by the participants:

The feedback on the Pitchify tool was clustered and categorized by the researcher into the following four groups:

- **Usefulness**
  Many participants believed that the Pitchify tool was useful, specifically for reflecting upon and analysing design concepts, and planning a story for pitching it. They shared comments such as
  “It’s quite useful for rethinking and analysing our design concept before pitching. We do need to do such things in order to identify what to pitch. As to how to pitch a design concept, it supports to plan a story as the elements of a story are there after analysing.”
  “The Pitchify tool is useful and logic to analyse a design concept. We often directly come to the point of the design concept itself by introducing what it is and how it works. It doesn’t make sense since something important seems to be missed.”
  “It’s important to relook at your design concept before pitching. A discussion may be indeed needed especially when working in groups. However, there seems much to discuss, and we are not sure what is relevant to be mentioned, or what is not so important that could be neglected. The Pitchify tool owns a benefit that it helps us to analyse and discuss our design concept within a story framework. The story elements match to design factors, and this avoids missing something and helps to figure out the important ones.”

- **Ease of use**
  Feedback on this aspect was mostly positive. Many participants said, for example:
  “I like to use the physical papers and cards. To fill in the blanks with Post-it stickers is popular and easy to do.”
  “It’s quite easy to use the Pitchify tool. We can use it individually or in groups, at any time, any place. The instructions are clear to understand. The explanation and examples on the cards are nice for help. I like it.”
• Problems
Despite the positive assessment of the Pitchify tool in terms of usefulness and ease of use, some problems were still reported. Participants helped to identify several of them, and some representative examples are as follows:

“I have a question. I think my problem is that some essential information might have been missed in my pitches. But after analysing the design concept, there seems to be much information. Which information can I use for planning a story?”

“I believe by using the Pitchify tool, I can analyse and even discuss a design concept with our group member in order to decide what to pitch and create a story. However, there is still a problem as to what exactly the story is. I mean the final result of using it. The story maybe already in my mind. Should I write it as a script of a story, or draw a storyboard? It’s too flexible. We were a little lost after using it.”

“Many pages to fill in. Many of these pages and cards are scattered, easily making the table in chaos. When being put on a wall, it could be much clearer. But it seems that a big blank wall or a big blank board is needed.”

• Suggestions for improvement
The problems that the participants encountered when using the Pitchify tool also inspired some suggestions for improvements. These suggestions covered different aspects such as functionality, usability, graphic design, and extension of the physical version, etc. For instance, one participant said that:

“There are many pages, and some of them may not need to be on a single page. Maybe you can combine some of them into one page to make it simpler. Or just make it as a big canvas with different areas. Then it will look more concise as a system.”

Another participant said that: “I tried to use the cards for help. But they are still limited as there are overlaps with the templates. I mean maybe they should be redesigned or improved with more and useful information for help. Clear explanation or more examples.”

Another suggestion: “The physical tool is easy to use. But I prefer to use digital tools so that it’s easy to make a copy or share with others. Do you think about making it digital? How would it be different from the current one?”

5.6 Discussion
5.6.1 Positive roles of the Pitchify tool
We reflected on some of the research questions identified before as a way to identify arguments in support of the Pitchify tool.

[1] It supported analyzing a pitch.

In step 1, the Pitchify tool was shown to be able to support analysing a pitch. When being used to analyse my own design, pitch used in a previous study, the limited amount of Post-it notes on most of the Pitchify templates indicated that some story elements in that pitch were only superficially covered or missing altogether. When being used to analyse some other pitches (presentations) made by famous people such as Steve Jobs and Hans Rosling, most of the Pitchify templates were almost completely filled with Post-it notes. This sharp contrast forced me to recognize the reasons for the failure of my earlier pitch and to think about what explains the success of these famous examples. In my pitch, essential information was missing such as the features of the people, their activities, their expectations and emotions, etc. Such information is important to demonstrate the value of the design concept, which might explain why I couldn’t recruit more participants for my earlier experiment. In contrast, the presentation by Steve Jobs Steve’s and the TED talk from Hans Rosling contain stories with vivid characters and scenarios. Hence, using the Pitchify tool for analysing pitches provides an opportunity not only to realize the problems in our own pitches but also to gain insights on how to improve them. This conclusion was also supported by the feedback from the participants of the workshop when they were invited to evaluate the new pitch that was made by the author.

[2] It supported planning a story for pitching.

The role of the Pitchify tool in supporting planning a story for pitching was partly demonstrated by the positive feedback from the workshop participants in step 3. On the one hand, most participants showed their appreciation for the story in the pitch, which was prepared by using the Pitchify tool in step 2. To some extent, it proved that the Pitchify tool was indeed helpful for planning a pitch with a story. On the other hand, participants of the workshop used the Pitchify tool by themselves, and shared their feedback. The interviews confirmed that using the Pitchify tool not only enhanced their awareness of using stories for pitching, but also supported the creation of a story in a very practical way.
5.6.2 Evaluating the design of the Pitchify tool

The Pitchify tool was developed starting from an earlier version called StoryPre and was inspired by insights for improvement from an earlier user test. In the study reported here, a research method was primarily applied, in which a case study was used to improve our first-person perspective on the Pitchify tool in order to evaluate the tool design itself and to identify insights for future work.

[1] Which part worked (well)?

Generally speaking, the templates and cards played different roles in supporting the analysis of a pitch, planning a story for pitching, and discussing the design relevance. The templates provided an environment that guided in an intuitive way the procedure of reflecting upon a design concept, analysing the concept with story elements, and planning a story for pitching. When putting all templates together, the essential elements for both a story and a design concept became clear. This avoided focusing solely on introducing the design concept without paying attention to related aspects, such as user and context characteristics. By combining templates and cards, the Pitchify tool made planning a story quite intuitive and easy. The individual templates obviously didn’t work equally well. Template 1 and the character cards indeed helped a lot for analysing and discussing the user or the stakeholders of a design, and for creating the character(s) in the story, and was in some ways similar to creating a persona. Template 2 promoted to make the context concrete in terms of time, place and the environment and was easily adopted. Template 3 required students to describe activities which provided background information to help interpret the design problem and people’s internal aspects such as thought and emotions. With the help of the Needs card, Template 4 provided support for specifying the design problems from the perspective of human basic needs. This made the design problem more humanized so that the audiences would more easily understand it and empathy could be triggered. Template 5 offered enough space to specify and interpret the design concept. Template 6 helped a lot to think about the impact of a design concept, an aspect that was too often neglected by both myself and the students in earlier pitches. The value and emotion cards pushed the user to specify the value and emotions in detail. Template 7 provided a structure for creating a story along the timeline, but its usefulness had only been explored superficially up to now. The curve of plot development was intended to work as a visual guide for organizing the elements into a story.

The guideline questions which were redesigned for Pitchify and included on the templates were appreciated, and they provided an assistance for the users when they encountered problems of what to fill in. They were easily understandable and available at any time.

[2] Which part didn’t work (well)?

The use of the cards was fairly limited, partly due to some overlaps with the templates. While some cards such as the Needs card, Value card and Emotion card were frequently used, other cards such as the Time card and the Place card were mostly ignored. Template 3 also seemed not to work well enough as many students told us that they didn’t know what information to include in this template. It was too abstract and difficult to understand for students.

5.6.3 Limitations and future work

Some of the limitations in this work can be summarized as follows:

Firstly, the collected information was limited to qualitative data due to the research method that was applied in this study, i.e., a case study and interviews. For instance, when evaluating participants’ attitudes to the pitch and the Pitchify tool, a questionnaire with a Likert scale might have been useful.

Secondly, the Pitchify tool only partly supported discussing the impact aspects. Based on my own experience in using the tool, Template 6 and the Value card reminded me to think about demonstrating the impact of the tool in the story. However, they were still somewhat vague and abstract. Making it more concrete and understandable for students is still a problem that needs to be addressed in the future.

In the future, work on two aspects should be taken into consideration. Given the insights from our own experience of using the Pitchify tool and the feedback from the students, the tool design can be further improved in a next design iteration. Optimization of the design includes improving the visual design, adding some functionalities, etc. Especially the parts that didn’t work well enough should be reconsidered. For example, the support for thinking about design impact of a design concept should possibly be enhanced. Giving examples or additional support might be a possible solution.

5.7 Conclusion

In this study, the Pitchify tool was developed and discussed based on the three research questions formulated in the introduction. In order to assist design students in successful pitching, the Pitchify tool has been pitched in order to establish if there is recognition for its potentially positive support for planning a story for pitching and hence discussing the relevance of a design concept.
Chapter SIX

Supporting students to plan stories for pitching design concepts with Pitchify tool

This chapter is based on


Abstract

Industrial design students often have difficulty to demonstrate the impact of a design concept and to convince their audience to subscribe to the concept that they are pitching. More specifically, we have frequently observed that students are prone to concentrate on the features of their product or service and fail to incorporate them into a story that can clarify important user and context characteristics. This is especially a problem in the case of interactive products that are assumed to affect the user experience. Appropriate tools such as the Pitchify tool, which is the outcome of an iterative design process described in the previous chapters, aim to enhance the awareness that incorporating stories (or at least story elements) into design pitches is important and moreover assist in the activity of planning such stories. This chapter presents a longitudinal study on how design students applied the Pitchify tool in their projects. The results confirm that the Pitchify tool can easily be adopted for planning stories that are used for pitching, and that doing so increases the appreciation for the proposed design concepts.

Keywords
Pitchify tool, design pitching, story-planning, tool development

6.1 Introduction

Using stories within design pitching is likely to have an impact on convincing audiences and on the extent to which they to subscribe to a proposed design concept, due to the irreplaceable benefits of stories such as promoting imagination [156], triggering empathy [20], arousing emotional resonance, etc. The fact that people can easily relate to characters in a story is expected to make audiences more easily aware of the value of a design concept and the impact that such a design concept can possibly bring to them. An earlier study [1] of ours showed that industrial design students have difficulties in planning stories for pitching design concepts and agreed that appropriate tools might help to improve in this respect. Given the lack of appropriate tools in support of planning a story for pitching, we explored the development of a relevant tool using a research-through-design approach [136]. Since design consists of both exploration [118, 119], and reflective practice [159], it is iterative and constructive, and offers an alternative approach to problem solving [160]. More precisely, the development of the tool included design iterations, user tests and expert reviews, including a
use case in which the researcher used the tool to improve her first-person perspective of the usability and usefulness of the toolbox. Despite the fact that these collected insights were considered in the final design iteration, which is called the Pitchify tool, a longitudinal validation of this final prototype was deemed necessary to provide additional evidence for the claims made in this thesis. This is exactly was is being reported in this chapter.

This study reported in this chapter is inspired by the following three research questions:

Q1: Which features of the updated version of the Pitchify tool need further improvement in order to improve the support for planning stories aimed at design pitching?
Q2: What are the arguments in favour of the current features in the Pitchify tool?
Q3: What are the problems when students use the tool and what are the possible solutions?

This chapter provides two contributions. First, a complete specification of the final prototype of the Pitchify tool is provided. It had been optimized based on insights collected in previous studies. Most prominently, thinking about and discussing aspects related to the impact of a design concept is now supported more extensively by providing more concrete examples on relevant aspects such as emotions, values and human needs. This addition should make it more feasible for students to highlight the design impact when planning stories for pitching. Second, this chapter describes an empirical study aimed at providing evidence that both the awareness of the need to plan a story for design pitching and the attention on showing design impact of a concept are enhanced with the support of the Pitchify tool.

Four sections make up the structure for this chapter. A review of the related literature is first conducted. Subsequently, a co-design session is discussed that was conducted to help define the final version of the Pitchify tool. Next, we observed how ID students applied the Pitchify tool to plan stories for actual design projects that they were involved in. We conclude by identifying the main insights obtained from the study and by proposing avenues for possible future work.

6.2 Related work

Stories have long been promoted for pitching or presentations in many fields [68,80] because of the active role they can play in communication such as bridging the imagination [156], initiating a dialogue [3], triggering empathy [20], etc. A typical story has a developing plot in which the characters and context are established in the beginning, then the conflicts are identified and developed through a middle phase, and finally the consequences are revealed at the end [53]. A story can provide rich information by detailing the characters and the contexts in which a product (design concept) is supposed to demonstrate its values/impact by helping to solve problems or conflicts. Stories definitely work in convincing audiences to subscribe to a design concept.

While the importance of stories is easily recognized, building a convincing story is a skill that many industrial students and design professionals feel they have not been trained for [149]. In the domain of design, we have seen an extensive and growing offer of dedicated tools for a wide spectrum of related purposes, such as tools that offer support for visualizing stories into storyboards or videos. However, very limited work is available that is specifically aimed at the relationship between design pitching and stories [101]. Therefore, we hypothesized that there was room for a tool that can facilitate planning a story for pitching a design concept.

6.3 Methodology

6.3.1 Sub-study 1— A Co-design workshop

In this paper, two sub-studies are reported. First, a co-design workshop was organized with students from our design department to help convert the insights from previous studies into the final design of the Pitchify tool. Involving intended users into the design process has been increasingly popular in design since design is a socio-cognitive activity [161], and involvement of users into the design is likely to result in better designs. It gives users a voice, evokes discussion, allows for testing ideas, fosters a common ground [123, 124] and provides an opportunity for developing a deeper understanding of the users’ desires. Obviously, working in a design department with design students made the choice for co-design even more obvious than it would have been in case of another user group.

The purpose of the co-design workshop was to optimize the current version of the Pitchify tool which had been used by the researcher herself in a previous study. Two rounds of the co-design workshop were conducted separately with 2 groups (of 4 and 3 participants, respectively). In each round, the researcher worked...
together with a group to accomplish a design iteration of the Pitchify tool. The workshops were structured into four steps:

1. Introduction of a design brief, background knowledge and procedures to acquaint the participants with the topic and the aim of the workshop.
2. The existing version of the Pitchify tool was used by the participants for planning a story to pitch a design concept described in a given scenario. The tool provided an environment in which all of participants worked together to envision an experience of a real situation.
3. All the participants worked together on proposing changes to the Pitchify tool. They were encouraged to share their opinions on possible design directions for the Pitchify tool by reacting to “what…if…?” questions. Any form of expression was allowed such as descriptions, sketches and paper prototypes.
4. A summary was made of the co-design session, and feedback was collected from the participants in order to capture their impression of the design relevance.

### 6.3.2 Sub-study 2--- A case study

The updated version of the Pitchify toolbox that arose from these co-design sessions was used in a follow-up study with 11 design students working in groups on 3 different projects. It was hence a case study that combined qualitative methods such as walk-through, observation and interview. The purpose of this study was to evaluate the revised version of the Pitchify tool and to collect feedback and insights for possible future work. The students primarily used the tool to prepare for the two mandatory presentations that were part of their project: a mid-term presentation clarifying the concept and approach and the final presentation on the demo day showing the prototype and aimed at convincing a wide audience (from family members to teaching staffs) about the value of their design. The mid-term presentation was held after about 10 weeks of design ideation with the aim to collect formative feedback on a design concept that can help to improve the design (concept). Students were allowed 5 minutes to pitch their design concept in groups, mostly with the use of PowerPoint slides and simple (e.g., paper) prototypes. The final presentation was conducted at the demo day, after about 20 weeks, where the results for all the student projects within the department were shown. The students pitched their design to an audience of both internal and external visitors with the support of posters, operational prototypes and videos. Informal interviews were conducted with members of the audience to collect feedback on the pitches. Data from both formal and informal interviews with the students who used the tool and from the observations were collected by audio recording and photographing. Questions of the interviews primarily referred to the opinions about the Pitchify tool, including its functionalities, problems that they encountered when using it, and suggestions for improvements.

### 6.4 Results

#### 6.4.1 Results of the sub-study 1 (a co-design workshop)

Each round of the co-design workshop lasted for 90 minutes, and the 7 participants were either bachelor students (two Dutch and 1 Chinese) or master students (2 Dutch and 2 Chinese). They were divided over two groups (group1 with 4 students, group2 with 3 students) (as shown in Figure 6.1). The proposed changes to the Pitchify tool were collected separately for the two groups and are summarized in Table 6.1 and Table 6.2, respectively.

![Figure 6.1 Work of the participants in the co-design workshop](image)

#### Table 6.1 Insights collected from the co-design workshop with group 1

<table>
<thead>
<tr>
<th>No.</th>
<th>Insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The current structure of the tool works well. No need to change.</td>
</tr>
<tr>
<td>2</td>
<td>The templates can remain as they are now.</td>
</tr>
<tr>
<td>3</td>
<td>Using stories to support thinking about how to convince other people makes sense.</td>
</tr>
<tr>
<td>4</td>
<td>In order to show the importance of the impact of design concepts, awareness of it may need to be enhanced. Provide a clearer interpretation or show examples.</td>
</tr>
<tr>
<td>5</td>
<td>The use of the cards is weak. Need to think about how to make full use of the cards.</td>
</tr>
<tr>
<td>6</td>
<td>The Value card is useful for thinking about the design relevance. But more details or examples are needed.</td>
</tr>
<tr>
<td>7</td>
<td>The Needs card is also nice. It would be better if each need is put individually on a single card.</td>
</tr>
<tr>
<td>8</td>
<td>Improve the visual design, as this will make the tool more appealing.</td>
</tr>
<tr>
<td>9</td>
<td>The character in each story will obviously be different. It’s impossible to have a uniform setting for a character. But a template or an example would be helpful as...</td>
</tr>
</tbody>
</table>
sometimes we are not sure what features a character needs to have for a pitch. It might be related to the relevance, and influence the effect of convincing the audience.

10 Template 3 (Activity) is a difficult one to fill in. Explain it more clearly or give the users an example. Or provide a card to help with its interpretation.

<table>
<thead>
<tr>
<th>No.</th>
<th>Insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Using stories for design pitching is a good idea as we often neglect to think about the results or impact of a pitch. Whether the audience believes or not is indeed a challenge that we designers should be more explicitly aware of. The Pitchify tool is useful in its support for creating a story for pitching. But its role in helping to identify the design impact or influence is less obvious.</td>
</tr>
<tr>
<td>2</td>
<td>The concept of design relevance is indeed a new term for us. Because it is important for convincing, it should be introduced or explained in the introduction of the tool. Maybe write it in the introduction of the tool usage.</td>
</tr>
<tr>
<td>3</td>
<td>A structured introduction to the Pitchify tool might be needed, so that all the required information, including the importance of design relevance would be available to the users when they start to use it.</td>
</tr>
<tr>
<td>4</td>
<td>A physical paper tool is adequate. It’s fit for group discussion and analysis. But to fill in all the templates still takes time. Use less templates or combine them into a big one in which each story element could be visible when needed, and be hidden when not using it, like paper folding.</td>
</tr>
<tr>
<td>5</td>
<td>The cards should be more useful. But in fact, we only had a look at some when we needed help to fill in the templates. May be more cards or more examples?</td>
</tr>
<tr>
<td>6</td>
<td>The cards have some overlap with the templates. Is this necessary? It’s right to match the cards with the templates, but they need to be differentiated. Make some changes on the cards or the templates.</td>
</tr>
<tr>
<td>7</td>
<td>Some of the cards are quite useful, for instance the Needs card, Value cards, and Emotion card. Improve the design of these cards. Make the explanation clearer, and give good examples.</td>
</tr>
<tr>
<td>8</td>
<td>Some details on the templates still need to be improved. For instance, the visual effect, the layout design, and the English of the guideline questions, etc.</td>
</tr>
</tbody>
</table>

6.4.2 The updated version of the Pitchify tool

Based on the insights collected from the co-design workshop, a design iteration of the Pitchify tool was conducted, specifically focusing on improving its functionality in support of discussing the design impact. The visual design was improved, and substantial attention was paid to the design of the cards, as many of the insights indicated a need to do so. The updated version of the Pitchify tool includes 7 templates and 42 cards. Only details were changed on the 7 templates, such as correcting language issues (shown in Figure 6.2). The cards needed to be completely redesigned, with special attention to the support for discussing the design impact of a concept. The number of cards increased from 10 to 42 with the aim to provide as much support as possible. All the cards have the same size of 75*100mm as before, are two-sided and color-coded into 8 categories (shown in Figure 6.3 & 6.4). On each card, on the front side, there is the title, sub-title, logo, explanation and tips for how to use the card. On the back side, there is the title and an example illustrated with an image for the purpose of inspiring. All the image examples were designed according to the specific content of a single card in order to assist the students to fully understand the card and apply the information when filling in the templates. The set of the 42 cards also includes 2 cards with instructions and explanations. Details of the cards in 8 categories are listed in Figure 6.3(b). The video introductions (as shown in Figure 6.5) was shown online (available by the link in Appendix 5).
Figure 6.2 The templates of the updated version of the Pitchify tool

(a) the inspiration cards

Figure 6.3 The inspiration cards in the updated version of the Pitchify tool

(b) the 8 categories of the cards

INSTRUCTION

Users
The Pitchify card tool is intended for designers and design students who are working for product design, user experience design, service design and interaction design, etc.

Purpose
The Pitchify cards are intended to inform and inspire designers and design students to analyzing and discussing the elements of a design concept. It's suggested to use the cards when working on the Pitchify canvases.

Specifications
The Pitchify card set consists of 40 cards, describing design elements in 8 categories.

The cards are colour coded for different categories.
6.4.3 Results of the second sub-study 2 (a case study)

In the sub-study 2, 7 students (5 male and 2 female) from 2 groups (4 Master students in group 1, 3 premaster students in group 2) in a design squad used the updated version of the Pitchify tool to pitch their design concepts for the same design brief (design an exhibit for Eindhoven Museum that uses machine learning). We traced their process of how they used the Pitchify tool. The third group of 4 bachelor students that we recruited for the study, decided later on not to use the Pitchify tool within their ongoing project.

For the mid-term presentation, since the design concepts were not fully matured, students’ use of the Pitchify tool was not as we expected. Even though the two
groups who adopted the tool used it to plan stories for pitching their design concepts, the stories in their presentations were not clear or complete. We noticed that many templates were not used at all. The presentation of the third group not using the tool concentrated on showing their design concept and resembled a product introduction with a weak sense of telling a story.

Fortunately, for the final presentation at the demo day, the students worked more actively to prepare their pitch. All the design projects were exhibited (as Figure 6.7 shown) and the students pitched their design concepts to a diversity of visitors. An example of how the students in group 2 (3 pre-master students) used the Pitchify tool to analyse their design concept and plan a story for pitching is contained in Figure 6.7.
Figure 6.7 An example of how the students in group 2 used the Pitchify tool to analyse their design concept and to plan a story for pitching.
The audiences’ opinions on these two groups’ pitching were collected in informal interviews. The manager of Eindhoven Museum who was in charge of the collaboration with the design squad for the EM design projects also shared his opinions, which were quite positive.

“I am so glad to see the great improvement both in the concept design and in their pitching. I noticed that both the two groups tried to tell stories about the design. A good story definitely could help me to see its influence that I questioned before. Obviously today they have already known how to clearly and appropriately introducing a design concept to other people. That’s quite nice.”

Some other people in the audiences, both externally or internally from other design squad, also shared their opinions. For instance, when asked about the pitching made by group 2, a lady said: “Yes, I can understand the design from their pitching. It is quite clear. To see the data collected by the museum printed out is so interesting. I like it, more emotionally.” A student who was from another design squad told us about his feedback on the pitch made by group 1 that: “I haven’t been to the museum. Their pitching and the prototypes attracted me. The pitch is nice, only problem is too fast. But I can see the points. The prototype is also helpful to interpret their concept.

All of the 7 students shared their opinions after the demo day. They indicated that most of them were very positive about the support that the Pitchify tool provided for planning the story in their pitching. They used it to analyse their design concepts, as well as previous pitches. While being asked to explain the reasons, rich information could be extracted from their feedback. Some representative examples are the following:

**For planning a story for pitching**

“I didn’t pay much attention to pitching before as I was confident in presenting. However, the feedback on our work from the mid-term presentation and also from the EM manager triggered me to think about how to do it better. The Pitchify tool is nice as it guided us to create a story. A story can include much information. It makes the pitch easier to be understood.”

“I like stories, but I always neglected it when pitching. The Pitchify tool actually pushed us to craft a story for pitching. I prefer to call it a reminder of storytelling. Of course, it works for creating a story.”

**For analysing a design concept**

“It’s right that the design concept should be looked at and analysed before pitching, so that the key points can be extracted and highlighted. We usually do this in our own way. Thus, there is a problem that we actually don’t know what is necessary that must be pitched and what is missing. The Pitchify tool provided a framework for how to analyse a design concept. All the story elements are related to interpret a concept. It’s quite useful.”
Ease of use

“Filling in the blanks on the paper is very easy. The cards are helpful with the explanation and examples. It’s also convenient to bring them with us so that they can be used at any time.”

The problems

“I can list three problems that we encountered. First, it took some time to fill in all the blanks. Actually, some information can be discussed orally, no need to write it down. Second, after using it, I was a little confused as there was much information. I don’t know what to choose for a story to pitch. Third, I don’t know what a good story should be. The tool can help to analyse the story elements and the story plot can help to create a story. But different people would make different stories based on the same information. The stories may be different in narrative sequence, description of the details or different styles. It’s still a challenge for us. If the tool can solve this problem, it could be much better.”

Suggestions for improvement

“My suggestion is that thinking about how to balance the time-consuming and the procedure of analysing and discussing. Writing down the information to fill in the blanks indeed took much time. Make the templates fewer or make them digital, so that it will be efficient and simple to copy and paste items. Another suggestion, too many cards. We cannot read every card. Selecting cards to use also took time. It seems that I care about time too much, ha!”

6.5 Discussion

6.5.1 the Pitchify tool supports story-planning for pitching design concepts

As the feedback of the students indicated, the Pitchify tool works well to support planning a story for pitching a design concept. By filling in the blanks on templates, a design concept is reflected upon through analysing the essential elements of a story. Missing information can be revealed and details of story elements such as the users or stakeholders (story characters), design impact like emotions, and values can be added and specified. All the created elements are potentially useful building blocks for creating a story around the design concept, so that it made the pitching more understandable and convincing. Selecting which elements to use was sometimes perceived as a problem (risk of information overflow).

6.5.2 the Pitchify tool potentially helps students to recognize and improve the quality of design concepts through story-planning

As the results of the second sub-study show, the adoption of the Pitchify tool was very poor at the mid-term presentation. There could be several reasons for this. For instance, we observed that the students were not intrinsically motivated to use the Pitchify tool in the beginning of their projects. This resulted in them only using very limited functionalities of the tool when preparing for the mid-term presentations. At the mid-term presentation, most of the design concepts were not developed enough and the students received feedback that improvements in many aspects were still required in order for their design to be appreciated by the client of the project. They had not advanced enough to demonstrate the possible impact of their design concepts. This external motivation may have contributed to the fact that the students of two groups much more actively used the Pitchify tool afterwards for analysing their concepts, discussing the design relevance and preparing their pitch. The feedback from the interviews confirmed that both the design concepts and the final pitching were much improved and quite convincing. This lends some support to the claim that the Pitchify tool indeed helps to enhance the quality of design concepts through story-planning. Since design for usability is quite popular at our department, it can easily result in a routine process consisting of ideation, prototyping, iterative improvement and user testing [164]. Information related to applicability or effectiveness of a design concept is usually collected after a usability test. But for design practitioners (students), it seems too late to make any change at this stage. If these aspects could be considered and discussed earlier, things might be different. And thinking about how to interpret the applicability and effectiveness of a design concept to demonstrate its value and impact might be easier. Furthermore, different to value sensitive design [165] which highlights the attention to human values, discussing the design impact enjoys a similarity with value-drive design [166] which changes the way to deal with extensive attributes of a product or system. Design is a process of problem-solving [167]. At the phase of ideation or design iteration, attributes or functionalities of a product should be proposed and developed according to user needs, after which the specific impact of a product can be identified. By planning a story with the help of the Pitchify tool, design students could be engaged into thinking about impact-related aspects such as values and emotions and human needs, etc. The discussion could be conducted more than once, and the quality of a design concept could be early recognized and potentially enhanced in the course of this process.
6.5.3 Limitation and future work

In this study, some important limitations were identified: 

First, only a very limited number of participants were involved in the second sub-study to use the updated version of the Pitchify tool. It resulted in limited external validity (as the sample was small) and user feedback from only a limited number of participants. We could only present the results from the two groups (out of three) which actually applied the Pitchify tool.

Second, the support of the Pitchify tool for discussing the design impact was confirmed by some remarks in the interviews which were conducted both formally and informally, especially with the people visiting the demo day. More insights might have been collected if the interviews would have been more structured, but this would not have been very appropriate in an already very crowded and noisy environment.

There is obviously space for improvement on the final prototype of the Pitchify tool based on the collected insights. The future work proposed mostly relates to making it feasible for more students to using the Pitchify tool independently without the researcher being available as an instructor. To put the materials for the tool online and provide a tutorial for how to use them is therefore an obvious next step.

6.6 Conclusion

In this paper, we presented the results of two co-design sessions that were used to iterate towards the final prototype of the Pitchify tool, as well as a fairly informal evaluation of this tool as part of some ongoing design projects. The final iteration of the Pitchify tool is presented and its role in supporting discussions of the design impact is outlined. We discussed the positive roles of the Pitchify tool in supporting story-planning for design pitching and enhancing the quality of a design concept.
7.1 Introduction

The potential benefits of incorporating storytelling more (explicitly) into the design process have been highlighted in recent literature. However, literature is empirically weak with regard to the designer’s practice of storytelling. The conflict between the theoretical claims and the observed reluctance in our design students to adopt storytelling into their design practice implied that the challenges and problems seem to be underestimated. This demanded an in-depth comprehension of the underlying problems in order to explore proper solutions.

In this thesis, we investigated how industrial design students currently incorporate storytelling in their design practice, and explored the ideation, development and evaluation of tools in support of planning stories for pitching design concepts. The research that we presented consisted of four explorations as introduced in Chapter 2 to Chapter 6.

In the first exploration in Chapter 2, we took as a starting point StoryPly, which is a recently-developed method in support of designers to envision and discuss their actual practice of storytelling in design. The observation of the workshops conducted with the StoryPly method indicated storyboarding as a bottleneck influencing both the adoption of the StoryPly method and the adoption of stories in design activities, especially for design practitioners who lack drawing skills. We presented an exploration into storyboarding tools and concluded with a proposition of three design directions for future storyboarding tools.

In the second exploration in Chapter 3, we adjusted the direction of our research and focused on industrial design students’ adoption of storytelling in their design practice because of the finding that our students at large showed reluctance to apply storytelling, as observed in the first exploration. We first explored literature on storytelling within the design context and successively conducted three sub-studies that jointly investigated students’ attitudes to the literature claims and their actual practice of storytelling in design. We concluded that the reasons for their reluctance to adopt storytelling could be attributed to the lack of a concrete purpose, and proposed design pitching as such a more concrete opportunity to enhance the acceptance. The research findings also pointed at a lack of accessible tools or methods that can assist those students that show an interest in storytelling. Consequently, we decided to undertake an iterative design exploration into a tool aimed specifically at supporting storytelling for pitching design concepts.

The development of the tool and the evaluation of initial prototypes is described in the third exploration in Chapter 4. We performed three separate sub-studies to develop and evaluate our StoryPrea tool. By reflecting on results, we identified the usefulness of this StoryPrea tool for planning stories for design pitching but also identified design requirements for further improvement. An interesting aspect of the study was that it revealed systematic differences between how students from different (Eastern and Western) cultures responded to and reflected on the tool.

In Chapter 5 and 6, we present the final design iteration of the tool and the evaluation of the final prototype formally called the Pitchify tool. We conducted two consecutive studies, including a first-person perspective case study in which the researcher used the Pitchify tool by herself to collect insights for improvement. Co-design sessions with students were conducted to help improve the design process, alongside an empirical study in which students utilized the Pitchify tool for pitching their ongoing design projects. We captured evidence for the positive role of the Pitchify tool both in facilitating story-planning for pitching design concepts, and in supporting the discussion of the design impact of a concept which is vital for convincing people when pitching.

In this final chapter we present the main conclusions and summarize the main contributions from our research. We end with identifying directions for future research, based on some of the limitations of this research, but also based on new opportunities that have been opened up.

7.2 Main research findings and contributions

7.2.1 Findings of Exploration 1 (Chapter 2)

Workshops with the StoryPly method [23] indicated that storyboarding was perceived as an obstacle for design practitioners to utilize this method, especially for those practitioners who were not skilled in sketching. Therefore, we started our research with an in-depth investigation of existing tools for storyboarding in Chapter 2. Three research questions inspired two sub-studies aimed at collecting designers’ opinions about such tools and collected more in-depth feedback from the participants who took part in a test of four selected tools.

Stories have been observed as a key to understanding user experience [e.g. 9, 12, 49, 50], and their use has been advocated in user experience design [9]. In the context of design, stories have often been visualized into storyboard. However, there is a lack of research on the actual practice of storyboarding in UX design. It is not an easy task to create a storyboard within a couple of minutes to present a product design, as the required techniques of sketching and/or photographic editing might not match the skills and interests of such UX designers [42]. Indeed,
current tools for storyboarding can be divided into two main categories; either
skill-based using traditional tools like pen and paper, or picture-based using
digital tools for image capturing end editing (on desktop, online and/or mobile
platforms.) In order to collect insight on such tools, especially the non-
professional tools, we first conducted a survey with an online questionnaire to
gather UX designers’ current tool-use and their opinions on the tools that they
currently use for storyboarding. Many different tools were suggested by UX
designers and four tools, including two picture-based tools [22] called
StoryboardThat and Pixton, and two sketch-based tools [22] called
SketchBookExpress and Procreate, were selected for a follow-up study. An
online storyboarding contest and a workshop were conducted to collect feedback
on these tools with the help of a USE questionnaire with 30 questions on aspects
such as usefulness and ease of use.

The data analysis revealed that the subjective attributes could be distinguished
into 3 clusters and represented in a 2D plane. The sketch-based tool Procreate
was superior to the other tools in terms of the attributes in Cluster 2 (Meet
expectations such as fun to use, flexible, and wonderful, etc.). The picture-based
tool Pixton scored for the attributes in Cluster 1 (Usefulness) and Cluster 3
(Simple to use) [42]. Sketch-based tools were superior in aspects such as offering
freedom, self-control, inspiring, etc., but required drawing skills and produced
output with an uncontrolled (variable) quality. Picture-based tools provided good
quality storyboards, but required substantially more time to master.

The contributions of the findings

The contributions of the findings include suggestions of three design directions
for future storyboarding tools. Design direction 1—functionalities of
storyboarding tools can be better managed by clustering them into groups, as
such clustering can also help to identify specific attributes in existing tools that
can be improved or should be added. Design direction 2—hybrid storyboarding
support and cross-device interaction can help to combine the strengths of sketch-
based and picture-based tools for storyboarding, as both types have specific
advantages. Design direction 3—online collaboration on creating storyboards
may help to overcome bottlenecks in storyboard creation that are caused by a lack
of such skills in the design teams that need them.

7.2.2 Findings of Exploration 2 (Chapter 3)

Exploration 2 in Chapter 3 was triggered by some insights from the first
exploration, which indicated that industrial design students at large showed
reluctance to utilize storytelling in their design practice, despite being encouraged
or introduced to the potential benefits of storytelling as advertised in literature.

This conflict motivated us to make an in-depth literature review on storytelling
in the context of design, and an empirical study with the aim to understand the
current status of design students’ adoption of storytelling.

The findings of the literature review on storytelling in design

First, the literature review helped to identify three separate directions for how to
explore the use of storytelling in design:

Direction 1—highlighting values or benefits of storytelling in design, for instance,
the positive roles of storytelling in design as advocated by Erick, Gruen, and
Brown, etc. [3, 6, 12]. Peter Lyloid et al. identified as benefits of storytelling the
communication within design team and the development of design expertise [16,
17]. Other claims stress storytelling as an essential part of design thinking [6],
and as a critical success factor for design processes and outcomes [8]. Storytelling
supports to inform and inspire design [18], to trigger empathy [20], and to
humanize the design [2].

Direction 2—integrating storytelling into the design practice. Literature shows
that storytelling has been incorporated into many different domains of design
such as interaction design [14], user experience design [9, 52, 53], Computer-
supported cooperative work (CSCW) design [12] and service design [13], and can
hence play various roles.

Direction 3—designing for storytelling. Literature in this direction generally
presents studies about designing products, method and tools for storytelling, such
as the StoryPly method [75], the Fictional Inquiry Method [79], Storytelling
Group [81], and the UserX story template [83].

Secondly, 130 claims of the (potential) benefits of storytelling for design were
selected from literature in the period from 1996 to 2018. These claims were
categorized into 5 groups according to the main phases of the design process, and
21 representative claims were selected to be included in a questionnaire.

Thirdly, we found that few empirical studies in the context of design were
actually presented in literature. The need for such studies was highlighted by the
gap that we observed between the advantages listed in literature and the
reluctance of our students to actually adopt storytelling in their design practice
(indicating that they were far from convinced of such advantages).

The findings of the students’ adoption of storytelling

We found that the students were not willing to accept that the effort invested in
incorporating storytelling in their design process was warranted [88]. First, they
raised questions on the perceived usefulness of storytelling. Despite the fact that
the usefulness of storytelling has been supported by several theoretical arguments, values such as triggering empathy, expressing emotions, and demonstrating values, etc., do not easily carry over into the design practice, which implies that students do not understand how they can be of concrete help. Hence, they remain skeptical and prefer alternative options such as sketches and prototypes of the products and services that they have in mind. The usefulness of storytelling needs to be conveyed in more practical terms in order to be perceived by the students. While some form of storytelling was broadly observed while presenting or pitching design concepts, the stories were more often than not incomplete and lacking a clear plot (a logical sequence of events). Design pitching therefore seemed the best opportunity to enhance students’ acceptance of storytelling.

Second, storytelling is generic in nature [98] and doesn’t seem to offer clear guidelines for good practice. Students create and tell stories primarily using their personal style. A lack of dedicated support for storytelling such as appropriate tools, methods, guidelines and instructions, was raised as an obstacle for acceptance by many students. Many students also think that the use of stories is equivalent to making storyboards, which is often viewed as a time-consuming and effort-requiring activity. Students thus showed their reluctance and/or rejection to utilize storytelling in their design practice, and no changes in this perspective were likely to occur in the absence of tools and/or methods that can offer practical guidance and reduce the required effort.

The contribution of the findings

The findings of the literature review constitute a comprehensive map of nearly all related studies on storytelling in design, summarizing the specific claims made in literature and identifying three main directions for research in this field. Our findings can be used as a reference for future research on storytelling in the context of design.

The findings in this exploration provided us with more concrete handles on how to study and address the observed gap between the theoretical arguments and the reluctance of students to actually adopt storytelling. They also inspired the choice to concentrate on the development of alternative tools for pitching design concepts in the form of stories, which shaped the remainder of the studies.

7.2.3 Findings of Exploration 3 (Chapter 4)

In the third exploration, the development of tools in support of story-planning for pitching design concepts was performed. A tool called StoryPrea was designed and an initial prototype was evaluated.

The findings confirmed that several aspects of this tool were appreciated by design students. They appreciated the physical templates of the StoryPrea tool which allowed them to start easily and work in a flexible way. The templates offered space for inspiration and collaboration by inviting engagement and discussion. They also appreciated that a session with the tool started with reflecting upon a design concept and identifying story elements which matched key elements of the design idea or concept. Unlike in the case of storyboarding, where sketching skills are required, users could either write down text or make simple drawings on the Post-it stickers that were used to reflect, analyse and discuss the key elements in the design concept, while it was easy to make changes to these stickers (so that they had the feeling that they didn’t need to commit too much). They also experienced that it became much easier to create a story for pitching a design concept once such key elements had been identified. Overall, the StoryPrea tool was regarded useful and easy to use.

The data analysis of the filled-in USE questionnaires revealed cultural differences in the reported attitudes towards the StoryPrea tool. In our evaluation, 81 industrial design students from 3 different universities in two countries (the Netherlands and China) participated either individually or in groups. Students with a Western cultural background seemed to be more critical towards our StoryPrea tool as they gave relatively lower scores as compared to students with an Eastern cultural background who were more positive and supportive of the tool. The qualitative data in the interviews revealed that Dutch students primarily showed an awareness of the potential values of stories in pitching design concepts, while Eastern students showed relatively weak awareness. We found that it might be influenced by different educational approaches in both cultures. In the Netherlands, the importance of reading and telling stories is stressed from a very young age, and the need for convincing stories is often emphasized in design education. For most Eastern students, especially Chinese students, it is not an important part of their design education, despite the fact that storytelling is popular in basic education. Storytelling is often viewed as creating storyboard by all students, thus showing limited awareness of the potential of stories for other design activities such as planning a pitch of a design concept.

The blind evaluation on the design pitches by specialists demonstrated that there was indeed a positive effect of using the StoryPrea tool that could be distinguished from many other factors influencing their judgement. We also
observed that story pitching seemed most suitable for pitching design concepts of interactive products that included a user-centered design perspective.

**The contribution of this exploration — The StoryPrea tool**

In this exploration in Chapter 4, we proposed and developed a tool called the StoryPrea tool. The core of the tool development lies in integrating the understanding of user needs into the story-planning so that the pitch of a design concept becomes more convincing. The StoryPrea tool includes two phases and three activities.

In the first phase (How it is now), the StoryPrea tool invites students to start with a reflection on the context as it is before introducing the new concept. In order to plan for pitching a design concept, developing an in-depth understanding of the current context is necessary and important. Aspects such as design background, design problems, design solution, etc., are identified by discussing key design elements using 5Ws (what, when, where, who, why) and 1H (how), and matching them to story elements such as character, setting, conflict and resolution, etc. Through filling in the blanks on the StoryPrea templates, students are guided step-by-step to finish the reflection and analysis.

After the activities in the first phase, in the second phase (How it could be), students plan a story with the story elements identified before, and create a pitch for their design concept. In this phase, students enjoy freedom to organize the information and create a story in their own style.

Despite identified limitations in the StoryPrea tool, the positive role that the StoryPrea tool could play (and the concrete assistance that it could offer) when planning a story for pitching a design concept through was recognized.

**7.2.4 Findings of Exploration 4 (Chapter 5 and Chapter 6)**

The final exploration was the design iteration of the Pitchify tool, including an evaluation through a first-person case study in which the researcher herself developed in-depth experience with the tool and a case study where design students applied the tool in their ongoing design projects.

Several attributes of the Pitchify tool were appreciated by students. The support for planning a story for pitching was greatly improved in comparison to the previous tool StoryPrea. More specifically, the feedback from the students confirmed that the 7-Story Plot Development template that guided them through the diverse story elements indeed provided good assistance when composing a story. Furthermore, they acknowledged that the Pitchify tool helped them not only to swiftly and easily plan a story for pitching a design concept, but also helped them to clarify the values in the story, specifically to highlight the impact or influence of the design concept. A story can initiate a dialogue [3], trigger empathy [20], and facilitate discussion on the design impact by describing a design concept and users’ activities in a concrete context.

We also found that the quality of design concepts could be recognized early and improved through planning a story with the Pitchify tool. Design for usability is popular and it easily results in a routine process consisting of ideation, prototyping, design iteration and user testing [164]. Information related to the design impact such as applicability or effectiveness of a design concept is often only collected at the stage of prototype testing. However, because of the time and effort already invested, it is often too late to make any fundamental changes at this stage, especially for design students who often postpone testing up to the very end of their project. If the design impact could be considered and discussed earlier, there would be more time available to take them into account into a design concept. We observed that student groups that used the Pitchify tool in their ongoing design projects constructed stronger design concepts that were pitched in a more convincing way. Although the study was still on a limited scale, these findings support our claim that the Pitchify tool can help to improve both the quality and the communication of a design concept.

**The contribution of the findings**

The main obvious contribution of this exploration was the formal version of the Pitchify tool. The basic framework and many attributes of the initial version of this tool, named StoryPrea, were demonstrated to be useful in a previous study, but this final version improved several details, based on the insights collected in this study. The positive role of the Pitchify tool was appreciated, especially the support for planning a pitch in the form of a story and the support for discussing the impact in terms of applicability, effectiveness, etc. of a design concept. In addition, the Pitchify tool helped to recognize and improve the quality of a design concept by considering how it could be pitched at different instances throughout the ideation phase.

**7.2.5 Contributions of this thesis**

In this section, we summarize the three major contributions of this thesis:

- **Firstly**, from the perspective of theoretical research, we performed a broad and in-depth literature review on story and storytelling, specifically in the context of design. We found that the existing literature lacked empirical studies on how storytelling is actually adopted (or not) in design practice.
Furthermore, three directions for research in this area were identified, and the claims of the benefits of stories/storytelling outlined in literature were summarized and used to create a questionnaire. Finally, the gap between these claims and the weak adoption of storytelling by design students was made explicit. Given the fact that the use of stories is increasingly promoted in diverse design practices, our findings provide useful insights for related research work in the future.

- **Secondly**, from the perspective of empirical research, the adoption of storytelling in industrial design students’ design practice was investigated comprehensively through a series of qualitative studies including observation, interview, field study and case study. We found that the adoption of storytelling by industrial design students at large, especially by students in an Industrial Design department of a university of technology, was relatively poor. They showed reluctance to use storytelling in their design practice for many different reasons. The reasons for this poor acceptance were related to perceived usefulness and ease of use. A lack of accessible tools that provide active support for students who are interested in practicing storytelling was identified as an important bottleneck.

- **Finally**, we presented the iterative design and evaluation of the Pitchify tool. In its final form it consists of 7 templates and a set of cards. It distinguishes two phases (P1-how it is now, P2-how it could be) and three activities including reflection, analysis, and story-planning. These activities are performed in a quite intuitive way by writing and drawing on post-it notes that are used to fill in the blanks on the templates. The cards provide information and inspiration in different stages of the process. The evaluation provided evidence for the positive role that the Pitchify tool can play both in supporting story-planning for pitching a design concept, and in facilitating the consideration and discussion of the design impact. Even though there were problems and limitations in both the tool development and the research, which leaves room for improvement, a concrete and useful tool has been realized.

### 7.3 Limitations and recommendations for future research

The research in this thesis adopted a research-through-design approach [136]. The research questions were addressed through several studies which also contained some limitations.

The original motivation for the research was the observation that most students at our design department in a university of technology were quite reluctant to adopt storytelling, despite encouragement in this direction by their coaches. This situation might be different for industrial design students in another program, such as an art college, or in a general university where the requirements on the design education might be quite different. However, in view of the benefits of storytelling advocated by many researchers, on the one hand, and a lack of empirical studies on storytelling in literature, on the other hand, it’s still worth conducting research on the discrepancy between such literature claims and observations in actual practice.

Next, in our research, several qualitative studies were conducted such as observations, interview sessions, a case study and a field study. In order to collect quantitative data and elicit useful insights, specific questions were added to a general-purpose USE questionnaire in the evaluation of both prototypes. The data collected in these qualitative studies indeed helped to understand and demonstrate the problems in more detail. The related literature on technology acceptance advertises large sample sizes for a valid evaluation of a new system or product [88]. In this respect, the evaluations of both the initial prototype called StoryPrea (Chapter 4) and the final prototype named Pitchify (Chapter 5-6) were carried out with a relatively small number of students recruited within our design department.

There are some problems and limitations remaining in the current Pitchify tool, as indicated by the results of the evaluation (Chapter 4-6). The generic nature of stories [98] implies that the procedure of story-planning is never an effortless task. To use the Pitchify tool for planning a story for pitching a design concept indeed requires time and effort. Aspects of ease of use and better user experience should be improved in future work. Furthermore, the existing Pitchify tool was developed from the perspective of the presenters with a focus on planning a story for pitching a design concept. It thus resulted in a story script informally written in text or just created in the mind. There were no rigorous studies on the outcomes of the pitching. There was also no explicit support for actually constructing the story nor for pitching it. The development of a digital tool, as suggested by many students, especially the ones with an Eastern cultural background in the evaluation (Chapter 4), was not taken into consideration in the design iteration. Our future research can address these problems when trying to improve the tool. We believe that future work will most likely benefit from the integration of existing tools, including presentation tools and storyboarding tools, both sketch-based and picture-based, as well as other media such as audio, video and animation, etc. The presentation tools primarily gain advantages in supporting rehearsal or feedback [84, 86, 87], while the picture-based storyboarding tools
7.4 Concluding Remarks

This thesis presented the research conducted in the field of tools for storytelling in the context of design. The value of stories/storytelling for design are indeed highlighted in literature, but making them available to design practitioners (especially design students) was shown to be a realistic concern in the design research reported here. In this thesis, the journey of research started with the StoryPly method, and several explorations were conducted successively following a research-through-design approach. Throughout this journey, the gap between the theoretical claims of the benefits of storytelling as outlined in literature and the weak adoption of storytelling by industrial design students was observed, and the demand for appropriate support through tools and methods for storytelling in actual practice was identified. We collected information to understand the problems and challenges and gathered insights that could be used to formulate requirements for developing appropriate tools. We developed the Pitchify tool through a series of design iterations in order to facilitate planning stories for pitching design concepts and performing evaluations on them.

Looking back at our research, we conclude that the design students’ acceptance and adoption of stories in design practice can be enhanced and improved, provided that they are facilitated through appropriate tools or methods. Furthermore, planning a story for pitching a design concept could improve the quality of a pitch and potentially improve the quality of a concept itself if used in the ideation phases. Our research reflection and lessons learned were summarized throughout the entire research process, and recommendations for future work were also proposed.

References


Appendix

Appendix 1 — the questionnaire used in study 2 in chapter 3

A Questionnaire for the Claims on the Values of Storytelling in Design

Dear participant,

Thanks for joining in this questionnaire survey. There will be 21 statements in this questionnaire. They are the claims of the values of storytelling in design selected from literature. Please read them carefully and give your scores based on your own opinions. If any problem, you can ask me whenever. Thanks again for your cooperation.

Q1: Storytelling can be introduced as an element to initiate a dialogue between designers and users, aiming at collecting useful information for the conception of a specific product. [Dan Gruen, 2000]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q2: Storytelling can be a useful tool to establish an unbiased communication with the user, since it allows a designer to not only focus on concrete characteristics of products, but also on emotional aspects which may be difficult to obtain through a direct dialogue. [Fritsch, J,2007]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q3: Storytelling is useful in designing for a better user experience. [Forlizzi & Ford, 2000]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q4: Storytelling plays many roles in the informal exchange of information, including access to local expertise, help in contextualizing abstract understandings, support for accessing tacit knowledge, and as a scaffold for the iterative social processes of achieving mutual understanding. [Wayne G Lutters,2002]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q5: Stories can be valuable at every stage of the product life-cycle, from inspiring the earliest vision, through concept definition, requirements specification, design, prototyping, development, product introduction. [Dan Gruen, 2000]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q6: Stories put ideas into context and give them meaning, and are essential to design thinking. [Tim Brown, 2009]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q7: Storytelling is useful in designing for a better user experience. [Forlizzi & Ford, 2000]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q8: Storytelling can be applied during the whole design process to improve the quality of the developed concepts regarding UX, as well as to support designers in exploring and communicating new concept ideas. [Quesenbery & Brook, 2012]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q9: Storytelling is a critical success factor in design processes and outcomes. [De Large,2004]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q10: Stories convince people of the value of a proposed product in a real-world domain, and by analogy that it would be valuable in their own settings. [Dan Gruen, 2000]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q11: Storytelling can be used to articulate, refine and conceptualize design solutions. [Lawson,1997]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q12: Storytelling can deliver understanding when used in design pitches. [D Parkinson,2016]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q13: Storytelling can stimulate critique when used in design pitches. Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q14: Storytelling can encourage a more holistic thinking when used in design pitches. [D Parkinson,2016]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q15: Storytelling can demonstrate value when used in design pitches. [D Parkinson,2016]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q16: Storytelling can be applied as a user experience tool to collect insights about the underlying motivation and needs. [Michailidou et al,2014]

Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q17: Stories provide a good first pass at what is important, from the point of view of the users; they provide the designers a glimpse of what the user’s terrain feels like and thus provide a starting point for future exploration. [T Erickson, 1996]
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q18: Stories help designers immerse themselves into the situations in which their interactive systems will be used. [Dan Gruen, 2000]
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q19: Storytelling can significantly influence the impact on its audience when it is applied to pitching design concepts. [D Parkinson, 2017]
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q20: Storytelling during a presentation is an excellent way to sell design ideas. [D Parkinson, 2017]
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q21: Telling a story in a design pitch can bring a familiarity to the design process, allowing the audience to engage in critical discussion around the design concept. [D Parkinson, 2017]
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Appendix 2 -- The questionnaire for the acceptance of the storytelling templates (in chapter 3)

The Acceptance of the Storytelling Template

Dear participant,
  Thanks for filling in this questionnaire. There are 20 statements in this questionnaire. Please read them carefully and give your scores based on your own experience in using the storytelling template. If any problem, you can ask me whenever. Thanks again for your cooperation.

Q1: They help me to be effective.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q2: They help me to be more productive.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q3: They are useful.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q4: They give me more control over the activities in my design.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q5: They save me time when I use them.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q6: They meet my needs.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q7: They do everything I would expect them to do.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q8: I am satisfied with them.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q9: I would recommend them to a friend.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q10: They are fun to use.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q11: They are wonderful.
  Totally Disagree 1—2—3—4—5—6—7 Totally Agree
Q12: They are pleasant to use.
   Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q13: I feel I need to have them.
   Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q14: They are easy to use.
   Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q15: They are simple to use.
   Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q16: They are user friendly.
   Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q17: They are flexible to use.
   Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q18: Using them is effortless.
   Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q19: I can use them without written instruction.
   Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Q20: I can use them successfully every time.
   Totally Disagree 1—2—3—4—5—6—7 Totally Agree

Appendix 3 — USE questionnaire used in chapter 4

The USE Questionnaire

Dear participant,

Thanks for filling in this questionnaire. There are 20 statements about the StoryPrea tool in this questionnaire. Please read them carefully and give your scores based on your own experience in using the storytelling template. If any problem, you can ask me whenever. Thanks again for your cooperation.

Part 1—Perceived usefulness in reflecting on a design concept
(1) It has the potential to help me to reflect on a design concept.
   Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(2) It can help me to gain more control over my reflection.
   Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(3) It can help me to improve the efficiency of my reflection on a design concept.
   Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(4) It can help me to identify critical aspects of my design concept.
   Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(5) It can help me to improve the reflection on a design concept.
   Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(6) It’s easier to reflect on a design concept.
   Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(7) Overall, I find it useful for performing reflection on a design concept.
   Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree

Part 2—perceived usefulness in Planning a story for pitching a design concept
(8) It has the potential to plan a story for pitching a design concept.
   Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(9) It can help me to gain more control over planning a story for pitching a design concept.
   Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(10) It can help me to improve the efficiency of planning a story for pitching a design concept.
    Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(11) It can help me to identify critical aspects of planning a story for pitching a design concept.
    Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(12) It can help me to improve planning a story for pitching a design concept.
    Totally Disagree -3 —2 —1 —0 —1 —2 —3 Totally Agree
(13) It’s easier to plan a story for pitching a design concept.
Part 3—perceived ease of use
(15) Learning to use this tool is easy for me.
   Totally Disagree -3 —- 2 —- 1 —- 0 —- 1 —- 2 —- 3 Totally Agree
(16) I find it easy to get me to know what I want to do.
   Totally Disagree -3 —- 2 —- 1 —- 0 —- 1 —- 2 —- 3 Totally Agree
(17) It is easy for me to remember how to use this tool.
   Totally Disagree -3 —- 2 —- 1 —- 0 —- 1 —- 2 —- 3 Totally Agree
(18) Using this tool requires a lot of mental effort.
   Totally Disagree -3 —- 2 —- 1 —- 0 —- 1 —- 2 —- 3 Totally Agree
(19) Overall, I find this tool easy to use.
   Totally Disagree -3 —- 2 —- 1 —- 0 —- 1 —- 2 —- 3 Totally Agree

Part 4—Intention for using the tool in the future
(20) I am likely to use this tool in my future work.
   Totally Disagree -3 —- 2 —- 1 —- 0 —- 1 —- 2 —- 3 Totally Agree

### Appendix 4 — the questionnaire for evaluating students’ pitches (in chapter 4)

**Evaluation of the pitches**
(Compare Pitch A and Pitch B)

Dear participant,
Thanks for filling in this questionnaire. There are two versions of pitching for a same design concept. Please have a look at both of the two versions of pitching, and then compare them based on the following aspects. Choose the score for each version based on your own opinion. If any problem, please feel free to tell us. Thanks again for your cooperation.

<table>
<thead>
<tr>
<th>aspect</th>
<th>Pitch A</th>
<th>Pitch B</th>
</tr>
</thead>
<tbody>
<tr>
<td>The pitch is easy to understand</td>
<td>Disagree 1-2-3-4-5-6-7</td>
<td>Agree 1-2-3-4-5-6-7</td>
</tr>
<tr>
<td>It provides essential information</td>
<td>Disagree 1-2-3-4-5-6-7</td>
<td>Agree 1-2-3-4-5-6-7</td>
</tr>
<tr>
<td>It raises my interest</td>
<td>Disagree 1-2-3-4-5-6-7</td>
<td>Agree 1-2-3-4-5-6-7</td>
</tr>
<tr>
<td>I can perceive the value of the design</td>
<td>Disagree 1-2-3-4-5-6-7</td>
<td>Agree 1-2-3-4-5-6-7</td>
</tr>
</tbody>
</table>

I prefer Pitch _______ (A / B).

### Appendix 5 — the video introduction of the Pitchify tool

Online Available:

[YouTube](https://www.youtube.com/watch?v=Hva08EezmJw&t=6s)
[YouTube](https://www.youtube.com/watch?v=XhlKp9BKywM)
Acknowledgements

I want to express my heartfelt gratitude to all the people that made my doctoral research journey possible. Without all your help, the wonderful journey would not be successful and wonderful.

First and foremost, I would like to thank my first promotor and supervisor, Prof. dr. ir. Jean-Bernard Martens for having me as your PhD student. Much appreciation for your patience and guidance. I indeed learned a lot in making research, especially in the aspects of data analysis and English paper writing.

To my second promotor, Prof. dr. ir. Caroline Hummels, thank you for your help in my thesis. Your feedback is so helpful and forced me to reflect on all my research work and think about how to interpret it clearly and logically.

To my doctorate committee, Prof. dr. Panos Markopoulos, Prof. dr. ir. Isabelle Reymen, Prof. dr. Karin Koninx, and Dr. Ambra Trotta, thank you for being on my committee. I am grateful to you for taking the time to read this thesis and provide your encouragement and insightful remarks.

Thank you, Jun Hu, Yoep Frens, Javed Khan, Ronghao Liang, Yaliang, Zhuang, Mathias Funk. Thanks so much for all your help.

I also thank all the colleagues Qi Wang, Yu Zhang, Jiang Wu, Xi Pei, Bin Yu, Pengcheng An, Cun Li, Kai Kang, Wei Li, Mendel, Hanneke, Aimi, Ine, Jesus, Nan Yang, Xu Lin, Feiran Zhang, Jingya Li, for their encouragement and support both in research work and life at TUE.

Appreciations also to our secretaries: Rosalinde, Marly and Anne. They helped me a lot not only in my daily work and life at TUE but also in preparing for the defense.

Also thanks the master and undergraduate students joining in my research work.

Curriculum Vitae

Qiong Peng was born in Sichuan, China. She received her master’s degree from the Design school at Shanghai Jiaotong University, China in 2011. In 2014, she was awarded a scholarship to visit the school of Industrial Engineering in Delft University of Technology. From September 2015 to August 2020, she was funded by the China Scholarship Council to conduct her doctoral research at Eindhoven University of Technology. This thesis is the results of her doctoral research under the guidance of Prof. Dr. ir. Jean-Bernard Martens and Prof. Dr. ir. Caroline Hummels on the topic of “Practicing storytelling in design with Pitchify --- a tool to assist in pitching design concepts”.

List of published papers


