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ORIGINAL ARTICLE

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The value of storyboards in the product design process

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Abstract In the realm of product design, communication between designer, client, design team and future users is of great importance. Throughout the design process, ideas and concepts are generated and must be conveyed to these people to evoke comments, judgement or acceptance, depending on the process phase. Storyboards are a valuable aid to the designer in this task by providing a common visual language that people from different backgrounds can 'read' and understand. However, the visualisation style of the storyboards influences the reactions. Where open and sketchy storyboards are inviting comments, sleek and detailed presentations can be overwhelming. Storyboards not only help the product designer to get a grip on target groups, context, product use and timing, but also in communicating about these aspects with all people involved.

Keywords Storyboards · Product design · Interaction design · Visualisation · Design process

1 Introduction

'Design a PDA for Taoist monks'. An unlikely brief . . . however, product designers face assignments like this every day: designing for somebody else's experience. Therefore, it is imperative that the designer empathises with the user and develops a feeling for, insights in, and knowledge about the desired context, before taking on the actual design. In this paper we argue that storyboards provide a common visual 'language' that supports people from different backgrounds to communicate on aspects of design. Clients, members of the design team, experts and future users all can 'read' a storyboard. Just as sketching, working with storyboards supports visual thinking, which is vital to the creative process during the synthesis phase [2]. Moreover, storyboards incorporate product-user interaction, context and time. The visualisation style changes with the different phases of the design process, depending on the needs.

Although the subject matter has considerable complexity, little research has been done on the use of storyboards in product design. Most publications on storyboards deal with the production of motion pictures, and on neighbouring fields such as comics.

Over the past 10 years we have gained experience in both research and education on the use of storyboards and their value to the designer in the different phases of the design process. This resulted in a set of guidelines and principles (P.J. Stappers et al., unpublished data).

Based on this experience, we argue that designers benefit from choosing appropriate visualisation styles for the needs of each phase.

2 Storyboards in cinema and product design

Storyboards are widely used in the movie and advertising industry. Here storyboards are looked upon as being "illustrations displayed in sequence for the purpose of pre-visualising an animated or live-action film. It is essentially a large comic of the film or some section of the film produced beforehand to help the directors and cinematographers visualise the scenes and find potential problems before they occur" [3]. This visual script integrates all parties involved in the production. Not only does it help the director and cameraman to 'see' the shots before executing, the producer uses the storyboards to convince potential financiers, search for locations and even start casting. Also, the construction of scenes, special effects and props can begin based on the storyboard.

This paper is part of the 3AD design colloquium Creative connections [1].

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Some of the expressive techniques used in cinema, and also comics, can be applied in product design storyboards as well. For instance, theories and techniques about framing (establishing shot, medium range shot and close-up) and sequence help to guide the readers attention [4, 5]. McCloud teaches valuable lessons about timing and styles of expression [6].

Although product design storyboards and storyboards used in cinema both share the visual form of sequencing pictures and words, the message and aims are different. Where film and advertising industries use storyboards to provide a preview of the movie for production purposes, the product design storyboard helps the designer in understanding the product-user interaction in context, and over time.

A product design storyboard is a powerful means to the designer because, by telling a story about (parts of) the interaction(s), it enables the reader access to the expressed ideas on two levels:

1. The reader can *experience* the visualised interactions by empathising with the user or the situation, like he or she would while reading a (comic) book or watching a movie. This establishes a common ground, which supports communication within the design team about each member's thoughts. These thoughts would otherwise be difficult to communicate in their abstract form because they may be tied to the person's specific discipline.
2. The reader can *reflect* on the visualised interactions from his or her own expertise, by withdrawing from the experience and looking at the unfolding event from the outside. This objective perspective supports analysis, picking out certain aspects of the interaction, and getting an idea about time development.This way the storyboard represents many of the important aspects of the context visually, reminds the design team of these aspects, and supports discussions by letting team members point at the visualised aspects and add annotations.

3 Phases of the product design process

The product design process is commonly considered to be a series of distinguished phases [6]. Each phase has its own style of exploring, developing, discussing or presenting the product-user interaction in storyboards. Thus, matching the appropriate visualisation style to the phase is important. The style can range from very sketchy to very detailed. A storyboard with a sketchy look and feel will evoke comments and suggestions, while a glossy, detailed one will be viewed upon as being final, to be accepted 'as is'. The considerations about each design phase in relation to visualisation style aspects are discussed in the remainder of this section. A schematic overview is provided in Fig. 5 at the end of this paper.

3.1 Analysis phase

During this phase the product designer's focus is in getting a grip on the function or intended behaviour of the new product in the widest sense. Not just the technical function, but also the psychological, social, economic and cultural functions of the product are attended to. This implies answering questions such as 'where', 'when', 'what', 'why', 'with who', 'for how long'. The activity of making storyboards encourages the designer to consider situations, atmospheres, feelings, interactions and context in relation to the product's intended use. The storyboard in Fig. 1 has an appropriate visualisation style. It illustrates the emotional experiences leading as far as having dinner with someone. This is emphasised by showing details such as the phone in frame 1, the setting of the table in frame 5, and by abstracting the faces of the people. The hearts in frame 4 are symbolic for the love with which the meal is prepared.

3.2 Synthesis phase

With the results from the analysis phase in mind, the product designer (together with other members of the design team) starts generating ideas and concepts that can lead to solutions for the new product. During this creative process a rough, sketchy visualisation style is called for. This results in many loose pages that can be spread out on the table or put on the wall, supporting discussion within the team as shown in Fig. 2. Details are not yet important and can be left out. In this phase storyboard are useful to explore and integrate concept ideas and to get a feel for the product-user interaction in context and over time.

3.3 Simulation phase

Ideas and concepts are developed into an image about the behaviour, interaction and properties of the product, which leads up to a 'working' model (e.g. a simulation or

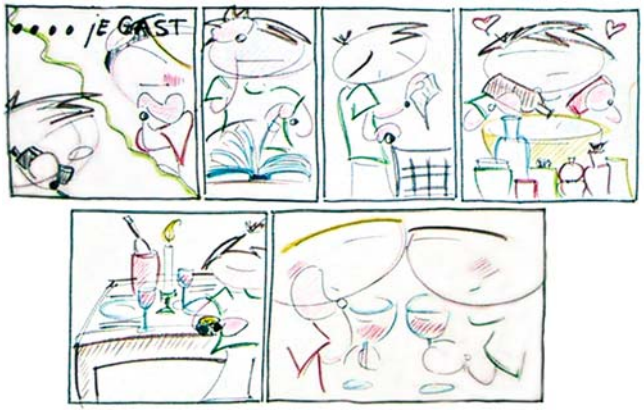

Fig. 1 A storyboard made in the analysis phase exploring the experience of having dinner (3rd year student project)

Fig. 2 Participants of the 2AD storyboard tutorial discussing their work

interactive prototype). In this deductive continuation of the synthesis phase, the storyboard evolves into a coherent narrative. Where in the previous phase the ingredients were addressed, here the story line becomes more important. Figure 3 shows two concepts for communication between mother and child.

3.4 Evaluation phase

The tentative designs are evaluated through concept testing and walk-throughs with future users. Storyboards help them to reflect not only on the product's form, but also on the values and qualities it carries. Figure 4 shows a selection of four sequential cards from a flipbook made to evaluate a concept for a workstation for radiologists. The visualisation style of such a presentation is more detailed than in previous phases and the story line is complete, suitable to evoke judgement.

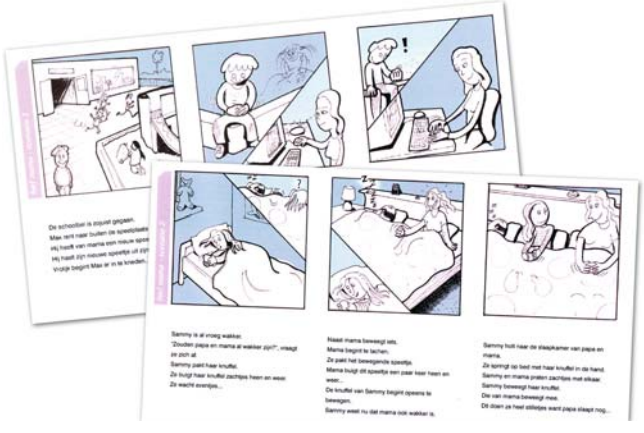

Fig. 3 Storyboards of two variant interaction concepts used in the simulation phase (from [8])

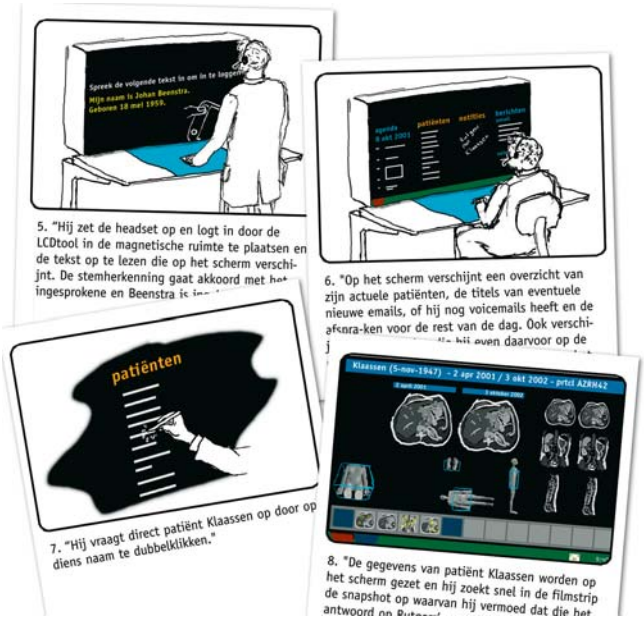

Fig. 4 Example of a flipbook used in a walk-trough with users (from [9])

3.5 Decision phase

Finally, designers do use storyboards sometimes in the way they are used in cinema: as a 'closed' presentation to sell the finished product. The visualisation style is detailed, photorealistic, often with a sales pitch to convince the client rather than invite comments.

4 Conclusion

Storyboards support product designers in getting a grip on context and time by forcing them to attend to diverse aspects, integrate these aspects and confront the implications that could be postponed with abstract considerations. Still, they provide designers with the freedom to leave out details or ingredients as the ideas' needs expand. They can be sketchy and open, evoking com-

Basic design cycle	Design activities	Purpose/goal	Visualisation style	Form
Function				
Analysis	ordering, surveying, listing, analysing situations and context	mapping out situations, problems, atmospheres and feelings (context)	detailed, factual, symbolic	storyboard panes
Criteria				
Synthesis	generating ideas and concepts, finding solutions within the design team	try-out; integration of concepts; getting an idea about time development	rough, sketchy, collated, gathered, assembled	loose pages; few details; plenty of annotation space; lay out on the table or put on the wall; intentionally vague
Provisional design				
Simulation	evaluating ideas and concepts with the design team, experts, panels and users	assembling different viewpoints, disciplines and backgrounds to get feedback	sketchy, open, incomplete; parts of the storyline; inviting reactions	
Expected properties				
Evaluation	concept testing; walkthrough with (future) users	getting feedback on the interaction(s) in time	detailed, complete storyline; evoking judgement	a flipbook, stepping through the story with questions/interview along the way
Value of the design				
Decision	presenting a finished idea or concept	transfering concept(s); convincing; gaining acceptance	polished, detailed, complete, photorealistic; to be accepted as is	presentation boards
Approved design				

Fig. 5 Aspects of storyboard in different phase of the design process [7]

ments and reactions, or detailed and closed, conveying facts and convincing. As the overview in Fig. 5 summarises, the value of the storyboards to the product designer is influenced by the visualisation style used in relation with the design phase and the intended goal. Storyboards provide the visual language that enhances communication within the design team, with experts and future users, bridging their different backgrounds.

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