INTERNATIONAL CONFERENCE ON ENGINEERING AND PRODUCT DESIGN EDUCATION
7 & 8 SEPTEMBER 2017, OSLO AND AKERSHUS UNIVERSITY COLLEGE OF APPLIED SCIENCES, NORWAY

DESIGNING INTERACTIVE OBJECTS THROUGH CINEMATIC PROTOTYPING

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ABSTRACT
This paper introduces Cinematic Prototyping as a new method for designing the precise sensuous and aesthetic flow of product interactions. Having cinematic codes and techniques such as enactment, puppeteering, shot composition and storytelling at its core, Cinematic Prototyping enables the exploration and development of future interactions early in a design process without being restricted by the limitations of any prototyping technology. As such, it provides designers with ways to fully concentrate on the exact interplay between product and user within a specific context, resulting in believable and engaging scenarios that are rich of expressions and meanings. The main principles of Cinematic Prototyping are presented, followed by a description of its application in a design course. An example case is used to illustrate its results. The paper concludes with a discussion of its strengths and weaknesses and its potential for improvement.

Keywords: Interaction design, design aesthetics, interactive prototyping, video prototyping.

1 INTRODUCTION

Design is a powerful means to make the future experiential and address the promises and pitfalls of emerging technologies. Trends and developments like 3D-printing, smart materials, nanotechnology and the Internet of Things are rapidly becoming mainstream design domains, producing products that are becoming more and more connected, responsive, immersive and adaptive. Thus, as interactions with such products are getting more frequent, complex and elaborate, designing their precise flow becomes an increasingly important part of the design process.

In response to this, simple microcontroller kits like Arduino, Teensy and several other alternatives [1,2], have in recent years become very popular amongst designers to quickly built interactive prototypes that are capable of sensing and controlling objects in the physical world. The open-source character of these platforms has led to large communities of users who have contributed code and released instructions for a great variety of projects. As a result, designers have a huge library of possible behaviour at their disposal, which they can apply and modify without the need to become experienced code warriors.

Not surprisingly given their affordability and accessibility these kits have also been embraced by design educators to provide their students with accessible tools to prototype their ideas [3]. However, while these platforms undoubtedly have their benefits, we as design educators observed at times that they also, through their specific set of functionalities, restricted the potential design space. In those cases the design of the interactions with an object would get more dictated by the characteristics and limitations of the specific prototyping platform than by qualities as intended by the designer. Thus while they are very useful to ideate interactions on a functional level, these platforms tend to fall short when designing how actions and feedback precisely integrate on a sensuous and aesthetic level.

To be able to design without being limited by the characteristics of a specific prototyping platform, we therefore decided to develop a new design method called Cinematic Prototyping. In what follows, we first describe the principles that guided the development of Cinematic Prototyping. We then provide a more detailed description of its application in a design course, showing its set-up, procedure and results, as illustrated through an example case. The paper concludes with an evaluation of the method from the perspective of both teachers and students.

2 CINEMATIC PROTOTYPING

The core of Cinematic Prototyping is the use of cinematic techniques and principles to create credible scenarios of use of future interactive objects, with film being its main medium of representation. Because of its visual richness and intrinsic narrative structure, film provides the possibility to merge the richness of today's everyday life with the possibilities of the near future in a believable and compelling way. In previous years we have acquired considerable experience with the application of film for different purposes in different phases of a design process, which clearly demonstrated the value this medium can offer to designers [4].

As such Cinematic Prototyping could be considered a form of design fiction [5, 6], which is a design approach that uses design as an instrument to generate awareness, raise concerns or challenge values about (the use of) new, emerging and future technologies, products and services by means of storytelling through and with designed objects. In design fiction these objects are being referred to as 'diegetic prototypes' [7], which implies that they are embedded into and consistent within the world of story, even though they might not (yet) exist in the real world. Rather than being just props for decorating the stage, they play an active and integral part in the narrative.

In Cinematic Prototyping we explicitly consider a diegetic prototype to be a story's protagonist, which implies that the story should be constructed in such a way that the audience is able to identify with 'her. Therefore much attention is being paid to applying film's visual and auditory richness for the creation of very detailed depictions, from which an intended experience can be deduced. By showing, for example, in detail how an object reacts when being touched, a viewer is able to construct a sense of its 'personality' through some of its intrinsic qualities, such as strength, elasticity and texture. Sound plays an important role in this, so attention for the design of the sound and their exact synchronization to the images is important.

As the main objective of the method is to envision, create and communicate future interactions with products in a vivid and convincing manner without the use of advanced prototyping technology, much attention is given to the use of experiential and theatrical techniques such as enacting, animating and puppeteering, resulting in models that would be functioning as 'film props' rather than fully functional prototypes. So, for example, instead of putting a motor into a model to make it move, simple nylon wires were attached to it and then pulled or released to simulate that same behaviour on camera. Rather than having a design process directed by the use of sensors, actuators, Arduino boards or Processing as tools to create working embodiments of interactive objects, it thus concentrates on freely exploring and designing the aesthetic and sensuous experiences and meanings that are evoked when interacting with such objects in a specific context of use.

3 APPLICATION

The method of Cinematic Prototyping was applied in a new master elective of 3 ect (84 hours) within the industrial design program of [removed for review]. As this was considered to be a pilot, the number of students was kept rather limited, resulting in three teams of two students and one team of three. All activities scheduled on a Friday, with the course running for nine weeks. The use of film was given much attention during the course. All teams were equipped with a DSLR, lenses, a tripod and a microphone during the entire course. Furthermore, they were given instructions on camera techniques; shot composition; storytelling; etc. to increase the production value and cinematic quality of their work. While in a strict sense the use of cameras to record and software like Adobe Premiere and After Effects to edit and manipulate film could also be considered as applying a form of technology, we carefully made sure that this would not in any way effect or influence the actual design process.

As a design case for the course, students focused on developing ideas for 'Objects with Intent'; the design of familiar everyday artefacts that act as intelligent and autonomous agents in their regular use by sensing, responding to, and cooperating in human activity [8]. Thus such objects can empower people in situations where they are unwilling or unable to act, or are unaware that action is possible. For example, when people experience difficulties to wake up at a specific time because of a depression, a pillow could become a supporting object by expressing its intention to help them through a careful collaboration of actions and reactions. The exploration of these kinds of collaborative processes provided a suitable platform for the application of Cinematic Prototyping.

The course was structured in four phases. Each will be described in detail, using one project from the course as an example case: Pat the Social Backpack, created by Jet Gispen and Romee Noorman. Pat is a backpack specifically designed for high school students that tend to be somewhat insecure about their identity and thus have some trouble connecting to other students. Pat, however, is full of confidence and eager to make new friends, which in her case means connecting to other backpacks. The idea is that by expressing this intention to her owner, Pat will support him in making contact with other people more easily as well. The other projects besides Pat were Harry, a drill for novice DIYers, that likes to make perfect holes with the least effort; Cane9, a walking stick for elderly, that is eager to explore its surroundings; and Sam, a pair of running shoes for lazy people, that needs to go outside and release its energy at certain times.

3.1 Concept phase (1 week)

After an introduction about the objectives and content of the course, students first conducted a brainstorm to identify possible problems. After selecting an interesting problem this was followed by an analysis of how this problem is manifested in human activity. Subsequently, an everyday object connected to that activity that can support in tackling the problem was identified. The functionality of this object was then initially defined, taking into account its autonomous behaviour, followed by a further specification in a state-change diagram, to provide detail on the products' sensing and actuating capabilities (Figure 1, left). A personality for the object that logically combines these functions was also created. As a last step, a photo storyboard was made, depicting the activity and how the object influences and affects the activity when addressing the problem (Figure 1, right).

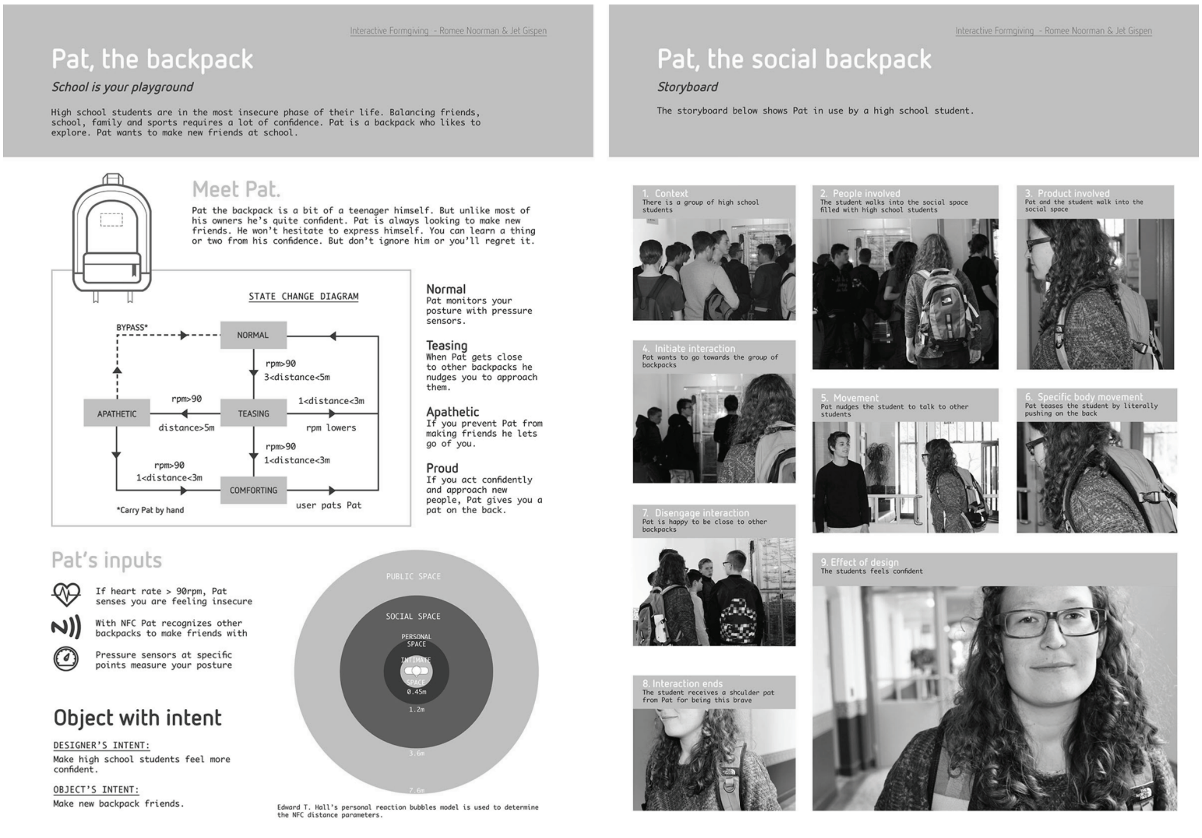

Figure 1. State-change diagram and storyboard of Pat, showing beside her neutral state, three other states: 'Teasing', in which Pat expresses her desire to connect to other backpacks; 'Apathic', in which Pat utters her disappointment when her owner ignores this desire, and 'Proud', in which Pat compliments her owner when he has made a connection

3.2 Embodiment phase (2 weeks)

In this phase+ the concept was further developed by engaging with materials to better articulate what the object looks and sounds like, as well as how it behaves and interacts. As a first step, simple mock-ups of the product are created, informed by the object's functions and personality, to explore its expressiveness, size, overall shape and material composition. Further, the auditory qualities of materials and online sound libraries were explored to determine possible sounds the object might produce. The object's behaviour was then further explored by animating it through human motion (e.g., puppeteering), which involved creating a motion-transfer mechanism to control the object. By aligning this behaviour with human actions (i.e., the user of the product), the interactivity was explored as well (Figure 2). A film was produced to study and show how form, movement and sound come together as coherent expressions. Finally, a more detailed mock-up of the object was made.

Figure 2. Pat's states were acted out using simple materials and tools, such as foam, tubes and nylon wires. When in the 'Teasing' state Pat would indicate her intentions through a slight nudge in the lower back, while the 'Apathic' state would be expressed by loosening her shoulder straps, resulting in her sliding from the back of her owner

Figure 3. The interaction between the 'design expert' on the right and the 'naive user' on the left when trying together to determine the exact behaviour that would be expressed when being proud. By having Pat tightening her straps, she would be positioning herself higher on the back of her owner, thus making it feel for him like a 'pat on the back'

3.3 Enactment phase (2 weeks)

The final mock-up was then put to the test to experience how the object was understood and used by people. In short enactments, fellow students are asked to imagine being the person who is using the object but also to provide critiques as a designer. When conducting the enactment, the activity needs to be staged and the object be puppeteered in response to any actions made by the participant. By taking part in an enactment as an actor, students learned to provide constructive input, combining the roles of being a ‘naive user’ and a ‘design expert’ (Figure 3). Again, film was used as an observation and communication tool to capture and show the way people act with the object and how they talk about it. After reviewing the films, the object was further refined.

3.4 Fiction phase (4 weeks)

Finally, in the fiction phase, a short film was produced that should vividly and convincingly demonstrate the object in use. In the pre-production phase, a detailed storyboard was made and the mock-up was further developed into a ‘film-prop’. The storyboard would show the overall story in separate scenes, list camera angles and zoom-levels, specify human actions and object feedbacks, and further describes the film’s affective and auditory qualities. In the production of the film, a real-world (but accessible) location were selected, lighting conditions were controlled, camera positions chosen and the interaction with actors and puppeteers was rehearsed and performed. Finally, in the post-production phase, the precise interaction flow between the user and the object was further detailed to create a convincing speculative design. Much attention was being paid to the design and synchronization of the sounds the object would make when in use, as it was clear from previous experiences that these should be realistic and perfectly timed to be credible. At the end of the course all films were reviewed, followed by a plenary discussion of course’s structure, method and results.

Figure 4. Two stills from the final movie, showing Pat longing to meet other backpacks and her disappointment, after her owner has failed to live up to her desire

4 DISCUSSION

Having film as their primary means of representation made students already in an early stage of the process more aware of the importance of the aesthetic qualities of their design and the interactions with it, as they wanted it to “look good on camera”. Interestingly enough, however, they also expressed that this at times conflicted with their natural desire to make the design actually ‘work as intended’. However, they also experienced that while it might be useful from a functional design perspective to create a fully functional prototype, it is much more constructive and less time-consuming to create the same effect in the film through enactments. Making the switch from looking at their mock-up as a working prototype to considering it to be a film prop was thus considered an important, but at the time somewhat confusing step in their process.

Students appreciated that the concept phase was deliberately kept short, even though they in the beginning sometimes doubted whether they had picked the right object. In hindsight they stated that they felt that the choice of object was less critical than expected and that the quick selection allowed them to go in much more detail with their design than in other courses. The enactment sessions were highly valued, as they provided an important frame of reference to evaluate and fine-tune the interactions between object and user. Having to play the role of both design expert and naïve user enabled the students to step out of their own project and give constructive feedback to the other teams.

Another eye-opener turned out to be the importance of sound design in creating a believable experience. Designing sounds that would fit the material and mechanical properties of the actuators embedded in the object as well as other types of feedback, and synchronizing them with the film footage, thus proved to be a crucial element in the post-production of the movie. Even though one of the teachers was a sound designer who gave instructions on this particular topic, all teams struggled with getting this right.

From our perspective as design educators the constant focus on managing the intentions of both object and user, on how these intentions would be expressed and experienced, and how the resulting interactions could be convincingly communicated in a film, allowed us to into much more depth than in regular design courses. Using the state-change diagram provided us with a functional frame of reference, ensuring that ideas were still grounded in realism while also already identifying key moments in the final scenario of the film. Finally, being unrestricted by prototyping technology enabled us to train students' sensitivity for the qualities of the interactions with objects, the behaviour that is needed to communicate these qualities and the meanings that can be deduced from them.

5 CONCLUSION

While this first use of Cinematic Prototyping was thus considered a success by both educators and students, there certainly is room for improvement. First, since producing high-quality films is such a critical element in its application, even more emphasis should be put on this. Not only at the end of the process, where its merits are clear, but especially in the beginning, where the rough and explorative character of the enactments might give way to a similar way of filming. Second, more attention should be paid to incorporating the difficult, yet critical aspect of sound design already in an earlier phase of the project. Finally, thinking and acting from the perspective of an object as being the main character in a compelling story, needs to be given more consideration throughout the entire process.

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