Applying the PLEX Framework in Designing for Playfulness

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ABSTRACT
In addition to functionality and usability, interactive products are increasingly expected to provide pleasurable experiences to their users. Playfulness is a part of these experiences. However, playfulness can manifest in many different ways as humans are inherently playful by nature. This poses challenges for designing for playfulness. To tackle this broad field, we have developed the Playful Experiences (PLEX) framework. The two-fold purpose of the PLEX framework is to be a conceptual tool for understanding the playful aspects of user experience (UX), and be a practical tool for designing for such experiences through established user-centered design (UCD) methods. In this paper we present an overview of our work during 2008-2010 on designing for playful experiences. After introducing and summarizing previous studies, we motivate the reasons for designing for playfulness by framing PLEX within the domains of user experience and emotional experience. Then, we briefly discuss the creation and evaluation of the *PLEX Cards* and its associated techniques as practical design tools based on the PLEX framework, followed by a concrete design case where these tools have been used. We also present the development of the *PLEX Design Patterns* for actual design solutions for playfulness. Based on this work, we propose the PLEX framework as a powerful tool for understanding playful experiences, and for providing inspiration to design interactive products that elicit playfulness.

Categories and Subject Descriptors
H.5.2: User interfaces, User-centered design.

General Terms
Design, Theory.

Keywords
Design Framework, Design Tools, Playfulness, Experience-Driven design, User-Centered Design.

1. INTRODUCTION
"*The opposite of play is not work. It is depression.*"

This provocative statement by psychiatrist Stuart Brown, first suggested by play scholar Brian Sutton-Smith, illustrates well how important play is in everyday life. Brown argues that play is essential for living a fulfilling life [9]. Playfulness has been regarded either as a state within a person [3] or as a trait of a person [36] and thus all kinds of objects can potentially be used and approached with a playful attitude. However, the affordances of a product can elicit playfulness in the user in either way. Thus, there is a need for tools that help to understand playfulness as one aspect of interactive product use.

In this paper we provide an overview of work we carried out during 2008-2010 to explore the possibilities of designing for playful experiences. Our focus has been on investigating what constitutes a playful experience in interaction with a product, how it relates to overall user experience (UX), and how to elicit such experiences through product design. We also elaborate on the motivations for including playfulness in product design. For this purpose, we developed the Playful Experience (PLEX) framework, which consists of 22 experience categories that are generally considered playful. Based on the framework we have developed practical design tools including the *PLEX Cards* and two idea generation techniques to help designers and other stakeholders think about playful experiences (e.g., during the brainstorming stage of product design). Another practical tool we have created is the *PLEX Design Patterns*, which combine PLEX categories into practical solutions of how certain kinds of experiences can be achieved in product design.

This paper is structured as follows: first, we briefly summarize the PLEX framework development process. Then, we position PLEX within user experience and emotional experience models, and present our motivations for introducing playfulness in product design. The main part of the paper describes design tools that have been developed based on the PLEX framework. We report the main findings from a design case where some of these tools were used throughout the design process to create a prototype of a playful product. Finally, we wrap up with the discussion, conclusions and outline future work.

2. DEVELOPING PLEX
One of the theoretical frameworks of pleasurable experiences has been published by Costello and Edmonds [11]. They put together the views of scholars and game designers to obtain a 'pleasure framework' that includes 13 pleasure categories of play for designing and evaluating interactive artworks. In their research, a range of experiences such as Exploration, Discovery, Creation, Captivation and Sensation were commonly reported. The pleasure framework was a starting point in studying more specific playful experiences, as it describes experiences elicited by interactive objects.

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To expand the scope of the framework, we included the works of additional play scholars and game designers to the pool of analyses, producing the PLEX framework. This body of work is discussed in earlier publications of the PLEX framework [4]. We made considerable changes to Costello and Edmond's framework to be better able to examine the wide range of experiences elicited by interactive products when they are used in a playful manner [4]. These changes include renaming and redefining experience categories, as well as adding new categories. The overall focus was shifted from pleasure to playfulness to indicate that not all experiences are always perceived as pleasurable. The current framework consists of 22 Playful Experience categories (shown in Table 1).

Table 1. The PLEX Framework and its 22 categories.

Experience	Description
Captivation	Forgetting one's surroundings
Challenge	Testing abilities in a demanding task
Competition	Contest with oneself or an opponent
Completion	Finishing a major task, closure
Control	Dominating, commanding, regulating
Cruelty	Causing mental or physical pain
Discovery	Finding something new or unknown
Eroticism	A sexually arousing experience
Exploration	Investigating an object or situation
Expression	Manifesting oneself creatively
Fantasy	An imagined experience
Fellowship	Friendship, communality or intimacy
Humor	Fun, joy, amusement, jokes, gags
Nurture	Taking care of oneself or others
Relaxation	Relief from bodily or mental work
Sensation	Excitement by stimulating senses
Simulation	An imitation of everyday life
Submission	Being part of a larger structure
Subversion	Breaking social rules and norms
Suffering	Experience of loss, frustration, anger
Sympathy	Sharing emotional feelings
Thrill	Excitement derived from risk, danger

Our work with PLEX includes three types of activities: developing the framework, designing for playfulness by creating and using design tools, and evaluating playful experiences.

The first study [23] to check the relevance of the PLEX framework involved the analysis of interviews of 13 players about their experiences with three videogame titles. In a follow-up study [5], we applied the PLEX categorization to identify and name the user experience of personal products such as mobile phones. Based on these two studies, we published the current version of the framework. This work [4] explains the earlier work that PLEX is based on and gives detailed definitions of the 22 categories. The first design tools we created based on the framework were the *PLEX Cards* and two associated techniques called *PLEX Brainstorming* and *PLEX Scenario*. We have presented the design and evaluation of earlier versions of the cards and idea generation techniques [28], as well as their final version [29].

Alongside this published research, there have been additional activities around PLEX that have not been published. First, we present initial attempts to frame PLEX within the domains of user experience and emotional experience. Second, we address the previously untouched topic of the motivations behind introducing playfulness in product design. We explain the theory of why designing for playfulness can make products more enjoyable. Third, previous evaluations of the *PLEX Cards* and its associated techniques have been based on short brainstorming sessions and we have therefore not been looking at whether those ideas are taken further. Therefore, in this paper we present the "Ecoway" project starting from idea generation up until full concept development and implementations. Fourth, we present the development of the *PLEX Design Patterns* for actual design solutions for playfulness. Finally, we discuss ongoing activities around studying the suitability of PLEX for evaluating playful experiences.

3. FRAMING PLEX

Playfulness in using interactive products must be discussed in the broader domains of user experience and experience design. The experiential qualities of interactive products have gained growing interest among Human-Computer Interaction (HCI) researchers and practitioners. Interactive products are seen as providers of experiences rather than being simple tools for achieving goals [19]. Additionally, Battarbee and Koskinen have emphasized the social aspects of interaction with a product or in conjunction with other users and its outcome as co-experience as part of UX [6].

In the shift from *functional experiences* (i.e., perceived usability and usefulness) to *emotional experiences*, the *pleasures* of using a product have received attention. Jordan [22] argues that *pleasurable experiences* have become a differentiating factor between products and proposes that the pleasure associated with a product is a sum of physical, social, psychological and ideological pleasures elicited by product use. These four types of pleasure indicate that there is a wide range of opportunities for product designers to provide pleasurable experiences to users. Extending these possibilities, Costello and Edmonds have proposed a more fine-grained division of pleasurable experience which includes 13 experience categories [11]. In our work we have focused on *playful experiences* which mainly belong to the emotional experiences side of UX, but there are also aspects that are related to the functional experiences side of UX. In relation to pleasurable experiences, playful experiences take a broader view to different kinds of pleasures and also social aspects of bringing joy to the users. Figure 1 illustrates our focus on playful experience within the broader UX domain.

Figure 1. Scope of Playful Experience in relation to UX.

UX is a broad concept that describes users' interaction with products, the associated services and objects *through a user interface* [26]. Academics and practitioners tend to agree that user experience is dynamic, context-dependent and subjective and it should be grounded in user-centered design (UCD) practices [26]. Even though a multitude of UX models and frameworks exist, there is very little researched knowledge or detailed categorizations of the actual experiences users have with products. Designing for particular experiences can be achieved only by understanding and knowing how users experience interaction with products. Desmet [13] has addressed this question through a product experience framework and the emotions a product can evoke from its users.

Recently, Hassenzahl et al. [20] have categorized user experiences by exploring whether the fulfillment of basic psychological needs

such as competence, relatedness, popularity, stimulation, meaning, security, and autonomy qualify as the source of emotional experiences with interactive products. Hassenzahl et al. suggest that experiences can be categorized by the primary need they fulfill. On the other hand, Preece et al. [32] have proposed from an HCI viewpoint that products should be emotionally fulfilling, enjoyable, aesthetically pleasing, entertaining and fun. Such design goals imply that experiences elicited by the interaction should fulfill a range of psychological needs.

Understanding what kinds of experiences a product can elicit is an important step towards experience design. Hekkert et al. [21] have demonstrated an experience-driven design case in which an intended user experience of a product was a primary design objective. Because of the subjective nature of experiences, it is not possible to design an experience, but it is possible to design *for* an experience. In the Experience Prototyping approach, designers confront a design problem in terms of an integrated experience [8]. For such approaches, a vocabulary or categorization of experiences is necessary.

4. PLAYFULNESS IN PRODUCT DESIGN

In addition to good functionality and usability, the experiential qualities of a product are important for both marketing and user satisfaction. Experiential qualities that support users' identification and individuality can help products be differentiated from competitors in a competing market situation.

Products which elicit playful experiences provide also benefits for users. Many researchers have noted that pleasures motivate users to use a product and thus enhance learning [27,30]. Enjoyable emotions increase motivation to use a product and allow for experiencing a wider range of emotions, which makes pleasurable products self-motivational [27]. Malone has argued that user interface features that raise challenge, fantasy and curiosity can make otherwise boring tasks and routines enjoyable [30]. Also, Norman suggests that positive emotions are essential for people's curiosity and ability to learn new things [31].

Lazzaro [27] lists five benefits that so called 'emotional products' have on users. These benefits are strengthening the users' enjoyment, focus, decision-making, performance, and learning. According to Lazzaro, users enjoy products that provide strong emotional shifts. Emotions support cognitive tasks by directing, focusing and holding attention. Emotions can support the right affective state needed to get the task completed as well as increase appeal. Emotions improve learning through motivating users to pay close attention and repeat actions, enabling them to master highly complex tasks and interactions.

Possibilities for providing pleasurable experiences are not limited to enhancing the visual and auditory qualities of a product. Lazzaro has suggested that interaction is the main source of enjoyable experiences [27]. Garris et al. have identified different aspects from the game-design literature which could be used in utilitarian product design [15]. They consider Mystery and Challenge particularly interesting elements which could be used to increase playfulness in products that are not primarily designed for entertainment [15].

The *reversal theory* developed by psychologist Michael Apter is another indication of the opportunities in designing for playfulness. The reversal theory states that seriousness and playfulness are two mutually exclusive metamotivational states, which structure human experience: any activity can be experienced either in a playful or in a serious manner [3]. Playful metamotivation however, requires the user to be shielded by a psychological *protective frame*, which allows entering the playful state with confidence. The protective frame is the subjective feeling of relative safety that protects a player from the possibly harmful consequences of the activity.

The potential of approaching products playfully can make them more engaging and compelling for a user. Play is an activity that can provide many different kinds of experiences that are usually perceived as pleasant. In a playful state users are more willing to put effort on doing tasks and even truly difficult tasks are not perceived overwhelming when the user is in a playful state [3].

Following Apter [3], we have defined playfulness as a state of mind while performing an activity. From the design perspective, we approach playful experience as *spontaneous enjoyment arising from an action* [28]. This enjoyment can arise, for example, from doing mundane activities in a way that is somehow different from how they are usually performed. These actions may not be planned in advance, or last very long. Designing for playfulness would then involve designing for the potential of minor actions that people can perform impulsively and with little effort, and that provide enjoyment. This differentiates designing for playfulness from game design as the latter is involved with creating systems with rules, goals and content.

5. PLEX DESIGN TOOLS

After publishing the first version of the PLEX framework, we wanted to put PLEX into practical use. More specifically, from a design perspective, we wanted to explore how the PLEX framework provides inspiration to design for playfulness.

The design process consists of multiple stages as proposed by for example Buxton [10]. Buxton models the process as two overlapping funnels, one of elaboration (i.e., concept generation) and the other of reduction (i.e., controlled convergence). We set out to develop practical tools based on the PLEX framework that could prove useful in the different stages of the design process.

5.1 The PLEX Cards

Several designers and researchers have proposed cards as design tools whose main purpose is to provide inspiration in UCD activities. For example, The *Personal Cardset* [34] is a documentation of the different experiences reported by end-users in generative sessions, wherein the cards can be used to communicate the results of these sessions to designers. Halskov and Dalsgaard's *Inspiration Cards* [16] consist of two sets of cards (*Technology* and *Domain Cards*) that are used by designers and other stakeholders at the start of the design process to generate ideas collaboratively.

Similarly, the *PLEX Cards* were motivated by our need to easily communicate the 22 PLEX categories to designers. We needed a low-tech medium suitable for discussing the dynamics of design. The form factor of physical cards was chosen for this purpose.

The design of the cards went through five iterations. Finding the appropriate visual language and content that would allow us to communicate the essentials of each category was perhaps the biggest challenge: Each iteration consisted of a redesign of the cards where we made adjustments to the image content, format, layout, colors and fonts. Each new version of the cards was evaluated in practice. The final version of the cards (Figure 2) is available online [http://www.funkydesignspaces.com/plex/].

Figure 2: The design of the final version of *PLEX Cards*.

5.2 The PLEX Cards Techniques

To make the cards practical to use, we created two techniques that support a more formal approach to idea generation: *PLEX Brainstorming* and *PLEX Scenario* In each technique, participants take turns drawing cards from the deck and make combinations of categories to generate together ideas of playful concepts. Similar kinds of idea generation games have been developed for design cards, such as the *VNA Cards* and *GameSeekers Cards* by Kultima et al. [25].

The *PLEX Brainstorming* technique was based on the *VNA Cards* game: three cards are drawn randomly from the deck to create an idea. The participants take turns in drawing a card and state how this experience category manifests in the idea. The second card extends the idea evoked from the first card, and so on. Due to the rather loose structure of the technique, sometimes cards drawn near the end do not contribute much to the final idea.

Figure 3: *PLEX Scenario* template in use. In one variation, shown here, the three cards forming a scenario are freely chosen from a set of seven or more cards drawn randomly from the deck.

In contrast, the *PLEX Scenario* technique is more structured. Like in the *GameSeekers Cards* game, a background template is used. Referring to the guidance provided by an A3 template (Figure 3, top), participants create a scenario using the three cards selected from a set of seven or more available cards. The scenario (or 'use story') is triggered by an action related to the first card, where it is then developed further with the second card, and finalized with the third card. The scenario is documented on the template either as text or sketched as a three-frame cartoon strip.

5.3 Evaluating PLEX Cards and Techniques

The techniques were evaluated both quantitatively and qualitatively during several design sessions [28,29]. In general participants commented positively on the *PLEX Cards* and techniques' role in supporting idea generation and guiding thinking about playfulness. Participants often mentioned that categories that could normally be considered controversial in the context of playfulness (e.g., 'Eroticism' or 'Cruelty') were actually helping them think in unconventional ways about playfulness.

Some participants preferred the *Scenario* technique above *Brainstorming*, because for example the turn taking in the latter was seen to block creativity. On the other hand, some participants felt that the *Scenario* technique was slower and more vague. We plan on conducting further experiments that include variations to both techniques before stating with certainty their relative effectiveness compared with other design methods.

Based on the feedback from the evaluations, we believe that the *PLEX Cards* and techniques can help facilitate UCD activities when used by researchers, designers and other stakeholders involved in the design process. Cards are a concrete, tangible tool for discussing and thinking about playfulness. The two techniques provide common and repeatable ways to use the cards.

5.4 Design Case: Project "Ecoway"

To gather feedback on the PLEX Cards and its associated techniques over a longer time period, we gave the cards to design students participating in a five-month course that was then starting October 2009 at the Utrecht School of the Arts in the Netherlands. Students were instructed to create an application that would elicit playfulness through social interaction. Eight fourth-year MA students in interaction design (ID) or game design (GD) formed a team to work on the project. Participants were not familiar with PLEX beforehand. We provided them with a deck of third version *PLEX Cards* and gave them an extensive written introduction to the framework.

At the start of the project, students organized a series of idea generation sessions in which they worked in pairs and used the *Brainstorming* technique. The rest of the section is based on the students' discussion in the project report about their experiences using these tools.

Overall, some students liked the cards and technique because they guided thinking and led to even surprising results:

"*Overall I think the PLEX cards are of great value when it comes to brainstorming. It forces one to think outside of the box, yet guided by playful experiences.*" (ID3)

"*I found the PLEX cards a very good brainstorming method. It gave surprising and interesting results which were very useful in the rest of the process.*" (GD4)

Altogether, the students created 25 ideas in the brainstorming sessions. This set was then narrowed down into six more detailed concepts. "Ecoway", the name given to the final concept chosen

for prototype implementation, combined aspects from several concepts.

The goal for the Ecoway concept was defined by the students as: "*How can we make a group of colleagues aware, through a playful system, of the influence their behavior has on a natural environment?*" From this statement, we can interpret the PLEX categories 'Discovery' (awareness of own behavior) and 'Sympathy' (awareness of the natural environment) as the main aspects of the design goal. The design goal statement further specifies that to achieve raising awareness of the natural environment, "*Ecoway simplifies this expansive context by scaling a natural system down to a small garden, and humanity to a single office ecology. (...) Within an office, thus, colleagues form a group that individually and collectively nourish a garden and are aware of their responsibility to keep it alive and flourishing*." From this concept brief we can further identify 'Fellowship' (colleagues form a group working collectively towards a common good) and 'Nurture' (nourishing a garden).

The students reported a number of iterations of the functionality built around the basic concept before having finalized the prototype. The PLEX categories were referred to throughout the development process: "*I think the real power of the PLEX cards are in defining an existing idea, and making it more playful. (...) What also worked for us, is placing (images of) each PLEX category randomly on the wall in our project room. It was useful for me to look at them sometimes and come up with an idea.*" (ID2)

The functional Ecoway prototype consists of a small interactive garden house made of small plants (Figure 4). There is a watering system and a small fountain. The users water their plant "virtually" by using a GPS-enabled mobile phone application that tracks the manner in which they travel to work: sustainable commuting makes the Ecoway garden provide more water for the plant. There is a touch screen interface next to the dome, where users can learn more about the system and the effect their behavior has on sustainability. The intended PLEX categories are clearly present in the final prototype, as it elicits 'Nurture' (taking care of the plants), 'Fellowship' (doing this together in a group), 'Simulation' (virtual and actual water), 'Discovery' (learning about environmental issues) and 'Sympathy' (realizing that the plant and the environment needs one's help to flourish).

Figure 4. The Ecoway prototype was designed to elicit primarily 'Nurture' and 'Simulation' when taking care of the garden.

The following quotes summarize well how the PLEX framework was perceived and used by the students during the five months:

"*In the first phase of the project, during the conceptualization of the project, I think the PLEX model contributed a lot to generating a vast amount of concepts in a short time. In terms of quantity it was an excellent tool, but the quality of the concepts weren't great in general.*" (ID3)

"*(...) in later stages of the development cycle the PLEX model allows itself to be used differently, as an iteration tool, an evaluation device or simply an inspirational direction. This diversity makes it a very strong model.*" (ID4)

Like in most brainstorming activities, many ideas need to be created in order to get some exceptional ones. The feedback from the students suggests that *PLEX Cards* and the *Brainstorming* technique are useful for creating many initial ideas within a short timeframe. However, the PLEX framework was also found to elicit a mindset of playfulness which was put into use when developing the ideas further into concepts incorporating playful aspects.

The Ecoway project showed that PLEX can be used in the different stages of designing a playful application. The project also provided input that was taken into consideration when creating the *Scenario* technique and when designing the fourth and subsequent versions of the *PLEX Cards*.

The *PLEX Cards* and the *Brainstorming* technique seem potent tools for idea creation, especially for the early stages of divergence in the design process [10]. However, for convergence in the concept creation stages, additional tools are needed. For example, during the later stage of the Ecoway project, the students may have needed more formal design tools that relate playful features into more traditional user interface and computer system design practices. One example of such established tools are design patterns.

5.5 PLEX Design Patterns

Design patterns [2] were introduced within the discipline of architecture for easy knowledge transfer between professionals and non-specialists. These patterns encode design practices as problem-solution pairs with accompanying information and are interrelated with each other to form hierarchies or nets. From the origins within architecture, the ideas of design patterns have spread to several other areas including programming [14] and interaction design [8,12].

The *PLEX Design Patterns* are an example of explicitly creating a design language [33]. A design language provides a way of understanding a design discipline through knowing which elements and materials are relevant, how these elements can be structured, and situations when specific elements and choices of structures are appropriate. Specifically, they let those involved in the design process consciously consider and discuss what the implications of design choices would be for the final design. Design patterns are not complete design languages in themselves since they describe the basic elements but do not describe the steps of a design process.

The structure of the *PLEX Design Patterns* differs from the original problem-solution pair proposed by Alexander et al. [2]. The *PLEX Design Patterns* use causes-consequences pairs describing how the pattern can occur in an interaction design and how it can affect the overall user experience. The structure takes inspiration from game design patterns [7], Yahoo! Interaction patterns [1] and the approach presented in the book *Designing Social Interfaces* [12]. The reason for the change was because the patterns were meant to support both the design and analysis of products and also allow the use of specific patterns as design goals. The generic structure of the playful design patterns and an example pattern is presented in Table 2.

Table 2. The elements of the *PLEX Design Patterns* and an example from the playful design pattern collection.

Design pattern element	Example
Name: Title of the pattern should be short, specific, and give a good sense of the content.	'Affordance Exploration'
What: Describes the main gist of the pattern in a few sentences. This section should allow identifying a design pattern in an existing product.	The affordances of a product incites users to explore the features and interaction techniques of the product.
Use when: Describes the design situation (including design goals and user requirements) when the pattern can be used.	When designer wants the users to explore the functionality of the product or system. Usually 'Affordance Exploration' also creates a more intuitive and engaging user experience.
How: Gives designers guidelines and even specific and concrete suggestions how to make the pattern emerge in the current design situation.	The physical affordances of the product should provide natural and intuitive interaction with the product, using well-known and embodied use metaphors. The physical interaction should resemble natural ways of using objects, such as sweeping, pointing and dragging. The results of actions should be reversible so that the users can easily correct their mistakes. The actions should provide immediate physical feedback.
Why: Outlines the reasons why the pattern could make the product more playful and also suggests further implications for the user experience.	'Affordance Exploration' can empower the user to try out different and new features of the product.
Related patterns: Lists other playful design patterns which can have similar impact on the design.	'Experimenting'
Examples: Lists concrete examples of existing products where the design pattern is evident.	Lego blocks are a prime example of 'Affordance Exploration'. The shapes of the blocks invite direct manipulation. The different ways in which blocks can connect to each other encourage exploring and constructing new shapes. Another example is the iPhone's interface, which provides physical and intuitive affordances for exploring the functionality of the product.
References are listed when the pattern is based on other existing patterns or work.	Hartson, 2003 [18]
PLEX categories invoked by the design pattern.	'Exploration'

Currently the playful design patterns collection contains 32 patterns. In some cases, one pattern corresponds to one PLEX category; for example, 'Affordance Exploration' is a specific case of the 'Exploration' category. However, a single pattern often manifests into several PLEX categories. An example of this kind of pattern would be 'Experimenting' which manifests into the categories 'Exploration' and 'Discovery'.

Creating and referring to the design patterns made us increasingly aware of the many ways in which the PLEX categories can be interlinked. Some categories may follow each other through an action-consequence pattern, like 'Exploration' and 'Discovery'. Categories such as 'Competition' and 'Completion' are temporally related. A preceding experience can make the following experience stronger, e.g., 'Suffering' followed by 'Completion'. The negation of a first experience can lead to a second experience; for example refraining from 'Submission' to norms can lead to 'Subversion'. Some categories can be mutually inclusive (e.g., 'Fellowship' and 'Sympathy'), while other categories can be mutually exclusive (e.g., 'Nurture' and 'Cruelty'). The elicited experiences can vary greatly depending on the viewpoint or actor-reactor relationship, for example, in being either the nurturer or the nurtured in a 'Nurture' experience. When used for design, the PLEX categories may be considered from these different perspectives.

The *PLEX Design Patterns* were conceived mainly as a tool for aiding designers in concrete design situations. The patterns can be used to describe a particular design situation, give guidelines on how to make further design choices, and also used as inspiration or design goals for the whole design project. Thus, the patterns can be used both for the early conceptualization phase by setting the scope and goals of the design project itself and also as an aid for concrete design choices later in the project.

6. EVALUATING PLAYFUL EXPERIENCES

In a complete UCD process, users are involved in both the design and evaluation phases. Tools that facilitate designing for playfulness are only one part of creating playful products. It is equally important to develop tools for evaluating how successful the designs are in eliciting playfulness in the users.

One approach is to use quantitative methods to measure the elicited experience [11,13,19]. Therefore, we consider quantitative questionnaires as a viable option to measure playful experiences elicited by products. The development of a quantitative PLEX questionnaire is currently under way. We have made some preliminary experiments with PLEX categories, focusing on how we can determine in a reliable way that a certain experience is elicited in the interaction with a product. Our aim is to build a questionnaire that will measure the experience categories present in the use of different kinds of playful products.

The development of the evaluation tool has many challenges that need to be solved. The PLEX framework includes several aspects of playfulness which makes the questionnaire quite extensive if all categories are included simultaneously. Responding to a questionnaire involves recalling and reflecting on *past* experiences elicited by product use, rather than experiences felt immediately during the interaction. Playful experiences are usually complex and very seldom experiences can be described with a single category. Playful experiences resulting from product use are usually a combination of several PLEX categories. Interpreting evaluation results so that they are understandable and useful for designers to improve the product design is far from trivial. Quantitative results from experiences should be transferred to subjective and sometimes abstract recommendations in order for the designers to meet user experience targets.

7. DISCUSSION

One purpose for creating the PLEX framework has been to study playfulness as part of user experience [19,32]. The PLEX framework attempts to provide a vocabulary for user experience researchers and designers to discuss playful experiences and playfulness among themselves and other stakeholders and users.

We started to develop the PLEX framework by exploring various domains where playfulness has been part of the design activities. The relevance of the PLEX framework has been checked in studies conducted in different domains and product categories. The current framework consists of 22 PLEX categories covering different playful experiences and their relationships between each other.

Practical implications of the PLEX framework have been introduced with the *PLEX Cards* and its associated techniques, which have been used during the brainstorming stage of product design. The *PLEX Cards* are also a helpful tool to complement UCD methods when assessing with users future product concepts and their early stage design alternatives incorporating playfulness. The Ecoway design project suggested that the framework can be used as inspiration as well as a common frame of reference throughout the design process. The project participants commented that the framework provided new perspectives when thinking about playful experiences. Design patterns are another practical embodiment of the PLEX framework to help designers in designing for playfulness. The design patterns show the relations of the PLEX categories.

We have identified some challenges when applying PLEX categories in practical design work. Some categories (e.g., 'Captivation') can be difficult to use to guide design in a practical manner. However, in the study presented by Costello and Edmonds [11], the corresponding category 'Captivation' was one of the commonly described experiences with interactive art installations. Another challenge is that categories such as 'Eroticism' and 'Cruelty' have strong connotations that may direct design into an obvious direction, if the designers are not careful to explore the design possibilities of the categories in a broader sense. On the other hand, these kinds of categories can provide surprising elements in the design process.

Our objective has been to understand playful experiences when they are related to *interaction with products through an interface* [26]. We have not validated the applicability of the PLEX framework in describing all kinds of playful experiences that humans can experience (ranging from horseback riding to bungee jumping), limiting them to product interaction instead.

Designing for playful experiences is by no means straightforward. As many user experience researchers have shown, users can experience interactive products in many different ways because the users' state of mind, previous knowledge and experiences will influence the overall experience of the product. Moreover, context will have an influence on user experience which further makes experiences more diverse. Experiences are usually complex and very rarely a single category can describe experiences in a sufficient manner. Playfulness will add another attribute to the complex issue. An interaction with a product may elicit a range of experiences, but experiences can be regarded playful only if using the product brings pleasure (fun and enjoyment) to the user. Being playful is not a persistent state of the user and it can be interrupted easily. Certain kinds of previous experiences and activities trigger a playful state of mind. A protective frame is also needed to change into the playful state [3].

Another issue in designing for playful experiences is their value for users: does playfulness really enhance experiences so much that designers should strive for eliciting playful experiences in the product design? Are playful experiences in some ways more satisfying than other experiences a product elicits in users? Furthermore, how well do playful experiences and other experiences bind together the overall user experience of a product? These are open questions that should be studied further with end-users of interactive products when designing for playfulness.

The PLEX framework is not the only conceptual approach to provide inspiration for designing for playfulness; it can be used to complement other conceptual models (e.g., [21,24,27,30,35]) when designing for playfulness.

8. CONCLUSIONS

By playful experiences we mean experiences that are mostly non-goal-oriented and mainly evoked by fun or pleasurable aspects of using a product. Playfulness can either be planned in the product design, or it can arise from the user's mindset during the interaction. Playfulness can make products more engaging and compelling.

Because playfulness is a state of mind, any activity can potentially be approached and performed in a playful manner. The aim of designing for playfulness is to create objects that elicit a playful state in the user and provide pleasure from using them. To help accomplish these design goals and to understand playfulness as part of user experiences, we have created the PLEX Framework.

We situate playful experience as part of broader product experience. Desmet [13] defines three levels of product experience: aesthetic pleasure, attribution of meaning, and emotional response. Different categories of the PLEX framework can help address these three product experience levels. For example, aesthetic pleasure can be achieved by addressing 'Sensation' and 'Expression' categories in product design. Attribution of meaning can be achieved through PLEX categories such as 'Simulation', 'Completion' and 'Fantasy'. Emotional responses can be achieved by addressing 'Thrill' and 'Sympathy'.

In addition to the framework itself, we have developed concrete techniques for design. The *PLEX Cards* have been our primary means for disseminating the PLEX Framework and obtaining feedback. Based on previous evaluations and the feedback discussed in this paper, the *PLEX Cards* and its associated techniques (i.e., *Brainstorming* and *Scenario*) appear to be helpful tools when designing for playfulness. In the Ecoway project, the PLEX framework provided guidance during the different stages from idea creation to refining the features of an interactive miniature garden. The PLEX framework clearly influenced the prototype as it was designed to elicit a set of specific playful experiences including 'Nurture', 'Fellowship', 'Simulation', 'Discovery' and 'Sympathy'.

The practical usefulness of the current design pattern collection is being evaluated at the same time as more patterns are being created. The focus of the future patterns is on designing playful interactions that are not derived from games. In order for the set of PLEX tools to be complete, we must develop proper evaluation methods and techniques, which will allow evaluating the playfulness of a product during and after the development process. We have already begun work on a quantitative evaluation tool that is yet to be validated in practice.

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REFERENCES

[1] Yahoo Design Patten Library, [Accessed January 27, 2011] http://developer.yahoo.com/ypatterns/

[2] Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M. *A Pattern Language: Towns, Buildings, Construction*. Oxford University Press, 1977.

[3] Apter, M. J. *Reversal Theory: The Dynamics of Motivation, Emotion and Persona*. 2nd edition, Oneworld publications, 2006.

[4] Arrasvuori, J., Boberg, M., Korhonen, H. Understanding Playfulness: An Overview of the Revised Playful Experience (PLEX) Framework. In *proc D&E*, Illinois Institute of Technology (2010).

[5] Arrasvuori, J., Korhonen, H., Väänänen-Vainio-Mattila, K. Exploring Playfulness in User Experience of Personal Mobile Products. In *proc OZCHI 2010*, ACM Press (2010), 88-95.

[6] Battarbee, K., Koskinen, I. Co-experience: user experience as interaction. *CoDesign 1,* 1 (2005), 5 – 18.

[7] Björk, S., Holopainen, J. *Patterns in Game Design*. Charles River Media, 2004.

[8] Borchers, J. *A Pattern Approach to Interaction Design*. 1st Edition, John Wiley & Sons, 2001.

[9] Brown, S., Vaughan, C. *Play: How it Shapes the Brain, Opens the Imagination, and Invigorates the Soul*. Penquin Books, 2009.

[10] Buxton, B. *Sketching User Experiences*. Morgan Kaufmann, 2007.

[11] Costello, B., Edmonds, E. A Study in Play, Pleasure and Interaction Design. In *proc DPPI*, ACM (2007), 76-91.

[12] Crumlish, C., Malone, E. *Designing Social Interfaces: Principles, Patterns, and Practices for Improving the User Experience*. 1st edition, Yahoo Press, 2009.

[13] Desmet, P. Measuring Emotion: Development and Application of an Instrument to Measure Emotional Responses to Products. In *Funology: from Usability to Enjoyment*, Blythe, M., Monk, A., Overbeeke, C. J., Wright, P. (Eds) Kluwer academic Publishers (2003), 111-123.

[14] Gamma, E., Helm, R., Johnson, R., Vlissides, J. *Design Patterns – Elements of Reusable Object-Oriented Software.* Addison-Wesley, 2001.

[15] Garris, R., Ahlers, R., Driskell, J. E. Games, Motivation, and Learning: A Research and Practice Model. *Simulation & Gaming 33,* 4 (2002), 441-467.

[16] Halskov, K., Dalsgaard, P. Inspiration card workshops. In *proc DIS*, ACM Press (2006), 2-11.

[17] Hartmann, J., Sutcliffe, A., De Angeli, A. Towards a theory of user judgment of aesthetics and user interface quality. *TOCHI 15,* 4 (2008), 1-30.

[18] Hartson, H. R. Cognitive, physical, sensory, and functional affordances in interaction design. *BIT 22,* 5 (2003), 315-338.

[19] Hassenzahl, M. The Thing and I: Understanding the Relationship between User and Product. In *Funology: From Usability to Enjoyment*, Blythe, M., Monk, A. F., Overbeeke, K., Wright, P. (Eds) Kluwer Academic Publisher (2003), 31-42.

[20] Hassenzahl, M., Diefenbach, S., Göritz, A. Needs, affect, and interactive products - Facets of user experience. *IwC 22,* 5 (2010), 353-362.

[21] Hekkert, P., Mostert, M., Stompff, G. Dancing with a machine: a case of experience-driven design. In *proc DPPI*, ACM (2003), 114-119.

[22] Jordan, P. W. *Designing Pleasurable Products*. CRC Press, 2000.

[23] Korhonen, H., Montola, M., Arrasvuori, J. Understanding Playful User Experience through Digital Games. In *proc DPPI*, Université de Technologie de Compiègne (2009), 274-285.

[24] Kubovy, M. On Pleasures of the Mind. In *Well-being: the Foundations of Hedonic Psychology*, Kahneman, D., Diener, E., Schwartz, N. (Eds) Russell Sage Foundation (1999).

[25] Kultima, A., Niemelä, J., Paavilainen, J., Saarenpää, H. Designing game idea generation games. In *proc Future Play '08*, ACM Press (2008), 137-144.

[26] Law, E. L.-C., Roto, V., Hassenzahl, M., Vermeeren, A. P. O. S., Kort, J. Understanding, scoping and defining user experience: a survey approach. In *proc CHI*, ACM (2009), 719-728.

[27] Lazzaro, N. Why We Play: Affect and the Fun of Games: Designing Emotions for Games. In *The Human-Computer Interaction Handbook: Fundamentals, Evolving Techniques and Emerging Applications*, Sears, A., Jacko, J. A. (Eds) Lawrence Erlbaum Associates (2008), 679-700.

[28] Lucero, A., Arrasvuori, J. PLEX Cards: a source of inspiration when designing for playfulness. In *proc Fun and Games*, ACM (2010), 28-37.

[29] Lucero, A., Arrasvuori, J. The PLEX Cards and its Techniques as Sources of Inspiration When Designing for Playfulness. To appear in *IJART* (2011).

[30] Malone, T. W. Heuristics for designing enjoyable user interfaces: Lessons from computer games. In *proc CHI*, ACM (1982), 63-68.

[31] Norman, D. A. *Emotional Design: Why Do We Love (or Hate) Everyday Things*. Basic Books, 2005.

[32] Preece, J., Rogers, Y., Sharp, H. *Interaction Design: Beyond Human-Computer Interaction*. 2nd Edition, John Wiley & Sons, New York, NY, 2007.

[33] Rheinfrank, J., Evenson, S. Design languages. In *Bringing design to software*, Winogard, T. (Eds) ACM Press (1996), 63-85.

[34] Sleeswijk, V. F., Stappers, P. J., van der Lugt, R., Sanders, E. Contextmapping: experiences from practice. *CoDesign 1,* 2 (2005), 119-149.

[35] Sweetser, P., Wyeth, P. GameFlow: a model for evaluating player enjoyment in games. *CIE 3,* 3 (2005).

[36] Tractinsky, N., Katz, A. S., Ikar, D. What is beautiful is usable. *IwC 13,* 2 (2000), 127-145.

[37] Woszczynski, A. B., Roth, P. L., Segars, A. H. Exploring the theoretical foundations of playfulness in computer interactions. *CHB 18,* 4 (2002), 369-388.