Interactivity attributes – controlling the 'feeling' of an interactive product

Perspectives on designing interactivity

Hilde Merete Fossan Slette
Department of Product Design
Norwegian University of Science and Technology

ABSTRACT

What makes an interactive product feel different from other similar products? This article focuses on how to design quality interactions at the level of detailed, single interactions, or microinteractions. A literature review was conducted, where the concept of interactivity attributes was discovered as a new way to describe aspects of interaction. Further, an exploratory design workshop was held to investigate the suitability of using interactivity attributes in a creative design process. The workshop was conducted with design students, who were given a practical case involving the design of a mobile application for teaching equations to high school students. After the workshop, the participants reported that when learning about the attributes and using them consciously, they were able to conceive of more dynamic and detail-oriented ideas for the interface.

KEYWORDS: Interactivity Attributes, Interactivity, User Experience, Design Process, Microinteractions.

1. INTRODUCTION

How to create great interactions between man and computer has been a concern with designers since the average Joe started to interact with computers. The creation of the desktop interface, the mouse and early text editors was achieved with user testing, co-design and by figuring out what made sense to people. (Moggridge, 2007) This still holds true today, but increasingly more complex challenges face the world of interaction design as the profession matures, and the technology develops.

New products such as tangible interfaces and wearables demand an understanding of the interactive experience that surpasses traditional computer-based GUIs (Graphical User Interfaces). As the computational power increases, and providers of software applications grow in number, companies who offer digital products need to distinguish themselves by means of providing the best user experience (UX). Since Don Norman coined the term UX in his employment at Apple (Nielsen Norman Group, 2016), design research has over the years grown more concerned with understanding users' emotional processes and how to arouse conscious or unconscious emotion through an interface. (Lockner & Bonnardel, 2014).

Considerable focus has been with the design of great user experiences in the service that a company provides, employing methods such as service design, service blueprints and user journey mapping. What has been overlooked in

some part, and now becomes more prominent, is how the details of interactive products affect the user experience. As the sheer number of possibilities with digital design increases, the potential for new ways to work with interaction also grows.

This article is an attempt to explore approaches to, and frameworks on how to control the 'feeling' of interactive products on a detailed level. This is done through a literature review, and an exploratory design workshop.

2. LITERATURE REVIEW

2.1. Method

A literature review was conducted with the goal of exploring current views on interactivity, what affects the 'feeling' of an interactive product, and how to design with details to ensure quality interactions. In order to establish what research exists, a preliminary search was first conducted with a wide scope and keywords that included 'details of interaction', 'feeling of interactivity', 'aesthetic interactions', 'affect qualities', 'experience qualities', 'quality of interaction' and similar wordings.

A second and more focused search was then performed with the keywords 'microinteractions', 'interactivity attributes' and 'user experience'. Google Scholar was the primary search engine, and backwards and forwards searching through sources and citations was done with the goal of gaining an overview of the field.

This review is restricted to HCI and UX research, as they often include perspectives from other fields such as psychology, product design and sociology, and it is a wide enough field for the scope of this article.

2.2. Findings

The theory of microinteractions was discovered as a framework to help designers focus on the details of interactive artifacts. A book by Dan Saffer called 'Microinteractions: Designing with details' (Saffer, 2014) was used as a primary source, and the concept is explained in part 2.2.1 Microinteractions. Diving deeper into the world of how to design great small-scale interactions led to the concept of 'aesthetic interactions'. This is a search for beauty in interaction and it promotes a view of interactivity as a conceptual 'thing in itself', separate from the interface. From this, a set of interactivity attributes has been proposed by several researchers over the recent years as a way of describing and controlling the aesthetics of interaction. This is explored in further detail in part 2.2.2, and the attributes are also the subject of investigation in the design workshop in part 3. Tightly coupled with beautiful interactions is the user experience, because interaction does not exist independent of a user. User experience can be viewed differently depending on the level that is being designed. When crafting a service, higher level emotions such as trust, joy and contentment are natural to consider, which often are results of long-term engagement with multiple touchpoints. On the other side of the scale, when designing with details, it can be fruitful to investigate lower-level and immediate responses such as 'surprise', 'stimulation' and 'calming'. They are analogous to the tactile dimension of physical products. This is discussed as experiential qualities in part 2.2.3.

2.2.1 Microinteractions

'For any kind of product or service, it's the little things that count. Having a button click when you push it down doesn't seem like much, but when that click makes the difference between getting coffee and not getting coffee, it matters a great deal'. (Garrett, 2011). The term 'microinteractions' encompass these little things; small-scale interactions that are simple, brief and good for accomplishing a single task.

One of the promoters of the term and associated framework is Dan Saffer, the author of the book 'Microinteractions' (Saffer, 2013). The book describes a framework of microinteractions, that consists of four parts: Trigger, rules, feedback and loops & modes. Triggers describe the parts of an interface which is possible to interact with, for instance a button. Rules are the built-in constraints that determine what is going to happen when activating a trigger. Feedback encompasses all feedback provided to the user,

both before and after the trigger is initiated. Loops describe what happens when engaging with the microinteraction several times over a time period, and modes are different events that occur under different conditions. A mode could for instance be a trigger that activates different events depending on the time of day, or a slider that has different values whether a button has been switched on or off.

Saffer claims that microinteractions are everywhere around us, but we hardly notice them before something goes wrong. They can make engaging with the product easier, more pleasurable and memorable, and we should therefore lay down care and attention to them. The notion of microinteractions has been promoted by many design blogs over the last couple of years and has gained interest in the design community.

The framework of microinteractions presents a way of categorizing interactions that has not been attempted earlier in the exact same manner. Envisioning a conceptual scale of the way people interact with products gives us some information about the experiences on different levels. On one hand there is the overall goal of the site, or the main experience, such as a game being immersive and fun or a project management tool being professional. On the opposite point of the scale are the simplest and most immediate ways to interact - such as microinteractions.

The prevailing opinion of microinteractions seems to be that they are something to be added – or not – to a design. That they are by definition something other than a macro (or feature)- interaction. Although they can be conceptually separated, it is here argued that there are no interactive features without microinteractions. They are the building blocks of all interactive artifacts.

Saffers book presents good examples on microinteractions, and provides some best practices on designing with details. It doesn't mention underlying mechanics of interactions or what affects the 'feeling' of the interplay between triggers, rules and feedback. Movement is an aspect of the interactive experience that holds potential for controlling the feeling of interaction. In 'Microinteractions' (2013), movement and animations are seen as something to be added rather than an integral part of the input-feedback loop. A theory that seeks to provide a new perspective, where animations are integral to the product and the experience, is the theory of interactivity attributes and aesthetic interactions.

2.2.2. Interactivity attributes

Several researchers have attempted over the recent years to establish a set of attributes/parameters of interaction that can describe the 'invisible' qualities of interacting with a product. Many of these attempts are at the same time concerned with the 'aesthetics of interaction'. This is a term that encompasses ideas about the beauty of an interactive experience. There are numerous studies concerning aesthetic interactions, trying to develop frameworks and explain the phenomenon (Petersen et. al., 2004, Tuch et. al., 2012, Hashim et.al., 2009). Most of the studies agree that aesthetics is perceived differently when interacting with a product and when watching it (Möttus & Lamas, 2015). For instance, looking at a well-designed knife is not the same as feeling the weight of it, or cutting it through a carrot. Looking at a pretty web-page and trying to navigate through the content also presents differences in perceived aesthetics. In order to create beautiful interactions, we need to know what they are comprised of, that is what 'materials' to manipulate, similar to physical products. This is where the effort to define a set of properties of interaction come into play. (Lenz, Diefenbach & Hassenzahl, 2014)

One of the earlier attempts to define and describe properties of interaction was concerned with the term 'interaction gestalt'. Lim et. al. (2007) recognized the recent focus on the role of aesthetics in interaction design, but lamented the lack of practical applications. Therefore, they set out to explore approaches on how to shape aesthetic interactions. They picked up the term 'interaction gestalts' proposed by Svanæs (1997), which is a 'composition of qualities that "creates a unified concept, configuration or pattern which is greater than the sum of its parts"' (Lim et. al.,

2007, p. 239), similar to the gestalt principles of graphical design. They extended the concept by proposing 11 concrete interaction gestalt attributes that can be combined by designers. The figure below describes the relationship between user experience, the interactive artifact and the interaction gestalt, which is comprised of interaction attributes.

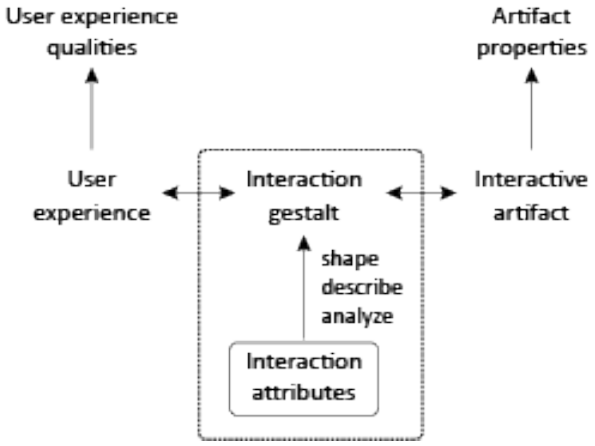

Figure 1: Diagram that shows the relationship between interaction gestalt, user experience and the interactive artifact. Interaction attributes are seen as properties that can be used to shape, describe and analyze an interaction gestalt. Source: Lim et. al. 2007.

Since then, the proposed attributes of interaction have been picked up by many authors and redefined several times in different contexts. Lenz et. al. conducted a literature synthesis in 2014 with the goal of evaluating approaches to define properties of interaction (Lenz et. al., 2014). They discovered that the approaches fell into two groups: one was a descriptive stance that dealt with the interaction in itself and the action/feedback-loop. Lundgren is one of those authors who argue that we should not bring in aspects of user experience or aspects that arise in use, but focus on the properties that we can control - properties of the artifact in itself (Lundgren 2011). The other group can be thought of as more prescriptive, and addresses the feelings and meanings that arise in interaction. Lenz et. al. concluded that we need to consider both stances, and that we need more research to explore relationships between prescriptive and descriptive attributes.

An attempt to explore this relationship was done in another article by the same authors (Lenz, Diefenbach & Hassenzahl, 2013). They were concerned with creating a vocabulary of interaction, and stated that it is crucial to differentiate between interaction attributes and the emerging experience. '(…) Creating a particular experience requires awareness and the purposeful combination of attributes on the interaction level. (…) We believe that the designer should first clarify and specify the desired experience and later match interaction attributes.' (Lenz, Diefenbach & Hassenzahl, 2013, p. 126 and 133) This proposes an instrumental way to design for experiences, and reflects the idea of a goal-driven design process. Cooper et. al. (2014) recommends that designers develop a set of keywords that can define the tone, voice and brand promise of a product - which they call experience attributes. This, they argue, is often done by visual designers as interaction designers are more accustomed to think about product behavior than brand. In order to achieve a cohesive and consistent tone of voice through the entire experience, this is perhaps something that interaction designers should be more concerned with. For interaction designers to implement tone of voice into the interactions, tools that enable such efforts in an earlier stage of the design process is needed. Interactivity attributes as such a tool is tested in the second part of this article.

Another attempt to explore the relationship between interactivity attributes and user experience was made in an article by Peter Tolstrup Aagesen and Clint Heyer (2016). They propose a set of nine dichotomies that describe aspects of a given interaction. In the article mentioned, they showed through user testing that certain attributes were related to particular brand traits. Their experiments showed among other that there is a 'clear commercial significance for deeper, systematic ways of analyzing and

critiquing interactive experiences.' (Aagesen & Heyer, 2016, p. 3126)

Lines can be drawn to the tactile dimensions of physical products, to gestalt principles in graphical design, but also to how we talk about and define human interaction. A hug could for instance be categorized as a microinteraction between two human beings. The hug can have different properties; it can be warm, friendly, formal or sensual. None of the properties/attributes are inherently positive or negative, it depends on the context. When hugging a distant relative, a friendly and formal hug is appropriate and elicit a good experience. Trying a sensual hug with an acquaintance would most likely lead to an uncomfortable experience. In a similar way, how we manage the properties of the microinteractions between man and machine, influences the overall experience. How the desired experiences are articulated, is therefore an issue worth investigating.

2.2.3. Experiential qualities

User experience design escapes precise definition, as it encompasses all the factors that affects the users experience with a product. This includes the service, the system and the usability of the interface. Perhaps it is too large a concept to bring it to a concrete level and use it in a practical way throughout the design process. The creator of the term, Don Norman, criticizes the modern use of UX and claims that it should not only be considered as a part of an interface – but the entire system around it.

Still, several attempts have been made in order to structure and categorize the types of experiences we can have with a product or service, in order to apply it in design practice and create targeted and thorough products. In order to design for experiences, it is argued that we need a vocabulary to describe the desired experiences and emotions. Emotional design is about recognizing that all human choices are influenced by emotion. All design is emotional whether intended or not, and the emotional perspective concerned with shaping emotions to benefit the product (Capper 2013). Emotions are tightly coupled with experience, and in order to design for experience we need a notion of what it means to design for emotions.

One of the biggest discussions in this field is related to whether or not it is possible to design for emotions in the first place. Marc Hassenzahl advocates a view that it is not possible to separate emotions and cognition, and that we need a more integral and unified approach to human-computer relationships (Hassenzahl, 2004). Appeal, emotions and attraction are highly inseparable from the context, and this view aligns with Norman's original concept of user experience. Researchers such as Lim et. al (2008) claims that even though we cannot entirely predict an emotional response to an interactive design feature, they are not completely random either. Through a case study Lim et. al. showed that interactive product qualities affect the emotional experience in a non-random way. If we want the interactive products to elicit a certain type of emotions or feelings, it is reasonable to take a closer look at the different types of emotions in question.

Don Norman suggests three levels of emotions that are widely used when discussing emotional design; visceral, behavioral and reflective (Norman, 2004). The visceral level is to do with gut feeling, or immediate responses. The behavioral level is concerned with how people use the product, and the top reflective level is about meaning and often determines the overall impression. A good design should according to Don Norman address all three levels.

Patrick Jordan agrees that we should move beyond usability-based approaches to design, and encourage pleasure-based approaches. (Jordan, 2000) He proposes a different, but related framework as a means to understand people's emotions; the four pleasures framework comprised of physio-pleasure, socio-pleasure, psycho-pleasure and ideo-pleasure. Physio-pleasure relates to the body, and pleasures concerning the senses. Socio-pleasure is derived from relationships and can include issues such as status and image. Psycho-pleasure relates to cognitive demands, and ideo-pleasure relates

to people's values, for instance ecological or moral values.

A third framework to consider when discussing emotional design was promoted by Marc Hassenzahl, and consists of three levels; a Why, What and How-level. (Lenz, Diefenbach & Hassenzahl, 2013) The What-level concerns the functionality of a product, the How-level addresses concrete interactions possible with the product, and the Why-level addresses psychological needs and emotions - what makes the use meaningful to people. He argues that we cannot design the Why-level, only observe and evaluate.

When comparing the three frameworks, it is evident that they have considerable similarities. They are all comprised of levels that move from cognitively simple to advanced responses. There is a notion of a 'lower-level' that relates to gut-feeling or bodily responses. In Hassenzahls framework, the lowest level is related to the product, but Jordan and Normans frameworks are more similar where the visceral level and physio-pleasures describes aspects of human reactions. The middle level is concerned with simple cognitive/emotional responses resulting from immediate interaction with a product. Jordans socio-pleasure and psycho-pleasure relates to Normans behavioral level, while Hassenzahls How-level is similar in that it advocates the immediate interaction with a product, but is more focused on the actual events instead of the emotional responses with the user. The last and top level describes more complicated long-term emotional responses that takes into account earlier experiences and the overall context. Normans reflective level, Jordans ideo-pleasure and Hassenzahls Why-level all refer to meaning, values and intellectual judgement.

When designing microinteractions, the details of an interactive experience, it is reasonable to assume that lower-level immediate emotions refer to the 'feeling' of an interactive product. Such emotions, or responses that occur in humans when engaging with a product, can be articulated as experiential attributes. As mentioned earlier in part *2.2.2. Interactivity attributes*, a distinction between descriptive and prescriptive attributes was called for by Lenz, Diefenbach & Hassenzahl (2013) among others. Lower-level emotions, or experiential attributes, refer to the prescriptive part, and it is argued that we need to investigate the connection between these and interactivity attributes. This is however a topic for further research, and is not studied here.

2.2.4. Summary

Microinteractions are small-scale interactions that are the building blocks of interactive products. They can be described using interactivity attributes, which are words to determine properties of the interaction and proposes a view of the interaction as a 'thing in itself'. According to researchers such as Lenz, Diefenbach & Hassenzahl (2013), Aagesen & Heyer (2016) and and Lenz et. al. (2013), these attributes can be consciously used by designers to shape the 'feeling' and invisible qualities of microinteractions. According to a study done by Lim et. al. (2010), the attributes can also influence designers in the direction of a more detail-oriented, quality-oriented and dynamic thought process, which is an assumption tested through an experimental design workshop in the next part.

3. DESIGN WORKSHOP

3.1. Setup

The workshop was conducted on the 29th of November 2016 at 17.00-19.00 with six participants in their final year of interaction design studies. Some of them had heard of interactivity attributes before, but they were not acquainted with the actual attributes or what they mean. One of the participants was especially familiar with microinteractions.

The duration of the workshop was two hours, which restricted the number of tasks to a minimum. The participants all had a busy schedule, and it was important to spend as little time as possible while still collecting useful data.

The topic of the workshop was to design a mobile application called Mathemateria that

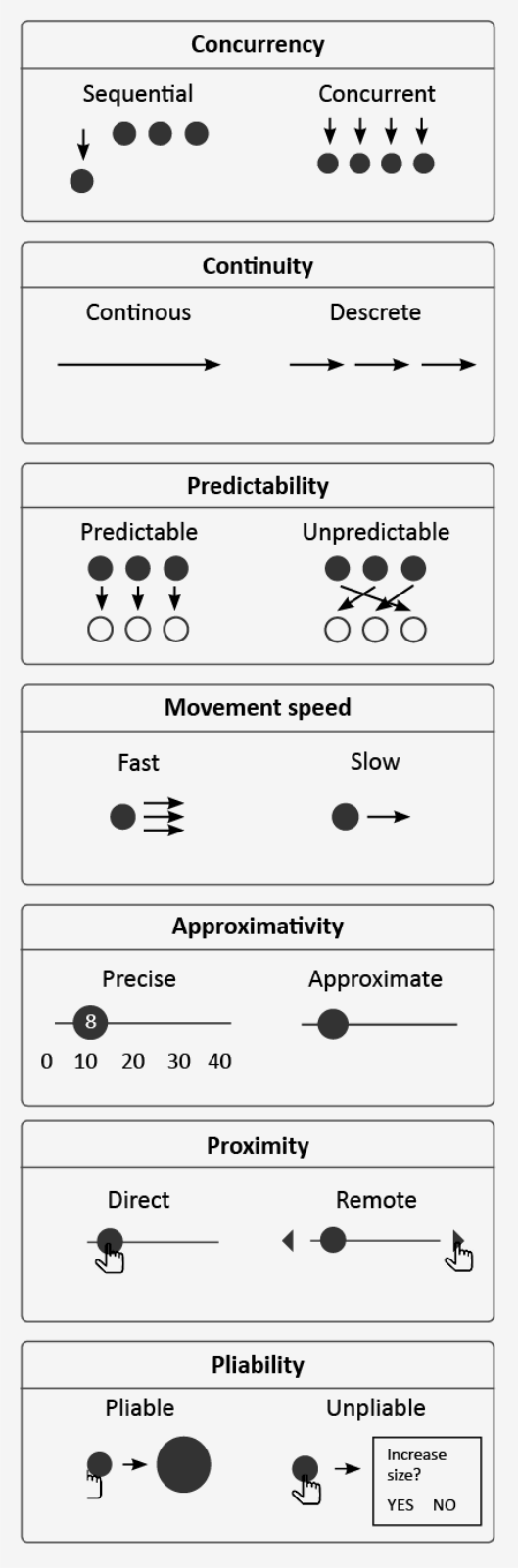

Figure 2: An overview of the interactivity attributes used in the workshop. Inspired by: Aagesen & Heyer (2016) and Lim et. al. (2009)

teaches high school students equations. This is an application that exists today. It was not shown to the participants, but was used as a case in order to provide a concrete task. A short summary of the problem and target group was given, as well as a walkthrough of a simple equation.

The workshop aimed to answer the following questions:

- Did the participants think more about animations and transitions – were they more dynamic in their thinking?
- Did they feel the attributes were useful and did it encourage them to think differently?

The attributes chosen were a combination of Aagesen & Heyer's (2016) and Lim et. al.'s (2009), see figure 2 for an overview. These had practical examples that were easy to understand, and were both developed in recent years. Attributes that were similar between the two sets were excluded, and the attribute 'Movement Range' was also excluded as it proved too difficult to explain and relate to. All attributes and their dimensions were translated to Norwegian.

3.2. Execution

The workshop had two distinct parts with a short break in between, and had three tasks. All tasks were based on brainstorming methodology.

The first part was for the participants to get familiar with the case, for them to empty their mind for initial thoughts, and to see how they would tackle the case without knowledge of the interactivity attributes. The part consisted of an introduction, a brief game, a presentation of the case and task 1. Task 1 comprised of four subtasks;

1a: Brainstorming on different ways a mobile phone can be used to solve equations.
1b: Brainstorming on how it can be fun to solve equations.
1c: Presentation of ideas two-by-two.

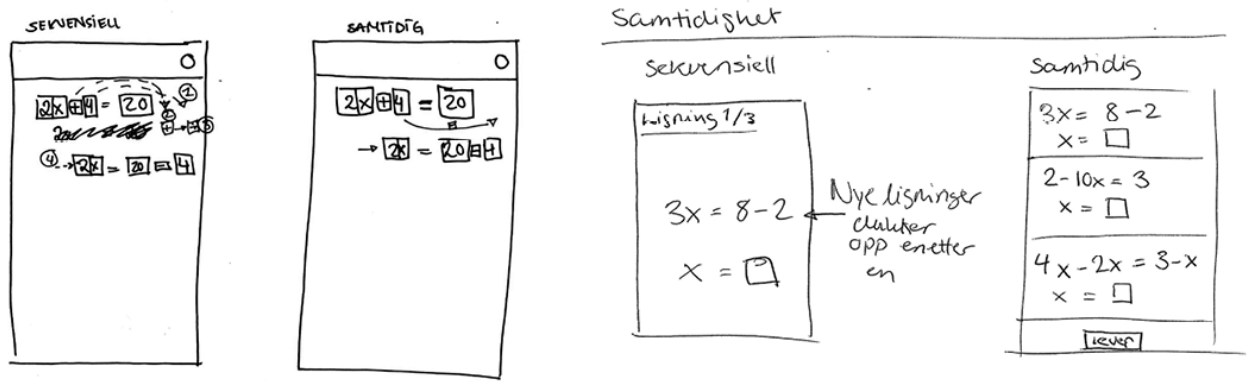

Figure 3: The use of forced combination enabled the designers to think of new interaction methods. Two of the participants tried the sequential and concurrent dimensions of the concurrency-attribute.

1d: Creation of a concept with ideas from task 1a and 1b, and a short plural presentation of the concepts.

After a short break, part two started. The goal of this part was to familiarize the participants with the interactivity attributes, and see how they would use them in an ideation process. Part two started with a presentation of the attributes with examples, and task 2 was given simultaneously, which was to write down which attributes that would fit the case. The participants were given a printed paper of the attributes to aid their memory and ease the cognitive burden. Task 2 ended with a short presentation in plural, and task 3 was given right afterwards.

Task 3 was an open ideation task, where they could either continue with the concept from part 1 or create a new one. The task was to experiment with the attributes, and they could choose the ones written down in task 2, or try **forced combination**. Forced combination is a method where a microinteraction is tested with the two dimensions of an attribute consequently. For instance, sketching what a continuous and a descrete interaction would look like with a given microinteraction. Part two ended with a presentation in plural, and the workshop ended with a short discussion.

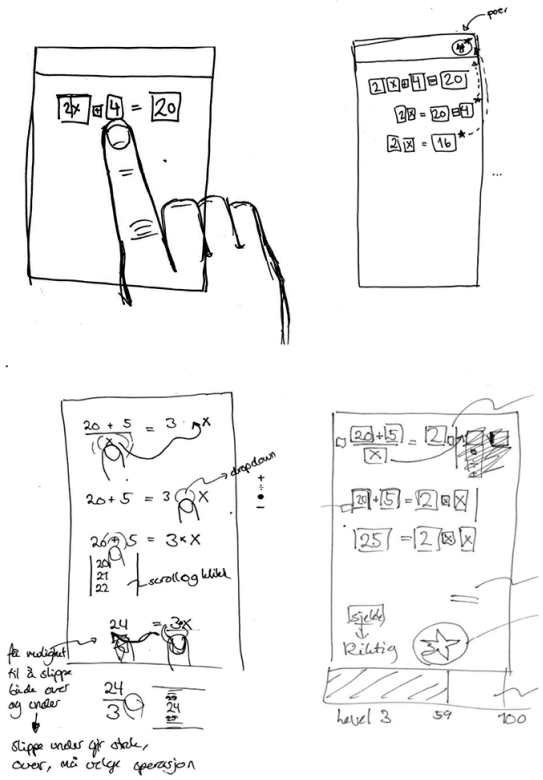

Figure 4: The two sketches on the left are inspired by the attributes. They use a finger to indicate the user's interaction, while the other two sketches focus more on the interface.

3.3. Results

The participants were overall positive to the use of attributes in the ideation process. One participant confused the attributes 'concurrency' and 'continuity', but aside from that, they understood the basics of the concept and were able to use the attributes in practice.

The participants suggested using the attributes to adjust the difficulty of the Mathemateria application in addition to increasingly complex equations. For instance, when moving up levels, the concurrency-attribute could go from sequential in order to clarify what's happening, to concurrent when the user has more control. Movement speed could also be adjusted from slow to fast with increasingly higher levels. This is something they didn't think about in task 1. Whether or not the design students would think of this anyway at a later time in the design process is unknown, and it would require a lengthy parallel study in order to investigate this.

When the designers were told to write down the attributes appropriate for the case in task 2, they all made certain assumptions that indicates a straight forward view of the attributes. Most of the participants felt due to the math theme that the interactions should be predictable. This assumption suggested that they didn't think of the interactions in itself, rather as an integral part of the math-application. Only when a few of them tried the forced combination and explored what an unpredictable interaction would look like, they saw that it wasn't the equations itself that was unpredictable (figure 5). Similarly, most of the participants agreed that a sequential interaction would be appropriate for the case in task 2, but when exploring how a concurrent interaction could look like in task 3, they thought of new aspects that could enrich the gaming experience. (figure 3) This indicates that a forced combination method could be fruitful for generating new ideas and confronting what seems to be obvious.

The participants reported that they felt the attributes made it easier to think of transitions and engage in a dynamic thinking process. This was also found in the sketches, as some of them had drawn fingers to indicate interactions and dynamics in task 3, but not to the same extent in task 1 (figure 4). This increased use of gestures could also indicate greater attention to the user and their interaction with the product. It could also be explained by the nature of the task, as they were told to be more attentive to the interactions. As mentioned by the participants in the finishing discussion, it was difficult to communicate the dynamic thinking, as sketches on paper is by default static. One suggested a defined set of symbols that could aid dynamic sketching and present the ideas more clearly, which could be a topic for further research.

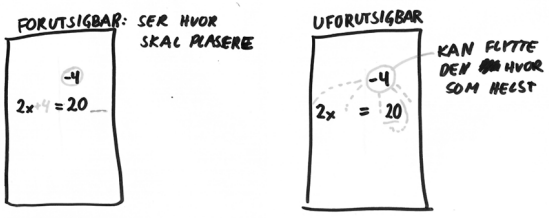

Figure 5: One of the participants tested how an unpredictable interaction could look like.

4. DISCUSSION

Articulating new concepts and categories such as microinteractions and interactivity attributes could lead to fresh ideas and new insight when shaping the details of an interactive product to affect the overall user experience. If not used in practice in a useful way however, the act of adding new terms to the designer vocabulary could be useless, or worse, confusing. In addition, there is a danger that specialized words and concepts could be alienating to some of the many people an interaction designer needs to cooperate with.

The results from the workshop indicates that the interactivity attributes affected the designers to think more about transitions and animations when generating ideas for the application. Being attentive to animations in such an early stage of the design process, could lead to

a more seamless integration of movement as a part of the total experience.

Perhaps the greatest advantage of the attributes discovered in the workshop, was their ability to inspire new ideas and overcome conventions as opposed to traditional ideation. The experiment had its flaws, as it was conducted in a short time frame, the participants had little time to get acquainted with the attributes, and the same group did brainstorming before and after familiarizing with the attributes – which could affect the result and prohibit direct comparison of the ideas. It is recommended to do a lengthier study that spans over a complete design process with one group that uses the attributes, and a control group that doesn't. This way, the results could be compared directly with user testing that measures the user's preference and perceived feeling of use. Still, participants in this experiment reported that they started thinking about interaction in a new way, and it inspired some of them to generate new ideas for a richer user experience. For instance, they discovered that increasing the difficulty of the application could be done by adjusting the attributes. By using the method of forced combination, some of the participants discovered that the interaction methods could be seen independent from the interface as in the example with the predictability attribute. Since they saw math as predictable, they intuitively felt the predictable-dimension was appropriate for the case. But when trying it out in practice, they developed ideas for an unpredictable interaction that could further enrich the gameplay.

5. CONCLUSIONS

Interactivity attributes is a tool proposed here to help designers in an ideation phase to develop new ideas regarding interactivity, and incorporate dynamic thinking earlier in the design process. This is a response to the growing need for new ways to view interactivity, and to work with the details of an interface. The attributes are properties of microinteractions, which are small-scale interactions that do one thing only. Crafting the attributes of microinteractions is a proposed concrete way to affect the 'feeling' of an interactive product, here seen as low-level emotions.

Which attributes that should be used with which microinteractions depend fully on the context, and it makes no sense to decide in beforehand without knowledge of the specific case and the desired target experience. As a tool in an ideation setting however, a set of no more than 7 attributes is recommended to work with, perhaps even fewer. More than this can be difficult to relate to, but too few could restrict the ideation. The attributes chosen for the workshop in this article proved to be understandable and intuitive for the novice designers, except the attributes 'concurrency' and 'continuity' which were mixed up by one of the participants. Further testing of the attributes is recommended in order to refine their value in a design setting.

For ideation in an early phase of the design process, the forced combination method is recommended in order to discover new interaction methods. This is where each of the dimensions in an attribute is combined in turn with the microinteractions. This proved to cause new angles on interaction methods.

For further research, it is recommended to do a lengthy study where the effect of using interactivity attributes in an early stage of the design process is compared with a control group that doesn't use the attributes. The resulting concepts should be tested with users in order to determine their preferences, and what feelings the concepts elicit. Matching the interactivity attributes with experiential attributes should be attempted in beforehand, as to compare whether or not the designers who used the attributes actually could control the feeling of interaction in a decisive way.

Design tools that take into account the feeling and dynamic nature of interaction should be researched and developed. A standard symbol library for communicating dynamic ideas with paper sketches could be a quick way for enabling designers to bring in dynamic thinking earlier in the design process. Other tools for prototyping that support microinteractions should be considered, which is a topic for further research.

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