# Creation and Evaluation of a Catalog of aesthetic and experiential Qualities samplified by an Intranet Application

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# Abstract

In the origins of software engineering, good software was primarily characterized by features like efficient and correct use. As technology advanced computer systems began to be used by a wider audience. Graphical user interfaces were invented and with their advent the field of "usability" emerged, which focuses on ease of use for software products.

Today computer systems are ubiquitous. People use them for work, leisure, social interactions, etc. Software has highly matured over the last years and while usability is an important aspect of our interactions with digital artifacts, it does not capture what users nowadays look for in software products: more meaningful and memorable experiences.

Concepts of user experience (UX) and interaction aesthetics go beyond mere usability considerations and look upon the software interaction more holistically. They focus on the user, his or her context and the elicited experience. Experiential qualities in this context describe characteristics of the user experience in the interaction with a product.

The goal of this work is to create a catalog of such experiential qualities, which promote a more meaningful and memorable experience. For that purpose the current state of the art is assessed through literature review of the fields of UX, (visual) aesthetics, interaction aesthetics and game design. Concepts from those areas, which represent experiential qualities, are collected, aggregated and refined until a catalog of eleven concepts is found.

This catalog is then applied to an intranet application. Improvements to the interaction are derived from the catalog and implemented. The effects of those improvements are evaluated by conducting open interviews with future end-users, which are transcribed and further evaluated using methods of content analysis.

The evaluation showed that the adaptions introduced by the catalog positively influence user experience, but have many side effects as users become more attentive in the interaction.

# Kurzfassung

In ihren Ursprüngen war gute Software in erster Linie durch Effizienz und korrekte Benutzung definiert. Technologischer Fortschritt machte Softwaresysteme für eine breitere Masse verfügbar, grafische Benutzeroberflächen kamen auf und mit ihnen das Forschungsfeld "Usability", das sich um einfach zu benutzende Produkte bemüht.

Heute sind Computersysteme allgegenwärtig. Sie werden für Arbeit, Freizeit, soziale Interaktionen, uvm. verwendet. Softwaresysteme haben sich in den letzten Jahren schnell weiter entwickelt und während Usability einen wichtigen Aspekt der Interaktion darstellt, kann sie allein dennoch nicht erfassen was Benutzer heutzutage in Softwareprodukten suchen: sinnvolle und einprägsame Erfahrungen.

Konzepte der "User Experience" (UX) und der "Interaktionsästhetik" gehen über Usability hinaus und betrachten Softwareinteraktionen ganzheitlicher. Sie setzen den Fokus auf den Benutzer, seinen Kontext und die aus der Interaktion entstehende Erfahrung. "Experiential qualities" (EQ) beschreiben Eigenschaften solcher Erfahrungen.

Ziel dieser Arbeit ist es, einen Katalog dieser EQs zu erstellen, die sinnvollere und einprägsamere Erfahrungen fördern. Dazu wird zunächst durch Literaturrecherche der Bereiche UX, (visuelle) Ästhetik, Interaktionsästhetik und Spieldesign der Stand der Technik evaluiert. Konzepte aus diesen Bereichen werden zusammengetragen, aggregiert und verfeinert bis ein Katalog von elf Konzepten gefunden wurde.

Dieser Katalog wird anschließend auf eine Intranetapplikation angewendet. Verbesserungen der Interaktion werden aus dem Katalog abgeleitet und implementiert. Die Wirkung dieser Verbesserungen wird anhand der Durchführung offener Interviews mit Endbenutzern evaluiert.

Diese Evaluierung hat gezeigt, dass die über den Katalog eingeführten Anpassungen die Wahrnehmung der Software positiv beeinflussen, allerdings entstehen dadurch auch einige Nebeneffekte, da die Benutzer ein verstärktes Bewusstsein für die Interaktion entwickeln.

# Contents

CHAPTER 1

# Introduction

## 1.1  Motivation and Problem Description

What is good, high-quality software? Initially, when software engineering was still a very young discipline, good software was primarily characterized by features like efficient and correct use. The software user of that time was an expert in a specific area, for whom the software was nothing more than a tool that enabled him to effectively and efficiently carry out his or her work.

In the 80s and 90s, the triumph of interactive software systems began and computer systems were used by a wider audience for a variety of tasks. The field of Human-Computer Interaction (*HCI*) concerns itself with the design of that same interface. With the advent of graphical user interfaces, people had to deal also with their design and their effect on the user, and the concept of *Usability* was born. The ISO defines usability as "the extent to which a product [...] can be used with effectiveness, efficiency and satisfaction [...]" [29].

So paying attention to aspects of usability is - simply put - designing the software's features in an intuitive and accessible way, i.e. trying to make the software simple to use. But the classic usability considerations observe only one aspect of what actually constitutes the use of a software, they "do not correspond with the extensive cultural applications and rich applications of modern digital technologies" [35]. Computers are no longer mere tools, but are all around us in our daily lives, they determine our culture and communication. Therefore the call for the need to examine qualities of interaction that go beyond mere usability considerations have become louder and louder in recent years. As Overbeeke et al. put it, "users are not interested in products, they are in search of challenging experiences" [45, p. 9].

*User Experience (UX)* makes the first step here, since it considers the holistic interaction with a product. The focus is less on technology, design or interface, but rather on using a product to create a meaningful experience [23]. This way of thinking makes it possible to consider software holistically and continue to move the user into the center of interaction considerations: After all, the user is not interested in the product itself, but rather the emotion and the experience that was produced by the product [46].

*Interaction aesthetics* helps to create such meaningful and lasting experiences, it promotes technologies that "inform, challenge, inspire and excite" [35]. Löwgren speaks of "aesthetic interaction qualities" in this context, which are properties that characterize the user experience in the interaction with a product or a service [43]. Aesthetic interaction concepts are still relatively incompletely formulated and they more and more begin to move into the focus of researchers like Löwgren in [44].

Today we are faced with the challenge of developing interactive software systems that see humans as such, with all their facets and conditions that define the use of the software and the created experience. There are already a variety of models, concepts and guidelines to help developers design and develop usable software. Also, there are several models that try to explain the complex and elusive concept of user experience. Aesthetic interaction concepts are still relatively vaguely formulated and surely still far from providing a comprehensive and complete picture of HCI.

Absence of errors is no longer a software quality characteristic today, but a basic requirement. The same applies to usability. With a myriad of software solutions to the same problems, all of them packed with features that an average user can never entirely explore, user experience is the decisive characteristic with which one can achieve differentiation [68].

The same is true for software solutions of intranet applications - there are lots of solutions on the market. Nevertheless, it was decided at *VI* (Virtual Identity AG, [1]) to conceptualize, design and develop the new intranet in-house. The results of this work are to be implemented and tested based on that software. Design and concept are fixed by the scope and corporate policy conditions and were evaluated and optimized in terms of usability. In the upcoming phase of implementation, this software should now be optimized with regards to user experience and interaction aesthetics, in order to ensure acceptance and dissemination in the company.

## 1.2   Aim Of The Work

This work wants to collect concepts, strategies and models, which promise to augment the user experience. The concepts are taken from various fields of studies that are relevant to HCI and interaction design. The result of this research is a catalog of the most important qualities regarding the creation of meaningful and memorable use experiences.

Subsequently these results are to be evaluated. The aim of the catalog is to be applied on arbitrary software products, in a first trial run it will be used to optimize the interaction of an intranet application. Here the goal is to see, if and how the catalog can be used to derive ideas, through which concepts of the catalog can be implemented within the intranet application itself.

In the last step, this work wants to evaluate the effects of that application on user experience. One aspect of that evaluation is, if the introduced adaptions are noticed at all. If so, the question is if users were influenced positively or negatively by those improvements. Through the analysis of end users' interactions with the optimized software, learnings and implications shall be derived for the catalog application and for the incorporation of experiential qualities in general.

These goals can be summarized with the following research questions:

1. What characteristics or properties promote a memorable use experience?

2. Can a condensed catalog of the most prominent ideas be created?

3. Can this catalog of experiential qualities be applied to a real world scenario?

4. Are optimizations introduced to a software via this catalog (positively) noticed by the user?

## 1.3    Approach and Structure

In chapter 2 the state of the art is assessed through literature review. Here the most important and promising concepts for augmenting the user experience are collected. While there are no doubt many fields of studies which are relevant to interaction design, this work focuses on four major areas which are most relevant to the research questions: user experience (UX), (visual) aesthetics, interaction aesthetics and game design.

Chapter 3 will show, how that abundance of collected concepts is trimmed down to a manageable and clear catalog. All the relevant concepts discussed in the first chapter are added to a list which is iteratively refined until a set of about ten coherent concepts remains. For that purpose, similar terms and concepts are aggregated with each iteration, while less relevant concepts or concepts which show less potential for practical applicability are left aside.

The catalog's application is handled in chapter 4. First the software, to which the catalog will be applied and on which end users will ultimately evaluate the catalog's application, is presented. It's goal, design, context and the most important uses cases are discussed. Ideas and strategies for implementing concepts of the catalog within the intranet application were created in a workshop. The results of that workshop and the adaptions that are implemented are presented and discussed.

The effects of the catalog's application are discussed in chapter 5. In order to allow the evaluation of the user experience, open interviews are conducted in which users are asked to comment on their actions, feelings and impressions. These interviews are supervised, but the experimenters role is to be as little intrusive as possible. For the evaluation of those interviews Mayring's approach of content analysis [49] is used, which in the end shows how users evaluated each of the optimizations introduced by the catalog and the software as a whole as well.

Chapter 6 gives a short summary on this work, then reflects and interprets the results and in the end discusses some research questions open for debate.

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CHAPTER 2

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# State Of The Art

## 2.1 Augmenting the user experience

Originally, software was oriented towards efficiency and correct use - it was designed as a plain tool. But technology has evolved and nowadays it surrounds us, is part of our everyday lives and there are much more possibilities to get in touch and interact with technology.

Software has matured as well. Today most products are optimized with regards to usability: they are easy to use, error-free, effective and possess a high level of quality. But still designers and researchers try to push beyond the borders of usability. This is due to the fact that by this raised level of quality, it became harder to differentiate just by implementing concepts of usability. Also people became aware of the fact, that there is more to technology than mere function. We don't just use technology, it affects us, changes us, engages us. In the end we don't use products for their functions, but for the experiences that are created via those functions.

This leaves us with the challenge of designing exciting and stimulating software and the challenge to understand the audience to do so. Good software is not about absence of errors or perfect usability, it is about creating a meaningful and memorable use experience.

This chapter gives an overview on various concepts, aspects, ideas and strategies which are employed and researched across different fields of study in order to augment the user experience. In the following sections, the role of various disciplines with regards to creating memorable user experiences will be briefly discussed.

### Usability

Usability, as defined by the ISO, is "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" [29]. Methods of usability have "tended to concentrate on identifying black spots rather than beauty spots" [45, p.107]. As we heard above, the ultimate goal is ease of use and therefore the first course of action is to eliminate any obstacles that stand in the way of that. Usability has

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allowed huge progress in the field of HCI and is a well progressed field of study. Many Methods and guidelines exist, that help in designing for and evaluating usability.

But a usable software is not necessarily pleasurable to use. Usability focuses on preventing frustration, in that aspect it is absolutely essential to user experience and interaction aesthetics as well: It's useless to augment an experience that is characterized by frustration with use. In the following sections we will see, that many concepts and experiential qualities are actually quite closely related to concepts of usability. There are however those as well, which contradict concepts of usability.

### UX Design

User experience is a vague concept and experts still struggle with a precise and widely accepted definition. Section 2.2 will try to give an overview on its ideas and concepts. At this this point it suffices to say, that user experience takes on a more holistical viewpoint in order to explain what usability can't, f.e. why a user may work with a product despite it being difficult to use, simply because it is surprising or challenging [45, p. 9].

### Aesthetics

Aesthetics as a field of study has an incredibly long tradition. The first known theorist of design, Vitruvius who lived in the first century BC, argued that there are three basic constituents of architecture: strength (statics), utility (the building's function) and beauty (aesthetic requirements) [33]. While today aesthetics in HCI still struggles, the importance of aesthetics is well known among other areas and industries. In the automobile industry for example, cars are carefully aesthetically designed among all dimensions (engine sounds, materials, interior design, etc.) to present a consistent memorable experience.

Nevertheless there are studies, which show the importance of aesthetics to a software's appeal, like those of Lavie [36], Hassenzahl [22] and more recently Tuch [69]. The importance and positive effects of aesthetics in HCI are well known and accepted. Petersen et al. state that aesthetic interaction "promotes curiosity, engagement and imagination in the exploration of an interactive system" [60, p. 275]. But the big question that still remains is how to design for and implement an aesthetic interaction.

### Pragmatist Aesthetics

As many of the authors presented in section 2.4 follow the pragmatist viewpoint of aesthetics, it is briefly discussed here. The pragmatist's view on aesthetics is to move away from appearance to a holistic aesthetic experience found in the use context [71] [60] [16] [15]. This means an orientation towards the aesthetic experience itself and the subject in which it takes place (the person experiencing), rather than focusing on the object or stimulus. Pragmatist aesthetics follow four principles [66]:

1. The aesthetic has practical use, next to intrinsic value: While the aesthetic experience has value in itself and "invigorates and vitalizes us" [66] (i.e. the improved experience helps in

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achieving operational goals), it also always has a purpose. The other contrary viewpoint on this problem of intentionality of aesthetic attitude is f.e. represented by Kant, who claimed that "the aesthetic attitude is found when one attends to the object in the absence of any purpose whatsoever" [58].

2. The aesthetic experience cannot be understood without socio-cultural context, it is always dependent on culture and may differ between persons and even within the same person (use context).

3. The aesthetic experience is linked to form, which can be described as the "dynamic interaction of elements" [66].

4. The aesthetic experience actively involves the whole human being: mind and body. Within other aesthetic systems or frameworks, the bodily dimension is often ignored.

Orientation towards the individual and context dependency are two cornerstones that can be also found within user experience and other aesthetic viewpoints.

## Playfulness

Playfulness and Gamification have become more and more popular over the last years and many applications nowadays try to incorporate concepts of games like scoreboards among various genres - most with little success. Learning from games is tricky, as users in this genre have a very different mode of interaction: they are relaxed, want to have fun and don't have to complete tasks like in a work environment.

Nevertheless this genre has a lot of intriguing insights to offer, as its evolution and progression is characterized by innovation and freedom to experiment. Compared to other genres, it is much less restricted and innovation is a determining factor in market success. In that regard, one could say that games are further evolved regarding interaction design, but due to the different context, learnings have to be handled accordingly. This is why only a brief overview on gaming concepts will be given.

## Experiential Qualities

The big question for all the disciplines mentioned above is how to improve the user experience. What can be done to incorporate an aesthetic interaction or a memorable experience? How can a user be engaged and immersed in the interaction and how can such knowledge be effectively shared?

One way to do that is to define and explain different characteristics and certain qualities of such interaction. Löwgren speaks of "aesthetic interaction qualities" in this context, which are properties that characterize the user experience in the interaction with a product or a service [43]. To include concepts of other areas than interaction aesthetics as well, we will use the term "experiential qualities" in our context, to describe qualities which potentially enable a more engaging, aesthetic interaction and a more meaningful, memorable user experience.

The following three sections will summarize concepts form the areas of UX, Aesthetics, Interaction Aesthetics and Gaming which qualify as experiential qualities.

## 2.2 UX

UX is an elusive term and concept. While this makes it hard to give a common definition, it also has implications upon the research on the topic: some authors create models to describe UX, others describe important aspects or qualities of the experience itself. The following section reflects that. First a definition will be given for UX, then models and concepts will be discussed.

### What is UX?

*UX* (short for User Experience) is a rather abstract term that is closely related to interaction aesthetics. The term is widely used and there are a lot of accepted definitions - depending on the context its meaning may differ quite crucially. Often it is used as a synonym for usability, user interface and user interaction design, interaction experience or as an umbrella term including any number of those areas [37]. Basically it involves all aspects of interacting with a product [45, p. 41]. In order to shed light on that confusion, some of the leading researchers on the topic formulated the UX White Paper [37], which tries to give a comprehensive definition and demarcate the term.

The White Paper defines UX as follows: "The field of UX deals with studying, designing for and evaluating the experiences that people have through the use of (or encounter with) a system" [37]. This includes a certain context of the scenario, which is an essential part in UX. There are three perspectives on UX: as a phenomenon, as a field of study and as a practice.

### UX as a phenomenon

UX stands for *user* experience, which means that there is a user encountering a system. Encountering in this sense involves "using, interacting or being confronted with a system" [37], so it even includes a passive experience. Each experience is unique and subjective, depending on user, context and the system.

### UX as a field of study

This perspective concerns itself with studying the experience itself. Important questions here are where an experience comes from, how it is constituted, the anticipation and forecast of experience and so on. Especially the last aspect is of big importance, as most commonly the ultimate goal is to create a specific experience.

### UX as a practice

UX has its roots in human centered design (*HCD*), which started out as a collaboration between psychologists and computer scientist and "borrowed" many ideas from these disciplines [45, p. 20f] HCD puts the user in the center of the design process. In order to achieve that, the usual approach is to identify and analyze the target user group and to develop the design iteratively.

So HCD already puts a great effort into identifying facets concerning user and context, which is an integral part of UX. The main differences however are the methods, tools and criteria used in UX work, as well as the representation of the UX idea, which sees the design process a little

more holistically than HCD does [37]: UX factors include social and aesthetic aspects and relate to "affect, interpretation and meaning" [37].

UX methods are concerned with assessing evoked emotions (in order to attempt to "measure" UX) and the assessment of specific UX qualities. As there is a multitude of those qualities (some of which will be discussed in the presentation of UX models in the following chapters), it is important to set a focus within projects and specify success or focus factors within UX. Many models and tools support exactly that process to illustrate the dependencies and payoffs between UX factors. Studies situated in the practice perspective are the focus of this work.

**Time spans of UX**

A very important factor when addressing UX, is being explicit about the time span of the user experience being discussed. "Experience" is a rather rambling term, it may be something very short and elusive or something very persistent that is built up over a long period of time. The user experience even starts before the actual use of the system, when we take the user's attitude and expectations into account.

The UX White Paper defines the following time spans:

1. *Anticipated UX*: This is primarily the experience before usage. Still, an anticipated user experience may occur at any time later again, f.e. when imagining using the system again.

2. *Momentary UX*: This describes the user experience during use, simply put the actual use experience itself.

3. *Episodic UX*: Time span after usage, when a previous usage episode is reflected upon.

4. *Cumulative UX*: Can be defined as the "overall impression", the experience that builds up over time when continually interacting with a system.

It is important to note, that experiential qualities discussed here primarily concern themselves with augmenting momentary and cumulative UX. Anticipated UX is definitely something that has to be taken into account, but it can hardly be influenced by a software developer.

**A Model of User Experience**

This model is taken from "The thing and I: Understanding the relationship between user and product" [45, chapter 3], where Hassenzahl gives us a very detailed view upon the subject. It is an analytical model on UX and unlike others has a rather holistic perspective. The key elements are shown in figure 2.1, which presents 2 perspectives: that of the designer and that of the user. A designer creates a product with a set of features, that contribute to his or her intended product character. The user however, will create his or her own constructed product character based upon the use experience, which will differ from the intended product character. This apparent character - which may also differ between uses - triggers emotional responses and the user experience is complete.

In the following sections the intended character, the (apparent) product character (with pragmatic and hedonic attributes), consequences and situations as well as their interplay will be described in more detail.

**Intended Character**

A designer can only influence the product's features, its style, content, etc. He or she can't influence the user's perception *directly*, but can only try to create a coherent product that supports certain behavior and promotes certain emotions.

The more consistent and thought-out such an intended character is, the higher is the chance to reduce cognitive complexity within the product. A certain character automatically triggers "particular interaction strategies" [45, chapter 3] in a user, which helps him or her coping with the software. An experience is however subjective, therefore it can never be forecast how a user sees a product. He or she may also judge it entirely differently in a changed context or on another day.

**Apparent Character**

The apparent character is the user's perception of a product. Content, presentation, functionality and interaction as planned by the designer and as apparent in the product, effect the user and comprise the overall impression, based on which every user infers his or her own character of a product.

As every experience is unique to a person, every apparent character is unique to a user as well. Personal factors such as expectations (see also Time Spans of UX 2.2), attitude, previous experience, etc. greatly influence the user's apparent character. It is also very unlikely, that a user perceives a certain feature exactly the way the designer intended, or that he or she infers exactly as planned by the designer upon that.

Hassenzahl distinguishes between two categories of a product's attributes. On the one side, there are *pragmatic attributes*, that address functionality and practicality. They describe qualities that deal with "externally given or internally generated behavioural goals" [45, p48], like "useful" or "controllable". *Hedonic attributes* on the other hand address psychological needs and factors and present a much stronger leverage for creating pleasure.

According to Hassenzahl, there are three categories of hedonic functions [45, p35]:

1. *Stimulation*: Individuals strive for personal development and growth. We are drawn by new ideas and concepts, by "new impressions and insights" [45, p35]. A product that provides such stimulation may provide a positive use experience as well.

2. *Identification*: Individuals strive for acknowledgement and self-fulfillment. People want to be "socially recognized" and "express themselves" [45, p35]. A product that helps in fulfilling that basic human need provides pleasure.

3. *Evocation*: When a product is able to make us recall positive memories, to wind up old positive experiences, it will be seen more pleasurable by the user.

**Consequences and Situation**

Every user creates his or her own apparent character. According to Hassenzahl, this then triggers an emotional response. We might be satisfied, when we can use a product in the way we intended and when we achieve the desired goal, or might be disappointed or even angered, if this is not the case. This has a direct influence on our behavior again, on how we interact with the product. If we are satisfied and associate the product with positive feelings, it is likely we will interact more with it in the future.

It is important to note here that, even if the emotional response is emerging from the apparent character, it is still highly dependent on the usage situation. Users may react totally different to the same stimulus when they are in a hurry or when they are simply browsing around, when they are tired or when they are well rested, etc. Hassenzahl suggests that - due to this instability - a designer should rather concentrate on a product's character than on trying to create specific emotional responses, as they are too volatile and unpredictable.

Another very interesting aspect in Hassenzahl's model is that he differentiates between two *usage modes* that correspond to two contrasting psychological states a user can be in when using a product. One he calls "goal mode", where a specific goal dictates all actions. The user's purpose is to effectively fulfill this goal, there is high frustration potential when there is no fulfillment. The other mode he calls "action mode", where there is no specific goal, but only the interaction with the product itself. Goals may emerge, but are of no importance.

This general distinction is quite interesting as it shows quite understandably how differently users may interact with the same product, depending on which state of mind they are in.

**Appeal**

In Hassenzahl's model, the end result of the user experience is a product's *appeal*, which in turn enables or creates certain emotional responses, such as pleasure or satisfaction (see figure 2.1). As we heard above, there is a strict distinction between pragmatic and hedonic attributes and both together comprise a product's appeal. In a series of studies [22] [24] Hassenzahl e.a. investigated the role and importance of these two dimensions of a product's qualities and how they actually influence the overall judgment of a product's appeal. The goal of these studies was to find out if the end user could actually perceive *ergonomic* and *hedonic qualities* [1] separately and what their respective importance is when forming the overall judgment.

In these studies users were asked to rate ergonomic and hedonic qualities and appeal of products: in one study seven (purposefully) very different prototypes that support the same use case were evaluated, in the other different types of computer screens (CRT, LCD and Projection). Measurement was taken twice (before and after usage) using scales (see A.2 for a list a scale items).

The results are very interesting and show the importance of hedonic qualities. Users were naturally able to distinguish between a product's functional and non-functional aspects. Moreover the results showed that ergonomic and hedonic qualities are to some extend negatively cor-

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[1]In these studies the term ergonomic is used instead of pragmatic, the distinction is the same as in the model above though: ergonomic qualities describe qualities of usability (like ease of use or understandability) that are task related. Hedonic qualities on the other hand are not task related (like originality or aesthetics).
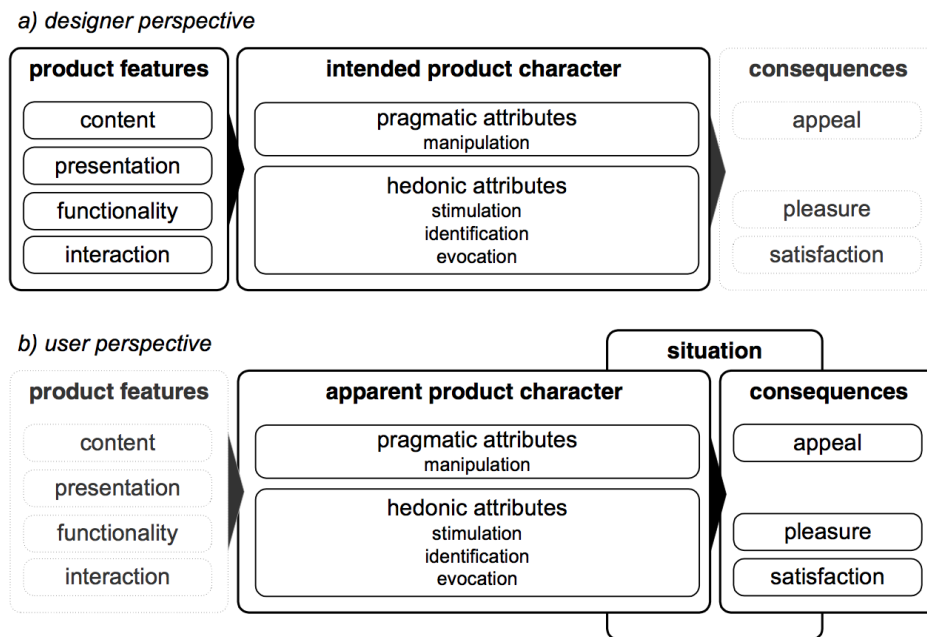
**Figure 2.1:** Key elements of the model of user experience from (a) a designer perspective and (b) a user perspective [45, p32]

related, which is no surprise when we look at the scale items: ergonomic qualities like "simple" and "familiar" are in conflict to hedonic qualities like "original" and "innovative". Regarding their influence on appeal, ergonomic and hedonic qualities seemed to have an equally important role, they compensate each other. The appeal can be seen as the average of ergonomic and hedonic judgment. Because of this "averaging model", it is important for designers to "try to find a subtle balance of both quality aspects, rather than to independently maximize them" [22]. Bad hedonic quality can negate a perfect ergonomic evaluation and vice versa.

Hassenzahl's model and his studies draw a very comprehensive and conclusive picture of user experience. The distinction between intended and apparent character, between usage modes and the role of context show the complexity thoughtful interaction design has to deal with. Also insights on the relationship between hedonic qualities and usability is given through his studies: the averaging model discussed above gives a very good overview on the (partly) contradicting goals of usabiltiy and memorable user experiences. The scales for hedonic qualities and appeal, as well as the categories of hedonic functions present a good starting point for experiential qualities.

## Morville's Honeycomb

Peter Morville's honeycomb diagram [52], due to its simplicity and practical orientation, is widely used and acknowledged. Also many other works have derived from it (see the following section 2.2 UX Wheel, for example). In essence, it describes various facets of user experience

and outlines the interdependencies and payoffs between those.

Morville defines seven facets, that contribute to a meaningful user experience:

1. *Useful*: Products and systems should be useful and fullfil a certain purpose. A "courageous and creative" designer should use his or her skills in order to create "innovative solutions that are more useful" [52]. Although an evaluation of this aspect would be highly user dependent (what is useful for one person might not be useful to another), it is still vital to remember that products are more likely to provide a positive experience, if they are beneficial to the user.

2. *Usable*: As in many other models, usability is a key factor in obtaining a positive user experience. Morville describes it as "necessary but not sufficient" [52] as well as "vital", which is also consistent to other models of user experience and interaction aesthetics as well.

3. *Desirable*: Here is where the user's emotions come into play. Image, identity, brand and other design elements have to be considered just like the efficiency of a system and should be used to evoke emotion. Such emotions have a great influence when it comes to choosing between products and evaluating overall impressions [64].

4. *Findable*: Findability is granted its own separate area (although it could be included in usability or accessibility as well) and simply states that content has to be "navigatable and locatable" [52]. Given the correct context, it is quite feasible to handle findability separately. In the web f.e., users want to "get the information they need from the many competing websites quickly" [50] - here findability greatly contributes to user experience.

5. *Accessible*: States that content has to be accessible to people with disabilities.

6. *Credible*: Design elements have the power to "influence whether users trust and believe what we tell them" [52]. This claim is supported by a study conducted by Robins and Holmes, which showed that websites that were perceived to have positive visual aesthetics, were perceived to be more credible as well, even if both websites have the same content [62]. Of course a higher credibilty and trust in a system means a better user experience.

7. *Valueable*: The model describes the value of a system as the value it creates for its sponsors, i.e. for non-profits the user experience, for profits it is customer satisfaction.

The aim of this model is to support designers and information architects in their work. It helps defining priorities, much like the well known triangle of cost, quality and time, which explains the payoffs between those factors. Depending on the context, it might sometimes be more important for example, to focus on credibility rather than desirability.

It also is based on a modular approach, which helps to focus on specific areas. The model can be used as a "singular looking class" [52] to focus on specific aspects of a system. The qualities described above, while being rather general, give a good orientation towards designing for positive experiences. They describe the most essential product characteristics that contribute
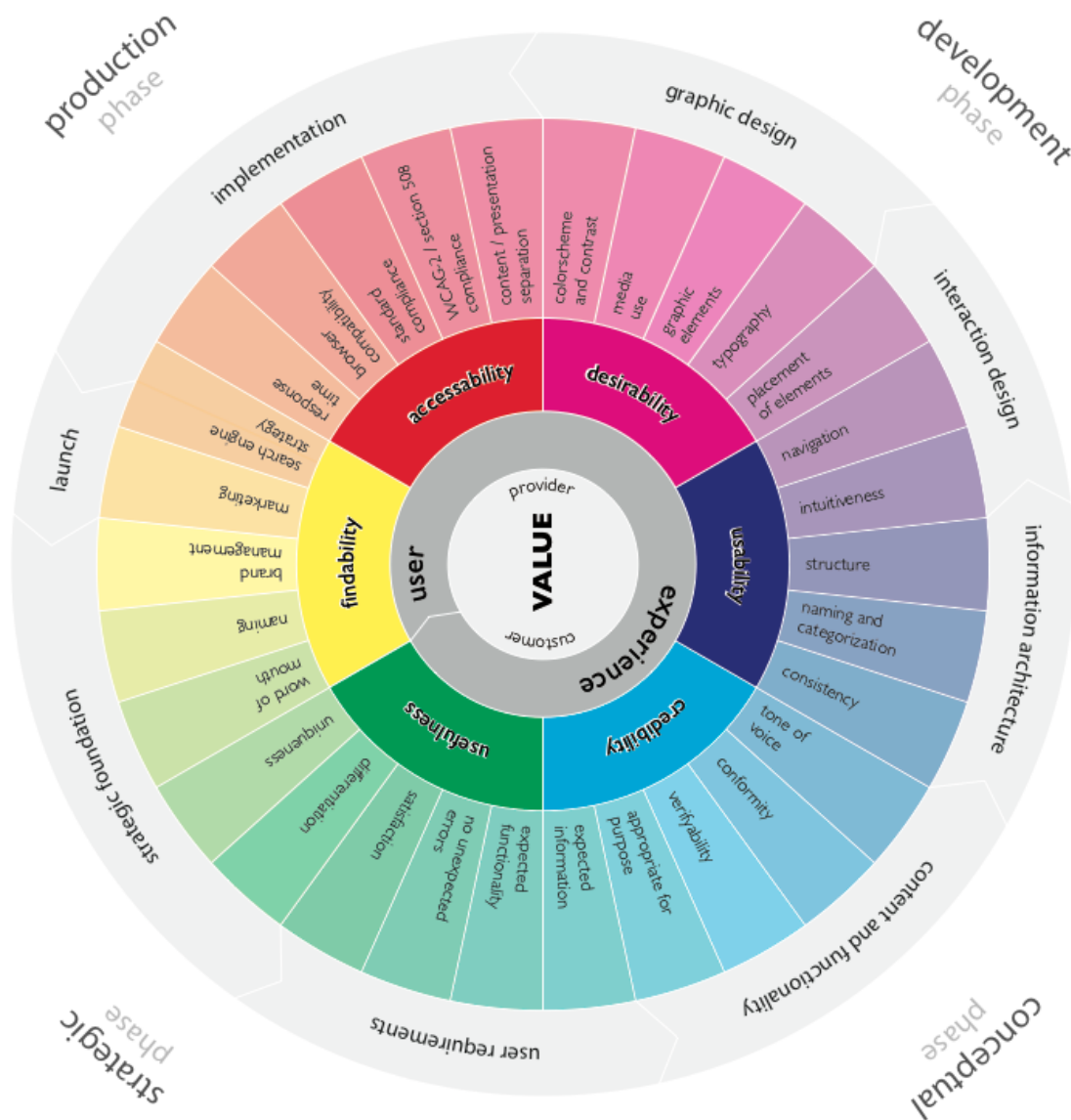
**Figure 2.2:** Morville's Honeycomb

to user experience. Sticking to the model allows for a well balanced product and prevents frustration on the user's part, but does not by itself directly include strategies to promote outstanding experiences.

**UX Wheel**

Magnus Revang took Morville's work and adapted it towards process application. In a first step, he gave the facets of Morville's honeycomb a linear ordering: findable → accessible → desirable → usable → credible → useful. The facets are ordered according to the experience itself, i.e. first a product has to be discovered by a user, then accessed, etc. In the next steps, the UX wheel was introduced [61], where he added 30 factors that contribute to the various facets, as well as a series of phases and process sections. The model in its current form is shown in figure 2.3.

The whole model resolves around the value in the middle, that should be accomplished through positive user experience. According to Revang, the user experience "is a series of phases" [61], namely findability, accessibility, desirability, usability, credibility and usefulness. For each of these phases, factors which promote a positive experience or have a big influence on it, are listed, like typography for desirability or differentiation for usefulness.

The realization process for implementing products is in the reverse direction of the linear process of user experience (in figure 2.3 design and development are done counterclockwise, while the user experience is ordered clockwise). The process starts and ends with findability - search engine strategy to be precise.

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**Figure 2.3:** Magnus Revang's UX Wheel

The UX Wheel takes Morville's honeycomb a step further and handles more practical and conceptional detail through the list of contributing factors. Some of these factors are also relevant in our context of experiential qualities, especially those in the area of content and functionality, information architecture, interaction design, graphic design and implementation. Factors like differentiation, uniqueness or media use have great influence on the perceived user experience and when implemented correctly in the right context, may also present experiential qualities.

**Pleasurable and Fun Experiences**

Throughout this work, the words "pleasure", "fun" and "enjoyment" are used quite often. Depending on the author and setting, the meanings may vary. With some authors, those terms may be used as synonyms, others put great effort into demarcating them.

A quite important distinction between "fun" and "pleasure" is given by Blythe e.a. [5]. The authors differentiate between the fleeting and trivial experience of fun and the aesthetic, long lived experience of pleasure as well as their respective enabling factors, which shall be described in the following paragraphs.

Fun on the one side is a quite specific term, and everyone will be able to associate, when we speak of "fun activities". Pleasure on the other hand is often used as a superordinate term, but here it is handled as a "specific type of enjoyment" [5] instead of a category. More specifically, pleasure is seen as the experience that emerges from meeting challenges and immersing in an absorbing activity, i.e. "self-actualization" (see also 2.2, where a similar model of self-actualization is discussed). The authors demarcate fun and pleasure along 4 dimensions:

1. *Triviality and relevance*: Fun is more or less the opposite of seriousness, or rather an experience can not be serious and fun at the same time. Serious experiences on the other hand may as well be pleasurable. The authors give "high art" as an example, which includes opera, classical music or ballet for example, which are rather pleasurable than fun. Moreover, fun activities do not always require our full attention, they are more a "distraction from the self", whereas pleasurable activities or objects are "absorbing" and "personally meaningful" [5]. When engaging in such "relevant" activities, we invest our skills and energy, the activity becomes meaningful and part of our personality, i.e. something persistent or at least long lived. Four factors are listed, which promote the emergence of a relevant activity: *personal growth*, *gaining insights*, *triggered memories* (an experience may become relevant simply by reminding us of a previous experience) and *anticipation* (anticipating an experience makes it relevant).

2. *Repetition and Progression*: Repetition is a common theme in f.e. pop art. A pop music song does not progress in most cases, but repeats itself. Also on a higher level repetition is commonly used, common themes and storylines are repeated over and over in soap operas for example. High art focuses on creating a complete experience, it is a finished and finalized "end product" so to say. Although we do find repetition in classical music as well, its focus there is progression: themes are varied or used to bridge or transition parts of compositions. Simply put: there is fun in repetition and pleasure in progression. Progression stimulates and surprises and this "deviation from expectations" [5] creates pleasure. This is as well important to the last dimension: a repetitive activity or object can hardly promote personal growth or anticipation.

3. *Spectacle and Aesthetics*: Regarding how experiences appeal to our senses, fun experiences are much more straight forward and intense, our attention is more or less "grabbed", like in a firework or with the bright colors in a tv show. Pleasurable experiences on the other hand don't focus on intensity of perception, but quality of perception. Impressions are more abstract and ordered and require much more effort on the perceiver's part.

4. *Transgression and Commitment*: Fun needs transgression, in jokes and satire transgression is a major element. An activity becomes less fun, the more variables there are to watch after and the more effort has to be put into conforming to those variables. With pleasurable activities it is the opposite, they require commitment and effort has to be put into understanding the underlying systematics, in order to being fully able to engage in an activity or with an object.

These observation have some important implications regarding the design of tasks: Routine work may be designed to be fun, as distraction is helpful to promote a positive experience. Creative work however must absorb and distraction would be highly counterproductive, therefore they should be designed as being pleasurable rather than being fun.

The authors stress the fact, that enjoyment is highly context dependent - it can never be guaranteed, that an enjoyable experience will emerge. Nevertheless reality shows us, that there is at least some "common ground", when we look at popular TV shows or theme parks, which are solutions or products that at least appeal to a majority.

The concepts discussed here show that a lasting and rewarding interaction has to be based upon design for pleasure rather than design for fun. As we have seen, a pleasurable experience may be seen as an aesthetic experience, enabling factors have been discussed.

## The Experience of Flow

Among artists, there is a well known state of mind in which someone becomes completely immersed in his or her painting, disregarding bodily needs like eating or resting. The activity becomes rewarding in itself and the end product a sort of "by-product", the interest is lost as soon the painting is finished.

Flow theory wants to understand this intrinsic motivation. Csikszentmihalyi and Nakamura [53] [9] have studied this phenomenon and put together existing research. Csikszentmihalyi broadened the focus of studied activities and also looked into other areas like chess players, dancers and rock climbers in order to find the common denominator. He found two factors in all flow experiences:

1. *Perceived Challenges*: In a flow experience, people have to overcome challenges. These challenges have to match the person's skills, in order to create optimal arousal. If the challenge is too great this creates anxiety, if it is too low the result is boredom.

2. *Clear proximal Goals*: The person is never in the dark about his or her goals and knows where he or she stands towards achieving it. There is immediate feedback about the progress and future actions can be immediately adjusted based on that feedback.

In the state of flow, a person is intensely focused and concentrated, i.e. he or she operates at "full capacity" [53]. As can be derived from the conditions above, there is a sense of total control in this state regarding the activity, as goals, situation and course of action are disclosed to the individual. Other characteristics of this state include a loss of "reflective self-consciousness" (as one is fully immersed in the activity) and temporal distortion, meaning that "time flies by".

Although some actions are predestined to create states of flow, it may be found in any activity - it is a universal concept that is applicable across activity contexts: It may be found when sorting beans, designing an engine or when training a dog. As long as there are perceived challenges and clear proximal goals, any individual may immerse in flow, depending on context and his or her own predisposition.

As with other interactive qualities, it is very hard to design for flow, as it is an "emergent motivation in an open system" [53]: it is a product of an interactive process, dependent on every antecedent variable. Also the perceived goals arise from the interaction itself and are quite unpredictable. However, one may facilitate that emergence:

1. *Match Challenges*: Subjective skills and challenges influence the quality of a person's experience. Matching those two variables facilitates flow.

2. *Open System*: Flow requires an open system with many interaction possibilities from which to choose from. The environment has to enable a stimulating experience.

The concept of flow is closely related to Brandtzæg's e.a. (or Karesek's respectively) demands and control model 2.2 and conveys the same idea of presenting people with reasonable challenges, in order to create a quality experience. Two necessary or enabling factors of flow discussed here are also quite important in the context of this work: *control* and *open system* are two influential contributors to a positive use experience.

## Engagement

The term "engaging" is widely used throughout the literature to describe pleasurable and memorable usage episodes of products. Many definitions, explanations and models exist on the topic, but probably the most holistic and thorough work regarding engagement in software products is given by O'Brien e.a. [57]. Based upon review of previous research and available literature, as well as an exploratory study including four different applications, the authors give a very distinctive definition of the term, identify key aspects that comprise an engaging experience and create a model based on their findings.

Demarcating engagement is not an easy task, four aspects are especially closely related: flow (see also 2.2), aesthetics, playfulness (see also 2.5) and information interaction. O'Brien e.a. see the differences as follows (for a full list of common attributes see table A.1 in the appendix, which gives a very informative overview):

1. *Flow* entails intrinsic motivation and goal orientation. It has a rather long term focus and always includes the effect of losing oneself in the interaction. Engagement on the other side doesn't have those limitations: it may also occur in for example non-voluntary use of a product or when multitasking and a loss of awareness is not part of the experience.

2. *Aesthetics* is an important aspect of engagement, but is only a part of the experience: The authors argue, that sensory functions, appearance, etc. are essential components or antecedents of engagement, but do not solely comprise an engaging experience.

3. The same is true for *playfulness*. While it "increases motivation, challenge and affect" [57], it plays only a part in the experience.

4. *Information interaction* concerns itself with the organization of data and tries to optimize the interaction between user and content. It therefore provides only the "connectivity for engagement" [57].

**Attributes of engagement** were traditionally narrowly defined: Jacques e.a. [30] see engagement comprised of three elements: attention focus, curiosity, and intrinsic interest. Another example is Skelly e.a. [67] who name curiosity as well among two other elements: feedback and challenge. The attributes of engagement suggested by O'Brien e.a. paint a very conclusive picture - they include attributes from extensive literature review on the subject as well as attributes derived from their own research (Awareness, Attention, Interest as well as Feedback and Interactivity have been grouped together):

- *Awareness, Attention, Interest*: In their studies, O'Brien e.a. found "awareness of others and one's environment, and perception of time" [57] to be a common aspect in engaging experiences.

- *Challenge*: Presenting users with demanding yet manageable challenges affectively involves them in the interaction.

- *Affect*: The user is emotionally involved in the experience and has affective responses.

- *Endurability*: Engaging experiences are not volatile but memorable.

- *Aesthetic and sensory appeal*: Engagement may be triggered by aesthetic or sensory appeal.

- *Feedback, Interactivity*: Immediate feedback to the user is important in sustaining and creating engaging experience. Without, no lively and immediate interaction is possible.

- *Variety/Novelty*: Play an integral part in creating engaging experiences.

- *Perceived control*: When engaged, users perceive themselves in control of the system.

- *Motivation*: When engaged, users feel highly motivated.

As the authors point out themselves, some of those attributes have great relevance in usability as well, which suggests that usability plays an important role in engagement: absence of usability often creates frustration, which in turn prevents or ends episodes of engaging experiences.

The resulting definition of engagement given by O'Brien e.a. is as follows: "Engagement is a quality of user experiences with technology that is characterized by challenge, aesthetic and sensory appeal, feedback, novelty, interactivity, perceived control and time, awareness, motivation, interest, and affect." [57]

In figure 2.4 O'Brien's e.a. model of engagement is shown. It includes four stages of engagement and the corresponding attributes for each stage. The first stage is the point of engagement where the engaging experience is triggered and begins. The authors state, that engagement may occur at any time during the interaction, which suggests that designers may consider any aspect of the software for creating engagement. The next stage is the engagement itself, that is
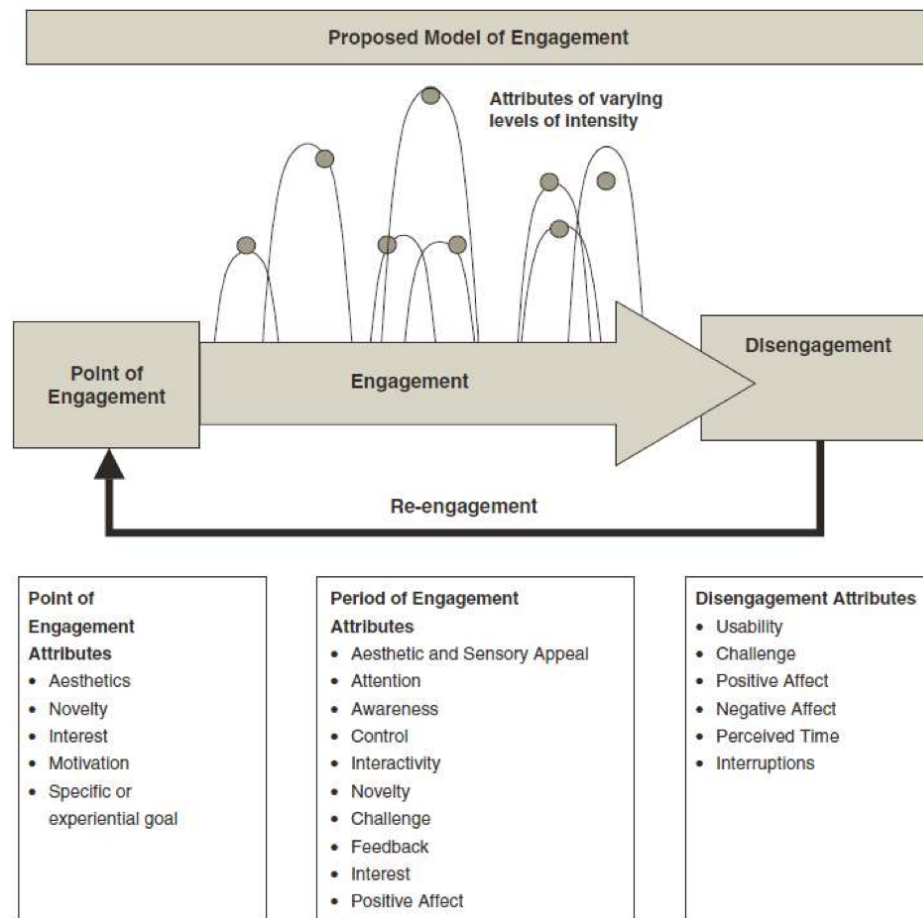
**Figure 2.4:** Model of engagement including attributes, as proposed by O'Brien e.a. in [57]

accompanied by positive emotions. It can be sustained if the user keeps his or her attention and interest. In this stage, users feel in control, are given immediate feedback by the system and are interactively occupied. The next stage is disengagement, which may be caused by internal factors like loss of interest or external factors like interruptions from the environment or usability problems. Here positive emotions may occur when the engagement comes to a "natural" end as well as negative emotions like frustration when usability problems emerge for example. The last stage is reengagement: In a session users may become engaged several times. The respective attributes for each stage can be taken from the figure.

O'Brien's model of engagement, although primarily descriptive of the experience itself, still leaves more than enough room for deriving enabling factors of pleasurable experiences. Most of those elements are also present in other models discussed here (as mentioned before, engagement is closely related to flow), but O'Brien's work integrates and unites a lot of available research on the topic and therefore reinforces the importance of those concepts.

**Demands, Decision Latitude and Social Support**

Motivation and enjoyment in the work context is a well studied area and there are many models trying to capture the components of a rich and stimulating work environment. One of those is Karesek's model for well being and motivation at work [31], which is composed of three major columns: experienced demands, available decision latitude and social support.

Experienced enjoyment when interacting with software products can be understood using motivation theory - more specifically in this case motivation at the work place. Brandtzæg e.a. [7] saw the general concepts in Karasek's model and also its validity regarding activities also outside of the work context. This section is about their adjusted model, which shows systematics of fun and enjoyment, which also relate to interaction design.

The first of the three major elements in the model is *challenge and variation*. People are intrigued by challenges, which can be observed on how much of our free time is spent on meeting those challenges, f.e. when solving puzzles or when playing video games. Overcoming challenges gives us pleasure, they are "connected to the opportunity and motivation to learn" [31], which is a very basic and strong intrinsic motivator. The activities carried out in order to overcome the challenge then become rewarding in themselves, as they serve a greater goal. Variation on the other side is an easy strategy to appeal to user's curiosity and to include surprises in the interaction. Identical experiences become boring very fast, Davenport e.a. even state that "unpredictability is necessary to experience fun" [11]. The degree of unpredictability however should never be outside of the user's comfort zone, i.e. it should only "involve minor risks" [7]. Moreover, the model's authors point out, that challenge and variation present *demands* in the experience. These demands have to be weighed and designed carefully, so that the interaction doesn't become frustrating. A very important aspect in this regard is that users always have a feeling of control and that there is a "balance between demands and control" [7] in order to prevent such frustration. Besides frustration, these concepts also potentially contradict concepts of usability (unpredictability can soon result in an unusable user interface). On the other hand "making something as simple as possible may make it boring" [7], as the authors put it. So it has to be ensured, that the very concepts which should augment the use experience don't destroy it.

To some extent interwoven into the concept of presenting the user with challenges (as discussed in the last paragraph) is to incentivate the user to employ his or her skills and to give him or her the right amount of control. Brandtzæg e.a. speak of *decision latitude*, which is defined as "the ability to use and develop skills, and the availability of decision-making authority or freedom of action" [7]. According to Karasek, well being at work is positively influenced by a worker's decision authority. The same is true for software interaction, where a dynamic environment with many interaction possibilities is more involving and stimulating in most cases. Karasek also mentions that people are more happy when they are able to develop new skills or use their existing skills to their full extent. Regarding interaction design, this implies that demanding tasks are no problem and even enjoyable, as long as the user has the feeling that a given goal can be attained with his or her skillset. "Unwanted complexity" and "unrealistic prerequisites" [7] on a user's skillset are bad influences however. Giving control and decision authority to the user is a key aspect in creating a positive use experience, but in many cases cannot be included in main features and is often "hidden", which means that possibilities for interaction have to be "hinted" [7] to the user. A common and easy strategy for implementing

decision latitude is to have personalization features.

People are social entities, in general we prefer to spend our time with friends and family instead of solitude. Karasek found social support from both co-workers and supervisors to be very influential on good and healthy work. Brandtzæg e.a. identified two corresponding elements in the context of software to explain enjoyment: *co-activity* and *social cohesion*. The former means, that technology should enable users to do things together and to engage in collaborative tasks. Studies showed that activities are already more motivating in the presence of others, even if there is no interaction with the other person. The latter means that users should have the feeling that they belong to a group or to a greater community, instead of having the feeling of being socially isolated. Today it is very common for example, to include the possibility to comment and other social media functionalities on websites.

### Enchantment

Enchantment, as defined by McCarthy e.a., can be seen as the "experience of being caught up and carried away, in which, although we are disoriented, perception and attention are heightened" [51]. The authors argue for enchantment as an experiential quality in order to create a more meaningful and lasting interaction. Enchantment in their eyes can be created through "depth of design", which gives the experience a "potential for the unexpected", "provides a range of possibilities" and the "chance of new discoveries" [51].

The authors argue that achieving enchantment nowadays is hard, as our society is "media saturated" [51]. A genre that still enchants most people despite that barrier is movies. McCarthy e.a. use Boorstin's model's of enchantment in films [6] to show how a medium needs a detailed understanding of its consumers' sense making, emotional and interaction processes in order to make those encounters meaningful. Borstin's model explains that enchantment needs to be achieved on every level in the experience (he names three, the pragmatic/logical, the emotional and the visceral/self-identification view). Film is a very mature medium, it creates enchantment by seeing its consumer holistically and by playing with the status quo, cultural standards, storytelling conventions and very importantly, also with the consumer's knowledge of the genre.

While film can be seen as a mature medium, computer technology and HCI can not. But there is a lot that can be learned and that has relevance as well in computer technology. McCarthy e.a. speak of *'sensibilites'* for designing that describe qualities, which may enable an experience of enchantment [51]:

1. *The specific sensuousness of each particular thing*: Enchantment is intimate as well as intense experience and is most commonly created when there is a strong appeal to the senses, something that "catches the eye" and doesn't let go. McCarthy cites Fisher [18] in that aspect, who "draws attention to the power of a corner of a painting, a color, line, or pattern observed there for the first time, to still the mind and limbs even as the senses continue to operate all the more acutely".

2. *The whole person with desires, feelings, and anxieties*: The authors argue that while enchantment appeals to the senses, it still engages the whole individual in the experience and appeals to him or her on an intellectual, emotional and sensual level.

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3. *A sense of being-in-play*: An enchanting experience is "playful", "explorative" and exciting. It is interactive and ongoing and continually "challenges familiarities" (like personal values).

4. *Paradox, openness, and ambiguity*: Enchantment is also described as "engagement through paradox and ambiguity" [51]. Creating an open and ambiguous interaction creates depth which in turn creates enchantment. It leaves room for "complex and layered interpretation" [51], that holds the key for surprise and engagement.

5. *The transformational character of experience*: The openness and ambiguity mentioned above imply a certain "unfinalisability", an ongoing process. An enchanting experience can only be created by understanding its transformational character: it continually plays with something thought stable, our current beliefs and values and in the end transforms the user himself as well through the experience.

The term "sensibilities" is carefully chosen: As the authors point out, the qualities described above are quite volatile, as they are influenced by culture and their effectiveness highly depend on the individual.

## 2.3   Aesthetic Principles and Visual Aesthetics

There are some patterns behind aesthetic judgments and while they vary widely among individuals, there is still some common ground. The first part of this section will look into those patterns from an evolutionary point of view. Also, aesthetic ideals are to a certain extent transferrable, what can be applied in one domain might work just as well in another. The second part of this section will look into visual aesthetics, to search for common ground there.

### Principles of Pleasure in Design

Evolutionary psychology explains human behavior through evolutionary concepts: humans adopted certain behaviors because it promotes our chances of survival. Based on those ideas, Paul Hekkert [25] argues for certain patterns or concepts that are aeshetically preferred, as they accommodate the way our senses work and are "beneficial for the development of the senses' functioning and our survival in general" [25].

Evolutionary aesthetics tries to answer the question of the source of personal (dis-)pleasure: Why do we like things, why do we prefer one thing over the other? Following evolutionary thinking, the answer would be that we prefer the things that are beneficial to our survival (or more strictly speaking: that the mechanisms responsible for making preference choices have proven to be beneficial for our survival). So under the assumption that our psychological mechanisms have evolved to "serve functions beneficial to our survival", it is only logical that we "derive (aesthetic) pleasure from patterns or features that are advantageous to these functions" [25]. Therefore our sense for and appreciation of beauty is seen as programmed into our perception as it promotes our chances of survival.

Derived from this argumentation Hekkert states four general principles of aesthetic pleasure:

1. *Maximum effect for minimum means*: Our perceptory systems want to function efficiently and economically. Therefore it is preferable, if something can be perceived faster or with less effort. Hekkert states: "We like to invest a minimal amount of means, such as effort, resources, brain capacity, to attain the highest possible effect, in terms of survival, reproduction, learning or explaining." [25]. There are many examples for this principle, across many disciplines: Visual patterns are more pleasurable, if simple design features reveal a lot of information. A function of programming code is more appealing if it is written with less lines of code and so on. A quite interesting application of this principle is using metaphors: "Via a simple reference to something else (the source), we can map a wealth of meaning and a novel perspective onto the target" [25]. Metaphors allow us to express ourselves and convey meaning and emotions very economically and efficiently.

2. *Unity in variety*: Our perception organs pass on a lot of impressions and information. This information has to be processed and organized. Evolutionary speaking, we have to extract the relevant information about the environment: what is harmful and what is beneficial to our survival. We automatically group and organize these perceptions into a meaningful whole, we continually try to detect order in the perceived chaos. As Hekkert puts it, "extracting relationships is an economically sound way to minimize allocation of attentional resources" [25]. A lot of these mechanism correspond to the *Gestalt laws*, like the law of similarity (elements are grouped together if they are similar), the law of proximity (elements are grouped together if they are close to each other), the law of closure (shapes/objects/etc. are perceived as whole even if they are not complete) and so on. Detecting structure, finding order and systematic relationship is thus pleasurable and rewarding.

3. *Most advanced, yet acceptable*: This principle combines two other, seemingly contradictory principles: On the one hand, we prefer the familiar or "the most typical example of a category" [25]. From the evolutionary perspective, being risk-averse is the preferable alternative to being a risk taker. On the other hand however, we are also attracted to new and unfamiliar things and possess a certain curiosity towards them. Hekkert e.a. studied those quite contradictory principles and formulated the combined principle of *MAYA* (Most Advanced, Yet Acceptable) [26]. There studies showed that "novelty ratings and typicality are highly negatively correlated, but this correlation is not perfect". So with regards to aesthetics, an object is more preferable, the better it combines and includes both aspects.

4. *Optimal match*: Another, maybe more intuitive term for this principle would be "consistency of impressions" [25]. In a real world scenario, we perceive our surroundings with all our senses and very seldomly we perceive specific objects with just one perceptuary system. When all our senses are involved, a consistent and matching picture across the senses is pleasing: If a fruit looks foul, it also smells and tastes bad. Regarding aesthetics and design, Hekkert states that "making all the sensory messages congruent with the intended, overall experience is therefore an important task for designers" [25].

Hekkert's work is a great introduction to the topic of aesthetics itself and also brings some important insights regarding experiential qualities: We have discussed, how qualities, that pro-

mote memorable experiences, may contradict qualities of usability (see f.e. 2.2): The MAYA principle aids in helping to find the correct ratio when it comes to f.e. including innovative elements and interaction concepts in the interface. Understanding optimal match helps in promoting consistency, unity in variety helps in understanding how stimulating elements can be introduced to the user interface, etc.

## Visual Aesthetics

Although the focus of this work clearly is interaction design, visual aesthetics cannot be neglected. When encountering an aesthetic feature or quality in a software product, it is not always easy to draw the line between visual aesthetics and aesthetics in interaction, especially when the source for the aesthetic judgment is in question. Moreover, aesthetic criteria applicable to the visual domain are to some extent also relevant when looking at interaction design. The web is a highly interactive medium, aesthetic judgments of web sites are therefore meaningful to this research question, especially as most of the studies presented here had users interact with the software they were evaluating. It is reasonable to assume, that knowledge gained from researching visual aesthetic principles can be applied to the interactive domain as well.

One of the first studies to deal with aesthetics of web pages was done by Schenkman and Jönsson [64] who noted that, as usability matures and is very widely looked upon and more thoroughly implemented, aesthetic considerations become more important. The aim of their study was to see why certain web pages are preferred over others, how web pages are experienced aesthetically and in turn to find out which factors influence the overall judgment of a website. In their study, participants gave visual judgment to 13 different web pages (interaction was completely shut out, no keyboard or mouse was present). In the first session, the webpages were shown pairwise (for similarity judgment), in a second session, judgment was given on the following seven aesthetic dimensions on a scale from 1 to 7 (for preference analysis):

- Complexity
- Legibility
- Order
- Beauty
- Meaningfulness
- Comprehension
- Overall Impression

The study showed, that for a website's appeal, beauty and illustrations are important but order and complexity are not, although classical experimental literature of aesthetics would suggest otherwise. "Overview" was also a determining factor for preference of web pages as well as "illustrations versus text".

Another study by Lavie and Tractinsky was done on a much larger scale and aimed at assessing dimensions of perceived visual aesthetics of web sites [36]. In their work they showed that there are actually two categories of user's aesthetic perceptions of web pages:

1. *Classical Aesthetics*: This dimension covers properties, that correspond to well know aesthetic principles and ideas, like ordered and clear design or symmetry.

2. *Expressive Aesthetics*: This dimensions covers properties that break with conventions, like creativity or originality.

Rather than testing hypotheses about effects of isolated elements of an object, this study focused on overall impressions and subjective perceptions of users. For that purpose, a set of measurement items was iteratively constructed and refined:

1. In a first step, aesthetic literature was reviewed for general aesthetic constructs. Also 11 respondents (four web designers, four HCI researchers, two interior designers and one architect) were asked to provide a list of aesthetic constructs.

2. Next, two studies were performed with university students in order to further refine and validate the initial items as well as items emerging from within the studies. Also the items were put in their respective categories, resulting in two constructs for evaluation: classical aesthetics and expressive aesthetics.

3. In order to establish validity of the aesthetic measurement, three more constructs were added. Two that were expected to be positively related to aesthetics (usability and pleasure, a third, playfulness, was initially added but later removed, as it verbally confused test users) and one that shouldn't correlate to aesthetics (service quality). Using these constructs in the same measurement, the accuracy of aesthetic measurement could be cross checked.

The final scales used in the studies for aesthetic judgment can be taken from the appendix, table A.5.

The study showed a strong cohesion within the two aesthetic dimensions and that in fact two distinct dimensions of website aesthetics exist. The items used for measuring classical aesthetics were: aesthetic, pleasant, clean, clear and symmetrical. They correspond to visual clarity, orderly and navigable design. But those comprise only one part of the aesthetic experience, as shown in the study. The other part are design attributes, that show visual richness, originality and creativity. The items used for expressive aesthetics in the study were: creative, using special effects, original, sophisticated and fascinating.

This distinction is also consistent to observations from other disciplines. Lavie and Tractinsky give the example of landscaping, where in 1966 Arnheim concluded: "complexity without order produces confusion; order without complexity produces boredom" [3]. And actually this also corresponds to some extent to the aesthetic principle MAYA discussed in the last section. Moreover, the study also found a strong linkage between usability and classical aesthetics. This is not too surprising, considering that clear and unconfusing design is seen as a prerequisite for good usability. The much more interesting finding is the missing link between expressive aesthetics and usability: in an extreme case, a web page might be evaluated as aesthetic with a decisive positive evaluation regarding expressive aesthetics, while it is evaluated to have low usability and classical aesthetics. This again is coherent with Hassenzahl's findings, where the study of hedonic and ergonomic qualities as well as appeal showed similar results (see 2.2).

## 2.4 Interaction Aesthetics

For software developers and designers, "not a beautiful appearance", but "a beautiful interaction" should be the focus of their work [15], or at least it should receive the same amount of consideration on their part. It is not uncommon that visually appealing products frustrate when they are actually used. Aesthetics doesn't stop with the visual level, it is the whole interaction and the experience that counts and should create a sense of beauty.

### Pragmatist Design Principles

Ross e.a. [63] translated the principles of pragmatist aesthetics (see 2.1) into design principles, giving them their own notion of aesthetic interaction. As a starting point the work of Petersen e.a. [60] was used, who further emphasized the importance of the socio-cultural background and including people's mind and body in interaction. The four adapted design principles are:

1. *Practical use next to intrinsic value*: Aesthetic interaction alone doesn't work. Although the aesthetic interaction should be valuable in itself, it should also serve a practical purpose.

2. *Social and ethical dimensions*: The designer has to be aware, that what is beautiful is dependent on the user and context. Those dimensions have to be taken into account when designing for aesthetic interaction.

3. *Satisfying dynamic form*: While form in design is generally associated with static features like color or material, it should in interaction aesthetics be dynamic in a sense that it "opens the design up to the dynamics of product and person behavior in interaction" [63].

4. *Involving the whole human being*: A designer should not focus on gratifying just a certain aspect of our perception capabilities, but an aesthetic interaction should appeal to a human being holistically. The research of Hummels, Djajadiningrat, and Overbeeke [27] identifies four main categories of human skill as relevant for interaction: cognitive, perceptual-motor, emotional and social skills - all those are sources of aesthetic interaction.

### Ten rules to augment fun and beauty

The problem of how to design engaging and pleasing products is of course not only bound to software products. Djajadiningrat, Overbeeke and Wensveen wrote a pamphlet in which they challenge the status quo in product design [15]. Although this work is mainly focused towards the interplay between augmented reality and product design and is meant as an appeal towards augmented reality communities not to repeat the mistakes HCI made, the ten "sloganesque points" presented apply to software products as well.

The authors argue, that in recent years human product interaction (and in that respect human computer interaction as well) has focused mainly on the user's cognitive skills, while perceptual-motor skills and emotional skills are left aside. This is due to the abstract nature of electronic products or products, which include a great deal of their functionality in electronics (products

that are free of electronics are pretty scarce nowadays). Electronic features have no representation in the real world, thus designers are more or less free to design interfaces as they like. To do so, they turned to cognitive sciences, color encoding, grouping and logically structuring interface items, which in turn overstrains the cognitive abilities of an average user.

Products in their view should appeal to all three levels of product interaction: cognitive ("knowing"), perceptual motor ("doing") and emotional ("feeling"). In order to achieve that, ten perspectives on (or qualities of) product design are presented, which enable a more meaningful use experience on all levels:

1. *Don't think products, think experiences*: In essence, a person doesn't buy a product because of the product itself, but because of its enabled usage episodes. To be more exact, we are "not interested in products, but in the experience a product creates" [15]. This has to be kept in mind when creating products. It means the focus in the design process shouldn't lie on the product itself, but to "create a context" [15] for a meaningful and enjoyable experience. The choice of words is very important here: A specific experience cannot be forced upon a user, but a designer can create the general conditions which enable the desired experience.

2. *Don't think beauty in appearance, think beauty in interaction*: The predominant view in product design is, that aesthetics is only seen as an aspect of appearance and that "usability is treated separately from aesthetics" [15]. The inevitable result is, that there are a lot of products that are very appealing when they are first looked upon, but "frustrate when interacted with" [15]. Therefore the authors argue to shift aesthetic consideration towards interaction, of which aesthetics in appearance is a big part. A lot of researchers appeal in a similar matter to shift focus, among those Philip Ross, who puts this dilemma in the following words: "a beautiful product is of little use if it elicits unpleasant, inappropriate, ugly or even inhumane interactions" [63].

3. *Don't think ease of use, think enjoyment of the experience*: Current product design focuses on "ease of use", a piece of software should be as easy to use as possible, probably because of the underlying assumption that ease of use defines product quality. It indisputably has a great influence on quality, but as reality shows, there are other (and maybe even more important) factors, that influence it. Some people use quite "unusable" products, just because of their special charm or the positive use experience. When solely focusing on ease of use, all this potential is left aside.

4. *Don't think buttons, think rich actions*: Recognizability is a very important aspect in interaction and user interface design. Many software products perform similar tasks and use quite similar controls to represent the underlying actions. But as the underlying actions have matured over the years, the controls basically stayed the same. Controls should relate closely to the actions they represent and there shouldn't be too much abstraction.

5. *Don't think labels, think expressiveness and identity*: As mentioned in the last item, there is a very widely used set of controls and concepts, that is (with adaptions) used in most software. The result is, that separate software products look very similar and are also very

hard to tell apart when looking at their interaction design. But a software's controls should "look, sound and feel different" [15] and should reflect their purpose, instead of being just adapted and understandable through descriptions and labels.

6. *Metaphor sucks*: A common strategy to improve usability and user experience is to use metaphors in design. This strategy might be "overrated" according to the authors, as it does not guarantee that a user fully grasps the concept behind it. A far better approach would be to create products with an "identity of their own" [15].

7. *Don't hide, don't represent. Show*: Currently, critical components are often hidden in product designs. Take a printer for example, where the paper is put in a drawer and remains hidden, which means that a display and warning message has to remind and warn the user, when paper is getting low. And then more often than not, the search for the correct drawer begins. Although this concept is used in the context of physical products in [15], it is still applicable to software products. Software systems and more specifically user interfaces are designed as black boxes and hide most of the systems complexity from the user. This is ok, as the average user doesn't like to interact on a source code level. But often it is not transparent for the user, what the program currently does, which might get frustrating in certain scenarios, f.e. when longer tasks are processed, or when the outcome of an action is not as expected and the separate steps in the action can't be followed.

8. *Don't think affordances, think irresistibles*: As mentioned before, current designs focus on understandability and usability. HCI uses the term affordances, to refer to "the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used" [54]. So affordances describe properties, that are attributed to an object with respect to their possible usage scenarios. An affordance is a positive thing, it allows to intuitively handle a product correctly. However, it does not invite to act and that's what a good software should do: invite to act through its beauty of interaction. By focusing on familiarity and conformity, a lot of potential for an enjoyable experience through other approaches is lost.

9. *Hit me, touch me, and I know how you feel*: How a person interacts with his or her environment is dependent on his or her emotional state. We talk or walk more hastily when we are stressed or do these things more slowly and warily when we are tired. Software products should allow that same kind of richness in interactions, not least because it allows to guess the emotional state of the user.

10. *Don't think thinking, just do doing*: As already mentioned in the introduction, current focus of HCI is on the cognitive level, which is separated from actual acting. In the domain of real world objects and problems however, most people have a very explorative attitude in their interaction: they turn things upside down they don't know, fiddle with the lawn mower when it doesn't start up, etc. This is a very vivid interaction that very often results in creative solutions. Moreover, doing something creates a far better context for experience than thinking something.

Although Djajadiningrat, Overbeeke and Wensveen focused on augmented reality and product design in general, their concepts are very intriguing and also apply to software products. The first rule strongly correlates with Hassenzahl's intended character (2.2) and also appeals to designers, to focus on the created experience rather than the product itself. The other rules also include a lot of experiential qualities such as richness/beauty in interaction (1.,3.,4.,10.), identity&authenticity (2.,5.,6.,7.), surprise (8.) and emotionality (9.).

Their critique on metaphor is also supported by Wiberg et al. [70] for example, who argue that a beautiful interaction has to overcome the limitations this concept presents. Historically designers strived to achieve operability and ease of use through abstraction. This means the underlying system and architecture is "obscured" and a symbolic system is created upon it which acts as a "substitute for being close to the machine" [70]. The most prominent strategy for creating such systems is metaphor. Computing Pioneer Alan Kay criticizes that this representation is imperfect and that it misses the "magic" of computing. Metaphorical correspondence is easily broken (an easy example is "undo", which - as an artificial, digital concept - can have no natural representation) and it "breaks where the action is".

## Use qualities

*Use quality* is a term phrased by Jonas Löwgren, who defines them as "certain properties of a digital design that are experienced in its use" [42]. He argues, that the way software is used today greatly differs from how it was used some decades ago, the main differences being that use today is "discretionary" [42, p. 1], meaning that people will only use a product if they want to. So in order for his or her product to be actually used, a designer needs to design for a good experience. Here is where the importance of use qualities comes into play: Defining them helps designers in new design situations and also with communicating concepts across stakeholders. But most importantly, use qualities represent transferrable knowledge, or best practices.

Those use qualities have to be put into context however. A use quality might be important in one genre, but completely superfluous in another (Löwgren mentions pliability (see below) to be of importance when presenting information f.e.). In [42], Löwgren describes a selection of eighteen use qualities, which - as he emphasizes - has no claim to be complete and represents a personal preference, partly based on literature review and his own work.

The qualities are organized in five clusters: Qualities having to do with motivation, qualities of interaction, handling and perception, qualities of actions and their outcomes on a social level, qualities of structure and engineering ideals and qualities for creating a distance between the user and the digital design. An overview on the concepts is given in table 2.1.

Use qualities of motivation are concerned with grabbing and maintaining the user's attention. Applying these concepts means keeping the user involved with the software and providing a captivating use experience. *Playability* can be achieved when there is a "balance of goals, resources and obstacles in the game" [59], which is a guideline coherent also with other authors presented in this work (compare f.e. *Experience of Flow* or *Demands, Decision Latitude and Social Support* in 2.2). So essentially the user has to put a certain amount of effort into overcoming a challenge and achieving his goals to attain good playability. Another concept mentioned in this cluster is *Seductivity*, which is based upon the seductive process as described by Khaslavsky and Shedroff [32] that is comprised of enticement (making an emotional promise), relationship

| Cluster | Use Quality |
|---|---|
| Qualities of motivation | Playability<br>Seductivity<br>Anticipation<br>Relevance, Usefulness |
| Qualities of interaction, handling and perception | Fluency<br>Autonomy<br>Pliability<br>Immersion |
| Qualities of actions and their outcomes on a social level | Identity<br>Actability<br>Flexibility |
| Qualities of structure and engineering ideals | Efficiency<br>Transparency<br>Elegance<br>Functional Minimalism |
| Qualities for creating a distance between the user and the digital design | Surprise<br>Parafunctionality |

**Table 2.1:** Use qualities of digital designs categorized in their respective clusters, extracted from [42]

(small fulfillments and more promises) and fulfillment (fulfilling the final promise - or failing to do so). This process of seduction is handled in 2.4 in more detail. *Anticipation* is connected to dramaturgical structure (see below). The goal here is to let the user escape from the "chronological cage" [42, p. 4], to stimulate him or her, appeal to his or her imagination so that he or she wants to know what lies ahead. Finally there are *relevance and usefulness* as motivational use qualities. If a product has no purpose and does not support in performing tasks, it is likely to become of little interest over time. Defining purpose however is not that easy across all genres: while relevance is easily found within task related software, defining the usefulness of computer games f.e. is much harder. Here it is especially important, to view the use qualities' applicability and importance in the right context.

The next cluster deals with use quality that are concerned with providing an appealing interaction. They describe how a user may or should interact with a software, or how he or she should feel during the interaction. *Fluency* as seen by Löwgren describes how a digital artifact is included in a person's everyday life and use case scenarios and with what level of attention and directedness a user may interact with it. This quality is handled in more detail below. *Autonomy* means the autonomy of the system. On the one side of the spectrum, a system may be completely autonomous, it "maintains its own goals, chooses its own means and can be said on some sense to have a will of its own." [42, p.5]. On the other end, the software is a mere tool, that directly corresponds to the user's input. While traditionally software solutions were designed with little to none autonomy, today a lot of intelligent logic is included within digital artifacts to aid the user in his or her task or to influence him or her in the decision making process: office solutions

include meaningful contextual defaults when creating illustrations for example, or cross selling on the internet. Autonomy may provide for a much richer experience and allows for stimulating, emergent usage episodes. *Pliability* is given when information can be manipulated directly and fluently, when the interaction has a sense of physicality. This concept is discussed below in more detail. *Immersion* may happen in any interaction, Löwgren gives the examples of surfing the web, being told a story, writing, drawing or programming. It occurs when one loses him- or herself in the interaction and loses track of the surroundings. There are many aspects that may enable immersion, as can already be seen from the examples. Listening to a captivating story is very passive, but may still be very stimulating. On the other side immersion may happen within a creative process like drawing or a highly interactive one like playing a game. The more interaction there is, the more this concept relates to flow (see 2.2), or may be triggered by it respectively.

The third cluster includes use qualities that appeal on a social level. Use qualities here enable the user to act within his social context and present means of self-actualization and self-expression. *Identity* describes the ability to which a digital artifact may be customized to give it it's own more or less unique sense of identity, as well as the ability of a user to represent his or her own identity through the artifact. A common example are skins for mobile phones or customizable color schemes in software. Social *actability* describes "the extent to which a digital design empowers you to act" [42, p. 9]. Today, most webpages try to include sharing functionality of social media channels to enhance the user's possibilities for social interactions within their context for example. But actability also means how artifacts affect our social interactions in general. Löwgren gives the example of ATMs, which drastically changed the bank's role in people's everyday lives. *Flexibility* lets users adapt a digital artifact not only in a visual sense, but also in its types of application and use cases. If a software allows for deep interaction, i.e. many possibilities in the interaction, it may evolve beyond its original application area. Flexibility means allowing a software to grow with the person interacting with it.

The next group is concerned with qualities, that provide a good experience from the functional, goal oriented perspective. These involve usability considerations as well, but focus more on the experience and the elicited emotional outcome. *Efficiency* and *transparency* is what HCI is mainly concerned with. Ultimately, the interface is what "stands between the users and their tasks" [42, p. 10], it is designer's duty to design for efficient and error-free use. Incorporating these qualities in a software is of great importance, as their absence can lead to frustration very fast. *Elegance* corresponds the an aesthetic principle: providing maximum output with minimal means, elegant solutions are simple and powerful. Allowing for elegant task completion means not only optimizing a software's effectiveness, but also appealing to users on an aesthetic level. Software has become increasingly powerful over the years and tools today are packed with features. The use quality of *functional minimalism* describes a step in the other direction: Reducing the number of features and concentrate on the main tasks, the software's purpose, but do those especially well.

The last category is about provoking or irritating the user, so that he becomes intrigued and interested and inquisitively interacts with the software. *Surprise* is such a quality: it "challenges our assumptions" [42] and pulls us out of our usual flow of interaction, it stimulates and may therefore enable a more meaningful interaction. *Parafunctionality* on the other hand is not re-

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ally targeted toward practical use, but its goal is to provoke active reflection on technology, its application and how it influences human behavior. Artifacts incorporating this quality are more of an experimental nature, used in the field of applied arts.

Löwgren handles two of those the use qualities discussed above (pliability and fluency) as well as two new ones (rhythm and dramaturgical structure) in greater detail in a later article [44], which will be described in the following paragraphs.

*Pliability* is higher, when the interaction feels "tightly coupled" and "highly responsive" and when information appears to be more "malleable" [42]. All these attributes make the interaction more inviting and more natural. Often strategies to design pliable interaction come from real world scenarios. Löwgren gives the example of "BumpTop", where the stylus interaction is inspired by objects that float on top of a liquid: when touching the "surface" of the interaction pane, they are pushed away at first, as they would on a natural liquid. Also, a sense of tactile manipulation is very helpful, where a user can easily relate to real world physics. A great example here is the scroll behavior on most apple products: Whether a touchscreen or touchpad is used, the scroll speed corresponds very well to the user input and eases out accordingly, just like pushing around a physical object on the desk.

Sometimes interactions with products are intuitively described as being *rhythmical*, i.e. the interaction has a certain regularity or periodicity to it. However Löwgren chose the term "rhythm", which might be because it is more associated with having a "flow" and being exhilarating to the user, therefore creating a more positive experience. Humans have a general preference towards consistency and predictability and rhytmical patterns in the interaction correspond to temporal predictability. Rhythm no doubt has a big impact on the perceived experience, when the following examples are considered:

1. Users prefer consistent response times over divergent ones. Consistent response times are even preferred, when the average response time is higher than in the inconsistent case. Every internet user can relate to that, when we think about browsing the web and all of a sudden a single page request takes a little longer than it should and immediate frustration emerges.

2. Users sometimes enjoy doing dull repeated tasks and prefer doing so over investing some time into automating it. F.e. bulk editing tasks (like switching points with commas in a spreadsheet or pasting names into a template), from which - as Löwgren puts it - a "hypnotic pleasure" might emerge.

A rhytmic interaction is a quality that can also be found with other authors. Djajadiningrat e.a. for example appeal for "richness in interaction" [14], where the engagement between user and system should have an "interesting and variable flow". Although this may sound very general, it still suggests putting thought into and explicitly designing timings of the interaction, which is also represented in the statement, that timings of system responses should be "appropriate to the actions and functions involved" [14].

*Dramturgical structure* may significantly determine how the use of a product is perceived. Through his analysis of ancient greek and Shakesperean drama, Gustav Freytag found out that they were basically comprised of five parts: exposition, rising action, climax, falling action, and

resolution [19]. The corresponding dramaturgical structure can be put on graph, where time is on the x-axis and tension is on the y-axis (the so-called Freytag graph). A Freytag graph for this classical dramas of five acts looks like a pyramid. These graphs may be drawn for any use case when interacting with a software and they may look very differently for each.

This of course leaves us with the question, how a dramaturgical structure should look like in order to create a positive interaction experience. For Löwgren, this is "largely a question awaiting exploration" [44], and it is no doubt very hard to answer indeed, if all the different usage scenarios, genres and contexts of software applications are taken into account: what works in an office application doesn't necessarily have to work in a computer game. But nevertheless it is worth keeping it in the back of the head, considering its undisputable effect on user experience.

*Fluency* as an interaction quality as characterized by Löwgren, is met when we have a "sense of dealing gracefully with multiple demands for our attention" [44]. Today, our perception organs are flooded with impressions and the amount of data that has to constantly be processed is higher than ever before. Therefore fluency becomes increasingly important, as it enables a user to easily and intuitively cope with a situation or scenario, that requires his or her attention.

Löwgren differentiates between two major areas, where fluency is important. On the one side there are digital artifacts in relation to everyday social norms and practices. Here fluency enables a person to adapt to or understand and interpret his or her environment more easily. One example given in [44] is the "marble answering machine" where the recorded messages are physically represented by marbles, which can be handled like any other object (if someone listened to a message intended for another person, he or she can simply give the marble to that person). On the other side fluency is important when we think about peripheral interaction, i.e. the information overload mentioned before. A common strategy to handle this problem is to use abstract or aggregated representations of the given information. A popular example is using simple charts instead of showing complete tables. Such approaches reduce the demands for our attention.

## Suppleness

Isbister and Höök [28] were inspired by the work of Löwgren and his articulation of use qualities. Based upon their experiences with projects in the past, where they found that some user experiences couldn't be described with Löwgren's set of use qualities alone, they propose to introduce the use quality *suppleness*. Given Löwgren's *map of use qualities*, the authors suggest to group suppleness with other qualities like immersion, fluency or pliability.

The word supple itself means (among other definitions) "easy, fluent, capable of being bent, able to perform bending movements with ease" [28]. The authors thought it important to introduce this use quality especially with regards to the new contexts of use emerging in the last years, like the possibility of using new types of inputs or the shift of ubiquitous products handling new types of tasks. The supple use quality depends upon

- *Subtle social signals*: a supple product "goes beyond the rational level of a GUI" [28] and allows for subtle and even indirect input, like facial recognition or gestures.

- *Emergent dynamics*: a supple product is highly adaptable and gives instant feedback. It "fits in the personal use context" [28].

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- *Moment-to-moment experience*

## Seduction

Seduction is a very common concept to incite consumers into buying or at least concern themselves with a product. We all know this concept from commercials and the media, but also the car industry is a very good example here, as cars are also purposefully designed to appeal to us emotionally. Julie Khaslavsky and Nathan Shedroff analyzed the seduction process and suggested how to implement it in software products [32], which will be covered in this section.

Seduction is intuitively connoted with sexuality, but is a universal concept that is not restricted to fornication. Another common preconception is the negative meaning of the word, that is being seduced is being manipulated into doing something, one wouldn't have done before. A far better and accurate meaning of the word is to "entice" and to "appeal". Seductive power "transcends issues of price and performance" [32] and presents a rather crucial variable in the decision making process that may even overrule aspects like beauty and efficiency. The seduction process as described in [32] has three steps, which will be described in the following paragraphs.

The first step is *enticement*. In the beginning a connection has to be made, the first thing that has to be done in order to achieve that is to get the user's attention. Some strategies are presented, like differentiation (a product that doesn't stand out in some sort of way is very unlikely to get a person's attention), or to surprise the user. In the best case, the user gets emotionally attached and curious. After having the user's attention, a "promise" has to be made. The idea here is to hold the attention and to "hook" the user. Again, this promise itself should be differentiated and go beyond fulfilling the usual needs and expectations of the user. The more such a promise connects with a user's goals and emotional aspirations, the more effective is the seduction.

The next step is the *relationship*, which may proceed indefinitely resulting in an endlessly ongoing seduction process. In this step the user's invested attention should be rewarded, the previously given promise(s) are (partly) fulfilled. Moreover, additional promises are made that keep the seductive process going. In the most successful seductions, emotional and intellectual growth is achieved through the use of the product, through which it is of course highly valued. Another important aspect is to focus on the parts of the use experience, that "matter most to the performance" [32], as a deeper connection will be made.

The last step is *fulfillment*, where the final promises are fulfilled and the experience ends. As mentioned before this step may never actually occur, either because the relationship is still ongoing or because the user terminated the process in the relationship, as he or she couldn't be seduced any more. Ideally this step should actually result in a positive fulfillment, as it will be hard to seduce again in the future otherwise.

A very important aspect to note in this whole seduction process is that as seduction appeals to emotions and personal expectations, its effects are of course highly dependent on the user - what might seduce one person might be repellent to another. Effective seduction can therefore only be achieved in certain user groups, where personal characteristics are coherent.

As stated in [32], seductive software should therefore try to include seductive, i.e. extraordinary features. They catch the user's attention and make promises about the software's character as well. This is easier said than done, in order to do so a design team should know its audience to

know what is appealing. Then the focus should be laid on the software itself, to identify opportunities to create emotional connections. These findings should then be combined. Afterwards it is advisable to find other examples of seductive design as an assistance in design orientation and then to establish these qualities in the software development process, also by involving a visionary designer or developer in the team.

## Graceful Interaction

There are many ways to create and derive models for aesthetic interactions, some of which have already been discussed. A fresh perspective is given by Hashim e.a. [21] who suggest a framework of "graceful interaction" for HCI that is based upon studies of human movement.

Human movement is an area well studied through disciplines like sports, dance or movement cognition for example. The authors base one part of their model upon the work of Rudolf Laban, who developed theories and systems to analyze human movement. Today, Laban movement theory and analysis are widely used in various areas like dance, drama, psychology, sociology, physical therapy, etc. As movement also "reflects human innermost feelings", his system is even used in philosophical contexts [21]. *Laban Movement analysis* consists of four components: Body describes what moves, where movement originates and how it spreads. Space handles the movement's pathways and their spatial extent. Shape explains the changing forms of the human body revealed in the movement. Lastly there is effort that describes the dynamic qualities of movement or "the inner attitude towards using energy" [21] and describes people's movements as an extension of their selves. Effort will be further described in the next paragraph, as it is one of the essential components in the presented framework.

*Laban theory of effort* explains effort as a quality of movement that is always present. During movement, there may be variations in effort which can express a lot of meaning. Effort - again - can be described by four factors: *time* (sense of urgency: lingering vs. urgent), *space* (directedness, attention to surroundings: wandering vs. focused), *weight* (delicate vs. powerful) and *flow* (describes the mental model of the performer, the "attitude towards control" [21]: ready to adapt vs. lack of control). For a more detailed overview on these concepts see table A.3 in the appendix. The last component, flow, is the most complex and hard to evaluate. Therefore movements can be described by combining the first 3 components.

The second aspect of the graceful interaction framework are formal movement qualities. The notion of relating theories of movement to interaction design is not new: Loke e.a. for example related various frameworks of movement to interaction design [41]. Bacigalupi showed that using movement qualities in interface design patterns of movements are also triggered in the interaction [4]. These *movement qualities* are: *rhythm* (intervals between active moments), *tempo* (pace of rhythm), *sequence* (events over time, causal order, showing relationships) and *direction* (sequence in space). A more detailed overview of these qualities is given in table A.4 in the appendix.

The graceful interaction framework itself combines Laban effort theory and formal movement qualities: Effort is used to describe the user's attitude towards certain tasks as well as his or her actual movement in the interaction, i.e. the movement created by handling the input devices. Movement qualities on the other side refer to the visual design and how patterns of movement

are incorporated there. All together the framework sheds new light upon interaction and what qualities may make it more beautiful.

## Inquisitive Use

Based upon the work of John Dewey [13] and more specifically his theory of inquiry [12], Peter Dalsgaard presents the experiential quality of *inquisitive use* [10]. Its roots lie in the pragmatist philosophy, which basically states that "ideas and theories we form are practical instruments for transforming our apprehension of problematic situations into fulfillment by resolving them" [10, p. 22]. Dalsgaard comprises inquisitive use of three interrelated aspects - experience, conflict and inquiry - that will be further described in the following paragraphs. For every aspect the author also states *design sensitivities*, which are aspects or considerations that present a foundation and should be taken into account when designing for or analyzing inquisitive use.

The first aspect is *experience*. The usage and definition of this term varies throughout the literature (as can also be observed in this work), Dalsgaard sticks to Dewey's definition, who differentiates between "an experience" and "having an experience". The latter describes what interaction design concerns itself with, the product of a usage episode. Dewey further differentiates between problematic experiences (those that challenge our mental models and therefore require inquiry) and aesthetic experiences (those that are in accordance to our past experiences and current models). These are not mutually exclusive however, as overcoming a problematic experience may result in an aesthetic experience. Dalsgaard names three design sensitivities for experience:

- *Experience in practice*: The experience needs to be practical, fostered by interaction and investigation. In order to support inquisitive use, it needs to support an ongoing, explorative interaction.

- *Continuous experience*: Means that the experience should "connect past and future": On the one side, it should connect and relate to known patterns (should be familiar), but on the other side should indicate novelty or uncertainty, i.e. encourage to explore.

- *Distinct experience*: An aesthetic experience stands out. With inquisitive use, the idea is to present a problematic situation that needs inquisitive action, the interaction needs to "perturb user's habitual conceptualizations with regards to framing, content, and modes of interaction" [10, p. 23]

The next component is *inquiry*, which can be described as a "particular mode of understanding and engaging phenomena" [10, p. 23]. It is initiated when someone finds himself in a problematic situation, where the usual action (as derived from the predominant model of the current situation) does not create the desired outcome. What follows is an iterative process of inquiry, where the situation is continually reevaluated, based upon the feedback gathered from the interaction. Design sensitivities presented for inquiry are:

- *Situated intentionally*: Inquiry requires interest and that interest has to be aroused. Although inquiry may also be entirely intrinsically initiated by the user, a system should actively try to initiate interaction and grab the user's attention.

- *Concurrent action-reflection*: Corresponds to continuous experience: known and unknown elements should be included to both give stability and uncertainty. This enables action and reflection.

- *Reciprocal change*: As the system challenges (and potentially changes) the users mental models, the user should be able to change the system as well in order to augment the experience.

Lastly there is *conflict*, which is the key component of inquisitive use. While the word is commonly negatively connoted, it simply implies an "unresolvedness" in the Deweyan sense. As mentioned above, conflict may originate on the user's or the system's side. When a user is confronted with conflict this usually initiates inquiry, therefore promotes engagement and enables the possibility to learn. However, situations of conflict may easily contradict concepts of usability, so it has to be woven into the design carefully. According to Dalsgaard, there are three design sensitivities for conflict:

- *Challenge*: Here it is important to match the challenge with the skills of the user, in order to generate flow 2.2.

- *Risk*: To augment the experience, the conflict situation may involve some risks: the higher the stakes, the more capturing is the experience. This has to be carefully balanced however, to avoid that the user is put off.

- *Resolution*: Inquisitive use is always directed towards resolution, in the end the experience may bring closure or not. A completed experience that can be contemplated is also necessary for creating an aesthetic experience.

The process of inquisitive use therefore looks as follows: A problematic situation arises (originating from system or user) that "challenges our conceptualizations" [10]. Next, iterations of inquisitive action follow until there is resolution (with or without closure). The design sensitivities as discussed above present considerations that aid in creating such a process or analyze experiences.

### Generation Y Interaction Qualities

A fresh perspective on interaction qualities is given by Liu e.a. [39], who argue that younger people today are missing a lot of rich interaction in their work context, while experiencing that same richness in their contexts at home.

*Generation Y* describes the generation that follows generation X, which is roughly defined as the generation that follows the generation of baby boomers (i.e. people born in the 1960s until early 1980s). Generation Y is therefore born in the late 1980 until late 1990 (generation Z roughly starts with birth dates from 1998 onward) and is characterized by being exposed to high tech equipment from an early age on. Today this generation is socially more active through the use of technology.

Liu e.a. describe a technological discrepancy between generation Y's home and work contexts. While at home there are a lot of rich interactions like "instant messaging, podcasting,

blogging, social networking" [39, p. 36] or highly engaging tools and games on tablets, mobile devices and game consoles, the work environment lacks those kinds of rich interactions. For the past decades it was the other way around, and technologically sophisticated tools at the work place were more advanced than those at home. However, as there is an ongoing transition from the industrial age to the knowledge age [8] and many new processes and tools emerge and are used, there is a lot of potential for products, that support generation Y interactions.

Based upon literature review and interviews, Liu e.a. defined *generation Y interactions*, which are comprised of six interaction qualities:

- *Instant*: There should be immediate feedback in the interaction.

- *Playful*: The interaction should "organize the user's attention" [39, p. 36] and integrate enjoyable and meaningful aspects.

- *Collaborative*: The experience should be perceived as being shared and supportive, it should connect coworkers.

- *Expressive*: The transport of emotion should be supported, the experience should be "animated and lively" [39, p. 36].

- *Responsive*: The artifact should adapt to the user and more specifically to his or her mental state and emotions.

- *Flexible*: The artifact should be adaptable and afford many possibilities for interaction.

These interaction qualities may be used as design principles, as was done in [38] for the creation of a "generation Y phone".

While it can be seen as "unfair" to uphold the work context to the same standards as the context as home (which is not goal oriented, relaxed and entails different modes of interaction), Liu e.a. still found out that people were missing those interaction qualities in their work context. It may be a lot harder to combine these qualities with other goals of work related software like effectiveness and ease of use, but nonetheless it holds great potential for augmenting the experience at work.

### Integrative Aesthetic Experience

A quite practical model of aesthetic experience is given by Gajendar [20]. In his view beauty is an aesthetic experience and he states that "beauty must evolve toward integrative aesthetic experience" [20]. By *integrative* he means, that beauty must go beyond appearance and that something desirable can only be achieved by an effective interplay of style, performance, utility and story (see below). *Aesthetic* means a product must appeal on all levels: sensually, emotionally and intellectually (in contrast to appealing only to the senses) and includes context, social norms and values as well. Moreover it is argued that addressing the experience is the "central task of designers today" [20] as well as its augmentation.

Gajendar states that consumers today have a "growing aesthetic consciousness" [20], as most products in every price segment are engineered to be beautiful. Designers have to think holistically and try to create a pleasurable and meaningful experience in order to differentiate,

i.e. an integrative aesthetic experience. The model of this experience consists of four elements, that can be found in every product experience:

1. *Style*: Is the look and feel of a product, good style results in higher perceived value. Today style is taken very seriously (f.e. IKEA, a producer of low pricing furniture, puts great effort into styling their products), as it is generally essential for market success.

2. *Performance*: Inlcudes the technical perspective, Gajendar states uptime or responsiveness as examples.

3. *Utility*: Means a product's usability, how it complies to standards, its ease of use, understandability and accessibility.

4. *Story*: A product's story includes the why, the software's purpose. It should show the benefits of using and owning the product and the scenarios of use.

By combining and equally leveling out those elements (i.e. every single one has to be taken into account) a quality engagement in product use can be achieved which may result in "a sense of flow and transparency, satisfaction and joy of use" [20]. However the author warns about the applicability of the framework, complying to and focusing on those elements alone does not guarantee a pleasurable experience.

## Seductive Interaction Design

A quite complete summary on experiential and aesthetic qualities is given by Stephen P. Anderson in his book "Seductive Interaction Design" [2]. In his work he examines several guidelines to involve users in more memorable interactions. The book is very practically oriented and gives many contemporary examples. The derivation of concepts is often based upon design best practices, which presents a new perspective upon the topic in this work which should not be neglected, also because its focus lies exactly in the context of this work as well.

As the author states, he opted for the term "seduction", because it is about understanding what motivates people. When designers know about why users do certain things and avoid others, this knowledge can be used in the design process to create a more meaningful and memorable user experience. In the following paragraphs a selection of the most important aspects and concepts presented in [2] for enabling such meaningful and captivating interactions are discussed.

*Progress dynamic* is a common concept applicable in almost any field. Anderson gives the example of karate, where students gradually proceed in the status system of colored belts, every step of progress being recognized by being given the next belt in line, instead of receiving only the black belt in the end. Progress dynamic is actually a combination of related concepts:

1. *Sequencing*: As in the example above, it is more motivating to have smaller manageable goals and challenges after each other, instead of one big one.

2. *Appropriate Challenges*: As we have heard before with other authors, it is important to match the user's skill with the challenge. The challenge has to be demanding, without creating frustration.

3. *Status*: People "constantly assess how interactions enhance or diminish our standing reltive to others and our personal best" [2, p.3]. Giving feedback on that status is important.

4. *Achievements*: Taking action is more attractive when those actions are recognized. Awarding achievements is one common strategy to do so.

Also sensory appeal is important for engaging users. Vision "is the most direct way to perception" [2, p.8], it allows for stronger reactions and more associations. So whenever an interaction can be represented in a pictorial way, this is preferable. In this context, aesthetics is important as well: it means involving the whole human being and therefore including all the senses. When speaking of aesthetics in interaction, the main concern is the elicited experience of the user: understanding how people respond to stimuli and what affects their emotions and behavior. With regards to aesthetics, Anderson states three primary aspects of interest: cognition, affect and associations, the latter will not be discussed in more detail.

*Cognition* is the process of knowing and understanding. Within a software product, this process shouldn't be demanding, but intuitive and accommodating. Designers use affordances, i.e. properties that communicate the possibilities of interaction, to show users how to interact with a product. Anderson states the importance of keeping those affordances consistent, also with design choices and perhaps used metaphors. To do so, there are already many guidelines to follow with regards to cognition, for example the gestalt laws or color theory, where the purely visual is concerned. A great strategy to use cognition mechanisms is to *stimulate*, in the sense that underlying patterns are not apparent but can be unraveled. The human brain naturally "seeks ways to organize and simplify complex information" [2, p.75], solving puzzles and understanding patterns is a rewarding experience.

With regards to *affect*, Anderson emphasizes the importance of product personality. Other areas of product development, like the car industry, put great effort into creating coherent personalities for their products. A product personality enables the communication of trust and certain expectations, it allows for identification by the user and maybe even anthropomorphization of the software. All those are essential factors for creating memorable interactions. *Fun*, like humorous messages, can also be a very effective strategy here (as long as it matches the personality). The author reminds us of the risks of humor though: It is highly culturally dependent and has to be used carefully, if the user base is not clear or varies.

Another concept presented is *surprise*. Anderson argues, that the unexpected is arousing and that surprise creates interest. Some strategies for surprise include [2, p.63ff]:

1. *Variable rewards*: Rewards are very motivating, but the big challenge is when and how often to give them away. When this happens too often, rewards become expected and the user becomes frustrated, when they are missing. Giving them away too seldom on the other hand presents no real value for the user, as it is essentially the same as receiving no reward at all.

2. *Delighters*: Are small eastereggs in the application that do not interfere with normal inter-action.

3. *Reciprocity*: As Anderson puts it "people feel obligated to repay debts". Gifting users is a great strategy for immersing them in a product. A gift should be "personal", "unexpected", "meaningful" and "pleasantly packed" [2, p.71].

It is important not to take control away from the user when designing for surprise, so as to prevent frustration. Somewhat related to surprise is *contrast*: Although visually connoted, contrast simply means sticking out from a more or less homogeneous whole. Contrast can also be implemented in the interaction, to emphasize certain core aspects.

Another aspect presented is instilling *curiosity*. Anderson argues, that in classical HCI the goal is to reduce uncertainty to a minimum: Labels, user controls, informational displays, etc. are aimed at being as clear as possible. So when usability has been ensured, the question is how to bring some "controlled uncertainty" into the game, to introduce some "thrill" to the interaction [2, p.80]. This can be achieved, when the range of possibilities is known (the uncertainty now only lies in the shape of the obscured instance) or the context is known and limited respectively. Anderson cites Loewenstein's information gap theory [40], who states that "curiosity happens, when we feel a gap in our knowledge", between "what we know and what we want to know". There are some very intriguing implications of Loewenstein's theory: First, the intensity of curiosity corresponds to the likelihood one is able to resolve the gap. Secondly, if more is known about a topic, the higher is the curiosity to complete the picture. An easy intuitive example for the latter is listing all the members of the European union: when you are only missing one state in the end, you would do anything to find out what it is. Strategies to incorporate curiosity in a software product may be to tease with information or to show what could be revealed (should be relevant or useful).

*Self-expression* is important to create engagement as well. As Anderson puts it, "people want to leave their marks" [2] and present themselves, also through products. Software is no exception. On the one side the product should therefore allow for possibilities to make a statement (like comments f.e.), for possibilities to represent the user him- or herself (like avatars) and for possibilities to convey emotion.

Based upon several psychological and social studies, Anderson also presents the concept of *commitment*. For example in an experiment, in which customers were handed out two types of loyalty cards for a car wash, Nunes and Drèze found the so called endowed progress effect [56]. When those loyalty cards are completed by continuous visits, customers were granted a free car wash. Some customers were given cards which had eight stamps to complete on them, others were given cards with ten to complete, but two were already completed. In both cases customers had to complete eight car washs, but customers who had the ten stamp cards completed them significantly more likely and also faster. So the strategy is to involve the user in the interaction, to suggest that he or she is already a part in it.

In any software there are parts or processes, which present a task for the user he or she has to perform - i.e. work that has to completed. In general people are inert and unsympathetic to lengthy tasks. To tackle this issue, Anderson presents the concept of economy and more specif-

ically, suggestion. By providing meaningful defaults and suggesting feasible and personalized preselected options, users can be significantly relieved.

Another chapter is dedicated to *challenges*. In contrast to other authors, Anderson handles the problem of introducing challenges very practically and includes factors to design meaningful challenges instead of just "sugarcoating" [2] the interaction, as so many applications, that try to introduce gamification elements in their interaction, nowadays have done: adding a layer with gaming concepts on top of an otherwise dull interaction, doesn't suffice. Those concepts cannot add anything that isn't already inherent in the interaction, they merely emphasize the playful character. Or as Anderson puts it: "game mechanics can be added, but only to something that people already enjoy" [2]. When designing for challenge, first it has to be clear why the activity is done, for what purpose users do it (Anderson gives the example of time tracking, which people may do for various reasons). Only when this question is answered, the next question may be asked: what can the user get better at. This in turn can then be presented as a challenge (f.e. through status: competing against one's own best). The main point is, that with this approach, a challenge that was inherent in the interaction from the beginning is simply emphasized and presented as such.

*Feedback* is another concept presented and it has already partly been handled in the paragraphs above. People want to see their actions affect their environment - if there is no reaction, what is the point of doing it? Presentation of feedback is important: depending on the application, feedback needs to be prominent or unobtrusive. Popular strategies include putting metrics on user actions or state (like number of followers), scoreboards (feedback on how I perform compared to others), etc.

*Playfulness* is mentioned as well by the author. The basic concepts have already been discussed above: the basic game elements are challenges, feedback loops, rewards and an imaginary world. All but the latter have already been handled. Imaginary world is of course quite limited to the gaming genre, but nevertheless also business software may try to tell a story and convey an identity.

The discussed concepts are only a selection of the most relevant ones presented in [2]. A lot more concepts can be found in the book itself, together with examples and common pitfalls. While some concepts are also present with other authors (like challenge or feedback) other present fresh insights, like commitment or humor. Anderson's work itself presents a very conclusive summary of aesthetic and experiential qualities.

## 2.5 Learning from Games

Playfulness holds great potential for augmenting the user experience. Noyes and Littledale were one of the first to investigate the potential of playfulness in software products, i.e. they showed the positive correlation it has to attitude towards the product [55]. Often the term playfulness is used synonymously with terms like pleasurable or engaging when the appeal of a software's interaction is discussed. A genre that is naturally concerned with maximizing playfulness in it's UI components and the use experience is computer gaming. "Traditional software" can learn a lot from that genre, where a lot of accumulated knowledge concerning the creation of a positive and motivating use experience in a software is already present.

Nevertheless those lessons have to be handled with care. As we heard above, the perceived use experience and the resulting emotions of a usage episode are highly context and situation dependent. What works in a first person shooter doesn't necessarily apply to a mail client. In Hassenzahl's model for user experience (see 2.2) two different usage modes have been discussed: when we are playing a game, we are relaxed and want to be entertained (we are in action mode), when we are handling our mails at work we want that to be fast and efficient (goal mode). Those are very different expectations towards a software.

## A model of playful UI characteristics

An extensive research of existing studies related to playfulness or playful user experience was done by Kuts [34] in order to identify common elements in playful user interfaces and interactions as well as enabling factors for a playful user experience. A total of 32 studies were identified to deal with playfulness and both theoretical and practical approaches were taken into account.

The Synthesis of these studies yielded a list of aspects and characteristics, that are most common throughout the literature and present key leverage in creating playful experiences (here only the most important aspects are listed, for a complete list see [34]):

- Creative Enjoyment
- Challenge
- Curiosity
- Ability to customize UI
- Fun-in-doing
- Exploration
- Feedback
- Fantasy
- Metaphor
- Social Interaction

Based upon those items a model was created (figure 2.5), in which the key aspects were assigned to three aspects of a user interface: interaction, visualization and style and complexity, which is dependent on the first two. The model shows a further distinction of interaction as well: user activity and application/service activity. This distinction will not be further discussed here though, as it has no relevance regarding experiential qualities.

## Reviewing games

Dyck e.a. looked into games in order to find "novel contributions that provide clear benefits to users" [17] and which are also applicable in other domains than the gaming genre. According to the authors, a lot can be learned from games due to the special conditions inherent in the genre.
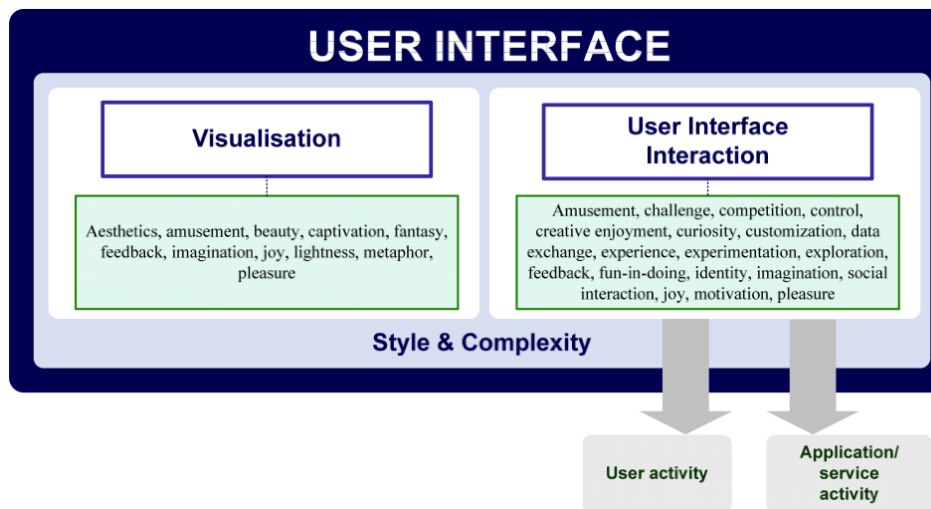
**Figure 2.5:** Playful UI characterisitcs grouped in UI model [34]

Games are purely focused on the user, as a positive use experience is the decisive factor for purchasing a game. This implies also a high degree of innovation, in order to be able to differentiate: innovation is a key success factor. Moreover, games are less constrained by conventions and guidelines, there is much more room for experimentation and creativity without frustrating the end user.

In their work, Dyck e.a. reviewed 14 state of the art games: they were played, discussed in group sessions, observations of others playing were done and also reviews of those game were used as a source of information. In the end, four common concepts were found, that all games possessed and may provide benefits in other genres as well: effortless community, learning by watching, deep customizability and fluid system human interaction.

In all those games there was big community that was easily accessible, often directly through the application itself. The authors call this concept *effortless community*. The community helps to resolve problems and in all cases had a big user base, which resulted in the emergence of subgroups according to specific interests. Other application don't make use of such communities, despite the apparent need: users fall back on third party tools, which in the end scatter discussions and take them out of context.

*Learning by watching* is an integral parts in all games. Users are able to watch others directly in action, all the reviewed game had according functionality built in: players can watch reviews of games of other players exactly from their perspective, other players can be observed in game and their action can be directly reproduced. Learning through observation and imitation is a very effective approach, but broadly unsupported in other software than games.

The reviewed games supported *deep customizability*, "simple but powerful mechanics for adapting the user interface" [17, p.4]. There are three mechanism, that incorporate that customizability:

1. Anything goes malleability: The UI and inputs are designed to be altered by the users. As

games are competitive and focused on performance, players look for advantages wherever they can. Optimizing the user interface according to situation and personal preference has a significant influence on effectiveness. But also the mapping of inputs to functions is supported and easily accessible: keys can be remapped very easily for example.

2. Natural extensibility: The applications can be easily extended and customized through built in functions, like macros.

3. Portable customizations: Configurations can be ex- and imported. This makes it possible to experiment, share and build upon the work of others.

A very important aspect for games is a *fluid system human interaction*. Games are demanding for the user's attention, communicating system messages is therefore a delicate matter. Messages are generally delivered in an integrated, unobtrusive way. They don't need to be acknowledged and don't interrupt the player's flow. Common strategies include sounds for conveying information, transient text which fades out or is superseded by newer messages and subtle animationsv to draw attention. The authors emphasize however, that an important aspect of games is that users are usually not concurrently using other applications, which makes it save to assume that transient messages f.e. are not missed. Another aspect of fluid interaction is that user interfaces of games are often context aware and modify themselves according to the specific situation in order to aid the user.

## Fun Features

The expectations towards computer software are rising, nowadays it is not enough to simply provide functionality, but it has to be fun doing it as well. Shneiderman [65] argues that while early studies of games do exist in the context of educational games for children, the adult world is only slowly catching on. The author states, that in the genre of non-professional software, like web services (f.e. shopping), mobile devices and entertainment electronics, competition is very rough, which only emphasizes the importance of including fun features in order to differentiate.

Shneiderman states three equally important aspects, that contribute to fun-in-doing. First of all, the *right functions* have to be provided. This means creating useful and creative solutions, that include accomplishable goals. Next a software has to be optimized with regards to usability and reliability, so as to prevent any frustration in use. Many guidelines already exist to support that goal. Lastly, a software should include "fun-features" to augment the user experience. He states that they should be added as a bonus, when the rest of the software has been adequately dealt with. Those fun-features are [65]:

1. *Alluring metaphors*: Metaphors make the interface more understandable and help the user in achieving his or her goals. Metaphors here are not restricted to the visual domain: "drag-and-drop" or "click-to-select" may also be seen as widely used metaphors. "When done well these techniques enable users to forget about the interface and concentrate on their tasks" [65, p.50].

2. *Compelling content*: Exceptional writing or photos are a very effective strategy for introducing fun and enabling memorable experiences, however it is hard to achieve for a broad audience and might also be quite tedious to achieve in general.

3. *Attractive graphics*: As with content, there are no real metrics which would guarantee attractive graphics. It is a question of aesthetics and therefore context.

4. *Appealing animations*: Animations are not only superfluous eye candy: they may give valuable feedback or help understanding the interface. When used correctly they may effectively enhance the user experience. Overuse or inadequate use however can distract and frustrate.

5. *Satisfying sounds*: Sounds are a quite effective way to give feedback: They involve an otherwise pretty ignored sensory organ and can help in keeping the interface clean (auditory instead of visual feedback). However, one may never rely on solely auditory channels and sounds should always be toggleable, so as not to frustrate the user.

## 2.6 Conclusion

This chapter has briefly discussed the motivation and concept of interaction aesthetics and experiential qualities. We have heard that usability is a very important and integral aspect to software interaction, but it does not suffice to create memorable and enjoyable experiences. UX and interaction aesthetics want to understand and support such experiences.

Various models and concepts of UX as well as studies performed in this area, show important aspects that should be considered when designing for meaningful experiences. Hassenzahl's model shows the discrepancies between the designer and user's view, hedonic and pragmatic attributes, usage modes and how this all plays together to elicit an appeal towards a product. Morville's Honeycomb and Revang's UX Wheel define facets that contribute to a positive use experience. Blythe argues for pleasurable long-lived experiences instead of short-lived fun experiences. Brandtzæg's model of demands and decision latitude contributed some insights from a work related context. Also the concepts of engagement, enchantment and flow were presented, which show characteristics of an immersing interaction.

Aesthetics in general as well as visual aesthetics are also important in the context of this work. Hekkert derives aesthetic design principles from evolutionary psychology, which also helps in understanding aesthetic viewpoints. Studies of visual aesthetics of websites show how aesthetics is evaluated by the user, assess the status of aesthetics and present aesthetic items via the scales used within the evaluation.

In the field of interaction aesthetics, pragmatist design principles give a good notion of the aesthetic viewpoint and approach. Djajadiningrat's sloganesque points to augment fun and beauty present ideas that aid in designing aesthetic interaction. Löwgren's use qualities are in the exact focus of this work and show many characteristics of an aesthetic interaction. Isbister's Suppleness and Liu's qualities of generation Y interactions add to those characteristics. The process of seduction and the notion of inquisitive use describe a highly engaging way of interaction as well. The models of graceful interaction as well as the model of an integrative aesthetic

experience have their own perspective upon aesthetic experiences and show what it is comprised of from their unique points of view. In the end the work of Anderson and his notion of seductive interaction design completes the picture with a designer's practical perspective.

While it is very risky to draw knowledge from games due to the characteristics of the genre itself, in which products are primarily used for leisure, there is still a lot of potential in it. The work of Kuts, Dyck and Shneiderman tries to capture the essence of what makes games so engaging and to frame these ideas into generalized concepts, that are applicable in other domains as well.

3

# Catalog Creation

In the previous chapter, the study of aesthetics and user experience in various disciplines has been discussed. A lot of concepts and ideas have been presented, that are aimed at augmenting the user experience. In this chapter, those concepts will be summarized, generalized, then compressed and finally refined. The end result is a catalog of the most promising experiential qualities and concepts.

## 3.1 Summary, Selection and Collection of Concepts

In chapter 2 the state of the art has been discussed by presenting a *selection* of concepts: there is no claim of completeness what so ever. The selection of authors and concepts handled in this work represent a broad spectrum of ideas that are relevant to the aesthetic experience of software: they come from the fields of aesthetics itself, visual aesthetics, evolutionary aesthetics, interaction aesthetics, product design, HCI, movement theory, user experience, game design and mechanics and the field of user experience in general. There are no doubt other fields of research, which are relevant to aesthetic software interaction as well, which are not handled here. Also, there is a lot more literature to be found for the fields explicitly handled here that could not be included. Again, the list of concepts presented here is only a subjective selection of the state of research.

Across all disciplines, aesthetic dimensions were found to vary. While there are of course a lot of common concepts which can easily be subsumed and aggregated, some of those concepts were found to be partly contradictory and incompatible, like "familiarity" and "originality". In a first step this section will give an overview on all the collected concepts. A list is available in the appendix (A.4) and includes the unified terms created in the next step (3.2) as well. This list is not entirely complete regarding the extraction of concepts of chapter 2: Some have been left aside beforehand, if they did not add specific value to the list. While duplicates of experiential qualities are not filtered out in this step, duplicates of other aspects, which are only peripherally relevant to experiential qualities, were. Usability guidelines for example are often strongly related to

such qualities and emphasized by various authors in their work, like ergonomic qualities in 2.2. The following sections show what has been selected for every discipline and what has been left aside, with a short justification.

Also, every concept that was added to the list was assigned an experiential quality. In most cases, this relation could be derived from the authors themselves: Löwgren's use qualities f.e. directly represent experiential qualities in our context. In other cases, concepts were presented more in general and the assignment to experiential qualities had to done based on the concept's central statement. When this statement was ambiguous or could not be pinned down to a single term, the concept was added multiple times, each time representing a different experiential quality.

### Concepts of UX

Hassenzahl's model of UX [45, Chapter 3] very effectively describes the most important aspects of UX: Differentiating between intended and apparent character, goal and action mode, the averaging model and the dependencies of appeal (according to the author). Those are all very intriguing aspects that have to be taken into account when designing for a meaningful experience, but they do not represent experiential qualities. Within his model however, Hassenzahl discusses hedonic qualities and more specifically, three categories of hedonic functions: stimulation, identification and evocation. They have been added to the catalog as experiential qualities, with stimulation further broken down into "personal development", "personal growth" and "new ideas, concepts", according to the author's explanation on the subject.

Related to his model of UX are the studies Hassenzahl performed on appeal, hedonic qualities and ergonomic qualities [22] [24]. The scales used in the studies for the evaluation of these three dimensions are carefully chosen and represent qualities that are directly influencing the judgment of a (software) product. As the focus of this work are experiential qualities that go beyond mere usability considerations, only the scales for hedonic qualities and appeal were added to the catalog.

Morville's honeycomb [52] describes the most important facets of user experience. While these facets are rather general, they still were all included to the catalog. As the final catalog itself is expected to be comprised of rather general concepts (as more specific concepts are likely to become aggregated and combined), this shouldn't be contradicting other concepts, as long as Morville's facets aren't granted too much weight: They represent basic considerations for a satisfying user experience and will be handled as such. Revang's UX Wheel [61] is an extension of Morville's model and therefore only concepts, that actually go far enough beyond Morville's ideas and add value and novelty compared to the original model were added to the list of concepts. Revang added contributing factors to the facets, which are very practically oriented and therefore in most cases not applicable in this context. "Browser compatibility" and "typography" for example are no doubt important considerations, but do not represent experiential qualities. In the end, the following seven aspects were added to the list after careful considerations: "colorscheme and contrast", "media use", "graphic elements", "differentiation", "uniqueness", "intuitiveness" and "response time". The first three are visually oriented, but still represent strategies to provide a more significant user experience. Differentiation, uniqueness

and intuitiveness can by themselves be seen as qualities of interaction, as well as response time, when viewed from an experiential angle, instead of a technical.

Differentiating between fun and pleasurable experiences is a most essential distinction. The aim of this work is to provide a catalog of concepts, which when applied enable meaningful, lasting, aesthetic experiences. Providing just a captivating experience for a couple of minutes, solely grabbing the user's attention, a fleeting short lived satisfaction would be on the other side of that spectrum. Blythe e.a. [5] make that distinction, the concepts they provide are strategies and anchor points to provide lasting experiences. In their work, four dimensions are discussed, along which fun and pleasure can be demarcated. Within those dimensions, strategies are provided, to achieve pleasurable experiences instead of fun ones: personal growth, gaining insights and triggered memories for relevance, deviation from expectations and closure for progression, abstraction and complexity for quality perceptions and interest, pattern recognition/obscurity and mastery for commitment. All of those were added to the list of concepts.

The experience of flow [53] [9] is a rather universal concept that is not confined to digital artifacts. But it is an experience that can definitely be classified as an experiential quality. It emerges from a challenging, highly responsive interaction and its antecedents or enabling factors are viewed as relevant concepts in our context. Therefore challenge, clear proximal goals, control and open systems were added to the list of concepts.

The goal of the catalog might also be defined as providing an engaging experience, in the sense of O'Brien e.a. [57]. Their work is based upon aggregation of ideas and concepts of present literature as well as practical studies and is therefore quite important and influential in this context. The authors provide attributes of engagement, which are common aspects found throughout the literature concerned with engagement and aspects that were apparent in their own research. These attributes simply describe aspects that correlate with engagement, whereas the focus of this work is providing strategies and concepts, that may cause or enable engagement. Therefore attributes, which were not found to be such enabling concepts, were not included in the list, leaving the following attributes to be added: interest, attention, awareness, challenge, sensory appeal, aesthetic appeal, interactive, immediate feedback, novelty, variety and perceived control.

Brandtzæg e.a. [7] created a model for enjoyment based upon motivational theories and studies in the work context, with the major columns demands, decision latitude and social support. Within the explanation and arguments of these columns, the authors provide factors to promote enjoyment. The following factors were added to the list of concepts: challenge, variation, surprise and control for demands, skill development, stimulation, rich interaction and personalization for decision latitude and co-activity and social cohesion for social support.

A fresh perspective on providing memorable experiences is given by McCarthy e.a. [51], who in their work view HCI as a media genre and argue in this genre specific context for enchanting experiences. The authors mention five specific concepts which are enabling factors for such an experience, four of which were added to the list. "The transformational character of experience" was not included, as it describes the nature of the experience, which is not relevant here. Moreover, "paradox, openness and ambiguity" was added twice, once in the sense of an open interaction, once in the sense of surprising and challenging the user.

**Aesthetic concepts**

The four aesthetic principles as defined by Hekkert [25] present very promising guidelines for providing memorable experiences, all of them have been added to the list. To be in accordance with other concepts, they were each assigned to experiential qualities, a relation which is not easily made in contrast to the concepts above. "Maximum effect for minimum means" was assigned to the experiential quality "efficiency", "unity in variety" to "detecting patterns". MAYA was added twice, as it represents the correct ratio between familiarity and novelty, the two experiential qualities it was assigned to. "Optimal match" was related to "consistency".

Also the pragmatist design principles by Ross e.a. [63] were added. Here the same problem of assigning those principles to experiential qualities arose, as they are not formulated for that context. Analogous to the aesthetic principles, the pragmatist design principles were assigned to the most fitting experiential qualities. "Practical use next to intrinsic value" strongly relates to "usefulness", "involving the whole human being" represents a holistic, aesthetic view and was related to "holistical". "Satisfying dynamic form" has a very dynamic and responsive character. While "pliability", "expressive", "interactivity" or "adaptability" might have been applicable concepts as well, dynamic form was related to "deep interaction", as it best captures the idea of the nature of the said interaction. The forth principle, "social and ethical dimensions", was not added to the list, as it can not be framed into an independent item and is basically already subsumed under "holistical".

Approximately thirty items on the list of concepts were added from the area of visual aesthetics. Schenkman and Jönsson's [64] seven aesthetic dimensions used for preference analysis were all added, as well as Lavie and Tractinsky's final scales used for assessing aesthetic judgments (this list is quite extensive and can be taken from the appendix A.4). An important difference to note at this point is that those items do not have the same status as other items in the list. These items are merely scales used in (visual) aesthetic judgments, where as the other items in the list represent well defined and thought out concepts for meaningful interactions - this is a huge qualitative difference, not visualized in the list in the appendix. Still those scales have their validity and importance in the context of this work, as the authors put a great deal of work into researching and defining those scales. Also, they represent dimensions of aesthetic judgments, which are important for deriving experiential qualities. In the next steps, the process of compression and refinement, all those consideration have been taken into account.

Djajadiningrat e.a. [15] present ten qualities of product design which may all be seen as experiential qualities, when moved into context. However, two of those qualities were not added to the list: "Don't think beauty in appearance, think beauty in interaction" and "don't think ease of use, think enjoyment of the experience" are essentially the main theme of this work and do not represent contributing concepts for memorable user experiences but rather appeals to focus on doing so. "Don't think products, think experiences" could have been left aside under the same consideration as well, but was added under the experiential quality "holistical", as it argues towards providing the right context for meaningful experiences.

Löwgren's use qualities [43] [42] [44] were all added directly to the list without adaptions or restrictions. They all fit into the catalog perfectly, the term "use quality" may even be seen as a synonym for experiential qualities. Isbister and Höök's concept of suppleness [28] was added in this context as well.

In their model of seduction, Khaslavsky and Shedroff [32] describe how to seduce, i.e. engage or appeal to a user. Concepts discussed in this work try to immerse the user in the interaction, therefore creating memorable experiences. For enticement (the first of step of seduction) those concepts are differentiation, originality, surprise and interest. For relationship (the second step of seduction) they are promises and expectations. All of those were added to the list. The last step of seduction is fulfillment, so closure was added as an experiential quality as well.

Hashim e.a. [21] introduce a fresh perspective to experiential qualities by researching the area of movement theory. The first part of their theory, which is based on Laban theory of effort, was not added to the list, as it only describes characteristics of movement or interaction respectively. Although it is quite interesting to analyze interaction based upon that model, those aspects do not relate to experiential qualities. The second part of their model however, was added to the list. It describes movement qualities, which are applicable to interaction design as well. Those are: rhythm, tempo, sequence (in the sense of order, patterns) and direction.

Inquisitive use is a concept introduced by Dalsgaard [10] that is comprised of three aspects: experience, conflict and inquiry. For each of those aspects, Dalsgaard states design sensibilities, concepts which present enabling factors for the enhanced (inquisitive) use experience. Those design sensibilities are directly related to experiential qualities, and were all added to the list of concepts. ”Experience in practice” describes a continuous explorative interaction and was added under the experiential qualities inquisitive and interactivity. ”Continuous experience” describes the problematic relation between ”familiarity” and ”novelty” (see also Hekkert's MAYA) and was added under those two qualities. ”Distinct experience” means presenting the user impressions that provoke inquisition, i.e. ”novelty” and ”originality”. ”Situated intentionally” was assigned the quite general quality ”interest”, as arousing interest is the main goal of this design sensibility. ”Concurrent action-reflection” describes a state of high ”interactivity, ”reciprocal change”, as described in the work, means ”adaptability” of the digital artifact. ”Challenge”, ”risk” and ”closure” were added under their respective experiential qualities.

Liu's generation Y interaction qualities (instant, playful, collaborative, expressive, responsive, flexible) [39] directly map to experiential qualities in this context, and were all added to list of concepts.

The integrative aesthetic experience by Gajendar [20] is a model comprised of four cornerstones: style, performance, utility, story. Style in this context primarily means visual appeal and extravagance and was added to the list despite its visual orientation, as it includes look an feel as well and goes beyond the purely visual as a concept. Performance in the model is the technical perspective. Concerning experiential qualities, this part is only relevant with regards to responsiveness, under which it was added. Utility in the model is the view on usability. The aspects stated in the model (standard compliance, ease of use, understandability and accessible) were all added to the list, as they represent an integral part of interaction in the model. Story is an essential part in the model and was added as an experiential quality as well.

As Anderson's concepts [2] are partly interrelated (many concepts are used as constituent parts in other concepts) not all of them were added to the list: those already subsumed under others of his concepts have been left aside, except when they presented a whole new concept within the list. Progress dynamic was added with challenge as an experiential quality as it contributes an important strategy for presenting proximal goals to the user. Sensory appeal was

added as well as aesthetics, as those presented an important aspect in the collection of Anderson's concepts. Humor, contrast and commitment were added as they present new concepts. Challenge was subsumed under playfulness, as with Anderson challenges are presented only in the context of playful interactions. The concept of affect was added as personality, as that was the only essential aspect remaining, after comprising aspects subsumed in other concepts had been removed. The rest of the concepts was directly added: surprise, stimulation, curiosity and self-expression.

### Concepts of game mechanics

As Kuts' collection of concepts [34] is already an aggregation of literature review, those concepts are quite general. Those listed in section 2.5 are already a trimmed down selection, two more of those were not added to the list of experiential qualities: "Creative enjoyment" was too elusive as a quality and "fun-in-doing" too general to be added. The rest of the given enumeration (challenge, curiosity, ability to customize UI, exploration, feedback, fantasy, metaphor and social interaction) was added to the list though.

Dyck e.a.'s identified concepts [17] were all included in the list. Although some comprising aspects of the four major concepts may have been relevant as well, they are still subsumed under their respective concept. Moreover, none of them would have introduced additional value (i.e. unique concepts) to the list. This left the four concepts "effortless community", "learning by watching", "deep customizability" and "fluid system-human interaction" to be added.

Five fun concepts are presented by Shneiderman [65] and all of them were directly added as experiential qualities.

## 3.2   Unification and Compression

As the goal of this work is to provide a manageable overview of concepts via a catalog of about fifteen items, the list of selected items, as described in the last section, is now further trimmed down. In the next step a list of "unified" terms is produced, to allow to eliminate duplicates in the list of concepts.

It has to be emphasized at this point, that by the compression and aggregation of concepts as performed in the following steps, a lot of information is lost. All the little details, that may be an integral part of the idea behind a certain concept, have to be left aside to be able to create a comprehensive overview.

### Unified terms

In order to be able to group and classify similar concepts, "unified terms" were introduced. They represent merely a (more or less arbitrary) formulation of ideas, under which synonyms and adequately similar terms can be summarized.

For most of the concepts, those terms are identical to the terms the authors themselves used for describing their ideas. There are however instances, where the relation wasn't as clear and obvious. For every concept added to the list, the respective unified term is given in the table in the appendix A.4.

In order to keep everything clear and simple, unified terms consist only of a single word, with the exception of "visual appeal", where the visual aspect had to be emphasized. While most authors framed their concept in a single word already like "story" in [20], other concepts were articulated as short sentences, like "don't think buttons, think rich actions" in [16] and had to be rephrased into a single word. Here the goal was to preserve the author's original meaning as good as possible.

The selection of unified terms was simply done by eliminating synonyms and adding a layer of abstraction to concepts of visual appeal and usability. Here, concepts were only marginally applicable with regards to interaction, or were believed to only marginally contribute to a more memorable user experience. Those concepts, although very important where the performance and appeal of a software as a whole is concerned, do little to further augment the (aesthetic) user experience and were therefore summarized under the terms "usability" and "visual appeal".

Also, concepts or terms used in the context of aesthetic appeal were summarized under the term "aesthetic". Those include primarily scales and items used by Hassenzahl [22] [24] and Lavie [36] in their studies. While this is a rather broad generalization, the terms that were summarized by it again can only marginally qualify as experiential qualities and were believed to be very unlikely to be applicable in the context of interaction design.

All unified terms are alphabetically listed in the first column of table 3.1.

## Mapping to unified terms

Except for the groups of concepts with only little relevance to experiential qualities (usability, aesthetics and visual appeal, see last section), the goal in this step was to lose as little information as possible, while preserving meaning and keeping the number of unified terms low.

As mentioned before, for most concepts the mapping is self-explanatory, as they directly correspond to unified terms of the same name. The complete listing of mappings can be taken from table A.5 in the appendix. The most important cases of concept where there was no clear mapping based upon semantic identity will be discussed in the following paragraphs.

- *Anticipation* was used as general term for concepts building up suspense. It summarizes other similar concepts like curiosity, promises or expectations.

- *Complexity* includes the term itself, but also the notion of order and Löwgren's concept of functional minimalism [42]. While the latter could have been related to efficiency or elegance as well, complexity best captures the idea of keeping things simple, clear and uncluttered.

- *Depth* was used as a collection for concepts, that describe creative, deep, dynamic, open or ambiguous interactions with many possibilities. Therefore this includes Djajadiningrat's notion of using all the possibilities in interactions ("Don't think buttons, think rich actions" [15]) and also the pragmatist principle of "satisfying dynamic form" [63].

- Löwgren's elegance, defined as power plus simplicity [42], was mapped to *efficiency*, which does not by itself contain this aesthetic ideal, but was believed to adequately subsume elegance.

- *Engagement* at this point was used as an anchor term for other, more fine grained aspects or factors of engagement. "Motivating", "attention" and "awareness" fall under this category. As those terms actually describe more an emotional state than an experiential quality, the reduction here is negligible.

- *Evocation* was used as the summarizing term for evoking positive memories or experiences.

- *Extravagance* summarizes concepts and terms of creating notions of exclusiveness and exceptionality.

- *Holistical* in the sense of involving the whole human being, is actually just some aspect of aesthetics, which by definition involves the whole human being. Therefore it could (and will) be subsumed under that term, but at this point was added as unified term, so as not to lose the information of the more specific idea behind it.

- *Interest* could have been subsumed under engagement as well at this point, but was added as unique term due to its frequent occurrence.

- *Originality* summarizes concepts and terms of novelty, creativeness, differentiation and innovation.

- *Self-actualization* entails terms and concepts of personal growth and development.

- *Stimulation* serves as the unique term for concepts of stimulation through patterns and pattern recognition. It also includes parafunctionality as introduced by Löwgren [42], as that concept's significance and applicability in our context is very low.

## 3.3   Refinement

In this step the list of unique terms was trimmed down to a set of 12 items within two iterations. In each iteration a set of terms was gathered and mapped upon a subset of itself. The whole process is summarized in table 3.1: The unique terms column in every iteration is an alphabetically ordered list of the refined items of the previous iteration without duplicates. For the first iteration the terms column is comprised of all the unique terms gathered from the list of concepts, its creation was discussed in the last section. The refinement columns of each iteration define the new assignment of the respective term in the terms column: If the refined term equals the unique term, then it is taken to the next iteration unaltered. When the refined term is different to the unique term, the term has been subsumed under the respective refined term. The unique terms of iteration three represent the final catalog of experiential qualities. In the following paragraphs a short explanation and justification for assignments and subsumptions is given.

In the first iteration, not all terms were assigned to other concepts and were not included for the next iteration. The ultimate goal of this refinement is to create a catalog of about fifteen concepts, that can easily be applied to a real world scenario: The focus for the selection of concepts lies on expressive and practical aesthetic or experiential qualities that can be used to improve the interaction and in turn augment the whole use experience itself. Concepts that did not fully qualify for those criteria had to eliminated for the following reasons (i.e. items not having a refined term in the first iteration in table 3.1):

- Concepts do not qualify as qualities of interaction: While it is imperative to have meaningfulness and usefulness as qualities of a software product, these characteristics do not really apply to the interaction itself. They are more of prerequisites to an interaction, that may be further optimized through experiential qualities afterwards. Visual appeal and content hold great potential for augmenting the user experience, but are relevant when the focus is narrowed down to interaction. Finally, fascination is more a byproduct of a memorable interaction than a quality which enables it.

- Concepts are not believed to have a significant impact upon interaction or do not add sufficient additional value: Usability is probably the most important aspect of interaction design, but the focus of this work lies within concepts, that go beyond usability. Therefore aspects of usability do not qualify for the catalog. Control was mentioned frequently throughout the literature, but is more related to usability than interaction aesthetics and holds little potential for augmenting the user experience. The same goes for closure. Abstraction and the use of metaphors are also rather techniques for ease of use.

- Concepts are not practically relevant: Evocation may be a powerful technique to augment the user experience, but is hard to achieve and design for. Also it is highly context dependent, while the strived for catalog should be broadly applicable. Introducing risk involves a similar problem: while it may improve the experience, it has the same potential to exacerbate it, especially in the work context. Sounds are out of the focus of the catalog, as their effective application would need more consideration than could be handled within this work.

In both iterations, the scope of some concepts was broadened to include other more fine grained concepts as well.

- *Engagement* was even more generalized to include the following ideas as well: anticipation, commitment, excitement, immersion, inquiry, interest, seduction, stimulation. It became a collective term for concepts that allow to "catch" and maintain the user's interest and will to interact.

- *Identity* encompasses anything that deals with giving a software a notion of personality or certain charisma.

- The elusive concept of flow was subsumed under *challenge*, as this is its most essential constituent. Also "goals" was subsumed there, as being a special kind of challenge.

- *Elegance* now includes the notion of complexity (or simplicity), efficiency, consistency and other aesthetic principles.

- *Sociality* was further broadened, to include the notion of expressiveness as well.

Other minor generalizations were made which are more clear and can be directly taken from table 3.1. The result of this procedure is a catalog of eleven concepts after the second iteration, which is discussed in detail in the next section.

## 3.4 The catalogue

This section describes the end result of the literature review: eleven general concepts which are believed to be most promising for improving the interaction and augmenting the user experience. Each of these concepts, what they are comprised of and what they try to accomplish, is discussed in the following paragraphs.

### Challenge

Introducing challenge to the interaction is a quite common concept and was found across all considered disciplines [2] [7] [9] [10] [34] [36] [53] [57]. Challenging the user creates active involvement and enables personal growth as well, as long as the challenge is accepted of course. Overcoming a challenge creates pleasure. There are two very important aspects that have to taken into account when designing for challenge:

1. There should be *clear goals* and they should be proximal, which means that they should be perceived as attainable in the near future. A goal that is too far away or too vague is not attractive. This also implies, that the path a user has to take in order to achieve that same goal has to be clear as well, the steps to be taken should be clear.

2. During this whole interaction, users have to keep *control* over the situation. That means that goals have to *match* the skills of the user, so that the interaction becomes neither boring nor frustrating. Only when the user feels in control of the situation, he or she may concentrate on attaining the goal and become immersed in the interaction. This is especially important as some challenges may contradict usability considerations, which may be very dangerous.

Challenges may arise from the interaction itself without presenting any further incentives, f.e. through the emergence of flow [9] [53]. An easy way to present challenges to the user however, is for example progress dynamic [2], which transparently shows the next goals and steps to be taken.

Playfulness is closely related to challenges, as challenges are an integral part of any game. Introducing concepts of games to a playful interaction, i.e. to emphasize the playful aspect of an interaction, can create new challenges for a user. Playfulness as a quality of interaction is mentioned for example in [38] [42], but Anderson [2] presents some very practical guidelines on how to include playful aspects:

1. *Status*: Giving the user the information on where he stands compared to others and himself (i.e. scoreboards or showing a personal best) can quickly engage a user.

2. *Metrics*: Other sets of metrics, that involve the user and his or her usage behavior, open new perspectives upon the interaction.

### Depth

Depth in interaction is a concept, that can easily get in conflict with usability. It mainly states that open systems, which leave many interaction possibilities, alternative decisions and possibilities

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for adaption open to the user, are a lot more engaging. If everything is straight forward and can only be performed in one specific way, the interaction becomes boring quite fast. The three cornerstones of a deep interaction found throughout the literature are:

1. *Decision latitude* [7] [9]: Granting the users many alternatives to choose from is stimulating, leaves room for experimentation and exploration and ensures long term motivation.

2. *Customization* [7] [10] [17] [34]: Allows the user to adapt and extend the system, to alter the interaction to a way that is more accommodating for a specific situation. Customization is more or less a standard feature nowadays, but the key for engagement is to have the essential part of the interaction customizable and to make those feature easily accessible and usable. Dyck's notion of "deep customizability" [17] describes this idea very well.

3. *Dynamic and rich interaction* [10] [15] [38] [51] [63]: Djajadiningrat speaks of rich actions to appeal to designers to look beyond well known functions and their representations. Software products have grown and actions performed within them have matured as well, which is often hidden to the user. There is more to the interaction than "save", "undo", "copy", "paste", etc. The interaction should also have potential for the unexpected and new discoveries, in the best case it even allows for different types of interaction according to the (emotional) state of the user.

**Elegance**

Elegance as an experiential quality in our context describes mainly aesthetic principles and the optimal payoffs between otherwise contradicting design principles. It involves the following aspects:

1. *Complexity and Order* [5] [25] [42] [64]: A software is not interesting if it is not complex, yet frustrating if this complexity is overwhelming or not accessible, i.e. not effectively managed through order. To Blythe, complexity is even necessary in order to create a pleasurable experience. Löwgren on the other hand argues for functional minimalism as a design quality. Those two ideas are in no way contradicting, but supplement each other. Functional minimalism means reducing the amount of functions, concentrating on core features - this merely reduces complexity on the interface, not the software itself. Elegance in this regard is about reducing demands on user's cognition while keeping complexity.

2. *Familiarity and Novelty* [10] [25]: Here a very similar problem arises: familiar and known software tends to be boring, while too much novelty may be irritating and frustrating. Hekkert best tackles this problems via his principle MAYA: most advanced, yet acceptable.

3. *Efficiency* [25] [42]: Löwgren speaks of efficiency and elegance, which is defined as "power + simplicity". Hekkert termed this idea "maximum effect for minimal means". An (inter-)action, that allows for great output while at the same time requiring little input, is very engaging.

4. *Transparency* [15] [42]: While most software tries to hide complexity, users can be intrigued and drawn into the interaction, when the underlying systematics of a system are overt.

An aesthetic interaction is much about dealing with the above problems effectively or finding the correct payoff between the contradicting dimensions of the first two items.

## Engagement

While the goal of this catalog itself is to create engagement, engagement as a concept within it describes aspects in the interaction that actively seek to involve the user and grab his or her attention. Engagement includes:

1. *Anticipation* [5] [22] [24] [32] [36] [42] [57]: Anticipation can be achieved by arousing interest or curiosity. By anticipating future events, the interaction becomes relevant and meaningful to the user. Also the whole process of seduction, making promises and playing with expectations, can be seen as a technique to create anticipation.

2. *Inquiry and Exploration* [10] [15] [34] This is closely related to the concept of deep interaction. The whole interaction should allow for possibilities to actively explore a software and its possibilities

3. *Commitment* [2] [5]: Commitment contains engagement. It may be actively created by suggesting that the user is already involved in the interaction.

4. *Stimulation* [2] [5] [7] [9] [21] [25]: This concept is very common among the literature and corresponds to the need of the human brain to search for patterns and to find patterns in basically everything that is perceived. Allowing the user to detect and decipher such patterns and puzzles immerses him or her in the interaction.

## Fluency

A fluent interaction is not only accommodating to the user and helps with regards to usability, but may as well augment the interaction and user experience to a level, where it becomes memorable and inviting. Fluency can be achieved along two dimensions:

1. *Fluent Interaction* [17]: A software should elegantly handle the user's attention and subtly aid him or her in achieving his or her goals. System messages are presented unobtrusively, they are highly responsive and transitions and subtle animations help in focusing the attention to where it is needed, without being intrusive.

2. *Fluent Integration* [44]: A product that is able to "deal gracefully with the demands for our attention" [44, p.11] is integrated fluently. People have to deal with a lot of information simultaneously. A product should try to be dynamic and adaptive to the user's current need of level of information and interaction.

**Identity**

Identity describes the idea of providing a product with personality [2] [22] [24] [36] [52]. This is mainly about being consistent in the characteristics of a software, about painting a consistent picture which a user can relate to. A software for example, that wants to communicate professionality and credibility, should have an accordingly straight and simple design, instead of being playful.

But it also includes the sense of being unique. This follows the notion of Djajadiningrat [15] that products should not fall back to standard components, concepts and metaphors, but to try to be different and expressive on their own. Moreover, a software should allow to be made unique through adaptation, to allow to represent the user's identity [42].

Another aspect of identity is to include and try to tell some story [20]: Where does the product come from, what is it's purpose, how should it be used, ... These are all little aspects, that should be interwoven into the design of a software. Also Löwgren's notion of dramaturgical structure [42] presents a way of introducing story, drama, tension and anticipation.

**Pliability**

Pliability describes primarily a highly responsive, immediate and reciprocal interaction. All the concepts of various authors that were summarized under pliability ( [10] [20] [28] [44] [34] [38] [57]) have a very similar understanding of such an interaction: it is tightly coupled, there is immediate feedback and also flexibility on the system's side. Löwgren speaks of information that appears to become malleable through such an interaction [44].

Giving the interaction a sense of "physicality" also contributes to pliability and makes the interaction more natural and lively. This means giving the user the feeling as though he or she was interacting with a real object, under the same laws that apply to the real world.

**Rhythm**

Rhythm is mentioned in [14] [44] and [21] and in the context of interaction design corresponds to explicitly timing system responses, outputs or other facets of the interaction. In general, people prefer a certain regularity, periodicity or temporal consistency. Designing for rhythmic interaction means accommodating that preference.

**Self-actualization**

Built within every human being is the urge to grow and develop skills. Self-actualization means allowing users to further develop existing skills, to develop new skills, to encounter new ideas and concepts or to gain insights through the interaction. For Hassenzahl [45, Chapter 3], Brandtzæg [7] and Blythe [5] it is this stimulation, that makes an interaction personally meaningful and relevant.

**Sociality**

People are social entities, we prefer to work, act and spend our time with others. Therefore, a software product shouldn't isolate users and accommodate that basic human need. Users should be a part of an integrated community, in which they may interact and collaborate with others [7] [34] [38] [42] and also learn from other users [17]. The interaction can be shared and connects individuals.

Another related aspect is allowing for self-expression. People want to be (socially) recognized, want to share their own opinion and represent themselves within the community [2] [15] [45, Chapter 3] [38]. In that way it should be possible also to express oneself emotionally as accurately as possible.

**Surprise**

Surprise is a common strategy to stimulate the user and catch his or her attention and is mentioned among various authors. There are two aspects to it: surprise in the sense of variation and in the meaning of presenting originality, something new.

Identical experiences become boring over time, so including variation [2] [5] [7] [10] is important to maintain a user's interest. The unexpected is arousing, creates pleasure and should always be part of an interaction.

Trying to stand out, to differentiate, to astonish is the other aspect to surprise. Among aesthetic and hedonic scales [22] [24] [36] items like "exclusive", "innovative" or "original" were used to describe aesthetic experiences or perceptions. Leaving the familiar and going beyond well known conceptualizations [15] [45, Chapter 3] [42] [57] provokes and stimulates, it makes a product unique, new and therefore appealing. Grabbing the user's attention via something extravagant and outstanding draws him into the interaction [51] [61] and is the first step in the seductive process as well [32].

In essence, surprise is always a positive contributor to the user experience, as long as it is not unbalanced (see "MAYA" [25]) and used elegantly.

## 3.5   Conclusion

This chapter has shown how the abundance of concepts presented in chapter 2 was iteratively trimmed down into more manageable sets and in the end refined to elicit a set of eleven concepts that can be applied to improve the user experience.

In the first step a list of concepts was created which contains most of the ideas that were extracted from literature review. A preselection was made at this point, as concepts irrelevant to the research question or concepts with very low potential of being selected for the final catalog were left aside, in order to keep the list shorter. More than two hundred concepts comprise the list.

Next a list of unified terms was created, so that similar concepts could be grouped and classified. Every item in the list of concepts was assigned to a unified term. While this was simple and not restricting for most terms, some concepts which were not mere synonyms of a unified term presented bigger problems during the mapping process. Especially to those concepts the

mapping process eliminated a lot of information and the fine notions of these concepts, which the original terms adequately described, are lost.

After that the terms were iteratively grouped and aggregated, until only a list of eleven terms, the final catalog, remained. The catalog consists of the following concepts: challenge, depth, elegance, engagement, fluency, identity, pliability, rhythm, self-actualization, sociality and surprise.

| Iteration1 | | Iteration 2 | | Iteration 3 |
| --- | --- | --- | --- | --- |
| **Unique Terms** | **Refinement 1** | **Unique terms** | **Refinement 2** | **Unique terms** |
| abstraction | - | adaptability | depth | challenge |
| adaptability | adaptability | aesthetics | aesthetics | depth |
| aesthetics | aesthetics | anticipation | engagement | elegance |
| anticipation | anticipation | challenge | challenge | engagement |
| challenge | challenge | complexity | elegance | fluency |
| closure | - | consistency | elegance | identity |
| commitment | engagement | depth | depth | pliability |
| complexity | complexity | efficiency | elegance | rhythm |
| consistency | consistency | engagement | engagement | self-actualization |
| content | - | extravagance | surprise | sociality |
| control | - | feedback | pliability | surprise |
| credibility | identity | fluency | fluency | |
| curiosity | anticipation | holistical | aesthetics | |
| customization | depth | identity | identity | |
| depth | depth | inquiry | engagement | |
| desirability | identity | interactivity | pliability | |
| efficiency | efficiency | originality | surprise | |
| engagement | engagement | playfulness | challenge | |
| evocation | - | pliability | pliability | |
| excitement | anticipation | rhythm | rhythm | |
| extravagance | extravagance | self-actualization | self-actualization | |
| familiarity | consistency | self-expression | sociality | |
| fantasy | extravagance | sociality | sociality | |
| fascination | - | stimulation | engagement | |
| feedback | feedback | surprise | surprise | |
| flow | challenge | | | |
| fluency | fluency | | | |
| goals | challenge | | | |
| holistical | holistical | | | |
| humor | identity | | | |
| identity | identity | | | |
| immersion | engagement | | | |
| inquiry | inquiry | | | |
| interactivity | interactivity | | | |
| interest | engagement | | | |
| meaningfulness | - | | | |
| originality | originality | | | |
| playfulness | playfulness | | | |
| pliability | pliability | | | |
| reciprocity | depth | | | |
| rhythm | rhythm | | | |
| risk | - | | | |
| seduction | engagement | | | |
| self-actualization | self-actualization | | | |
| self-expression | self-expression | | | |
| sociality | sociality | | | |
| sounds | - | | | |
| stimulation | stimulation | | | |
| story | identity | | | |
| suppleness | pliability | | | |
| surprise | surprise | | | |
| transparency | fluency | | | |
| usability | - | | | |
| usefulness | - | | | |
| variation | surprise | | | |
| visual appeal | - | | | |

**Table 3.1:** Refined concepts/experiential qualities after each iteration of refinement.

CHAPTER 4

# Catalog Application

This chapter will show how the catalog created in the last chapter was applied to an actual software application. First the application itself will be briefly described, its concept, design and features. Then the aesthetic optimizations introduced via the catalog are laid out.

## 4.1  Evaluation subject

The catalog of eleven concepts was applied to an intranet application, that is being developed at Virtual Identity AG. It is a platform for social exchange, collaboration and learning. Its concept, features and the most relevant use cases in the interaction are discussed in the following sections.

### Context and Goals

Virtual Identity (*VI*) [1] is an agency founded in 1995 that develops web-based solutions for the management of brands, corporate communications and marketing communications. They connect brands and businesses with our networked society. There are about 200 employees across the four branches in Berlin, Freiburg im Breisgau, Munich and Vienna. The agency's portfolio of services includes consulting (research, strategy, governance), setup (software development, editorial concepts, design concepts) and management (performance tracking, community management, content production) of digital channels.

The company is characterized by an open culture focused on personal proximity and connectedness. Hierarchies are pretty flat and employees are organized in more or less self-sufficient small teams. Giving and receiving feedback is an integral part of the company's culture, employees are instructed and enticed to explicitly state and express their opinions and emotional states of minds. Learning and growth is the extension of that principle. There are reviews after every project and even at the end of every single meeting, to allow and support the development of every single employee as well as the development of the organization itself.

In order to reduce geographical barriers, promote social exchange and to facilitate learning and collaboration across branches, it was decided that an intranet application should be im-

plemented. At this point informational exchange is handled on a variety of platforms, like an abundance of blogs or other commercial intranet software like "Yammer". Every branch and even subgroups among branches have their own way of communicating among each other. This exchange is to be channeled into a single solution, which should be used across all branches and subgroups.

In a first stage other commercial solutions were tested, but none of them managed to effectively support the most important use cases. The intranet application should reflect the company's culture as well and established business processes have to be supported and covered by the application. As available software solution failed to be compatible to those criteria without major adaptions, it was decided to develop the intranet application in-house.

The most important goals of the application are the following:

1. Having a single platform for announcements. There are many cases, where all or certain groups of employees should be informed about new tidings. For example when there is a new employee joining the company or when the management directors give a report on their monthly meetings. Currently those announcements are made via the respective blogs, employees have to check those blogs regularly in order to stay informed, which most don't feel inclined to do.

2. Allowing social exchange for employees across all branches. Social networking and private communication within the organization is currently done via many platforms, there is no social enterprise software for the whole agency. The new intranet application should support internal communication.

3. Support project collaboration. While there are established tools for issue tracking within projects, there is no established way to effectively collaborate on projects across all project members, especially when the project team is scattered across multiple branches. The intranet solution should facilitate communication and collaboration within projects and also implement and support the company's unique processes that are employed for project management and execution.

4. Support learning and self-actualization. Personal growth and self-actualization are highly esteemed within the organization. The new intranet should be a platform, where employees can engage in stimulating professional discussions and share their own best practices.

**Design and Feature Overview**

There are two major areas in the intranet application. One is the intranet itself with feeds and pages (so called "spaces") for projects, users and news. Figure 4.1 shows a screenshot of the application, where the logged in user has navigated to a project space.

The main parts of the page are visible in figure 4.1 as well:

- Navigational sidebar on the left: It shows all news spaces the user is assigned to at the top and all projects the current user is part of at the bottom. Via the tools section, users can navigate to the best practice application (see below) or start a new project.
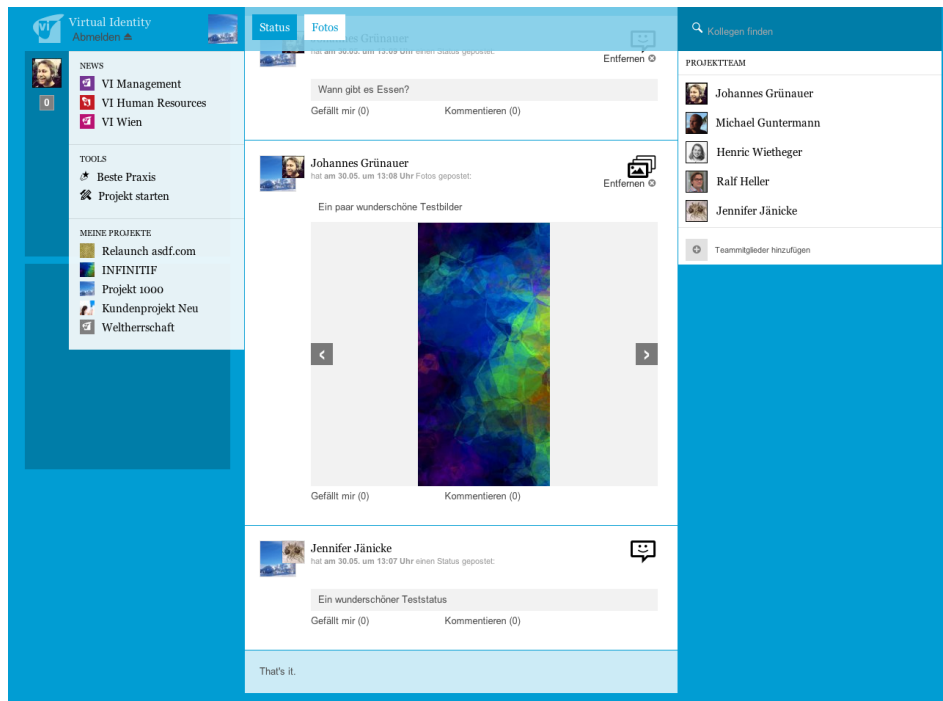
**Figure 4.1:** Screenshot of the intranet application, showing a project space

- Forms and feed in the middle column: Via the forms block users can create new content. In the case of projects (figure 4.1), only statuses and photos can be posted as of now. Other content types are available on the landing space or news spaces. The feed below the form shows all content that has been posted by project members sorted chronologically.

- Space-specific sidebar on the right: Shows additional content according to the currently active space type. For project and news spaces, members of those spaces are shown. For user spaces, additional information about that user is shown.

There are four different kind of spaces, which determine possible actions by the user. A screenshot of every different type is shown in figure 4.2. Every post is done on a specific space, which means that the feed corresponds to all items posted on that space (except for the landing space). Navigation and static header items (logo and user on the left, searchbar on the right) are identical on all pages. The different space types are:

1. *Landing Space*: Is the entry point of the application. Here users see an aggregated feed of all the spaces the user is a member of. Content generated on the landing space is actually assigned to the user's personal space.

2. *Personal User Space*: Every user has his or her own personal page, which is automatically created upon first login. In the sidebar a widget shows some contact information and a short text about the user. Also statistics regarding the user's posts are shown.
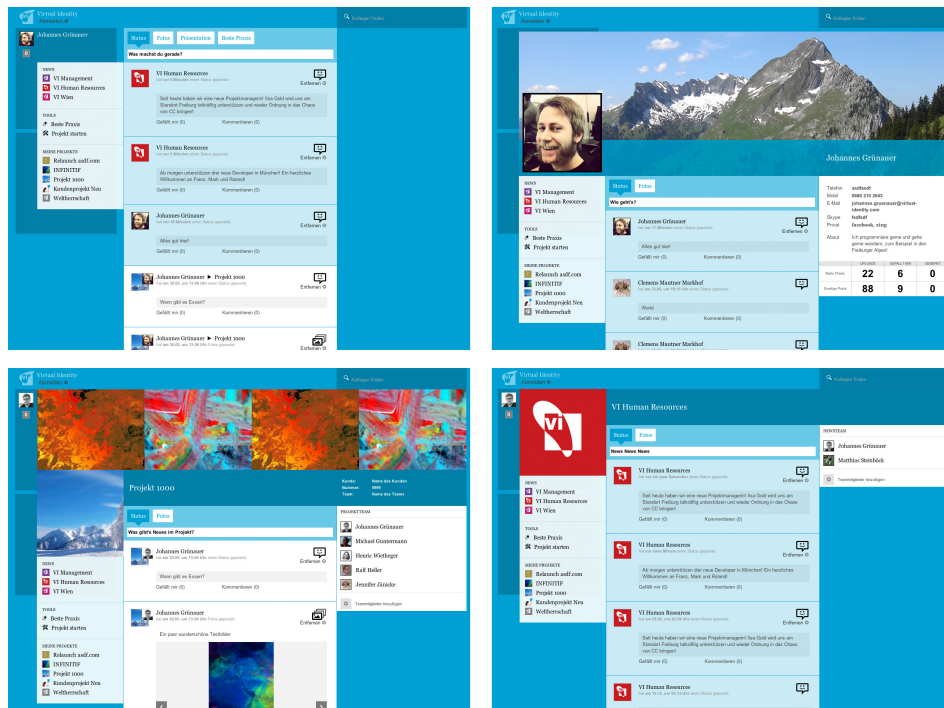
**Figure 4.2:** Screenshots of all space types: landing, user, project, news (left to right)

3. *Project Space*: Every user can create projects, there is no limit as to how many can be created or in which context they have to be used. That way project spaces can be used as personal subgroups for specific interests as well. In every project there is some editable information like project name, team, customer and header images. Users can be added to and removed from projects, an added user has full rights within the project.

4. *News Space*: According to their roles, users are automatically added to news spaces. In its current state, there are news groups for every branch (Vienna, Freiburg, Munich and Berlin) and also global news groups every employee is a member of, like VI Human Resources and VI Management.

Within every space type, different content types, like statuses, photos, presentations, etc. can be created. The various post types will not be handled in detail, except for the best practice type. Employees are encouraged to constantly look for and develop best practices. Most commonly they are derived within project reviews, but there is practically no limit as to what can be posted as a best practice, as long as it fits into the employee's profile of competencies for his or her function. Best practices consist of a title, a description, a meaningful visualization, a mapping to the profile of competencies and optionally additional authors.

The other major area of the software is the best practice application, that can be seen in figure 4.3. This application shows only content of the type best practice. Users can explore the created content in various categories and have them sorted by popularity or novelty. Also a ranking of
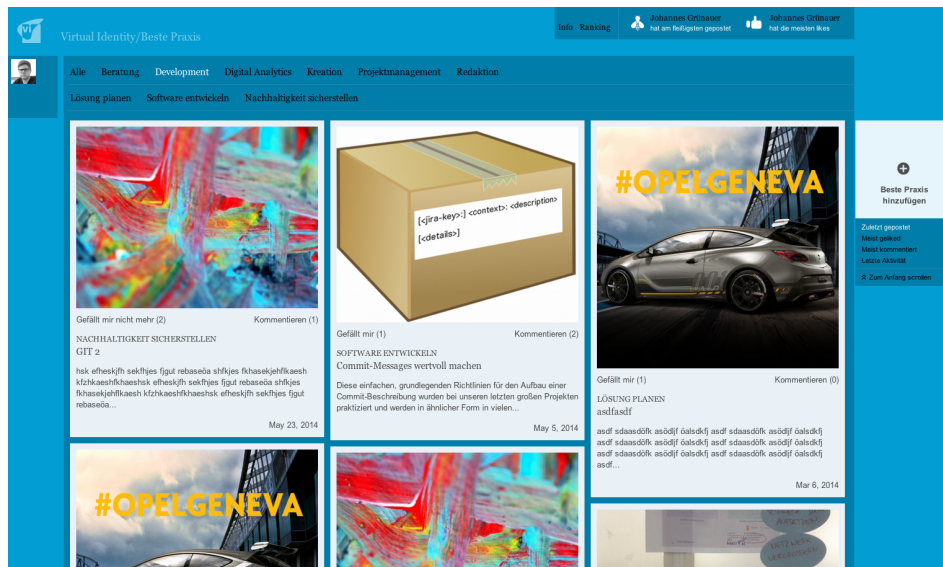
**Figure 4.3:** Screenshot of the best practice application

which posts were liked the most and who posted most of the content, is available here. It is also possible to create a new best practice directly in the best practice application, instead of the main part of the application.

## Most relevant Use Cases

This section describes use cases, which comprise the most essential parts and aspects of the interaction. The use cases cover the software's most relevant features and core functionalities and therefore hold the most potential for aesthetic optimization as well. This list is not complete of course and does not cover all of the possible interactions, but it gives a good idea about how users act within the application in general.

### Creating projects

Via the tools section in the navigation, users can create new projects. When clicked, the user is redirected to a blank project with name "New Project" which is also added to the navigation. The project has exactly one member now, its creator. Within a project, the following parameters may be edited:

- Header images: There are four pictures in the header section that are customizable. They represent goals, approach, resources and success factors (from left to right). The idea is, that during a kick-off meeting, those aspects are defined and documented on flipcharts and then photographed and uploaded to the project header. But there is actually no restriction, arbitrary pictures can be uploaded to the header.

- Profile image: The image shown on the left below the header is the project's profile image, which will also be shown in the feed when something is posted in the project.

- General project information: There are four text fields which can be changed via inline editing by a project member. This includes the project's name, the team realizing it, the project's customer and a project number, which corresponds to an ID that is used in the time tracking tool used throughout the organization.

- Project team: Any project member may add and remove users to and from the project. Users who are added or removed will receive a corresponding notification. Users may also remove themselves from the project, the only way to become member of an existing project is to be added by another user. The permissions system is intentionally very simple: A user who is member of a project has full permissions and may edit and adapt all of the items listed here. The content posted within projects is only visible to project members, users can not see or navigate to projects, which they are not a member of.

**Creating posts**

Posts can be created on any space where the user has the necessary permissions. Depending on the space's type, possible post types and the post's presentation may differ:

- On the landing space, users can post statuses, photos, presentations, best practices, links and questions (the last two are not part of the prototype and are not visible on the screenshots). These posts behave as if they were posted on the user's personal user space. The feed on the landing space shows all content that was posted in projects the user is a member of, in news spaces the user is a member of, or in any personal user spaces.

- In project spaces, users can post statuses, photos, presentations, best practices, minutes (short protocols), links and questions (the last three are not part of the prototype and are not visible on the screenshots). On the landing space, these posts show the project's profile image as well and they have a different background color, so that users can quickly differentiate between work related and private communication. Project feeds show the content posted within the project only.

- On news spaces only news admins may post. In contrast to projects, they can be freely navigated to by all users. Posts which are created on news spaces only show the space's name, not which user created it. On news pages, the same content as on project spaces can be created.

- On user spaces, users can create the same content as on the landing space. The feed shows all content created by the user the space belongs to, minus those posts created in projects the currently logged in user is not a member of.

Posts are created via forms which are shown below the types in the forms block. The shown fields correspond to the specific chosen type. The form for statuses consists only of a text area for example, whereas the photos' form consists of a description and an upload widget. Posts are

created and posted when the form is submitted and successfully validated. All posts can be liked and commented on.

**Adapt own profile**

Adapting your own profile works analogous to creating projects. A user can navigate to his or her personal space by clicking on the profile image in the top left corner. Within a user's own personal space, the following parameters can be edited:

- Header image: The user may customize his or her header image. It will be stretched to fit the page's dimension

- Profile image: The image shown on the left below the header is the user's profile image, which will also be shown in the feed when something is posted by the user.

- Personal information: In the sidebar on the right a box with personal information is shown. Via inline editing, users can change their contact information there and also write some sentences about themselves.

**Browse best practice application**

The best practice application is an integral part of the software. It should allow users to grow and learn from each other. Within the application, best practices are shown as boxes in a three column grid. Those boxes contain the best practice's visual, its category, name and the beginning of its description. By clicking on the box, an overlay is opened which shows all the detail information and where users can comment on and like the best practice item.

Browsing the content is facilitated by the following filters:

- Category filters: When creating a best practice, it has to be assigned to an area of the organization, like "development" or "project management". Within every area, there are again categories which correspond to the profile of competencies of the area's function, like "software implementation" or "solution planning" for development. Then again for every category there are subcategories, like "master technologies" or "developing in teams" for software implementation in development. By clicking on these categories, users can filter the shown items.

- Adaptable sorting: Via a menu to the right, users can change the order of shown items. By default items which were created last are shown first, but it is also possible to sort by "most liked", "most commented" and "last activity".

## 4.2 Catalog application

This section describes how the catalog was used in an attempt to improve the user experience of the application. First a short overview is given on how concepts to be applied were identified and which concepts received more attention than others and why.

**Approach and relevant concepts**

In a workshop possibilities to apply the catalog to the application were discussed. The catalog was printed out and available to both participants, who were already familiar with the concepts provided by the catalog and interaction design in general. While exploring the application bit by bit, every aspect of the interaction was looked upon from the perspectives provided by the catalog. Due to the context of the application itself, some concepts from the catalog received more attention than others.

Sociality for example is already incorporated by the software. It is a corporate social networking software, with the goal to connect individuals. Of course there are many possibilities to further emphasize those social aspects, but those would hardly improve the experience significantly. The good thing about the catalog is that it shows potential for optimization along many dimensions, which helps to identify weak and strong spots in the application. As improving weak spots was believed to show a higher yield with regards to user experience, aspects of sociality were neglected.

The same applies to self-actualization. While it is quite hard to allow for self-actualization in the first place, this concept is already implemented through best practices, where employees can share their own knowledge and browse as well as explore that of others. Little focus was therefore laid on applying self-actualization to the software.

Challenge is a tricky concept as well, especially in a work environment. The concept actually involves other concepts of gaming as well, as providing status and metrics on activities for example. Rankings of that kind were already implemented in the best practice application and on user's personal spaces as well. Although in the end aspects of challenge actually were introduced by aesthetic optimizations, challenge had a low priority in the application of the catalog.

The emphasis was put on concepts that describe certain qualities of the interaction itself and how it should feel, like depth, elegance, fluency, pliability or rhythm. Those concepts can provide a more immersing and interesting interaction and present completely new perspectives, as those aspects have not been considered in earlier phases of design and implementation. On the other side there are the concepts engagement, identity and surprise, which focus more on the software itself, how it represents itself, how it is perceived by the user and how it can be designed to be more interesting and appealing. Here again, it was not explicitly considered before on how to incorporate these aspects within the software.

**Applied concepts**

The following paragraphs describe the end results of the workshop, the catalog application and in turn the implementation of the applied concepts as well. While there were a lot more ideas discussed, the ideas presented here are all those which were deemed applicable and were selected for implementation.

**VI commands**

Via a specific syntax, special functionality can be triggered when entering statuses. The syntax is as follows: "*vi:command parameters". A screenshot of when the color palette is changed via

**Figure 4.4:** Screenshot of VI commands in status.

the corresponding command is shown in figure 4.4. Within the prototype, two commands are supported:

- *color* to change the color palette. Currently there are 8 different color schemes supported: aubergine, basil, blueberry, chili, dijon, ice, peach and plum.

- *deleteSpace* to delete a project space. There is no other possibility other than vi commands to delete a previously created project.

These commands should create engagement through curiosity, stimulation and surprise, as parameters and commands can easily be guessed. The idea is to include many more eastereggs and possibilities than the above mentioned two.

**Rhythmic site composition**

The software is implemented as a single site application, which means that there are no complete page reloads, but that only parts of the page are replaced when the URL changes within the application.

As some parts of the requested resources take longer to load than others, site composition can become quite erratic. More and more content loads over time and changes sizes and positions of boxes, which produces a quite unsettling feeling. This behavior was altered, so that location changes within the application become more orchestrated.

Upon changing location, the profile image will fade out and move to the left. 120 milliseconds later, the space header begins to fade out and move up, another 120 milliseconds later the right sidebar begins to fade out and move to the right. The navigation sidebar and the static bar at the top of the page are static and remain unchanged. The new content will then fade in and move in from the direction the old content moved out to.

This behavior was termed rhythmic site composition. By using very small time differences between the starts of the animations and using short duration for the animations itself, the interaction still feels immediate. As the fade out of current content and the fade in of new content are

completely decoupled, these animations don't interfere with loading times. The focus was put on reducing perturbation and trying to make these transition as smooth as possible.

**Form fluency**

The interaction with forms is maybe the most important aspect of the whole application. Employees should post frequently in order to make the software a success and ensure dissemination throughout all branches. This interaction has to be inviting and graceful, therefore forms were optimized with regards to fluency:

- The order of form fields when the tab key is used was adapted, so that the upload widgets come last.

- Rather than going for consistency, forms comprised of only a textarea (like post type status) can be submitted via the enter key.

- Select inputs of the best practice form were optimized. Three selections of categories have to be made via dropdowns in the best practice form, as shown in figure 4.5: area, category and subcategory have to be chosen, the choices for category and subcategory depend on their predecessor. When choosing an area or category, the subsequent dropdown automatically shows, which saves the user two superfluous clicks necessary with standard select inputs to show the choices. Choosing the three categories becomes very fast and fluent by that approach.

**Best practice pliability**

Another very important interaction is that within the best practice application. Employees should browse through best practices with pleasure and they should do it regularly. Only by seeing and discussing the content that others produced can personal growth and possibilities to learn be achieved.

Therefore the browsing of best practices in the application was improved. Whenever users change categories, the items animate accordingly. As can be seen in figure 4.3, there are various categories for best practices and they are arranged horizontally for each level of hierarchy: areas are in the first row, categories in the second row and subcategories in the third row of navigation. Figure 4.3 only shows the available areas and the three categories of "Development". All category changes on the same level of hierarchy are therefore horizontal and either left or right to the currently active category. Changing the category from "Development" to "Digital Analytics" for example, would be a change to the right. The currently active items would then animate out of the viewport to the left and the new items would come into the viewport from the right. When a vertical change is performed (changing into a upper or sub-category) items animate up or down. Also items that belong to the subcategory don't move out of the viewport, but remain there, as the selection still applies to them. When changing into an upper category, items always remain in the viewport.

This approach gives the interaction a sense of physicality, pliability and immediacy. Also this pattern provides some potential for stimulation, as detecting that pattern might not be trivial.

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**Figure 4.5:** Screenshot of the optimized best practice form

**Message identity**

Supplying a software with a notion of personality and identity is hard and risky, as it is never clear how the audience will react to it. The same goes for humor, which can quickly become offending depending on context and culture. These risks are however mitigated in our context, as the audience is limited and well known.

All status messages by the system were altered and randomized. They were sketched to be humorous and entertaining, to reflect a jaunty and open interaction not only within the software itself, but also within the organization. Take the following two loading messages for example:

- "Please wait, it was late yesterday..."

- "One moment, still working on my ZAFR..."

The first example reflects the company's culture, where colleagues like to go for a beer after work and share their leisure time. The other shows how internal processes and habits can be played with. Before a meeting, employees are required to prepare a ZAFR, which stands for goals (**Z**iele), tasks (**A**ufgaben), functions (**F**unktionen), resources (**R**essourcen). When done thoroughly this can take some time, as reflected in the message.

**Figure 4.6:** Screenshot of additional facts shown when entering a status

Those messages are randomized and only shown with a certain possibility. There are still standard loading messages like "Loading, please wait..." and they are shown most frequently. This ensures surprise and also prolongs the effectiveness of the measure. Otherwise, messages would have to be changed more frequently.

**Status engagement**

As mentioned before, frequent content updates are essential for the software's success. In order to incentivize and motivate users to create more content more regularly, some small metrics or facts regarding the posting behavior are included with statuses, which can be seen in figure 4.6. This is a small piece of additional information that appears when users have started typing. Those metrics include:

- Number of total posts in a given duration, by the user or by all users in total

- The last activity within the application.

- The own activity compared to others, like posts per day.

These little insights create engagement and challenge, they show the user's personal status compared to others in an unobtrusive way.

**Minor improvements**

Other minor improvements were introduced to the application, primarily with regards to engagement and fluency. Those include some animations and transitions and some keyboard interactions not worth mentioning. Primarily they are used to surprise and to include some "eye candy" in the application.

## 4.3 Conclusion

This chapter has discussed, how an intranet application was optimized with regards to interaction aesthetics and experiential qualities. The software is to be used as a platform for social

exchange, collaboration, learning and self-actualization. This basically means that all corporate communication, including private networking, project coordination and all sorts of announcement from various departments and sub divisions, is handled via that platform. Supplementary to the main part of the software where all these informational feeds come together, a best practice application allows employees to browse and explore the collective knowledge of their coworkers.

Next to other minor improvements introduced to the software's prototype, there are six improvements which could be derived through the use of the catalog, in order to augment the user experience:

1. VI Commands, which allows users access to additional features not represented in the user interface.

2. Rhythmic site (de-)composition, which orchestrates timings and animations of content that leaves and enters the viewport, when users navigate to different spaces.

3. Form fluency, which optimizes the interaction with various forms to be as graceful as possible.

4. Best practice pliability, which enhances the explorative interaction in the best practice app and gives it a more interesting touch and a notion of physicality.

5. Message identity randomizes the system's status messages and includes engaging messages that are tuned to the company's culture.

6. Status engagement includes small facts and metrics in the status form, to engage and motivate the user.

The next chapter will show the evaluation of those optimizations, more specifically if and how they were noticed by end users.

CHAPTER 5

# Evaluation

This chapter describes how the software and the optimizations introduced in the last chapter have been evaluated. The goal of the evaluation is to disclose the effects of those optimizations, the grade to which they are noticed and if they have a positive or negative effect on the user experience.

## 5.1   Approach

This section will handle the approach for the evaluation, how it was executed in general and why this specific approach was chosen.

### Prototype Evaluation

As mentioned before, the intranet application was not completely finished at the time the aesthetic changes were introduced via the catalog. Some features were still missing, but nonetheless the prototype was far advanced. It was tested and optimized with regards to usability before it was analyzed via the catalog.

All test users used the application twice. The first time was done with the current state of development. Also dummy content was created, so that users would feel as though they would interact with an actually rolled out software. For that purpose profiles of about ten actual employees were created, their personal spaces were customized and a set of about 50 content items was created, including posts of various users, likes, comments and posts on news spaces. A snapshot of this state of content was saved, so that all users would interact with the same state of the software.

From the test users' perspective, every evaluation started with joining the network. With their login, they were first time users to the application. Therefore their personal spaces were filled with default content, they were members of the assigned default news spaces but no news space admins. Also they were naturally not members of any project.

The second evaluation was done with a branch of development, that was created on basis of the snapshot of the first evaluation. In this branch only changes with regards to interaction aesthetics were added. No new features, no design updates or other upgrades of any kind were introduced, with two exceptions: Aesthetic enhancements as described in the last chapter were added as well as feedback by the users themselves regarding usability feedback. That way users would have two clean prototypes to evaluate: One without and one with optimizations of interaction. For the second evaluation, the content state of the first evaluation was restored.

## Open Interviews

For each test user, two interviews were conducted. The prototypes which were presented to the users each time were described in the last section. The first interview served the purpose of familiarizing the users with the software, so that in the second evaluation they wouldn't be distracted by the means of interaction itself. Also this allowed users to have two states which are comparable. Approximately three weeks were between the first and the second interview, which allowed to introduce the necessary changes to the prototype and also to temper the impressions of the first evaluation.

Each interview was conducted in an open manner. They were done in a meeting room where monitor, mouse and keyboard were set up. Each interview was conducted in the presence of a researcher who tried to be as little invasive as possible. Users were asked to login and then to do whatever they want within the application. All users were asked to verbosely comment on their own actions, feelings and thoughts. The researcher's role was to clarify ambiguous statements and to remind test users to comment their actions. Also directions were given, whenever users didn't know what to do next. All the major use cases as described in section 4.1 had to be completed during the interview.

At the end, when all use cases were completed and the test users themselves didn't feel inclined to use the software any more, they were asked to give an overall judgment of the software. An interview lasted for about 30 to 45 minutes each.

## Qualitative Analysis

In total 3 test users were interviewed, which means there were 6 interviews in total. Instead of a quantitative approach of evaluation, a qualitative approach was chosen, as it allows deeper and better interpretation of the users' experiences. Some additions of the catalog are quite subtle, a quantitative approach would not have supported an in-depth analysis of the users' statements.

The test users were taken from different areas of the organization: there was one developer, one project manager and one designer. Each of them adds a new perspective not only to the interaction itself, but also regarding the attitude towards the intranet application. All the interviews were recorded and transcribed. The transcribed content was taken as a basis for text analysis, which is described in the next section in detail.

## 5.2   Text Analysis

The analysis of the recorded interviews was done via content analysis as described by Mayring [48] [49]. Mayring distinguishes three kinds of qualitative content analysis: *summarizing analysis* for reducing the material with the goal of preserving the core statements, *explaining analysis* with the goal of gathering additional material that helps explaining and interpreting parts of the source material and *structural analysis* which tries to filter certain aspects of the material, reorganizing the material under a certain aspect or categorizing the material. The latter is the approach followed in this evaluation.

### Structural Analysis

Mayring states four kinds of structural analysis: formal, content, typifying and scaling [48] [49]. For all types, the basic approach is the same though. Here a combination of content and scaling analysis was applied. The approach in this work is based on Mayring's approach of inductive creation and deductive application of categories [48] [47] and was only very slightly adapted and simplified:

1. *Define research question*: The research question and the goal of the analysis have to be clearly defined.

2. *Define unit of analysis*: First it has to be clear what will be analyzed and what the actual material is, on which the subsequent analysis will be performed.

3. *Definition of structuring dimension*: The analysis is based on building a system of categories, which is iteratively refined. Before starting the first run on the material, the basic dimensions for structuring have to be defined deductively. These first categories are derived from the research question and should be created with regards to supporting the interpretation of results in the end. With subsequent iterations, the categories may also be refined inductively, based on the material itself.

4. *Definition of coding guidelines*: In order to ensure inter- and intra-coder reliability (i.e. the material will be classified in the same way when different persons classify it or the same person classifies it multiple times) a set of guidelines is maintained, which explains which parts of the material are assigned to categories and which aren't.

5. *Material run*: Based upon the current set of categories and coding guidelines, the relevant parts of the material are extracted and assigned to categories (=*coding*)

6. *(Optional) Refinement*: The categories are iteratively refined until they represent a meaningful and coordinated whole. When there are ambiguities or missing assignments, categories and guidelines have to be revised and the process starts at 3. again.

7. *Processing of results*: All coding instances can now be further refined, organized and analyzed.

This general approach was implemented in the following way in the process of evaluating the intranet application:

1. *Research question*: Did the aesthetic optimizations have a direct impact on the user experience?

2. *Unit of analysis*: The three transcribed interviews of the second evaluation. The first three interviews can not contribute to the research question.

3. *Structuring dimension*: In the first iteration the categories were defined as follows:

   - Six categories corresponding to the six introduced aesthetic improvements.
   - A category for other minor improvements.
   - Direct comparisons between the two prototypes.
   - User states a change, where in fact nothing changed.
   - User states no change, where in fact an optimization was introduced.
   - Overall judgments of the software.
   - General judgments of goodness regarding other functionality than that optimized.

4. *Definition of coding guidelines*: The coding guidelines for the first run were simply to add all statements which represent a judgment of goodness or an emotional declaration that can be assigned to one of the categories. The final coding guidelines are handled in detail in the next section 5.2.

5. *Material run*: -

6. *(Optional) Refinement*: -

7. *Processing of results*: All coded instances were paraphrased to allow for the elimination of duplicates and to be able to put the various text parts into context. Also five emotional scales were defined: very negative, negative, neutral, positive, very positive. Every coded instance was assigned an item on that scale, to see if optimizations were assessed positively or negatively. The results were then quantitatively analyzed, details are given in section 5.3: results.

The final coding guidelines together with a short explanation are the subject of the next section.

## Coding Guidelines

The guidelines for the first run were quite general and there were many coded instances not relevant to the research question. Therefore the coding guidelines were iteratively refined until the application of the following rules elicited a set of coding items directly relevant to the research question:

1. Include all judgments, that can be mapped to (interaction) aesthetics.

2. Include all statements that compare the software to its previous state.

3. Include all overall judgments of the software.

4. All instances need to represent a judgment of goodness, attitude, beauty or appeal or represent an emotional statement.

5. Purely visual feedback is irrelevant.

6. Include only judgments of the intranet application itself (exclude f.e. login screen)

7. Statements regarding general effectiveness of features are irrelevant (f.e. "it worked fine")

8. Statements referring to changes in functionality and/or the input given by the user in the first usage episode, are irrelevant.

9. Judgments originating from software failures should not be regarded (i.e. positive judgments due to features now performing as expected or negative judgments for features now suddenly not performing as expected)

10. Statements originating from the limitations of the software in its current state (f.e. complaints about missing features) are irrelevant

11. Statements originating from limitations of the user (i.e. complaints about missing permissions) are irrelevant

The first seven items dictate what kind of statements should generally be added. Statements which are purely visual judgments or don't directly refer to the intranet application, are not relevant. Because the user experience is evaluated only judgments from which an attitude or emotional state can be derived are relevant.

Guidelines 8 and 9 exclude all judgments which falsely originate from a comparison between usage episodes. As some of the feedback given in the first interview was implemented until the second interview, many statements positively referred to these adaptions. These adaptions however were not part of the catalog application and are therefore irrelevant. Also a prototype was used for evaluation, therefore there were still some minor software failures in the first and second evaluation. Those judgments - however crucial - do not refer to aesthetic optimizations either.

The last two guidelines exclude statements that originate from the evaluation setup. As only a prototype was available at that time for evaluation, all statement concerning the prototype's unfinished state were not relevant regarding the catalog application. Also all test users were given the same basic permissions within the software - complaints about missing permissions are also irrelevant to the research question.

## Final Categories

Together with the coding guidelines, the category system was iteratively refined. In the end nine categories emerged: 7 for the various optimizations introduced through the catalog application, one for experienced changes and one for overall judgments regarding the software. The final categories together with their anchor examples and the paraphrased anchor examples can be taken from table 5.1.

| ID | Category | Anchor Example |
|---|---|---|
| C1 | Experienced changes, where in fact there aren't any changes | Aha, dann ändert er das hier unten auch gleich ab. Ja das ist schön. *(paraphrased: The project's name is updated in the navigation in real time, that's nice.)* |
| C2 | Commands in Status | Das Projekt muss ich löschen? Ja das mach ich nicht. Das ist für mich kein User Interface. *(paraphrased: Using a command language in statuses to trigger functionality is unpractical and not user friendly)* |
| C3 | Rhythmic site (de-)composition | Es ist sehr fancy, also der Anspruch vom Seitenaufbau und so (...) *(paraphrased: The site (de-)composition animations are impressive)* |
| C4 | Form fluency | Aber ich finde es schön dass die sich automatisch aufpoppen. Das ist auch nett, dass man nicht noch extra reingehen muss. *(paraphrased: I like that dropdowns automatically pop up, when i choose a category)* |
| C5 | Best practice pliability | Ja ich finde ja diese Animation immer noch witzig (...) *(paraphrased: The animations in the best practice application are quite impressive)* |
| C6 | Message identity | Feedende, Zeit für ein Review (lacht). Großartig *(paraphrased: I like the system's status messages)* |
| C7 | Status engagement | Aha, das wird dein dritter Status heute, nein insgesamt. Ok. Ist das wichtig? *(paraphrased: I don't see the relevance of the infotext next to the status)* |
| C8 | Other improvements | Ah, die neigen sich. Schön. *(paraphrased: I like the animations of the foto galery.)* |
| C9 | Overall judgements | Da wird viel Zeit in unnötige Sachen investiert (lacht). *(paraphrased: A great effort is invested into non-essential aspects of the software)* |

**Table 5.1:** Final categories of content analysis with anchor examples

For two categories additional coding guidelines were defined to allow unambiguous assign-

ments:

1. **C1:** If it is a reference to an aesthetic optimization, it belongs there (categories C2-C8)

2. **C3:** Include all direct correspondences, even if they do not convey emotional meaning.

When compared to the initial categories it is quite clear that many categories were excluded with continuing iterations. Most of these reductions were motivated inductively, as the material didn't sufficiently support some categories. But there were also categories which in the end did not add value regarding the research question and were therefore excluded.

## 5.3   Results

In the final material run, 94 text passages were coded, within cases (i.e. interviewees) there were 22 duplicates of paraphrased statements. Duplicates were not included in the analysis of results, as they mainly represent repetition of statements rather than reinforcements. Moreover, the results are not altered significantly, when duplicates are allowed. Figure 5.1 shows the mean evaluated appeal across all cases for each category.

C1 and C8 have the best evaluated values of appeal. These categories include all the smaller improvements and only perceived improvements. This can be explained by a heightened awareness of users towards the smaller details of the interaction. By introducing big noticeable improvements, users look for improvements elsewhere as well, these improvements seem to have side effects all over the implication. Also the small delighters were generally better evaluated than the other more extravagant adaptions. They are not so controversial, but still positively add to the user experience. Smaller improvements could therefore present a safer strategy for optimization.



| Categories | |
|---|---|
| C1 | Experienced changes, that in fact didn't change |
| C2 | Commands in Status |
| C3 | Rhythmic site (de-)composition |
| C4 | Form fluency |
| C5 | Best practice pliability |
| C6 | Message identity |
| C7 | Status engagement |
| C8 | Other improvements |
| C9 | Overall judgements |

| Scales of Appeal | |
|---|---|
| -2 | Very negative |
| -1 | Negative |
| 0 | Neutral |
| 1 | Positive |
| 2 | Very positive |
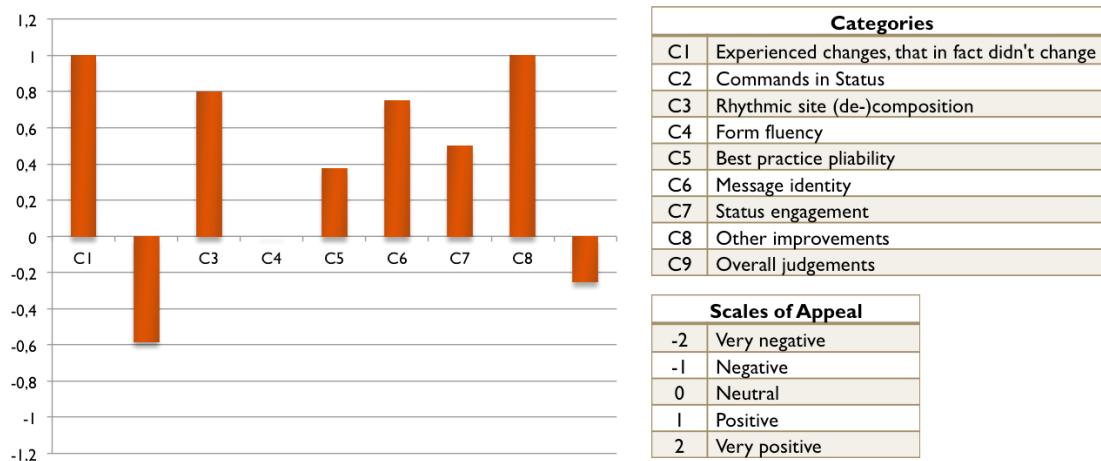
**Figure 5.1:** Results of the evaluation: Evaluation of appeal per category.

The commands were generally evaluated negatively. As stated by all users themselves as well, this concept interferes with usability and standard functionality is made inaccessible. Instead of engaging the users, the commands actually frustrated them and the concept was termed "not user friendly". Although users did enjoy experimenting with the commands and possibilities of color palettes for a brief period of time, frustration always prevailed.

Rhythmic site composition was evaluated very positively. For all users there was a wow effect, it was immediately noticed. Users felt stimulated, aroused and invited to further explore the application. While very positive feedback was given on this concept, this effect did not last forever and the originally quite passionate statements were mitigated in the overall evaluation of the software.

Form fluency was evaluated neutrally in the end. While introduced optimizations were noticed immediately and evaluated positively in two cases, one test user became frustrated as some of the concepts interfered with standard form functionality. Keyboard interaction was not supported in the usual way, which weighed in very negatively and in the end practically negated the invested effort. Here more time should have been invested to optimize keyboard interactions as well.

While two users did not understand the pattern behind the best practice pliability, it was still positively evaluated and described as interesting, as users wanted to understand the underlying patterns.

Message identity was also noticed by all users and evaluated very positively. Again this implementation represents a rather small delighter, but still had a very positive impact. Of course the question remains, how users will react to those messages with continued use.

Status engagement was also positively noticed. While some liked the statistics, other simply evaluated them as being unimportant. As this concept was implemented in a very unobtrusive way, the potential for frustration with continued use is very little, as those messages can easily be ignored.

Although in total the improvements should result in a positive appeal of the software, the opposite is the case. Most likely this is due to the fact, that with optimizing certain aspects of the software and investing resources in details, general expectations towards the software rise. So as soon as there are small issues, these weigh in more heavily than before. Moreover the optimizations are not as present at the end of the usage episode any more, but experienced insufficiencies are still prominent in memory.

## 5.4 Conclusion

This chapter has discussed how the improvements to the intranet application as introduced through the application of the catalog, were perceived by end users and what effects they had on the interaction and the user experience.

Two interviews were conducted with about three weeks between them, one before and one after the optimizations. This allowed users to be able to compare their usage episodes and also to already be acquainted with the software in the second interview.

Interviews were recorded, transcribed and evaluated using Mayring's technique of content analysis [48] [47] [49]. It is an iterative process where categories of analysis as well as guide-

lines, which describe which parts of the material will be used for analysis, are refined with every material run. In the end nine categories emerged: 7 for the various optimizations introduced through the catalog application, one for experienced changes and one for overall judgments regarding the software. Every relevant statement was also assigned a value of appeal, to see if the optimizations are perceived positively or negatively. The mean values of those appeals were then calculated for each category.

The evaluation showed, that minor improvements are generally perceived positively. They are uncontroversial and negative feedback is more unlikely than with bigger adaptions. The bigger optimizations however create a "wow-effect", which is highly engaging and draws users into the interaction. In general most optimizations were perceived positively, when viewed upon separately. There some exceptions however: vi commands and form fluency. Here the optimizations interfered with usability and users quickly became frustrated.

Also the optimization created a heightened awareness towards quality of interaction and quality of the software in general. As the evaluation was done with a prototype, there were still small imperfections present. While these were not a big problem in the first evaluation, they were evaluated very negatively in the second evaluation. It seems that as more effort is put into optimizing the interaction, the expectations towards the software in general rise.
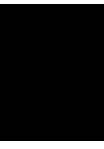
CHAPTER 6

# Conclusion

This chapter will give a brief summary on this work as a whole, then critically reflect on the results discussed in the last chapter and finally give an overview on open research questions and future work originating from the results.

## 6.1 Summary

This work has shown how a catalog of experiential qualities has been created that can be applied to software solutions in order to augment the user experience. This catalog was tested on an intranet application and its effectiveness was evaluated, showing that the adaptions introduced by the catalog were positively noticed by end users, but also had some quite drastic side effects.

First a catalog of those experiential qualities had to be created. Experiential qualities in this context mean characteristics and qualities, which define the user experience and potentially make it more engaging, meaningful and memorable. This approach therefore goes beyond the traditional perspective of usability, which is mainly concerned with error free and efficient use, and tries to look upon usage episodes more holistically.

Other fields of studies which are particularly interesting with regards to the creation of that catalog are user experience (UX), aesthetics, interaction aesthetics and concepts of game design. In order to find experiential qualities, various models, approaches and concepts of those areas have been extensively discussed at the beginning of this work. Concepts of UX range from simple models focused on applicability, like Morville's Honeycomb [52] or Revang's UX Wheel [61], which define facets that contribute to a positive use experience, to more complete models of user experience, like that of Hassenzahl [45, Chapter 3], which shows how pragmatic and hedonic attributes play together in creating a software's appeal. But also models that originate from more creative areas like the work environment [7] have been discussed, together with more complex concepts like engagement [57], enchantment [51] or flow [53] [9]. Also aesthetic principles derived from evolutionary psychology [25] and scales used in the study of visual aesthetics [64] [36] have been considered. Concepts of interactions aesthetics have the greatest

relevance concerning the research question. Pragmatist design principles [63], the process of seduction [32] and inquisitive use [10] are compelling concepts to augment the use experience as well as the models for a graceful interaction [21] or the model of an integrative aesthetic experience [20]. Qualities and concepts described by Anderson [2], Isbister [28], Liu [39] and most importantly Löwgren [42] [44] contribute greatly to the goal of this work, as those authors describe experiential qualities directly relevant to the catalog. Also the work of Kuts [34], Dyck [17] and Shneiderman [65] was analyzed, as those authors try to capture the common denominator of what makes games so engaging and to frame these ideas into generalized concepts, that are applicable to other domains as well.

This literature review elicited a list of more than two hundred concepts, which can be termed as experiential qualities. Out of this extensive list a catalog of eleven concepts was iteratively created. First the list was trimmed down to concepts only directly relevant to the research question and to concepts applicable as qualities in the interaction. Next a list of unified terms was created, based on which similar concepts could be grouped and classified. These unified terms were then iteratively aggregated until finally eleven concepts remained: the final catalog. It consists of the concepts challenge, depth, elegance, engagement, fluency, identity, pliability, rhythm, self-actualization, sociality and surprise.

This catalog was used in the attempt to augment the user experience of an intranet application currently in development. The object of the catalog application is a platform for social exchange, collaboration, learning and self-actualization which means that all corporate communication, including private networking, project coordination and all sorts of announcements from various departments and sub divisions, are handled via that platform. Through the application of the catalog, six major improvements to the interaction and the user experience were derived:

1. A hidden command language, which allows users access to additional features not represented in the user interface.

2. An orchestrated site (de-)composition, through which parts of the page rhythmically fade in and out.

3. A fluent interaction with forms.

4. An enhanced interaction for browsing specific content items, which emphasizes the explorative use and provides the interaction with a notion of malleability and physicality.

5. Varied randomized system status messages, formulated to be humorous and to reflect the company's unique culture.

6. A small informational text that appears when creating content, which includes some metrics on the user's activity and the activity within the platform in order to engage and motivate the user towards becoming more active.

Also some minor improvements were introduced, which mainly enhanced transitions and added some state of the art animations.

These adaptions, their effect on the user experience and how they are perceived in general, were evaluated in open interviews with three employees from different teams of the organization.

Within these interviews users were asked to freely browse the application and to comment on their actions and thoughts. Tasks were only suggested, if users didn't know what to do next. The interviews were recorded, transcribed and analyzed using Mayring's methods of content analysis [48] [47] [49]. In an iterative process categories and guidelines, that define which parts of the material are relevant and to which category they have to be assigned, were defined and revised. The nine final categories are comprised of seven categories for the various optimizations introduced through the catalog application, one for experienced changes and one for overall judgments regarding the software. Every statement added to a category was also assigned a value of appeal on a five point scale, from very negative to very positive.

The analysis of those values revealed, that in general the introduced adaptions were perceived positively, when considered individually. Especially minor improvements are evaluated very positively, as negative feedback is less likely due to their unobtrusive and discreet implementation. On the other hand bigger improvements proved to be captivating, grab users' attention and incentivate users to further explore the software. However there were two concepts, vi commands and form fluency, which were evaluated negatively and neutrally respectively. Those concepts partially interfered with usability and led to frustration. The general appeal of the software was also evaluated negatively, most likely because smaller flaws are weighed more severely when other aspects of the interaction are highly advanced and optimized.

## 6.2   Reflection & Interpretation

The application of the catalog of experiential qualities proved to be very effective. Throughout the interviews, users showed more interest in the software and felt more inclined to interact with it. Also, the interaction itself seemed to be more vivid and relaxed compared to the first usage episode. The catalog succeeded in creating a more interesting and stimulating interaction. This is not only supported by the observations of the researcher present in the interviews, but also by the fact that the second interviews, in which the same use cases were completed for a second time, lasted longer for all participants by ten to twenty minutes. While in the end the final concepts of the catalog may be quite general, they still give a good basis for inspiration and offer primary directions for improvement.

However, some improvements were quite resource intensive. To realize the rhythmic site composition for example, the whole DOM of the application had to be restructured. There were also a lot of side effects and special cases, that had to be considered. While in the end this concept reached the desired outcome, this came at great cost as many days had to be invested to have these quite complex animations work in all browsers and in all special cases as well. On the other side there were concepts like status identity, which were implemented quite easily and don't present much of a technical challenge. These concepts were noticed as well and created a considerable impact on the user experience, which suggests that already small and less resource intensive adaptions are worth introducing to the application. This may be especially interesting for projects in which resources are scarce.

Also some aspects of the literature regarding usability could be reproduced. Hassenzahl [22] [24] speaks of an "averaging model", in which hedonic qualities and ergonomic qualities compensate each other in the overall evaluation of appeal. Also many authors introduced the concept

of challenge, but always emphasized the importance of giving users a feeling of control in the interaction when applying it. This means that also in challenging situations, users should know what to do and how to do it, the challenge may not arise from trying to understand how to interact, but rather from the interaction itself. So whenever experiential qualities are introduced, it is important not to negate concepts of usability and if doing so, a good balance has to be found. The concept of commands in statuses did definitely not find that balance. Users complained about its user-unfriendliness and in one case a user even refused to use the commands, as he termed them to be "no way interact with a software". Standard functionality like deleting a project should not be hidden in a secret command language, but be easily accessible. The same goes for the customization of the color palette: users liked the feature itself, but became instantly frustrated by having to use a command language to be able to access it. Form fluency had a similar problem. While it was positively evaluated by two users, one user was used to interact with forms using the keyboard, an interaction that wasn't fully supported by the adapted select inputs. The fastest and most fluent interaction for that user would have been the standard form fields that were replaced. It is important that when replacing standard components, to either introduce a completely new way of interaction or to be "backwards compatible" with standard interaction when standard components are simply enhanced and still remind of their original counterparts, which was done here. All the effort put into optimizing form fluency was basically negated by failing to support standard functionality. So the learnings of the two not positively evaluated concepts are that aesthetic adaptions may not contradict usability where standard functionality is concerned and that each adaption has to be carefully evaluated as to how it may influence usability.

As was mentioned before, smaller and less visible improvements were as positively evaluated as big improvements. All adaptions were noticed by all test users, no matter how big or extravagant the improvements were. However, only more lavish concepts like rhythmic site composition created a certain "wow-effect", which stimulated users and enticed them to further explore the software. It may even be, that smaller improvements have only been noticed because the bigger more noticeable ones heightened the attention. However, the smaller improvements proved to be less controversial and there was practically no negative feedback. This may be because smaller aspects can more easily be ignored, in case they are not so appealing. In general, smaller improvements therefore present a "safer bet", they improve the experience without risking negative evaluation with some users. On the other hand big improvements hold the power to grab the user's attention and to engage him or her in an interaction, he or she may never have participated in otherwise.

Throughout the interaction, users seemed to have a heightened awareness towards aspects of interaction. Compared to the first usage episode, users were more attentive and observant, every little detail was noticed. Introducing aesthetic optimizations to the interaction seems to stimulate users also in a way that makes them mindful of all aspects of the software. This is generally a very positive thing, as efforts invested in the frontend pay off: users noticed elements they had not been noticed in the first usage episode and saw improvements, where actually none existed. But it also has severe implications regarding negative aspects: little flaws and the smallest inadequacies are instantly noticed, and more negatively evaluated than within an interaction of lesser quality. This means that an aesthetic interaction needs flawless usability

and complete absence of errors.

## 6.3   Future Work

Experiential qualities hold the power to greatly improve the user experience and through the application of the catalog created in this work, a positive effect on the experience was achieved. However, this is just a single case of the catalog's application. The question remains, if its effectiveness prevails when applied by different persons. Here the catalog was applied by experts who were very familiar with the concepts aggregated within the catalog, which suggests that a lot of implicit knowledge was used in the application as well. It is unclear, if people less familiar with concepts of interaction design would have been able to achieve the same results. Moreover the catalog was applied to a single software product in a specific context. Its application to other software products in various genres would be of interest as well, especially which concepts of the catalog create the most effect depending on the genre.

A very important aspect that remains unconsidered in this work is the effect of the introduced adaptions with continued use. Many optimizations created the before mentioned "wow-effect", but even within a single usage episode, users mitigated their own excitement from the beginning, stating there is a little too much of visual extravagance. It might be possible, that the positive evaluations actually change into negative evaluations over time, as users become more acquainted and weary of the adaptions.

Another big issue in the evaluation was how users perceived some of the optimizations as being disruptive to performance. One example are loading times, which were criticized by all test users. Loading times were actually more or less identical in both usage episodes, but only in the second interviews they were negatively noticed. This may be due to the before mentioned rising expectations towards the software. But still one of the goals of rhythmic site composition was to mask loading times, therefore latencies should not have manifested so strongly within users' perceptions. However the opposite was the case and users stated that they believed that the animations interfered with loading times, as the delayed fade in of the content suggests that requesting the necessary resources was delayed as well, which was not the case. Therefore the question, of how animations and transitions can be designed without giving the end user the impression of negative performance impacts, would be worth investigating.

# Appendix

## A.1    Attributes of engagement

Overview of attributes of engagement and their relevance in other theories.

| Attributes from the theories | Flow theory | Aesthetic theory | Play theory | Information interaction | Attribute of engagement? |
|---|---|---|---|---|---|
| Aesthetics | | x | x | | Yes |
| Affective appeal | | x | x | x | Yes |
| Attention | x | x | | | Maybe |
| Challenge | x | x | x | x | Yes |
| Feedback | x | | x | x | Yes |
| Goal-directed | x | | x | | Maybe |
| Meaningfulness | x | x | | | Maybe |
| Motivation | x | x | x | | Yes |
| Perceived control | x | | | x | Maybe |
| Sensory appeal | | x | x | | Yes |

**Table A.1:** Attributes of flow, aesthetic, play, and information interaction theories, and proposed relevancy to engagement [57]

## A.2   Hedonic Qualities

Scales used by Hassenzahl e.a. [22] [24] for evaluating a product's ergonomic and hedonic qualities and overall appeal.

| Scale Item | Anchors | |
|---|---|---|
| EQ 1 | Comprehensible | Incomprehensible |
| EQ 2 | Supporting | Obstructing |
| EQ 3 | Simple | Complex |
| EQ 4 | Predictable | Unpredictable |
| EQ 5 | Clear | Confusing |
| EQ 6 | Trustworthy | Shady |
| EQ 7 | Controllable | Uncontrollable |
| EQ 8 | Familiar | Strange |
| HQ 1 | Interesting | Boring |
| HQ 2 | Costly | Cheap |
| HQ 3 | Exciting | Dull |
| HQ 4 | Exclusive | Standard |
| HQ 5 | Impressive | Nondescript |
| HQ 6 | Original | Ordinary |
| HQ 7 | Innovative | Conservative |
| APPEAL 1 | Pleasant | Unpleasant |
| APPEAL 2 | Good | Bad |
| APPEAL 3 | Aesthetic | Unaesthetic |
| APPEAL 4 | Inviting | Rejecting |
| APPEAL 5 | Attractive | Unattractive |
| APPEAL 6 | Sympathetic | Unsympathetic |
| APPEAL 7 | Motivating | Discouraging |
| APPEAL 8 | Desirable | Undesirable |

**Table A.2:** Scales used to evaluate ergonomic qualities (EQ), hedonic qualities (HQ) and appeal.

## A.3 Graceful Interaction

The following two tables are taken from [21] and present aspects of interaction derived from Laban movement theory.

| | | |
|---|---|---|
| **Space**: attention to the surroundings | **Indirect**: flexible, meandering, wandering, multifocus<br><br>**Examples**: waving away bugs, slashing through plant growth | **Direct**: single focus, channeled, undeviating<br><br>**Examples**: pointing to a particular spot, threading a needle |
| **Weight**: sense of the impact of one's movement | **Light**: buoyant, delicate, easily overcoming gravity, marked by decreasing pressure<br><br>**Examples**: dabbing paint on a canvas, describing the movement of a feather | **Strong**: powerful, having an impact, increasing pressure into the movement<br><br>**Examples**: punching, pushing a heavy object, expressing a firmly held opinion |
| **Time**: lack or sense of urgency | **Sustained**: lingering, leisurely, indulging in time<br><br>**Examples**: stretching to yawn, stroking a pet | **Sudden**: hurried, urgent<br><br>**Examples**: swatting a fly, grabbing a child from the path of danger |
| **Flow**: attitude towards bodily tension and control | **Free**: uncontrolled, abandoned, unable to stop in the course of the movement<br><br>**Examples**: waving wildly, shaking off water | **Bound**: controlled, restrained, able to stop<br><br>**Examples**: moving in slow motion, tai chi, carefully carrying a cup of hot liquid |

**Table A.3:** Motion Factors and Effort Elements, taken from [21]

| Quality | Characteristic |
|---|---|
| Rhythm (balance the uniformity and diversity) | Calm-dynamic |
| Tempo (attention) | Faster/quick – narrow, small, thin object<br>Slower – larger, wider, thicker object |
| Sequence (expectations) | Cause-effect<br>Ordered pattern of events |
| Direction (attention) | Upward – positive associations, an increase in magnitude<br>Downward – negative associations<br>Right - forward<br>Left – reversal |

**Table A.4:** Formal Movement Qualities, taken from [21]

## A.4 All Concepts

Table A.5 shows all concepts extracted from literature, with their respective authors. Column 2 describes the context in which the concepts are presented, Column 4 "Strategy/Concept/Aspect" states the concept in the words of the author, while columns 3 and 5 show the experiential quality and the unified term, the concept was mapped to.

| Author | Theme / Goal / Outcome | Experiential Quality | Strategy / Concept / Aspect | Unified Term |
|---|---|---|---|---|
| Hassenzahl | Categories of Hedonic Functions | stimulation | personal development | self-actualization |
| | | stimulation | personal growth | self-actualization |
| | | stimulation | new ideas, concepts | originality |
| | | identification | self-fulfillment | self-expression |
| | | evocation | memories | evocation |
| | Scales for Hedonic Qualities | interesting | interesting | interest |
| | | costly | costly | extravagance |
| | | exciting | exciting | excitement |
| | | exclusive | exclusive | extravagance |
| | | impressive | impressive | extravagance |
| | | original | original | originality |
| | | innovative | innovative | originality |
| | Scales for Appeal | pleasant | pleasant | aesthetics |
| | | good | good | aesthetics |
| | | aesthetic | aesthetic | aesthetics |
| | | inviting | inviting | curiosity |
| | | attractive | attractive | visual appeal |
| | | sympathetic | sympathetic | visual appeal |
| | | motivating | motivating | engagement |
| | | desirable | desirable | desirability |

| Author | Theme / Goal / Outcome | Experiential Quality | Strategy / Concept / Aspect | Unified Term |
|---|---|---|---|---|
| Morville | Facets of User Experiences | useful | useful | usefulness |
| | | usable | usable | usability |
| | | desirable | desirable | desirability |
| | | findable | findable | usability |
| | | accessible | accessible | usability |
| | | credible | credible | credibility |
| | | valueable | valueable | usefulness |
| Revang | UX Wheel | desirable | colorscheme and contrast | visual appeal |
| | | desirable | media use | visual appeal |
| | | desirable | graphic elements | visual appeal |
| | | useful | differentiation | originality |
| | | useful | uniqueness | originality |
| | | usable | intuitiveness | usability |
| | | accessible | response time | usability |
| Blythe | Pleasurable vs. Fun Experiences | relevance | personal growth | self-actualization |
| | | relevance | gaining insights | self-actualization |
| | | relevance | triggered memories | evocation |
| | | relevance | anticipation | anticipation |
| | | progression | deviation from expectations | surprise |
| | | progression | closure | closure |
| | | quality perceptions | abstraction | abstraction |
| | | quality perceptions | complexity | complexity |
| | | commitment | interest | interest |
| | | commitment | pattern recognition / obscurity | stimulation |
| | | commitment | mastery | self-actualization |
| Csikszentmihalyi | Experience of Flow | challenge | challenge | challenge |
| | | clear goals | clear proximal goals | goals |
| | | control | control | control |
| | | open system | open system | depth |
| | | flow | flow | flow |
| O'Brien | Experience of Engagement | focus | interest | interest |
| | | focus | attention | engagement |
| | | focus | awareness | engagement |
| | | challenge | challenge | challenge |
| | | appeal | sensory appeal | visual appeal |
| | | appeal | aesthetic appeal | aesthetics |
| | | interactivity | interactive | interactivity |
| | | interactivity | immediate feedback | feedback |
| | | novelty | novelty | originality |
| | | novelty | variety | originality |
| | | control | perceived control | control |

| Author | Theme / Goal / Outcome | Experiential Quality | Strategy / Concept / Aspect | Unified Term |
|---|---|---|---|---|
| Brandtzæg | Factors of Enjoyment | challenge | challenge | challenge |
| | | variation | variation | variation |
| | | variation | surprise | surprise |
| | | challenge | control | control |
| | | decision latitude | skill development | self-actualization |
| | | decision latitude | stimulation | stimulation |
| | | decision latitude | rich interaction | depth |
| | | decision latitude | personalization | customization |
| | | social support | co-activity | sociality |
| | | social support | social cohesion | sociality |
| McCarthy | Design sensibilities | original | specific sensuousness of each particular thing | originality |
| | | holistical | the whole person, with desires, feelings, anxieties | holistical |
| | | control | sense of being in play | control |
| | | deep interaction | paradox, openness, ambiguity | depth |
| | | surprise | paradox, openness, ambiguity | surprise |
| Hekkert | Aesthetic principles | efficiency | maximum effect for minimum means | efficiency |
| | | detecting patterns | unity in variety | stimulation |
| | | novelty | most advanced, yet acceptable | originality |
| | | familiarity | most advanced, yet acceptable | familiarity |
| | | consistency | optimal match | consistency |
| Schenkmann | Aesthetic Scales for Evaluation | complexity | complexity | complexity |
| | | legibility | legibility | visual appeal |
| | | order | order | complexity |
| | | beauty | beauty | aesthetics |
| | | meaningfulness | meaningfulness | meaningfulness |
| | | comprehension | comprehension | usability |

| Author | Theme / Goal / Outcome | Experiential Quality | Strategy / Concept / Aspect | Unified Term |
|---|---|---|---|---|
| Lavie | Aesthetic Items | admirable | admirable | desirability |
| | | original | original | originality |
| | | clean | clean | usability |
| | | pleasing | pleasing | |
| | | sophisticated | sophisticated | extravagance |
| | | breathtaking | breathtaking | extravagance |
| | | clear | clear | usability |
| | | fascinating | fascinating | fascination |
| | | organized | organized | usability |
| | | creative | creative | originality |
| | | enjoyable | enjoyable | |
| | | uses special effects | uses special effects | extravagance |
| | | beautiful | beautiful | aesthetics |
| | | artistic | artistic | aesthetics |
| | | skilfully designed | skilfully designed | visual appeal |
| | | colorful | colorful | visual appeal |
| | | energetic | energetic | visual appeal |
| | | modern | modern | originality |
| | | pleasant | pleasant | visual appeal |
| | | professional | professional | visual appeal |
| | | includes pictures | includes pictures | visual appeal |
| | | symmetrical | symmetrical | aesthetics |
| | | challenge | challenge | challenge |
| | | intriguing | intriguing | interest |
| | | aesthetic | aesthetic | aesthetics |
| Ross | Design Principles | useful | practical use next to intrinsic value | usefulness |
| | | deep interaction | satisfying dynamic form | depth |
| | | holistical | involving the whole human being | holistical |
| Djajadiningrat | Ten Rules to Augment Fun and Beauty | holistical | don't think product, think experience | holistical |
| | | deep interaction | don't think buttons, think rich actions | depth |
| | | identity | don't think labels, think expressiveness and identity | identity |
| | | identity | metaphor sucks | identity |
| | | transparency | don't hide, don't represent. Show | transparency |
| | | surprise | don't think affordances, think irresistibles | surprise |

| Author | Theme / Goal / Outcome | Experiential Quality | Strategy / Concept / Aspect | Unified Term |
|---|---|---|---|---|
| | | expressive | hit me, touch me, and i know how you feel | self-expression |
| | | inquisitive | don't think thinking, just do doing | inquiry |
| Löwgren | Use Qualities | surprise | surprise | surprise |
| | | parafunctionality | parafunctionality | stimulation |
| | | anticipation | anticipation | anticipation |
| | | seduction | seduction | seduction |
| | | playability | playability | playfulness |
| | | engagement | engagement | engagement |
| | | relevance | relevance | usefulness |
| | | useful | useful | usefulness |
| | | immersion | immersion | immersion |
| | | fluency | fluency | fluency |
| | | pliability | pliability | pliability |
| | | identity | identity | identity |
| | | social actability | social actability | sociality |
| | | functional minimalism | functional minimalism | complexity |
| | | efficiency | efficiency | efficiency |
| | | elegance | elegance | efficiency |
| | | transparency | transparency | transparency |
| | | dramaturgical structure | dramaturgical structure | story |
| | | rhythm | rhythm | rhythm |
| Isbister | Use Qualities | suppleness | suppleness | suppleness |
| Khaslavsky | Seduction | enticement | differentiation | originality |
| | | enticement | original | originality |
| | | enticement | surprise | surprise |
| | | enticement | interest | interest |
| | | relationship | promises | anticipation |
| | | relationship | expectations | anticipation |
| | | fulfillment | closure | closure |
| Hashim | Movement Qualities | rhythm | rhythm | rhythm |
| | | tempo | tempo | rhythm |
| | | patterns | sequence | stimulation |
| | | sequence | direction | stimulation |

| Author | Theme / Goal / Outcome | Experiential Quality | Strategy / Concept / Aspect | Unified Term |
|---|---|---|---|---|
| Dalsgaard | Design Sensitivities: Experience | inquisitive | experience in practice | inquiry |
| | | interactivity | experience in practice | interactivity |
| | | novelty | continuous experience | originality |
| | | familiarity | continuous experience | familiarity |
| | | novelty | distinct experience | originality |
| | | original | distinct experience | originality |
| | Design Sensitivities: Inquiry | interest | situated intentionally | interest |
| | | interactivity | concurrent action-reflection | interactivity |
| | | adaptability | reciprocal change | reciprocity |
| | Design sensitivities: Conflict | challenge | challenge | challenge |
| | | risk | risk | risk |
| | | closure | resolution | closure |
| Liu | Generation Y Interaction Qualities | instant | instant | feedback |
| | | playful | playful | playfulness |
| | | collaborative | collaborative | sociality |
| | | expressive | expressive | self-expression |
| | | responsive | responsive | depth |
| | | flexible | flexible | adaptability |
| Gajendar | Integrative Aesthetic Experience | holistical | aesthetic | holistical |
| | | style | style | visual appeal |
| | | responsive | performance | feedback |
| | | standard compliance | utility | usability |
| | | ease of use | utility | usability |
| | | understandability | utility | usability |
| | | accessible | utility | usability |
| | | story | story | story |
| Anderson | Creating Playful, Fun and Effective User Experiences | challenge | progress dynamic | challenge |
| | | sensory appeal | sensory appeal | visual appeal |
| | | aesthetic | aesthetic | aesthetics |
| | | identity | personality | identity |
| | | humor | humor | humor |
| | | surprise | surprise | surprise |
| | | stimulation | stimulation | stimulation |
| | | curiosity | curiosity | anticipation |
| | | self-expression | self-expression | self-expression |
| | | playful | playful | playfulness |
| | | commitment | commitment | commitment |
| | | contrast | contrast | extravagance |

| Author | Theme / Goal / Outcome | Experiential Quality | Strategy / Concept / Aspect | Unified Term |
|---|---|---|---|---|
| Kuts | Aspects for Promoting Playful Experiences | challenge | challenge | challenge |
| | | curiosity | curiosity | anticipation |
| | | adaptability | ability to customize UI | customization |
| | | fun-in-doing | fun-in-doing | interactivity |
| | | exploration | exploration | inquiry |
| | | fantasy | fantasy | fantasy |
| | | metaphor | metaphor | abstraction |
| | | social interaction | social interaction | sociality |
| Dyck | Contributors to Positive User Experience | effortless community | effortless community | sociality |
| | | learning by watching | learning by watching | sociality |
| | | deep customizability | deep customizability | customization |
| | | fluid system-human interaction | fluid system-human interaction | fluency |
| Shneiderman | Fun Features | alluring metaphors | alluring metaphors | abstraction |
| | | compelling content | compelling content | content |
| | | attractive graphics | attractive graphics | visual appeal |
| | | appealing animations | appealing animations | visual appeal |
| | | satisfying sounds | satisfying sounds | sounds |

**Table A.5:** All concepts extracted from literature with mapped qualities and unified terms

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