

Tallinn University  
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# The Evaluation of User Interface Aesthetics

Master Thesis

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## Author's Declaration

I declare that, apart from work whose authors are clearly acknowledged, this document is the result of my own and original work.

This work has not and is not being submitted for any other comparable academic degree.

Thesis has been supervised by PhD Rui Torres (University Fernando Pessoa, Porto, Portugal) and PhD David Lamas (Tallinn University, Estonia).

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# **Abstract**

This thesis studies the possibility of applying evaluation methods for visual aesthetics of user interfaces.

The work focuses on the analysis of evaluation methods for visual aesthetics of user interfaces. Some subjective methods are analysed in detail and the possibility of the use of objective methods next to subjective ones is studied. Furthermore, connections between the two types are searched for. To reach these goals, literature review, user questionnaires, user observation, interpretive analysis, and correlation study were used.

The purpose of the study is to find applicable evaluation methods for visual aesthetics and analyse their application.

The results indicate the absence of reliable objective evaluation methods and shortcomings of proposed subjective methods. As a result of the analysis, suggestions for improving and applying existing methods are proposed.

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# Chapter 1

## Introduction

“Beautiful things do work better,” claim Tractinsky, Katz and Ikar (2000) summarizing a research concerning the usability of applications with different levels of visual aesthetics. How can the level of interface beauty be measured in order to develop better working applications? This thesis studies the role of visual aesthetics within user experience. It aims to collect the knowledge and existing evaluation methods for measuring and evaluating visual aesthetics, analyse them and propose a development of a combined method.

Within product and application development process, different procedures have become standards while others are still forming. Functionality and usability are measured and tested upon both during and after the development process, while the effect and quality of visual design has not been specifically concentrated on. Several recent studies (Tractinsky, Katz & Ikar, 2000; Mahlke, Lemke & Thüring, 2007; Lindgaard, Dudek, Sen, Sumegi & Noonan, 2011; Papachristos & Avouris, 2011; Strebe, 2011) reveal strong effect of first impressions (visual stimuli) about the product to the overall judgements and user satisfaction. These results indicate the possible need for more detailed design decisions and consideration of applying evaluation methods for design proposals.

Birkhoff (1933) introduced as early as in 1933 objectively measurable aesthetics of objects. His measures of complexity, symmetry, balance, and others have been widely used and interpreted later on. In the field of information technology and graphic screens, Ngo, Samsudin, and Abdullah (2000) propose an approach of



using Birkhoff's and further measures to objectively evaluate layout aesthetics. Other authors (Tractinsky & Lavie, 2003; Bertelsen & Pold, 2004; Moshagen & Thielsch, 2010) propose subjective approaches based on questionnaires to evaluate visual aesthetics.

The scope of this thesis is limited by the human-computer graphical interfaces. Chapter 2 discusses the role and future of interfaces in the modern world. As interfaces are aimed at communication with users, their effect and design requirements are in strong connection to user experience. Chapter 3 presents the aspects of user experience, its components, design issues and reasons to consider visual aesthetics within the user experience design. In chapter 4, the notion of visual aesthetics, its elements and constructs are examined. The existing approaches and methods of evaluation are then gathered for more thorough analysis. Chapter 5 describes the design, process and results of the evaluations of methods. Finally, the work is concluded and a combination of methods to use is proposed with suggestions.

## **1.1 Purpose of the Study**

The work aims to collect the knowledge and methods for measuring or evaluating visual aesthetics. The purpose of the study is also to enhance thinking towards the possibility of using both subjective and objective evaluation methods in the course of development process in industry.

Hypothesis: Applicable methods exist to evaluate visual aesthetics. Next to the qualitative user questionnaire methods, objective aesthetic measures can be used to evaluate the level of interface visual aesthetics.

## **1.2 Research Questions**

To justify the hypothesis and confirm or refute it, the following research questions were posed:

- How to measure visual aesthetics of interface during the development process?
- Can a correlation be found between counts-based aesthetic measures and simplicity, diversity, colourfulness, craftsmanship, classical and expressive aesthetics?

## **1.3 Research Methodology**

The literature review was chosen as a research method for the first phases (see table 1) of the work, as the field is rather new and based on literature not well-known or used by the industry yet. Doing this literature review gives a better opportunity to establish subject background and learn from other research.

User questionnaire and observation of users was chosen to collect data for evaluating the application of subjective methods. The questionnaire contains three predefined tools of evaluation (see chapter 5.5) and provides a score evaluations of different aesthetic aspects of website interfaces (see chapter 5.4 and appendices 4.1 – 4-8). The same websites were evaluated by the author using counts-based method.

Correlation analysis was chosen to detect connections between collected data from objective and subjective methods. A limitation of correlation analysis results is the scarcity of test users, which is the result of carrying out time consuming questionnaires with the participation of the author as observer. Therefore the qualitative data analysis is more significant for the study and is carried out following interpretive approach.

Research process	Research questions	Research methods	Objectives
Phase one	What is the role of visual aesthetics in modern user interface design?	Literature review	To explore the theories and the results of previous studies.
Phase two	Which methods exist for measuring and assessing VA?	Literature review	Collecting detailed information about existing methods.
Phase three	Which are the advantages and disadvantages of found methods?	Analysis of the application of the methods - tools needed, advantages and disadvantages.	To find out which method and how would be suitable and easily applicable within design process.
	Are the methods applicable within design process?	User questionnaires. Observation of evaluation process. Correlations. Interpretive analysis.	Evaluation of interfaces using chosen methods. Strengths and weaknesses of the methods. Correlations between the two types.

Table 1. Research Methods

## **Chapter 2**

### **Interface**

Interface is a cultural, technological and aesthetic phenomenon of our society. A phenomenon that gives reason to speak of “interface culture” (Johnson, 1999). It is an inseparable part of digital technologies used in all fields of life. Various types of interfaces exist even though we do not always realise that we are confronted by one. In this chapter, the role, meaning and developments of interfaces will be discussed.

#### **2.1 Interfaces in Our World**

Let's imagine this situation: You make a photo using a camera – choose the right program or adjust the settings of colour, balance of light, zoom and all other needed options. You interact with the interface of the camera. You take the memory card with you to the automatic photo kiosk and insert it in the printing machine. You make use of the interface for restoring, transporting and importing the data. You select, edit and order photos and interact with the printing kiosk graphical user interface. The emotions and resulting experience of getting your dear memories on the photo paper depend strongly on the success of the design of the above-mentioned interfaces. And speaking of graphical interfaces, the experience gets affected not only by the quality of interaction but also by the level of interface aesthetics.

Interfaces are met on every step of modern life – keyboards, touch screens, cameras, USB plugs, and many more. Interfaces can exist for connecting different data layers within a machine or between them in network, for connections between humans and machines like graphical interfaces and for connections between people as for the social networks and net culture. Interfaces can embed choices, behaviour, languages, values, world views, and aesthetics into technical infrastructure (Bertelsen, Pold 2004).

Human-computer interface has become a layer to present both information as well as all culture from past and present. Technically speaking it is ought to represent data, the data flow, and structures of the computer to human senses, while setting up a frame for human input and interaction, and translating it back into the machine – visualise invisible data. More broadly speaking, mingling with cultural dimensions of everyday life, interfaces create an understanding of the cultural significance they carry and present through their representational language, text, image, sound, space, and other characteristics (Pold, 2005).

Interfaces can be observed and analysed in various ways depending on the perspective we choose. A principal question of the future of interfaces asks whether the interface should be invisible in order to let the user freely interact with the content, or if it should be the essence of the interaction and strongly connected to the content. Or could it be the both? Based on the views of Donald Norman (1998) and Bolter and Gromala (2003) this problem will be discussed next.

## **2.2 An Interface – To Become Invisible or Not?**

Donald Norman (1998), in his book *The Invisible Computer*, has proposed a vision of computers and their interfaces becoming invisible as “windows” to see through and only frame the contents. Bolter and Gromala (2003), in their book *Windows and Mirrors*, challenge Normans' views and explain why the interface must not and will not be invisible, but on the contrary should become reflective, connected to the contents and meaning of a system. They describe these implications through

digital art works which make the viewers look at the surface of the interface and communicate with it.

The electric motor once was a very visible part of many appliances but has become a totally invisible component within electrical appliances today. Norman used this analogy to predict what will happen with the personal computer as we know it. He proposed a view of information appliances that will be inexpensive, simple to use and enabling convenience in any activity of life. At the same time he stressed the need of technology becoming invisible, not to stand on the way of filling a task – an appliance should be there just for a certain task to be filled out (Norman, 1998).

Bolter and Gromala (2003), contrary to Norman (1998), stress the role of an interface as an inseparable component, as well as the communicator of the content. Through analysing digital art works, the significance of an interface can be better explained while digital art is all interface, entirely defined by the experience of its viewing or use. Furthermore, digital art can be seen as the purest form of experimental design, encouraging and testing the borders of an interface.

Contrary to invisible interfaces, the reflective design can change the world of human experience. Reflective interface – the design that reshapes the contexts as well as responds to it – can offer us specific mirroring experiences. Through this kind of experience users can become aware of dogmatic views that they may wish to change. So can the interface affect the user's relationship with one's physical and cultural environment (Bolter & Gromala, 2003).

But no digital design can be purely transparent or purely reflective. Good interface is balancing between being transparent and reflective. It is true that “serious” applications like productivity software emphasise transparency, while digital art emphasises reflectivity. The supporters of transparency claim that it enables “usability” and direct access to content, while supporters of its counterpart speak for reflectivity, multiplicity and self-awareness through action. The exact oscillation between the two, therefore, depends on the goals of the specific interface (Bolter & Gromala, 2003).

Next to the discussion of transparency and reflectivity, the immediacy and hypermediacy of interfaces gains attention. Immediacy is often connected to transparency; it refers to instant perception of the content. Aiming at greater transparency, often hypermediated interface is created – a combination of numerous different media whereby the user is aware of the interface.

Which applications are aiming at which interfaces? As explained previously, not each interface can be purely transparent or reflective – they need to find a balance between the two. This decision can be reached through analysing interface genres. What does the interface aim to achieve? Possibilities for analysing interface representations will be discussed in the next chapter.

### **2.3 Interface Genres**

An interface carries high responsibility of representing the data behind it. It can be argued if an interface of a pure informational website needs to be, aesthetically, of high quality. The existence of experiential or aesthetic dimensions certainly is characteristics of arts and new media arts whereby the content and interface are in tight connection to each other. Changing the interface will change the understanding and perception of the ideas or information represented by the interface.

Jay Bolter and Diane Gromala (2003) used digital arts to analyse interfaces, as did Soren Pold (2005). Pold uses the same parallel to establish interface as an aesthetic and critical framework around digital art. He introduces three realisms of interface – illusionistic, media realism, and functional realism. Realism hereby is about the urge in engineering to deal with reality, not the realism from aesthetic tradition.

Illusionistic realism aims beyond pure representation, maximising the reality towards immersive simulation. As the experience of the media itself is minimised and user is expected to experience the content immediately, this kind of realism

could refer to the transparency of the interface. The user should forget about the media and be immersed to the illusionistic world it presents. On the other hand, the numerous methods used to produce the illusion suggests the hypermediacy of the interface. Illusionistic realism begins with human senses and the way sensation has been addressed in earlier media like cinema and then collides with the forms and potential of the interface. It is a genre driving the computer game industry, whereby the player will be totally immersed to the plot and environment (Pold, 2005).

Media realism acts vice versa – it starts with the media and then tries to show how it collides human senses, knowledge, cultural forms, and expectations. It aims beyond the visual surface towards the imperceptible and unreadable code. This type of interface takes the aesthetics of the computer and form it into art. These interfaces may appear very abstract offering challenging reflective experiences whereby the user may get lost in the environment but still enjoy the process. Many contextual artistic applications may make use of this approach, challenging the human mind (Pold, 2005).

Functional realism is a more active form that regards the computer and its software as a tool. It produces software with interfaces that one uses instead of focussing on them, therefore it is about functionality and control rather than immersion and illusion. It aims beyond the artwork as self-contained and disinterested towards a functional aesthetics of the instrumental medium (Pold, 2005).

The genres discussed above aim at offering different kind of experiences. Taking the desired experience into account brings us to the user experience. Developing new and analysing existing interfaces forces us to consider user experience as the most important result of communicating to an interface. Different styles, perspectives and solutions can evoke various emotions and reactions. To better understand these results of interactions, user experience as a field will be studied.



## **Chapter 3**

### **User Experience**

“Every application needs to be an experience – to design a digital artefact is to design an experience.”

(Bolter & Gromala, 2003, p. 22)

Users today do not expect just a usable device or system, they expect much more. In order to design more appealing and satisfying products and services, user experience is studied as a phenomenon and developed as a field of science. User experience has become an inseparable field of user-centred design. But even though UX has become a part of the design and development process in HCI, it is still constantly forming as a field. In this chapter the meaning of UX, its role in product development, and relationship to interface aesthetics will be discussed.

#### **3.1 Importance of User Experience**

In the situation of high competition of companies producing various products and applications, for developing successful systems, the process of “designing for user experience” should not be avoided. A main confusion when speaking of user experience is the exact role of usability in connection to user experience – is it a part of UX, a distinct field or are they exactly the same. Several authors (Thüring & Mahlke 2007; Roto, Law, Vermeeren & Hoonhout, 2011) indicate that UX should not be equalised with usability, even though it carries significant role in UX formation in many cases. Roto et al. (2011) add that the usability perceived by the users contributes to the overall UX, whereby objective usability measures are not

sufficient for measuring UX as they do not indicate if the user perceived them as negative or positive.

Therefore, it is not enough to say that high quality UX equals with having no usability problems. Furthermore, Hassenzahl and Tractinsky (2006) explain that HCI's main objectives in the future is to contribute to our quality of life by designing for pleasure rather than for absence of pain. This is the idea behind designing for UX. This new role and focus needs new approaches beyond usability questions.

Can aesthetics affect users to gain positive emotions and experience surprising positive outcomes – “outstanding quality experiences”? These are the experiences that give an unexpected positive impact for the users. A system should correspond to user's expectations in order not to cause disappointment, but there may exist cases where the expectations can be exceeded positively, giving users a positive emotional rise. The new focus will be on positive emotional outcomes such as joy, fun and pride (Hassenzahl et al., 2006). The latter should be addressed in further studies as for example to learn how to design interfaces evoking specific emotions.

Various issues concerning further aspects of user experience exist. In order to improve the quality of discussions, teaching user experience design principles and processes, research in the field and the resulting level of future products, a common understanding, and definition of UX should be reached. Developments of UX definition will be discussed next.

### **3.2 Components of User Experience**

The increasing body of literature from the field shows that during many years the definition of UX has given reason for lively discussions – to define its components, design process, evaluation methods, and other possible aspects – eventually aiming at providing practitioners with proven methods for its design. Lately,

several attempts have been made to clarify the scope and evaluation of UX and come up with solid definition. To start with, ISO has defined user experience in the standard named “ergonomics of human-system interaction” under the human-centred design for interactive systems section as follows: “A person's perceptions and responses that result from the use or anticipated use of a product, system or service.” (ISO 9241-210:2010)

In order to provide more thorough understanding of the term, the discussion of definition developments will be reviewed, based on selected articles from various authors.

User experience is one experience among many. Experiences may be divided into three types according to their context (Forlizzi & Battarbee, 2004; Roto et al., 2011) – experience (experiencing), an (user) experience, and co-experience. The first type is described as the stream of perceptions, its interpretations and resulting emotions; the second one has a beginning and an end, emphasizing the memories and outcome of an experience; and the last one is the experience derived in social context, experienced together with other people. An approach by Law, Roto, Hassenzahl, Vermeeren and Kort (2009) suggests a distinction between experience and user experience. They recommend user experience to be scoped to products, systems, services, and objects that a person interacts with through a user interface.

User experience is impacted by various factors that could be divided into three categories: the context of system's use, characteristics and expectations of the user and the system's properties (Roto et al., 2011). These factors help us describe the situation and reasons behind a certain user experience but not the experience itself. Within the scope of this work, the system's properties are of interest. One of the system properties is for example the quality of user interface visual design with challenging factors like aesthetics. The latter has come to the focus of research next to the more traditional usability metrics and is in the focus of this thesis at hand.

User experience can be described through a compound of three elements in system's properties (Thüring & Mahlke, 2007): the perception of instrumental qualities, the perception of non-instrumental qualities (aesthetics and haptic

quality), and user's emotional responses to system behaviour. These ideas of user experience framework and its components are presented on figure 1. The position of visual aesthetics can be seen under non-instrumental system properties together with haptic and sonic aesthetics.

To conclude, the effect of system's properties, including its aesthetic values to the users, reveals itself in user experience. The components of user experience were discussed. Following, the process of designing for user experience and possibilities of measuring user experience will be studied.

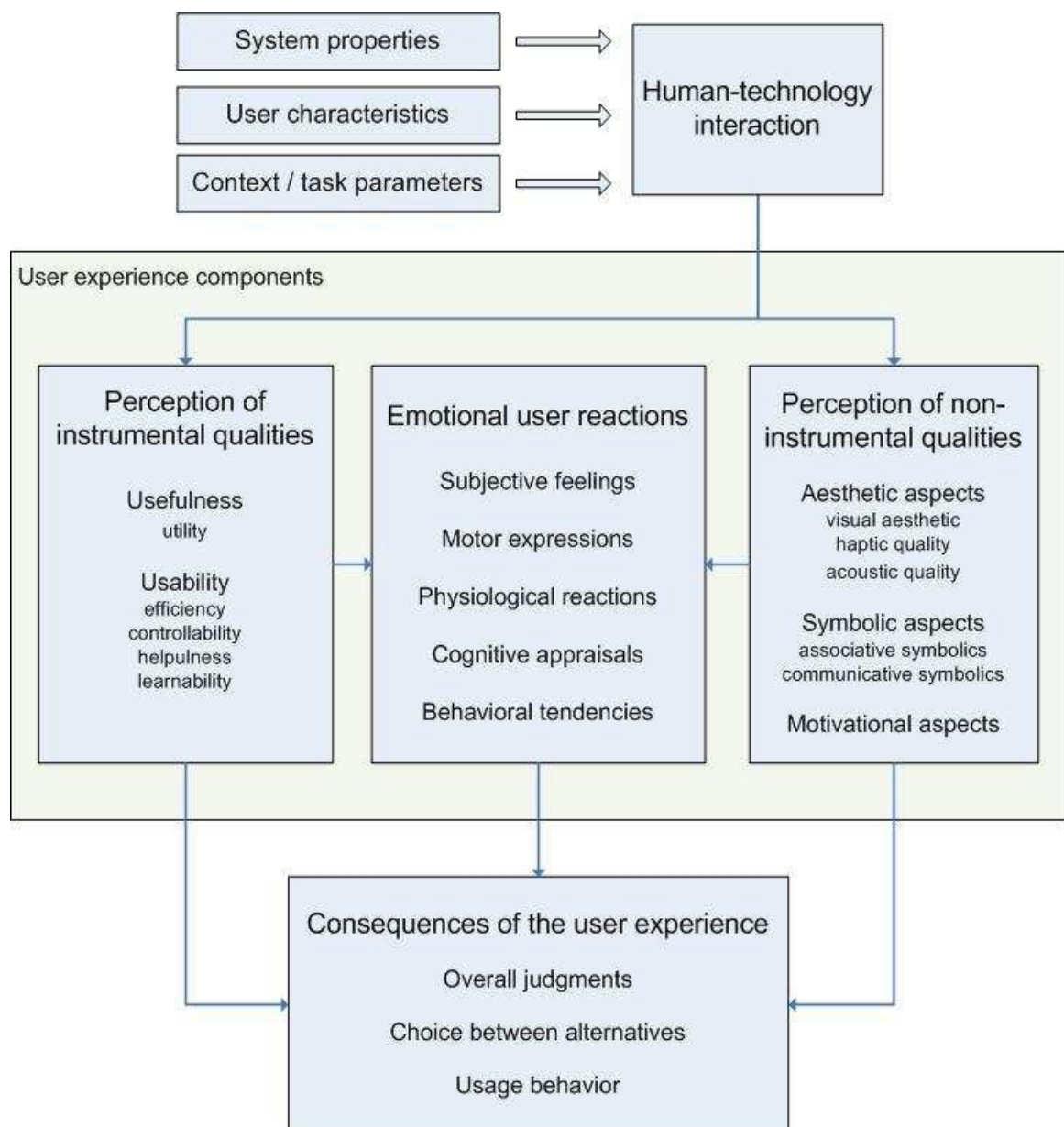


Figure 1. User experience research framework, components of user experience (Thüring & Mahlke, 2007).

### **3.3 User Experience Design and Evaluation**

Whether design teams are designing UX or designing for UX, it is a dilemma in the research. While users meet the designed interface after it being designed and delivered, we should say that the experience encountered at that moment will evolve on its own. Therefore, the designers can put all their effort to designing for the experience, not the experience itself.

Difficult factors impacting user experience include the context of use, prior knowledge of and attitude towards the product type, and users emotions. Where is the product to be used? Can the situation and atmosphere be foreseen? Is there a social context or the user is alone in the interactions? Such difficult issues like social, emotional, and aesthetic considerations are often handled intuitively, relying on professional judgements (Roto et al, 2011). Some guides to design for the best user experience have been proposed.

User experience design is also called an extension of the user-centred design. In this respect, Norman (1998) emphasises the field study for user needs and behavioural design for user cognitive models as the first activities of UX design process. Followed by model building or prototyping, user testing with built models, graphical design, and finally technical writing for the product specification, the process appears exactly reversed to the real practice of many teams. Even though this sequence of activities appears as time consuming, Norman claims that it will become effective as the number of tests needed later in process are minimized through detailed planning (Norman, 1998).

As for Norman's guide, in a perfect case of user experience design, all possible user experience factors should be identified and analysed for the project. In their white paper, Roto et al. (2011) state that in the real world, it is never possible because of the resulting irrational workload. The team needs to sort out the critical factors for the project and make sense of the existing information as early in the UXD process as possible. "This means:

- scoping out the factors that are known, because evidence exists, or are thought likely to be the drivers of UX in their particular instance,
- identifying those factors that are critical to the success of the design and can be satisfactorily dealt with by the design team, given their own operational circumstances,
- identifying those factors that are likely to need further investigation and, if so, the form that those investigations could take.” (Roto et al., 2011)

The main factors that a designer can affect are connected to the system and its properties. No step-by-step process for designing user experience exists, while each product and application has specific needs. But orientation towards and consideration of user's needs and expectations come strongly to the focus of the systems design. Those needs and expectations will be taken into account throughout the system planning and development.

The main phase of UXD is to study user behaviour and needs during their daily activities. This needs to be done to understand the desired UX the system should be offering. In order to control the development of the system and interface design, different sub-categories forming the UX need to be evaluated. Suitable tools and evaluation methods both during and after design process must be chosen while planning the UXD process. The evaluation during the development stage includes producing the representations of future system interface to get feedback and emotional responses of the users (Roto et al. 2011).

For evaluating UX, no generally accepted overall measurement exists. In comparison to UX, usability is well studied and better applied practically having many techniques and methods for evaluation and measuring its level. UX can be made assessable in many different ways. The methods for usability and user experience are not always clearly distinguishable. Usability tests focus on evaluating task performance whereas user experience emphasises lived experiences. Some more subjective usability metrics may be of importance in UX evaluation, but UX encompasses various other subjective qualities. In 2010, a thorough work was carried out to collect all different UX evaluation methods. The final list consists of 96 methods which are also listed on the “All about UX” (All

about UX) website.

The components of user experience were presented. Concerning this study specifically system's visual aesthetics is under observation. Its position within user experience was cleared above. The following chapter detects the elements of visual aesthetics and ways to evaluate its level.

## **Chapter 4**

### **Visual Aesthetics**

Aesthetics is a sub-field of philosophy that carries an important role in various disciplines – mainly arts and literature – but has lately become to focus and proven its importance in the context of human-computer interaction as well. It has become evident that when going beyond the instrumental qualities, i.e usability issues, speaking of interface design is inevitable. Emotional and non-instrumental aspects of design also need to be considered. Non-instrumental qualities encompass visual, haptic and sonic aesthetics, associative and communicational symbolics, and motivational aspects (see figure 1). In this chapter, visual aesthetics, its role in HCI, constructs and existing methods for measuring its quality will be discussed.

#### **4.1 Visual Aesthetics – Its Role and Effect**

Aesthetics is about understanding the beauty and the ways of sensing beauty. Through history the discussion has developed from objects' properties either being beautiful or not, to critique based on historical reasoning, to subjective judgements, but also to more scientific approaches. As a result of the latter, we can speak of the constructs and some rules (layout or colour choice) for aesthetics as well as user reaction evaluation methods derived from research.

An artefact may be considered beautiful or aesthetically pleasing due to its meaning, associations, representation or appearance that affects human senses. Aesthetics refer to the sensual experience a product elicits, and the extent to which



this experience fits with personal goals and spirits (Thüring & Mahlke, 2007). Moorthy and Bovik conclude, based on other authors, that visual aesthetics is a measure of the perceived beauty of a visual stimulus (Moorthy & Bovik, 2011). Throughout the literature the term “visual aesthetics” can appear interchanged with “beauty”, “visual appeal”, and “attractiveness”.

The effect of visual aesthetics of an interface reveals itself in the usage behaviour, choices between alternatives, as well as in the judgements that users make about the interface - after a first short period of seeing it, as well as after the interactions. The empirical research results from the field show strong correlation between the level of first visual appeal and perceived usability, and the resulting user experience evaluations. Therefore better understanding of visual aesthetics and its evaluation methods could help improve both the usability and UX of a product.

Thüring and Mahlke (2007) propose a model of non-instrumental qualities of interactive products (see figure 1) with its sub-categories. They show that integration of those values into the evaluation of interactive products has the prognostic advantage for the overall judgements of the users (Thüring & Mahlke, 2007). To achieve a measurement of various non-instrumental quality aspects they have used existing questionnaires for users. They also suggest using their model for designers as guidance during the design process. Visual aesthetics is a part of this model, but is not discussed in more detail.

During recent years, numerous authors (Tractinsky, Katz & Ikar, 2000; Mahlke, Lemke & Thüring, 2007; Lindgaard, Dudek, Sen, Sumegi & Noonan 2011; Papachristos & Avouris, 2011; Strebe, 2011) have studied the influence of visual aesthetics to users' opinions about the interfaces they see. Lindgaard et al. (2011) name the types of judgement the visual appeal affects (perceived usability, perceived information quality, user satisfaction, usefulness, etc) and conclude the list stating that beauty matters: it influences decisions that should be independent of aesthetics. In addition, experiments confirmed that appeal, trust, and usability of home pages are judged upon viewing them for only 50 msec consistently with the judgements given after longer period of facing the website (Lindgaard et al., 2011). The same phenomenon was also proven by the experiments of Papachristos

and Avouris (2011).

Papachristos and Avouris (2011) question if first impressions about an interface are only positive or negative feelings about stimuli and the resulting judgement is the assessment of given stimuli. They attempt to find out if there are other constructs the users are able to form an opinion about during the first moments looking at the interface. The results of Papachristos' and Avouris' (2011) experiment prove that other characteristics (credibility, novelty, and perceived usability) next to visual appeal are also evaluated based on the first short experiences with an interface.

Not only perceived quality of the system is influenced by visual aesthetics, but also the task completion results. Often cited work of Tractinsky et al. "What is Beautiful is Usable," (2000) states that beautiful things work better. The experiment was motivated by a previous work with similar results they aimed to challenge. To their surprise, the research also proved that beautiful things seem to and do work better. The research was based on testing ATM machines screen layouts that had the same combination of buttons on screen, but were designed and placed differently. Using more beautiful design had impact on the task completion, and the users found this system easier to use.

Donald Norman explains this phenomenon with studies of psychology – positive stimulus affects proceeding actions. People who have been given some present or showed a comedy video are performing better in problem situations, their thought process improve, becoming more creative and imaginative. This means that emotions play an important role in the interpretation of the signals that the user receives from the use of an interface. This results in the change of task performance ability, either increasing or decreasing it according to the emotions (Norman, 2004b).

The design of the elements or constructs of visual aesthetics manipulate the user's choices and decisions connected to the system. Hoffmann and Krauss (2004) point out the importance of visual aesthetics in supporting the communication between an interface and the user, whereby aesthetics can enhance the learnability,

learning outcomes, and understandability of the message (Hoffmann & Krauss, 2004).

The goal of modern products and systems should be offering positive experience to users – joy, fun, aesthetic pleasure. Usability and understandability are just means towards the goals while user experience offering pleasure, enjoyment, and fun can be the goals themselves (Norman, 2004a). The aim of today's design ought to be aesthetically pleasing, desirable, providing additional emotional charge next to its practical values, as well as teach us or direct us towards better behaviour.

Visual aesthetics has a leading role to play in the formation of first emotions about an interface and the product behind or within it. It affects the emotions users encounter while interacting but also the way they think of the product after using it. Following, the components and constructs of visual aesthetics are studied.

## **4.2 Components and Constructs of Visual Aesthetics**

Numerous visual attributes exist that have been named as of importance to the visual appeal. Among those some have stronger effect on users' first perceptions about the interface than others. Even though some studies have been carried out aiming at defining visual attributes, Lindgaard et al. (2011) summarise that the research for determining the judgemental strategies of web design, as well as suitable constellations of visual attributes is still in its infancy. The components and constructs of interface visual aesthetics will be collected in following.

The elements of visual aesthetics can be characteristics of layout, quality of graphics, amount of text, number and choice of fonts, use of colour, etc. Ngo et al. (2000) define the following aesthetic measures for graphical interface layout: balance, symmetry, equilibrium, sequence, order and complexity, cohesion, unity, proportion, simplicity, density, regularity, economy, homogeneity, rhythm. The values of these measures can be calculated mathematically based on the sizes and placements of visual objects on the screen.

Next to layout, the use of colour plays an important role. Parallel between characteristics of layout and colours can be drawn. The order in the use of colours is the similarity and contrast of hue, value and chroma, and the balance of areas of colour. Complexity of colours used equals the sum of the number of colours and the number of pairs of colours having hue difference, value difference, and chroma difference. Based on these interpretations, an aesthetic selection of colours could be evaluated but it stays unclear how to objectively decide upon the suitability of different combinations of hues (Pham, 2000).

Symmetry, order and complexity, balance, and contrast are listed by Papachristo and Avouris (2011) as low level evaluative constructs related to aesthetic design, whereas perceived usability, credibility, trustworthiness, novelty, and visual appeal represent high level constructs. High level constructs can not be measured mathematically, and need application of user questionnaires to be evaluated.

Some studies have suggested models and constructs for visual aesthetics. An exploratory study carried out by Tractinsky and Lavie (2003) resulted in a two-factor structure, forming two overall aesthetic dimensions of users' perception of website aesthetics – classical and expressive – represented by five site attributes each. The first, “classical aesthetics” stands for orderly and clear design that is very close to the views of many usability professionals. It corresponds to “visual clarity” dimension (Nassar, 1999, cited by Tractinsky & Lavie, 2003) and “simplicity” (Moshagen & Thielsch, 2010) that in Tractinsky's and Lavie's model refers to the following website attributes: aesthetics, pleasant, clean, clear, symmetrical. Secondly, “expressive aesthetics” representing creativity and originality of designers, breaking the design conventions. It corresponds to “visual richness” dimension (Nassar, 1999, cited by Tractinsky & Lavie, 2003) and “diversity” (Moshagen & Thielsch, 2010) that in Tractinsky's and Lavie's model refers to the following website attributes: creative, using special effects, original, sophisticated, and fascinating.

The model of visual aesthetic suggested by Moshagen and Thielsch (2010) contains four facets – simplicity and diversity, mentioned above, and colourfulness and

craftsmanship. The latter was added to stress the importance of being up-to-date, professionally designed and structured. Colourfulness aims to consider the use of colours in the design as it is mostly considered too complicated to evaluate the use of them. Based on this model, an evaluation questionnaire called VisAWI was developed and will be closer studied below.

Based on the components and constructs of visual aesthetics, different kinds of approaches are developed to evaluate the level of interface aesthetics. In the following, these approaches will be introduced.

### **4.3 The Evaluation Methods of Visual Aesthetics**

It is clearly shown in literature and previous studies that visual aesthetics affects the users experience and the perceptions of the system or product. Which methods to choose and apply to evaluate its level is a less studied field. The level of aesthetics can be evaluated based on users emotions evoked by the communication of the interface. Emotions can be manifested in following ways: in physiological reactions, in facial expressions, in behaviours and in feelings connected to the experience (Thüring & Mahlke, 2007). Correspondingly, different user study methods to measure the impacts of an aesthetic experience can be applied.

Next to studying users' reactions, several approaches of measuring and evaluating aesthetics of certain objects exist. For example, analytical aesthetics based on mathematical and logical rules of aesthetics, which makes its evaluation objective while reactions on certain conditions (i.e users uneasy and uncomfortable feeling while seeing an unbalanced and asymmetrical screen layout) have been proved earlier. Reflecting on this view several objective aesthetic measures can be calculated.

Therefore, evaluation methods may be divided into two principal groups based on their type. First, relying on the rules of aesthetic values – global objective values derived from empirical studies – and second, based on subjective user feedback.

To develop more objective methods, the connections between objective and subjective measures should be detected. Lately, a study was carried out (Altaboli & Lin, 2011) in order to detect correlations between the results of some objective and subjective aesthetic measures. 42 websites were evaluated using both objective methods and subjective questionnaires. The results showed high correlations, which allows to predict that these objective layout-based measures could be successfully applied on evaluating visual aesthetics of websites.

Among objective methods, different assessment algorithms have been described mainly concerning layout, but also colour schema. Among subjective methods, several user questionnaires and a critique guideline covering different aesthetic aspects are presented. Following, the methods are introduced.

#### 4.3.1 Objective Measurements of Aesthetic Screen Layout

Objective aesthetic measures for graphic screens are balance, equilibrium, symmetry, sequence, order and complexity, cohesion, unity, proportion, simplicity, density, regularity, economy, homogeneity, and rhythm (Ngo, Samsudin & Abdullah, 2000; Ngo et al. quoted by Zain, Tey & Soon, 2008). It is possible to objectively measure and design a scientifically proved aesthetic screen layout based on calculations of these measures. For example, balance of both sides of horizontal and vertical axes can be achieved through symmetry or asymmetry (static or dynamic balance). Unbalanced screen layout produces the feeling of stress. The method does not take into account object types, colour, shapes, type fonts and weight, number of fonts or colours used, space of background left, which all have an effect on the measures introduced.

A piece of software has been developed using the first six measures of Ngo et al. Aesthetic Measurement Application (AMA) was created by Zain et al. (2008) and tested upon a learning environment. The application is easy to use and enables simple evaluation of layout aesthetics. The user can drag and drop screen elements at their place to find out the aesthetic measure of the resulting layout. This application uses six above-mentioned measures and could be extended to contain

more constructs of a layout, as well as take into account more characteristics of the measures.

#### 4.3.2 Objective Counts-Based Evaluations

Counts-based method (Altaboli & Lin, 2011) gives a numerical description of the simplicity or diversity through counting various design elements. These elements are number of visual objects on the screen, number of different sizes of visual objects, number of images, number of different font types used in the web page, and JPEG file size of screenshot of the webpage. The negative correlation has been found between some layout object measures (the number of visual objects and the number of different sizes of visual objects) and simplicity and classical aesthetics.

#### 4.3.3 Aesthetic Colouring System

Aesthetic colouring system is a method for producing aesthetically pleasing colour schema for complex layout (e.g mobile phone) (Zhang, Zhao, Ming & Kang, 2009). Coloured layouts can be automatically produced using an optimisation tool that assists decision making in identifying optimal or near optimal solutions for problems with large search space. The tool integrates a modified genetic algorithm and aesthetic measure. This method proves the possibility to generate mathematically selected colour combinations for various types of interfaces and eventually the way to evaluate inserted layout solution.

#### 4.3.4 Measuring Users Physiological Reactions to Experiencing Aesthetics

Measuring the physiological changes of users enables assessing their reaction to the experienced aesthetics. Strebe (2011) suggests research of affective reactions in order to apply it on evaluating website aesthetics. To evaluate the impact of

affectively effective aesthetics of websites on approach and avoidance behaviour, she suggested using screen saving, facial and eye movement tracking. An interesting tool to measure facial reactions is based on the evidence that different levels of aesthetics in websites results in proved facial reactions – movement of a muscle above eyebrows and a muscle on the cheek (Strebe, 2011).

A pioneering study has been carried out (Tschacher, Greenwood, Kirchberg, Wintzerith, van den Berg & Tröndle, 2011) to monitor visitors' physiological reactions to aesthetic perception of works of art (paintings and sculptures) in their natural surrounding – a fine art museum. The visitors were invited to wear electronic gloves for the measurements. Some parallels to HCI field might be drawn from there. For example, the works described as “beautiful, high-quality artwork, surprising-humorous” were related to raised heart rate variability. The higher rate of skin conductance variability was significantly linked to more dominant or stimulating works.

This approach could be applied for evaluating the visual aesthetics of an interface based on users' first response when seeing it, as well as users reactions while using a website. The question of choosing a tool is more free in case of computer applications as no moving around is mostly needed (as it was in the case of fine art museum).

#### 4.3.5 Subjective Classical and Expressive Aesthetics

This evaluation method is based on subjective and expressive aesthetics developed by Tractinsky and Lavie (2003). Classical aesthetics constitutes aesthetic design, and is close to the simplicity of the design. Its bipolar evaluations are: orderliness in design, clean, pleasant, symmetrical, and aesthetic. Expressive aesthetics relates to creativity and originality of websites. Its bipolar evaluations are: creative, using special effects, original, sophisticated, and fascinating.



### 4.3.6 Subjective VisAWI User Questionnaire

Visual Aesthetics of Website Inventory (VisAWI) consists of four facets with various questions in categories of simplicity, diversity, colourfulness, and craftsmanship. It has been developed (Moshagen & Thielsch, 2010) as a reaction to the need for a solid tool to measure visual aesthetics of an interface. Next to simplicity and diversity, the use of colours and expertise of design are taken into account. It consists of 18 questions in total. If a shorter version is needed, VisAWI Short can be applied with only four questions, one for each facet.

### 4.3.7 Interface Criticism

Interface criticism is a method based on literary and art criticism traditions. It is the only method (apart from specific questionnaires and experiments) concentrating on higher level constructs as representations, genres, and stylistic references. It also suggests analysing the use of standards and developmental potentials of interface and supports further developments of the guidelines.

Interface criticism guidelines:

- Analyse stylistic references in the interface;
- Identify the use of standards and the conformance to tradition;
- Materiality and remediation. Consider the materiality of the interface (e.g. code, algorithms, pixels) and discuss how it is used. Consider how the interface draws on the materiality of other media (e.g. text pages, photography, cinematic language, control panels). Discuss immediacy and hypermediacy in the interface;
- Identify and consider various genres in the interface;
- Discuss the interface as a hybrid between the functional (control interface) and the cultural interface;

- Identify representational techniques and analyse how they work (e.g. realistic and naturalistic representations vs. symbolic and allegorical representations);
- Identify challenges to users' expectations;
- Consider the developmental potentials. How is development in use supported? How may the interface support the development of unanticipated use?

Interface criticism is an alternative to traditional assessment methods within HCI. Practically, interface criticism is a guide suggesting a design-oriented procedure that utilizes aesthetic perspectives on the interface. Interface criticism, as other evaluation methods, may be applied during different stages of product life-cycle. Applying it in parallel with other traditional evaluation methods will give the best outcome (Bertelsen and Pold, 2004).

## **Chapter 5**

### **Study of the Evaluation Methods**

In the first phase of the research, knowledge about visual aesthetics of user interfaces was collected – issues of user interfaces, user experience, and visual aesthetics within it. The process of analysis of all collected evaluation methods of visual aesthetics will be presented in this chapter – the selection of methods for detailed analysis, the process of their evaluation, and the results of the analysis will be described.

#### **5.1 Introduction**

To improve interface design process and results, the evaluation of the interface aesthetics could be integrated to the development process. Design decisions are usually based on the designers or art directors decisions and intuition. The evaluation methods would help them in the process of deciding between various design choices, not by replacing a designer. With the aid of the methods, comparable aesthetic scores of different designs could be calculated. The methods collected from the literature review will be analysed for suggestions of use in the design process.

Discovered methods are analysed descriptively in order to detect the ones which would be immediately applicable without the need of special equipment or software development. Product or application development consists of many time consuming steps which need to be justified considering the budget of the project.

In this respect, the evaluation method has to provide the important aesthetic measures quickly. The goal is to reach a suitable method or a set of methods for immediate application.

Objective (based on calculations) and subjective (based on user evaluation) approaches exist. This study compares the use and results of chosen objective and subjective methods. Based on test user evaluations of website screenshots, the observation of the process of evaluation, and test user comments, the subjective methods are further analysed and evaluated. Correlations between the results of objective and subjective methods are calculated.

With a small sample size within this study, caution must be applied to the results of quantitative analysis. However, the findings match previous results of research with noticeably larger sample size, which gives reason to believe their usefulness.

## **5.2 The Design of the Study**

The study is carried out as follows:

1. The analysis of collected methods.
2. The collection of websites to be evaluated.
3. The evaluation of websites – test users answer the questionnaires, users are observed and asked for additional feedback about the method; Counts-based evaluation is carried out.
4. The analysis and evaluations of methods – qualitative and quantitative data analysis.
5. Description and interpretation of results.

## 5.3 The Analysis of Collected Methods

In this section, each method is described and commented on concerning its immediate use with developmental perspective. Tables of methods are presented below – table 2 for objective, and table 3 for subjective methods. Based on this descriptive analysis, the methods for practical analysis are chosen.

### 5.3.1 Objective Aesthetic Measures for Graphic Screens

Fourteen (14) different screen layout measures are proposed. Five of them are mentioned more often: balance, equilibrium, symmetry, sequence, order and complexity. Each measure contains several inputs which makes the resulting formulas rather complex. To use them practically several complications need to be overcome – the correct division of the layout into visual objects and software for the calculations.

Perspective: Constructing suitable software that enables placing predefined layout elements and calculating aesthetic measures would give the designers the opportunity to experiment with layout solutions and develop various highly aesthetic templates. The tool would also enable comparison and ranking of different layouts.

Because of the absence of the software this method will not be further analysed within this study.

### 5.3.2 Objective Counts-Based Measure

Objective counts-based measure is an evaluation method (Altaboli & Lin, 2011) that is easily applicable by the designer – count the visual objects on the screen, the number of different sizes of visual objects, number of different fonts, number of images, jpeg file size of the screenshot.

Perspective: In case of further research proving the correlations between some element count and other aesthetic evaluation results, this method could be easily applied within the design process. Better knowledge of optimal number of different measures (i.e number of objects) should be achieved.

This method will be further studied through application on the test websites and correlation calculations.

### 5.3.3 Objective Aesthetic Colouring System

Coloured layouts can be automatically produced using an optimization tool that assists decision making in identifying optimal or near optimal solutions for problems with large search space. The tool integrates a modified genetic algorithm and aesthetic measure.

Perspective: This method proves the possibility to generate mathematically selected colour combinations for various types of interfaces and, eventually, the way to evaluate inserted layout solutions. The tool would also enable comparison and ranking of different layouts.

The method is not directly applicable at the moment and will not be further analysed within this study.

### 5.3.4 Objective Physiological Measurements

Measuring physiological changes – heart rate, activity of certain muscles (i.e. facial), skin conductance – can be used to assess users reactions to different aesthetics.

Perspective: Using the knowledge of connections between user physiological reactions and aesthetic value of the interfaces confronted, this method could be used for evaluations. It is more useful tool for specific situations.

Physiological measurements need to be carried out using various specific technologies. Therefore it will not be further analysed within this study.

### 5.3.5 Subjective Classical Aesthetics

Classical aesthetics can be evaluated with a user questionnaire. Five dimensions are asked to evaluate on a scale from 1 (“strongly disagree”) to 7 (“strongly agree”). The dimensions are: clear, clean, symmetric, aesthetic, and pleasant design.

This method will be further studied through application on the test websites and correlation calculations.

### 5.3.6 Subjective Expressive Aesthetics

Expressive aesthetics can be evaluated with a user questionnaire. Five dimensions are asked to evaluate on a scale from 1 (“strongly disagree”) to 7 (“strongly agree”). The dimensions are: fascinating, sophisticated, original design, and use of special

effects.

This method will be further studied through application on the test websites and correlation calculations.

### 5.3.7 Subjective VisAWI Questionnaire

Questionnaire that aims to evaluate interface aesthetics through four factors: simplicity, diversity, colourfulness, and craftsmanship. Each factor is evaluated by 4 to 5 questions on a 7-point scale (1 - “strongly disagree” to 7 - “strongly agree”). Some questions marked by “r” need to be recalculated while being a negative expression.

This method will be further studied through application on the test websites and correlation calculations.

### 5.3.8 Subjective Interface Critique

Interface critique is a collection of guidelines to help analyse and critique an interface. It has no simple answer questions and is not scalable numerically. Interface critique is an analytical tool that could be used well in parallel with other methods – usability metrics and other evaluation methods of visual aesthetic.

In comparison to other methods, interface criticism guides the designer (or other user of the method) to think of and analyse the interface through various aspects well-known in arts and literature. These aspects can give deep insight to the design and help improve it principally. It is a method that can be very helpful, but needs further analyse in order to be used effectively within the process.

This method will not be used in this study.



## Table of objective evaluation methods

<b>Characteristics</b> <b>Name of Method</b>	<b>Elements of evaluation</b>	<b>Tools</b>	<b>Pros</b>	<b>Cons</b>	<b>Choice of selection</b>
Objective aesthetic measures for graphic screens (Ngo, Samsudin & Abdullah, 2000)	Balance, equilibrium, symmetry, sequence and order and complexity, cohesion, unity, proportion, simplicity, density, regularity, economy, homogeneity, rhythm	Mathematical calculations of objects or specific software like AMA (Zain, 2008)	Long-term research based characteristics of elements, clear comparable score for result	No access to existing software, calculations are complicated, screen division to objects is complicated, large number of constructs, selection of the most important ones is not clear	No
Counts-based measure (Altoboli & Lin, 2011)	Number of: constructs or chunks of elements on the screen, number of different sizes of visual objects, number of mages, number of different font types, JPG file size of the screenshot	No special tools	Simple method for the designer to use as the information for counting is well-known and quickly countable, well-suited for informative and task oriented sites	Can be time consuming with complex and rich designs, complications of division of visual objects	Yes
Aesthetic Coloring System (Zhang, Zhao, Ming & Kang, 2009)	Colours of layout areas	Specific software	Offers a selection of aesthetic combination to specific layout	Special software needed	No
Physiological measurements (Strebe, 2011; Tschacher et al., 2011)	Reactions of users to the interface based on eye movement, breathing, heart rate, skin conductance etc.	Specific equipment	Real-life results for user reactions	Need of specific technology and knowledge	No

Table 2. Objective evaluation methods.

## Table of subjective evaluation methods

<b>Characteristics</b> <b>Name of Method</b>	<b>Constructs</b>	<b>Tools</b>	<b>Pros</b>	<b>Cons</b>	<b>Choice of selection</b>
Classical aesthetic judgement (Lavie & Tractinsky, 2003)	Aesthetic, pleasant, clear, clean, symmetric design.	Questionnaire and some evaluation tool for scale evaluation	Important for task oriented sites, simple and quick, score result	Evaluation of just one kind of aesthetics, has to be combined to some other method	Yes
Expressive aesthetics judgement (Lavie & Tractinsky, 2003)	Creative, using special effects (not evaluated when using screenshots), original, sophisticated, fascinating design.	Questionnaire and some evaluation tool for scale evaluation	Important for creative sites, simple and quick, score result	Evaluation of just one kind of aesthetics, has to be combined to some other method	Yes
VisAWI (Moshagen & Thielsch, 2010)	Simplicity Diversity Colourfulness Craftsmanship (General factor)	Predefined questionnaire and some evaluation tool for scale evaluation	Carefully chosen questions based on studies, fast – about 3 minutes for one evaluation, diverse aspects, score result	May be time consuming to evaluate quick changes, (for this a short version with four questions can be used)	Yes
Interface Criticism (Bertelsen & Pold, 2004)	Whole interface and its parts, associations and communication.	Critique guideline	Concentration on the communicative and associative aspects, deep analysis	Time and knowledge consuming, no score result for comparison	For descriptive analysis

Table 3. Subjective evaluation methods.

## 5.4 Collection of Websites

### 5.4.1 Principles of Selection

Visual aesthetics of websites is evaluated based on screenshots of the opening page (above fold) using one objective and three subjective methods: counts-based measure, VisAWI questionnaire, classical and expressive aesthetics. The websites are chosen in two phases. Initial collection of websites is chosen according to following criteria:

- Websites of different art museums – fine arts and digital art. Websites from one topic that vary in their looks and quality;
- Clear enough for detecting visual objects – one of the most complicated task of counts measure;
- Sites with different aesthetic values: symmetrical – asymmetrical, colourful – no colours, enough white space – no white space.

The chosen 14 websites were evaluated using VisAWI Short questionnaire with 7-point scale and ranked based on it (table Web1). Eight websites were chosen based on the analysis. Four selected sites are with score lower than 4,0 and four sites with score above 4,0. Four sites are colourful and four grey or black and white combinations. Four sites are not symmetrical and four with symmetrical or almost symmetrical layouts. For the evaluations screenshots (1280x760 pixels) of each site were produced. Following, the websites will be described. See appendix A.1, the initial evaluation of 14 websites.

## 5.4.2 Selected Websites

**Amoda** ([amoda.org](http://amoda.org) – see appendix B.1) – website of Austin museum of digital art, in English. The site introduces the events taking place at the museum. Very strong bright blue colour for background, the full screen version is strongly asymmetrical while all the contents stays on the left side of the screen. Specific choice of the colour, strong asymmetry of the screen and rather small font size can be distractive to many users while the site still seems to have no other big design flaws.

**Bauhaus** ([bauhaus.de](http://bauhaus.de) – see appendix B.2) – website of Bauhaus archive, museum of design, in German. Black-and-white website whereby black is strongly dominating, has almost symmetrical placement of elements. The website design is well presenting the ideas of Bauhaus design school and fits well to its context. While evaluating this site, being aware of the context can play a key role.

**Lacda** ([lacda.com](http://lacda.com) – see appendix B.3) – website of Los Angeles centre for digital art, in English. A page rich in white space between visual objects, asymmetrical with all the contents stays on the left when looking at full screen. Using few colours but numerous variations of the text font.

**MamParis** ([mam.paris.fr](http://mam.paris.fr) – see appendix B.4) – website of museum of modern art in Paris, in French. A modern website with no colours in design but colour images for presenting different events. Almost symmetric layout with contents placed in the centre. An up-to-date concept of the website.

**MBAR** ([mbar.org](http://mbar.org) – see appendix B.5) – website of the museum of fine arts in Rennes, in French. Introduces the events, exposition and exhibitions taking place at the museum. An unusual design with use of several different colours. Not traditional placement of layout elements.

**Moca** ([moca.virtual.museum](http://moca.virtual.museum) – see appendix B.6) – website of museum of computer art. Most crowded website in the collection with many small details and text. The site appears to be not up-to-date but is in fact operative at the moment of the study.

**Psyché** ([yk.rim.or.jp/~psyche](http://yk.rim.or.jp/~psyche) – see appendix B.7) – website of museum Psyché, in English, with French heather seen large over the illustration. The website is symmetrical, contents placed in the middle, having no colour in design. A large colourful image is presented in the middle, catching the eye. It shows that it is not a very recent design but nothing really seems to disturb.

**SFMoma** ([sfmoma.org](http://sfmoma.org) – see appendix B.8) – website of museum of modern art in San-Francisco. A design with strong colours used whereby lots of white space is left. Not symmetrical layout as the contents stays on the left side of the page.

## **5.5 The Conditions of Evaluating the Websites**

### **5.5.1 Selected Methods and Tools**

The methods, collected from literature review, were analysed for possibility of immediate application (see chapter 5.3, table 2 and table 3). Four methods were chosen to be further studied. These methods – objective counts-based measure, classical aesthetics, expressive aesthetics, and VisAWI questionnaire – were pretested by the author evaluating three websites. The use of methods was commented to decide on their further use (see appendix A.2). All these methods were decided to be used. The tools for their application will be described next.

Objective counts method was used by the author to count the measures – number of visual objects on the screen, number of different sizes of visual objects, number of images, number of different font types, JPEG file size of screenshot (KB) – for all 8 websites. This method can be applied with simply observing the website and counting specified elements. The results are presented in table 5.

Test users evaluated the aesthetics of all 8 websites with three methods – VisAWI, classical and expressive aesthetics – designed into one six-paged questionnaire.

The questionnaire was prepared with Google Forms. The questionnaire had a written introduction but was also introduced by the author. The questionnaire was originally in English but had to be translated into Estonian. The translations were discussed with an English philologist, a native Estonian.

Testing the methods by the author and pilots of the questionnaire confirmed the plan of meeting the test users in person with three main reasons. Firstly, filling the questionnaire took at least 5 minutes per website, which is at least 40 minutes in total for 8 interfaces. This would be too demanding when using an online questionnaire, which predicts not having very many voluntary participants. Secondly, meeting the test users gives an opportunity to collect valuable qualitative data during the process of evaluations. Thirdly, meeting the test users gives a better opportunity to decide if this approach would justify itself over online evaluation in a real life situation.

Test users were sitting in a calm surrounding at a table in front of two laptops. The screenshots (1280x760 pixels) were presented on a 13" MacBook Pro screen fullscreen on their left, while the questionnaires were answered on another laptop to their right. The users were encouraged to think aloud and express their hesitations concerning both the interface design and the questionnaire itself. The author was observing the evaluation process and making remarks about test user behaviours – speed of answering, hesitations and questions. No suggestions or explanations were given. The complications were discussed after the evaluations.

Collected qualitative and quantitative data was further analysed to produce evaluations' conclusions and suggestions for the application of the methods. These result are presented later in the work.

### 5.5.2 Test Users

Test users were chosen to be met for the evaluation process. Three male and three female users, with average age of 35,7 years (between 26 and 49). All are daily

users of Internet, familiar with modern web, not educated or experts in design or arts, active in different fields of life (for example accountant, teacher, IT product manager, educator, doctor).

## 5.6 Results and Discussion

The results of the use and analysis of collected methods, scores of evaluation of visual aesthetics and collected qualitative data with discussions are presented.

### 5.6.1 The Results of Objective Interface Evaluations

From collected methods only one objective method was immediately applicable for the use in this study. The tested method is based on counting elements on the screen. Table 4 presents the results obtained from counts-based evaluation. Eight website designs were analysed by the author to detect the visual elements, their sizes, number of images, different font types and screenshot file size. The screenshots under evaluation can be seen in appendix B.

<b>Measure Site</b>	<b>Number of visual objects on the screen</b>	<b>Number of different sizes of visual objects</b>	<b>Number of images</b>	<b>Number of different font types</b>	<b>JEPG file size of screenshot (KB)</b>
Amoda	8	3	4	4	218
Bauhaus	6	3	8	3	152
Lacda	8	4	1	2	314
MamParis	9	4	4	2	860
MBAR	9	4	15	3	537
MOCA	16	4	1	3	293
Psyche	2	2	1	2	136
SfMoMa	9	3	2	3	196

Table 4. Evaluation results of counts-based method.

Following, table 5 shows the descriptive statistics about the counts-based measures.

<b>Statistics Measure</b>	Min	Max	Average	Standard Dev.
Number of visual objects on the screen	2	16	8,4	3,9
Number of different sizes of visual objects	2	4	3,4	0,7
Number of images	1	15	4,5	4,9
Number of different font types	2	4	2,8	0,7
JPEG file size of screenshot (KB)	136	860	338,3	246,2

Table 5. Descriptive statistics for the selected count-based measures for 8 websites.

As expected (based on previous study by Altaboli & Lin, 2011) the number of visual elements on the screen had negative correlation to simplicity and classical aesthetics. Within this study the correlation between the same subjective measures and the number of different sizes of visual objects was not found. Therefore, based on this and previous studies the measure of visual objects on the screen can be suggested as an evaluation tool for visual aesthetics concerning its simplicity and level of classical aesthetics. The challenge of finding an optimal number of different visual elements remains. Finding optimal conditions for interface design is a problem which together with finding more useful objective measures could be addressed in future works.

### 5.6.2 The Results of Subjective Interface Evaluations

Subjective methods are better known for evaluating user experience as a whole. This work introduced and analysed through application some well developed questionnaire methods for evaluating visual aesthetics. The average results of user questionnaire – VisAWI, classical and expressive aesthetics – are presented in table 6. The independent scores are average scores from six users on a 7-point



scale with 1 the lowest and 7 the highest. General score is the sum of four facets (simplicity, diversity, colourfulness, and craftsmanship) of VisAWI questionnaire (the highest possible score 28). The statements forming the VisAWI questionnaire can be seen in appendix A2.

<b>Measure Site</b>	General Score (max score 28)	Simplicity	Diversity	Colourfulness	Craftsmanship	Classic	Expressive
Amoda	14,3	4,3	2,4	3,7	3,9	3,5	2,3
Bauhaus	19,8	5,6	4,6	4,8	4,9	5,8	4,6
Lacda	15	5,6	3,1	3,1	3,2	3,9	2,5
MamParis	22,4	4,9	5,2	5,8	6,4	5,9	5,1
MBAR	14,2	4,5	3,1	3,3	3,3	4,1	3,2
Moca	8,4	2,2	1,9	2,3	2	2,6	1,8
Psyche	17	4,6	3,1	5,3	3,9	5,1	3,7
SfMoma	22,4	5,3	5,3	6,2	5,6	5,8	4,9

Table 6. The average evaluation results of 8 websites by 6 users, on a 7-point scale.

### 5.6.3 Correlation Analysis of the Results

The correlations between objective and subjective measures of interface aesthetics are shown in table 7. It can be seen that no significant correlations were found concerning most of the objective measures, but as expected, the number of visual objects on the screen has strong negative correlation to simplicity and classical aesthetics, also affecting the general score.

<b>Objective Subjective</b>	Number of visual objects on the screen	Number of different sizes of visual objects	Number of images	Number of different font types	JEPG file size of screenshot (KB)
General Score	<b>-0.505</b>	-0.285	0.016	-0.286	0.211
Simplicity	<b>-0.682</b>	-0.223	0.150	-0.285	-0.015
Diversity	-0.279	-0.084	0.074	-0.287	0.290
Colourfulness	<b>-0.538</b>	<b>-0.509</b>	-0.130	-0.130	0.086
Craftsmanship	-0.371	-0.196	0.017	-0.185	0.351
Classical	<b>-0.573</b>	<b>-0.366</b>	0.084	<b>-0.362</b>	0.151
Expressive	-0.417	-0.249	0.133	-0.316	0.264

Table 7. The correlations between subjective and objective aesthetic measures.

Based on the study by Altaboli and Lin (2011), it was predicted that negative correlation exists between some objective measures (number of visual objects on the screen and number of different sizes of visual objects), simplicity, and classical aesthetics. The correlations of this study repeated the result considering the number of visual elements on the screen (-0.682 with simplicity and -0.573 with classical) but the correlation concerning the number of different sizes of elements on the screen did not appear so strong (-0.223 and -0.366 respectively).

Surprisingly, strong negative correlation was found between colourfulness measure and both number of visual elements on the screen and the number of different sizes of visual elements on the screen. This can be explained while having more visual elements can result in having more colours to use eventually causing not so appealing design being too colourful or just the simpler layouts resulted in higher appeal from the colourfulness view.

#### 5.6.4 Observation Results and Discussion

Test users' observation gave two types of results – about the questions forming the methods, and about issues concerning the understanding of visual aesthetics. The time spent on answering varied from 3-15 minutes per site.

##### **Considering the questionnaire:**

- There are two questions that cause confusion because of the use of words “patchy” (“existing or happening in small, isolated areas”, synonym to uneven) and “botched” (“carry out a task badly or carelessly”, synonym to unskilled). These terms were difficult to translate into Estonian but they also made the native English-speaker stop and ask for explanations. The user then explained that it must be American-English use of the words that is uncommon for British-English. Therefore the German version was analysed to find solutions.

- “The site appears patchy” is a translation (by Thielsch and Moshagen) from German questionnaire to correspond to “*Die Seite erscheint zu uneinheitlich.*” “*Uneinheitlich*” could also be translated as “uneven,” “spotty,” “nonuniform” or “irregular.” From this list the author would suggest using “uneven” or “nonuniform” to correspond to the meaning of “*uneinheitlich.*” As these do not sound exactly suitable either, author suggests using “The site appears (too) inconsistent” as best describing the meaning behind the German statement.
- “The choice of colours is botched” is a translation (by Thielsch and Moshagen) from German questionnaire to correspond to “*Der Farbeinsatz ist nicht gelungen.*” “*Nicht gelungen*” could also be translated as “not successful,” “not turned out well” or “not suitable.” The author suggests translating the statement as “The use of colours is not successful” as best describing the meaning behind the German statement.
- The users got confused several times by the reversed questions. For example, with the statement “The site is not up-to-date” - if the opinion would be “it is not up-to-date,” scale evaluation needs to be above 4 points (agreeing to the statement), but user spoke out loud “no, it is not up to date” and pointed the mouse to lower scores. In these cases author directed the user to think once again – “do you agree with this statement, if so your answer should go to the other side of the scale.” These situations were repetitive but it stays unclear how many times it happened and how many mistakes of this kind was made, as not all users were thinking aloud consistently.

### **Considering the concepts:**

- Interpretation of symmetry – some users consider a site with all content on the left symmetric, while the contents itself is symmetrical even though the placement in fullscreen mode is asymmetrical. Symmetrical layout is considered an important condition of higher aesthetic level and should therefore be clearly addressed within evaluations. It must not be only a part

of subjective evaluation as it can be evaluated objectively through geometrical layout dimensions, visual balance and weight of the elements. It must be decided though, which significance to omit to objective and subjective views of symmetry – the perceived weight derived from the use of colour on different elements can vary subjectively and should be evaluated accordingly.

- Interpretation of “being patchy” – being patchy is considered a negative characteristic within the questionnaire but some well designed sites (getting high scores in other questions) were evaluated as patchy while consisting of clearly separated graphic blocks which otherwise is a good characteristic forming structure and clearness. The confusion of the term can be eliminated by retranslating the statement as referred above.
- Impact of images – a website considered uninteresting and not very well designed can be evaluated with high positive scores while the only existing image on the site looks really nice or vice versa. In real life, dynamically changing pictures often appear on the site and their quality, fitting to the design and appeal have great impact on the evaluation score.
- Presenting objects for evaluation in random sequence is common practice. When presenting several interfaces for evaluation, the order matters while all following sites will be compared against the previous ones. The first site presented from a larger set for evaluations should be of average aesthetic level not an extreme. The evaluations the user gives to the website seen first will be the orientation for the evaluation of the next ones.
- The aim within this study was to evaluate static screenshots. It showed that it is worth considering if a little interaction should be able, as to understand the dynamics of the site. For example, seeing if some graphics is there for navigation or just as “illustration”. A case example: the first impression was good, but after realising that the graphics were not meant for navigation, the site would have gained lower score. In real life situations, within first seconds the mouse is often moved across the screen and the dynamics will be seen.
- Knowing the concepts – recognising the site and understanding the

concepts makes change in evaluations, as for example Bauhaus. In case of other topic the site would gain lower score, but knowing the background the design makes perfect sense and it gets higher score.

VisAWI questionnaire proved to be a successful contribution to the field and should definitely be further tested within the real development process. Some problems with translations and misunderstanding of the selected terms were addressed and changes for improvement suggested. With these improvements the questionnaire should be more fluent for the user to be filled. Another problem concerning the score evaluation of negative statements was detected. It should be considered if the user needs to be guided to pay attention to these aspects in before hand or consulted during the evaluation process.

Evaluating the use of colours has been addressed in VisAWI questionnaire as a previously missing but inevitably important aspect of interface aesthetics that needs more attention. Within VisAWI questionnaire, the aspect is covered concerning the appeal of colours, attractiveness of colour composition, colours matching together, and success of their selection. This facet, together with addressing the craftsmanship, are noticeable additions to subjective questionnaires, and could be further studied in order to understand users perception of these values.

Carrying out user testing with selected subjective methods gave an insight not only to the advantages and disadvantages of the methods, but interesting knowledge about regular users understanding of layout and design. It also made clear how context, previous knowledge, and attitude towards specific areas (be it an institution or style) instantly affect the overall judgement of certain design. This all together confirms the usefulness of further work studying the methods to improve them, make conclusions about the suitability and affordance into the process and eventually integrate to the design process should they prove to be cost-effective.

Several authors have drawn a parallel between digital arts and the interface design. As an extension to the objective and subjective methods discussed above, a very

interesting method – interface criticism – was found and introduced. Its detailed analysis was out of the scope of this work but as a perspective development and contribution its deeper analysis is suggested. Interface criticism covers important aspects of interfaces that explain the phenomena on a deeper level. It addresses the stylistic references through well-known historical styles, immediacy and hypermediacy, genres, representational techniques and other aspects.

To conclude, a suggestion for a combined methodology for designers to apply within development process could connect three approaches: selected objective measures while putting the design idea together, a short user questionnaire with few users on design proposals, and eventually interface criticism guidelines to analyse the development interface in greater representative detail. This combination could be further studied and evaluated by professional designers for its applicability in real life situations.

## **Chapter 6**

### **Conclusion**

The main aim of this work is to study and analyse the existing methods of evaluating visual aesthetics.

Visual aesthetics is an important component of the user interface, but based on literature review, it is not yet addressed within development process. Therefore, a research problem has been put forward to detect the importance of visual aesthetics within the user experience, to find possible methods for its evaluation, and to analyse their application.

Literature review carries an important role within this study as the tool to collect existing knowledge about the evaluation methods. As a result of literature review, several subjective evaluation methods of visual aesthetics have been found. No immediately applicable objective method exists, but several approaches with promising developmental perspectives are detected. Some objective measures are used for finding correlations to subjective measures.

Hypothesis has not been proved positive as the existing objective methods are not sufficient for using in application development and interface design process yet. Still, a part of the counts-based method proves to have some correlation to subjective evaluation results and can therefore be used. Furthermore, this method could be studied to develop optimal margins for existing measures and adding other measures concerning colour or other elements.

Subjective methods are addressed more in detail through user testing and observation of the evaluation process. VisAWI questionnaire, classical and

expressive aesthetics have been used to evaluate eight websites. Useful feedback was gathered as the evaluation was carried out with the author observing – this information can be used to improve the methods for further testing in real life situations. The VisAWI questionnaire proved to have several strengths – it is fast for users to complete, it covers four important facets and gives well comparable numerical score. However, problems with translations and terminology have been detected and improvements suggested. Also the need for planning and preparing the user for evaluation process is addressed. With these improvements the method could be used within real life situations.

The study at hand is a contribution to the mapping, improvement and future application of methods for evaluating visual aesthetics of interfaces. The work forms a basis for discussing a well applicable combination of methods to improve the interface design process. As a future work the combination of objective measures, subjective user evaluation and eventually integrating interface critique could be considered.



## Summary

Käesoleva magistritöö eesmärgiks on kasutajaliidese visuaalse esteetika hindamise uurimine ja võimalike hindamismeetodite analüüs.

Visuaalne esteetika on kasutajaliideste oluline komponent, kuid kirjanduse põhjal ei pöörata esteetika hindamisele arendusprotsessis mingit tähelepanu. Sellest tulenevalt on püstitatud uurimisprobleem, et leida visuaalse esteetika mõju kasutajakogemusele, visuaalse esteetika hindamismeetodid ning analüüsida nende kasutamist. Töös püstitati järgnev hüpotees: kasutajaliideste visuaalse esteetika hindamiseks eksisteerivad kvalitatiivsete küsitlusmeetodite kõrval ka koheselt kasutatavad objektiivsed hindamismeetodid.

Antud töö puhul on oluline roll kirjanduse uurimisel, et koguda olemasolevat informatsiooni hindamismeetodite kohta. Leitud meetodid on arengujärgus või veel mitte praktiliselt kasutusel. Antud töö analüüsib leitud meetodite rakendamise protsessi ja tulemusi ning otsib vastastikuseid seoseid objektiivsete ning subjaktiivsete meetodite vahel.

Hüpotees ei saanud täielikku kinnitust, kuna koheselt rakendatavat objektiivset hindamismeetodit ei eksisteeri. Subjektiiivsete meetodite analüüsi tulemusel leiti mitmeid probleeme, mille lahendamine parandaks nende kasutamist. Soovitatud muudatuste rakendamise järel võiks antud meetodeid kasutada reaalses arendusprotsessis.

Käesolev uurimus on osa kasutajaliideste visuaalse esteetika hindamismeetodite analüüsist, et edendada nende kasutamist ning seeläbi loodavate kasutajaliideste disaini. Töö tulemusena esitatakse ettepanekud analüüsitud meetodite arendamiseks ning omavaheliseks kombineerimiseks.

# **Appendices**

## **Appendix A. Test Evaluations**

A.1 Initial Evaluation of Websites

A.2 Test Use Case of Methods

## A.1 Initial Evaluation of Websites

Measures Website	WisAWI S					Comments
	Sim	Div	Colo	Craf	Av	
<a href="http://spruethmagers.com">spruethmagers.com</a>	7	1	4	2	3,5	Not symmetrical, unbalanced, 3-4 colours, unprofessional, clear objects.
<a href="http://bauhaus.de">bauhaus.de</a>	7	7	6	6	<b>6,5</b>	Almost symmetrical, graphics navigation, white text on black (difficult combination for many).
<a href="http://moma.org">moma.org</a>	6	7	5	7	6,25	Almost symmetrical layout, graphics navigation, colourful, images-dependent (changing) effect of colour.
<a href="http://dam.org/home">dam.org/home</a>	7	6	4	7	6	Almost symmetrical layout, very clear layout, colourful, specific choice of colours.
<a href="http://lacda.com">lacda.com</a>	3	3	5	3	<b>3,5</b>	Not symmetrical, unbalanced, classical placement of navigation, simple use of 2-3 colours.
<a href="http://amoda.org">amoda.org</a>	6	2	6	3	<b>4,25</b>	Not symmetrical, unbalanced, bright colours, simple layout.
<a href="http://georg-kolbe-museum.de">georg-kolbe-museum.de</a>	4	2	2	4	3	Not symmetrical, unexpected placement of navigation and contacts, grey.
<a href="http://guggenheim.org">guggenheim.org</a>	6	5	5	7	5,75	Symmetrical, well-organized, colourful, professional, rich in information.
<a href="http://tate.org.uk/modern">tate.org.uk/modern</a>	4	4	6	6	5	Not symmetrical, unbalanced, colourful, rich in information .
<a href="http://moca.virtualmuseum">moca.virtualmuseum</a>	2	4	1	4	<b>2,75</b>	Symmetrical, patchy, uninteresting, monotone, lack of "white space".
<a href="http://mbar.org">mbar.org</a>	3	4	3	5	<b>3,75</b>	Not symmetrical, not traditional layout, unorganised, use of several colours.
<a href="http://sfmoma.org/">sfmoma.org/</a>	6	6	6	7	<b>6,25</b>	Not symmetrical, clean, clear, few strong colours.
<a href="http://mam.paris.fr">mam.paris.fr</a>	7	7	6	7	<b>6,75</b>	Almost symmetrical, Modern, grey, with few colours.
<a href="http://yk.rim.or.jp/~psyche">yk.rim.or.jp/~psyche</a>	6	1	2	2	<b>2,75</b>	Symmetrical, not up to date, lot of white space, white-black.

Table A-1. Initial evaluation of 14 websites using VisAWI Short questionnaire.

## A.2 Test Use Case of Methods

Website Method / elements	Site1 – Sprüth	Site2 – Bauhaus	Site3 - MoMa
<b>Counts measure</b>			
Number of visual objects on the screen	6	6	8
Number of different sizes of visual objects	5	4	4
Number of images	1	8	5
Number of different font types used in the web page	3	2	3
JEPG file size of screenshot of the web page, (KB)	548	153	648
Comments:	<b>Pros:</b> fast method for a designer for his own work, more valuable for informative and task oriented sites. <b>Cons:</b> question of detecting visual objects (question of the level of detail)		
<b>Classical aesthetics</b>			
Clear design	7	7	5
Aesthetic design	5	7	6
Pleasant design	5	4	6
Clean design	7	7	7
Symmetric design	1	6	5
<b>Mean score</b>	<b>5</b>	<b>6,2</b>	<b>5,8</b>
Comments:	<b>Pros:</b> simple procedure, fast method for user, clear score calculation (the mean). <b>Cons:</b> questionable reliability caused by users ability to evaluate their perception, in development phase can be time demanding to carry out reliable user questionnaire.		
<b>Expressive aesthetics</b>			
Creative design	1	2	3
Sophisticated design	2	3	2
Original design	2	4	3
Using special effects	1	1	2
Fascinating design	3	4	4
<b>Mean score:</b>	<b>1,8</b>	<b>2,8</b>	<b>2,8</b>
Comments:	<b>Pros:</b> simple procedure, fast method for user, clear score calculation (the mean). <b>Cons:</b> questionable reliability caused by users ability to evaluate their perception, in development phase can be time demanding to carry out reliable user questionnaire, complication of evaluating still image, while perceiving many Expressive elements may need seeing the dynamics (i.e changing pictures, the transition style etc.)		


<b>Website Method / elements</b>	<b>Site1 – Sprüth</b>	<b>Site2 – Bauhaus</b>	<b>Site3 - MoMa</b>
<b>VisAWI</b>			
<b>Simplicity</b>			
The layout appears too dense. (r)	1 (7)	2 (6)	4
The layout is easy to grasp.	7	7	6
Everything goes together on this site. *	7	7	6
The site appears patchy. (r)	1 (7)	2 (6)	4
The layout appears well structured.	7	7	6
Mean score:	7	6,6	5,2
<b>Diversity</b>			
The layout is pleasantly varied. *	1	7	7
The layout is inventive.	1	4	6
The design appears uninspired. (r)	6 (2)	2 (6)	2 (6)
The layout appears dynamic.	1	6	7
The design is uninteresting. (r)	4 (4)	3 (5)	2 (6)
Mean score:	1,8	5,6	6,4
<b>Colourfulness</b>			
The colour composition is attractive. *	4	6	5
The colours do not match. (r)	1 (7)	1 (7)	4 (4)
The choice of colours is botched. (r)	1 (7)	2 (6)	4 (4)
The colours are appealing.	5	6	5
Mean score:	5,75	6,25	4,5
<b>Craftsmanship</b>			
The layout appears professionally designed. *	2	6	7
The layout is not up-to-date. (r)	6 (2)	2 (6)	2 (6)
The site is designed with care.	3	5	6
The design of the site lacks a concept. (r)	4	3 (5)	2 (6)
Mean score:	2,75	5,5	6,25
<b>Total score:</b>	<b>4,325 (0-1: 0,618)</b>	<b>5,99 (0-1: 0,855)</b>	<b>5,588 (0-1: 0,798)</b>
Comments:	<p><b>Pros:</b> Well defined questionnaire enabling results for different factors as well as whole aesthetics. Suitable for both user feedback as well as designer himself. Considers colour.</p> <p><b>Cons:</b> In development phase may be time consuming to carry out with users.</p>		

Table A-2. Test use case of evaluation three websites using counts-based measure, VisAWI, classical and expressive aesthetics. \* Questions for VisAWI Short.

## **Appendix B    Website Screenshots Used for Final Evaluations**

- B.1    Amoda
- B.2    Bauhaus
- B.3    Lacda
- B.4    MamParis
- B.5    MBAR
- B.6    Moca
- B.7    Psyche
- B.8    SFMoma

## B.1 Amoda



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Jan 28, 2012  
**Performance 16**  
Saturday, January 28th  
AMODA's next event will feature music for percussion and electronics performed by Line Upon Line percussion (Austin) and composer Sam Pluta (NYC). They will play a selection of pieces by John Cage, Sam Pluta, and Anders Vinjar, some of which warp percussion music almost beyond recognition. Join us for an exciting program including finely honed performances on metal, wood, skin, and re-purposed consumer electronics, along with live video and state-of-the-art signal processing. [More >>](#)



Feb 26, 2011  
**Digital Showcase 50**  
Friday, March 11th  
AMODA is celebrating the 10th anniversary of the Digital Showcase Series by holding our most ambitious show ever. There will be two stages of music, a full Laptop Battle, an exclusive appearance by FaftyDL (Planet Mu) from NYC, live video from local luminaries like Wiley Wiggins, animation pieces from around the world, a selection of indie videogames curated by Brandon Boyer, and a special live reading from Bruce Sterling. Don't miss what promises to be a truly special event! [More >>](#)



Feb 26, 2011  
**Digital Showcase 51**  
Saturday, March 10th  
Once again AMODA is kicking off SXSW with one of its legendary Digital Showcases. This event will feature a musical Laptop Battle, live video projections, performances from local electronic musicians and DJs, a wide range of interactive installations, and stunning animation pieces from around the world. Don't miss what promises to be an amazing event! [More >>](#)



Jan 29, 2011  
**Performance 15**  
Saturday, January 29th  
AMODA's next Performance will feature Ensemble Pamplemousse, a group of five New York-based composer/performers who have been described as both 'extremely forward looking' and 'breathhtakingly virtuosic.' The ensemble's members are trained in the classical (flute, violin, cello, piano, percussion), electronic, and improvisational realms. Their collective love for experimentation leads them to persistently discover new vistas of sound at the frayed edges of dissective instrumental performance. Their live sets weave together shapes of resonance, clusters of glitch, and skitters of hyper action into impeccable structures of unified beauty. The ensemble's Austin first appearance promises to be one of AMODA's most ambitious Performance Series events yet. [More >>](#)

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## B.2 Bauhaus

**BAUHAUS-ARCHIV museum für gestaltung berlin**  
klingelhöferstrasse 14 d - 10785 berlin telefon: +49 30 - 25 40 02 0

english

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**bauhaus\_news: kostenlosen newsletter bestellen**

**Zum ersten Mal! Das bauhaus-café wird zur Jazzlounge.**  
Dienstag, 13.03.12, ab 20 Uhr

**Die Sammlung Bauhaus. Originale der Klassischen Moderne**  
**Bauhaus\_Sonntagsführung** - jeden Sonntag, 14 Uhr  
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**Stühle ohne Beine . Die Neue Sammlung – The International Design Museum Munich – zu Gast im Bauhaus-Archiv**  
21. März bis 10. Juni 2012


sitemap impressum



## B.3 Lacda

**lacda**  
los angeles center for digital art  
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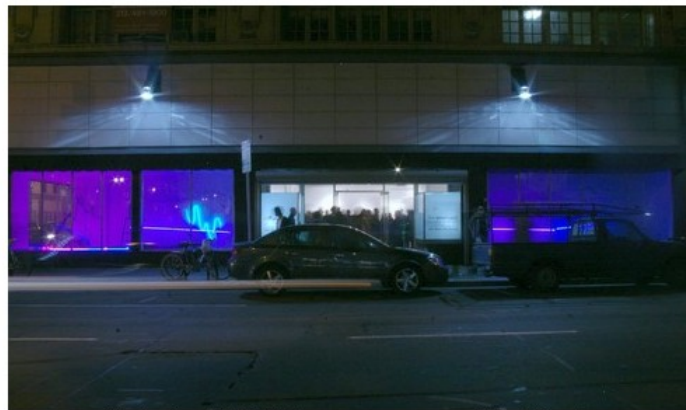
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## B.5 MBAR



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RENNES

## B.6 Moca

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<p><b>DIRECTORS CHOICE</b></p> <p>Tiago Manuel Santos Self Portrait</p> <p>Dolores Glover Kaufman Anybody's Guess</p> <p>Charles H. Carver Eye and Mind</p> <p>Rafael Patiño Góez Trompe l'oeil</p> <p>Carlos Bacha You &amp; Me</p> <p>Andreina Polo Turinstan C</p>	<p><b>FREE MEMBERSHIP</b></p> <p><b>Membership is free</b> click to join and enjoy all benefits</p> <p>Learn more about graphic design at one of the many <a href="#">graphic design schools</a> in the country</p> <p>AdChoices ▶ ◀ ▶</p> <p><b>Affordable Irish Art Sale</b> Over 160 lots with low reserves. Live Bidding Now Available! <a href="#">www.gormleysartauctions.c...</a></p> <p><b>Téléchargez Google Chrome</b> Le navigateur gratuit qui vous permet d'en faire plus sur le web ! <a href="#">www.google.com/chrome</a></p>	<p><b>DIGITAL VIDEO AND AUDIO ART</b></p>  <p>▶ <b>PLAY VIDEO</b> Labyrinth Nr. 13 by Gerhard Mantz</p> <p><b>PHOTO-BASED ART</b></p> <p><b>HoryMa</b> The Painting of Light</p> <p><b>Photographic digital</b> Shannon Hourigan</p> <p><b>Digital photos/illustration</b> Andy Ellis</p> <p><b>Donnie 2012 Contest and Exhibit</b> Entries Winners Catalog</p> <p><b>Salon I Digital Art Contest</b> Entries Winners Catalog</p>	<p><b>FREE SUBMISSION</b></p> <p><b>Free Submission of your digital art</b> Click now to get an exhibit on our site at no charge</p> <p><b>SURREAL ART</b></p> <p><b>Christos Magganas</b> Photographic Renderings</p> <p><b>Robert W. McGregor</b> On the Surreal Side</p> <p><b>Ondrej Rudavsky</b> Subconscious Worlds</p> <p><b>Jean-Marc Rulier</b> Portraits in Depth</p> <p><b>Gilles Tran</b> Oyonale: 3D</p> <p><b>Ed Unitsky</b> Fantasy</p> <p><b>Jason Kelly</b> Dreamscape</p>	<p><b>MAIN GALLERIES</b></p> <p>AutoGallery 2012 AutoGallery 2011 AutoGallery 2010 Open Gallery Photo-based Drawn/Painted 3d Rendered Surreal Algorithmic/Fractal New Media/Video</p> <p><b>Upload Video</b> to Web's best fineart digital video collection right here on this site</p> <p><b>DRAWN/PAINTED</b></p> <p><b>Peter Mc Lane</b> Digital paintings</p> <p><b>John Hughson</b> Art as Discovery</p> <p><b>JD Jarvis</b> Mixed Technique / Thematic Art</p>
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