



# Perceived web site aesthetics by users and designers: implications for evaluation practice

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## ABSTRACT

The set up of practical methods for evaluation of web site aesthetics from the user perspective and the provision of useful feedback to designers is an open issue in Human-Computer Interaction (HCI). The paper presents an evaluation study of aesthetic attributes of two web sites from the user perspective and compares the results to the design team. The study initially involved the formulation of a set of aesthetic attributes and their appreciation by a user group of 111 users for two web sites, following a traditional user testing approach. The user evaluation was then compared to the design team's appreciation of these aesthetic attributes for their own designs. The main results of this test was that: (a) the two groups have a similar view about the presence of a considerable number of the selected aesthetic attributes; (b) users have rated most aesthetic attributes significantly lower than designers; (c) different aesthetic attributes become important for different objects of study for both groups. The design team found the evaluation informative and inspiring; however they identified the need for further explanation of user responses in terms of suggested design patterns and examples. Also, a number of recommendations towards an evaluation method of aesthetics in HCI are identified and discussed

*Keywords:* web aesthetics; comparative evaluation; user testing; design team;

## INTRODUCTION

The aesthetic value of interactive systems is gradually appreciated for the development of the web and new media technologies and applications. Besides that it has been shown that aesthetics affects perceived usability (Sonderegger & Sauer, 2010), the practice of web design now requires the collaboration of many design professionals, while the development of technology gradually raises the constraints to creative design. For web sites in particular, their aesthetic value has been reported as a critical factor for user acceptance in many studies (e.g. Van der Heijden, 2003; D'Angeli et al, 2005; Hartmann et al, 2008).

Despite that aesthetics is widely acknowledged as a desired property of web design, there are too few methods and knowledge about the evaluation of aesthetics in HCI. In this respect, Norman (2004) remarks that "*we solely lack a standard body of terminology, theory and methods of investigation of aesthetics in HCI*". Therefore, we need methods, guidelines, tools, frameworks, for the design and evaluation of aesthetics in HCI in general (Mattila et al, 2008) and for the web in particular. Furthermore, related studies of aesthetic appreciation of web sites have not considered the views of their designers in this respect, which is an important issue due to the largely subjective nature of this appreciation; web site designers can explicate the aesthetic goals of the product and reflect upon user responses on the basis of their intended approach.

This paper presents a method and a case study for the evaluation of the aesthetic value of web sites. The method extends important practices of traditional usability testing, in contrast to other studies that follow various experimental designs, and considers the aesthetic goals of web sites as provided by the design team. The study compares the perceptions of 111 users about the aesthetic attributes of two web sites to those of the 3-member design team, and discusses implications for respective evaluation practice. The paper is structured as follows: Section 2 presents the related work in terms of perspectives about aesthetics in HCI and about aesthetic attributes considered for the evaluation of web sites aesthetics in other studies. Section 3 presents the evaluation study set up, conduction and results. Section 4 provides a discussion of recommendations and challenges on the basis of this study. Finally, section 5 presents conclusions and future work.

## RELATED WORK

Over the last few years, the study of aesthetics in HCI attempts to identify the relationship of aesthetics to other dimensions of the interaction experience, especially usability. In addition, researchers in this area set out to investigate the essential nature of aesthetics in terms of evaluation studies that examine various aesthetic attributes that have been proposed to constitute the total aesthetic value of web sites.

### **Aesthetics in HCI: nature and relationships with other dimensions of the interaction experience**

The study of aesthetics has been the interest of a number of philosophic, artistic and scientific areas throughout human history. In their review of relevant studies of aesthetics in HCI, Lavie & Tractinsky (2004) identify the following areas: philosophical approaches for the study of aesthetics, empirical studies of aesthetics, the role of aesthetics in engineering design and the role of aesthetics in human-computer interaction. HCI is concerned with the “*design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them*” (Hewett, et al, 1996) and therefore the study of aesthetics is relevant for both design and evaluation of interactive systems as well as for the understanding of the concept in its own right.

In order to approach the issue of aesthetic evaluation and appreciation, one must consider whether the aesthetic value is in the object (observed) or/and in the subject (observer). Pandir & Knight (2006) have described approaches to aesthetics as belonging to the streams of objective, subjective and holistic. Objective approaches attempt to provide general definitions on the basis of philosophical argumentation and theoretical analysis; in subjective approaches, aesthetic judgement is determined by the pleasure or displeasure that perception of the object arouses in any spectator (Ward, 1992); while holistic approaches posit that an understanding of aesthetics can have both subjective (e.g. personal preference) and objective (e.g. colour) dimensions.

The ‘holistic’ study of aesthetics is similar to the current understanding of the concept of usability in HCI: the prominent definition for usability is that it consists of “*the effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments*” (ISO 9241); and it is generally accepted that effectiveness and efficiency can be objectively measured (for specific users, context and ‘environment’), while satisfaction is a subjective attribute.

An important issue to be taken into account for the identification of a method for evaluation of aesthetics in HCI is related to the understanding of the concept of aesthetics in relation to other significant attributes of the interaction experience, and especially usability. Hassenzahl (2004)

investigated the interplay of beauty, goodness, and usability in interactive products in two studies that investigate users' responses to different MP3 player skins. His experimental approach is based on a model (Hassenzahl, 2003) that assumes that two distinct attribute groups, namely pragmatic and hedonic attributes, can describe product characteristics. Pragmatic attributes are connected to the users' need to achieve behavioral goals, and hedonic attributes are primarily related to the users' self. He suggests that "*usability is a pragmatic quality that is understood as a bundle of low-level product attributes (e.g., clear, supporting, predictable) and beauty as a higher level evaluative construct, comparable to (but not identical with) other evaluative constructs, such as goodness or pleasantness*".

From the perspective of the practice of design and evaluation of interactive systems, it is useful to consider aesthetics as a distinct quality of interaction that is related to other attributes of the interaction experience in specific context of use. The context of use is implied in the above definition of usability ("specified users, specified goals, particular environments") and it is widely accepted that affects the quality of the usability evaluation studies. In this respect, Frohlich (2004) argues that beauty is a subjective experience in context. His perspective is explained in that "*beauty is not an objective continuous property of interactive products but rather a rare and discrete response by users to something they see in those products or their interaction with them.*" Thus, we consider that aesthetics can be a distinct goal for the evaluation of an interactive system, which can be related to other attributes like usability in ways that should be identified in the context of particular evaluation studies.

### **Attributes for the evaluation of web sites aesthetics in other studies**

Previous studies of web sites aesthetics have investigated several dimensions of aesthetic experiences, with the aim to reach to a limited set of attributes that may be used to aesthetic appreciations of web sites.

Schenkman & Jonssons (2000) employed an experimental approach to investigate how web pages are experienced aesthetically by a group of users and what subjective factors determine users' overall impression. In their study, eighteen users rated thirteen websites according to seven aesthetic attributes: complexity, legibility, order, beauty, meaningfulness, comprehension, and overall impression. Multidimensional analysis of similarity and preference judgements found four important dimensions: beauty, mostly illustrations versus mostly text, overview and structure.

Lavie & Tractinsky (2004) assessed dimensions of perceived visual aesthetics of web sites by conducting four subsequent studies of aesthetic appreciation of web sites by large user groups. They first identified a total of 41 aesthetic attributes generated from a literature review undertaken to identify the aesthetic construct in general, and from eleven professionals in HCI who were asked to provide a list of adjectives representing aesthetics. Then, they performed exploratory factor analysis in the first three studies to reduce the aesthetic attributes to a lower number of uncorrelated attributes, while in the fourth study they performed confirmatory factor analysis to validate the two-factor aesthetic model that emerged in Studies 2 and 3. They conclude that users' perceptions consist of two main factors, which they termed 'classical aesthetics' and 'expressive aesthetics'. Classical aesthetics emphasizes "*orderly and clear design*" and is tightly related to a great number of usability rules, and expressive aesthetics reflects "*the designers' creativity and originality*" as well as "*the ability to break design conventions.*" Additionally, they emphasize that perceptions of usability and aesthetics are extremely correlated.

The study of Pandir & Knight (2006) investigated (a) how Berlyne's theory (1974) is related to

website homepages and (b) whether an experimental aesthetics approach is useful and relevant to design research. In their study, a ranking method using card sorting and questionnaires was employed to measure users' preferences and the relationships between the attributes of complexity, pleasure and interestingness. Their findings show that complexity is a serious inhibitor of pleasure: a complex web site "*received the lowest scores of pleasure*" and also "*interestingness decreased as complexity increased.*" Furthermore, individual aesthetic preferences are determined upon a great amount of subjective factors which include personal differences in relation to lifestyles and tastes that change and develop over time, thus an experimental aesthetics approach can shed light into these individual characteristics to inform design decisions related to aesthetics.

Hartmann et al (2008) propose a theoretical framework for assessing the attractiveness of websites, which they consider it as consisting of the attributes of usability, content, aesthetics, reputation/identity and customisation. They conduct three comparative studies of assessing user engagement in pairs of web sites of the same brand and content but different design. Their findings agree with previous studies that reported a correlation between perceived usability and aesthetics, and they indicate the users' overall impression (halo effect) of a web site could be a determinant of user satisfaction and system acceptability, even overcoming poor usability experience and poor content.

These studies provide various insights about web site aesthetics and their relationship to usability, but they tend to focus on the study of the concept of aesthetics per se, and do not propose actions regarding the web sites under evaluation. Each one of these studies has examined a wide range of different aesthetic attributes, and still we have not seen an established set of these attributes besides high-level dimensions of aesthetics like those of 'classical' and 'expressive' aesthetics proposed by Lavie & Tractinsky (2004). In addition these studies vary with respect to the distinct experimental methods employed that range from card sorting and interviewing to user appreciations of aesthetic attributes. Last, but not least, no study has compared user perceptions about aesthetics with designers' views; this is required to do justice on the intended aesthetic goals of any web site, as these were set by its design team. This paper attempts address these issues to some extent, by comparing user responses to designer's goals and views and investigating practical issues of evaluation including the interpretation of user responses for providing useful feedback to web designers.

## **Scope of our approach for an evaluation method of web site aesthetics**

We have constructed a composite method for the evaluation of web site aesthetics that involved a large number of users providing the views on aesthetic attributes identified from related work and previous studies. In addition the design team of these two web sites participated in the study by (a) validating the initial aesthetic attributes identified in related work (in a similar vein to the identification of aesthetic attributes by Lavie & Tractinsky, 2004) and (b) by providing their own appreciation of the aesthetic factors of their designs. The main considerations for the method used included:

**1. Combining user responses with designers' feedback.** In the usability testing approach, there are many objective attributes or metrics that can be selected to measure the user experience on the basis of user performance and/or with user perceived usability survey tools (Tullis & Albert, 2008). However, when evaluating the aesthetics of an interactive system there are no such objective attributes or metrics. Thus, it is important to consider the view of the designer during the evaluation of the aesthetic quality of an interactive product. Designers will explicate the aesthetic goals of the product and reflect upon user responses on the basis of their intended

aesthetic approach.

**2. Identification of aesthetic attributes of web sites from related work and designers' feedback.** There is not a widely accepted set of subjective attributes about the aesthetics of web sites, and many studies have employed different sets of attributes (Schenkman & Jonssons, 2000; Lavie & Tractinsky, 2004, Pandir & Knight, 2006). Therefore, we initially identified a set 16 aesthetic attributes in related work and literature (Table 1, 1-16). Furthermore, the design team was interviewed in order to provide the aesthetic goals they had set for each web site in terms of these attributes (Table 2) and they were also asked to propose new items that they considered important for the aesthetic appreciation of their work. The design team assessed these attributes with different degrees of importance for each web site and they additionally suggested another four attributes (Table 1, 17-20) that were added to the questionnaire that would be provided to users, thus reaching a set of twenty aesthetic attributes.

Table 1: Aesthetic attributes of web sites were identified in related work and literature

	<i>Attributes</i>	<i>References to other studies</i>
1	Artistic	Lavie & Tractinsky (2004)
2	Harmony / Order	Schenkman & Jonssons (2000)
3	Analogy / Symmetry	Lavie & Tractinsky (2004)
4	Unity	Pandir & Knight (2006)
5	Overall Impression	Schenkman & Jonssons (2000)
6	Energetic	Lavie & Tractinsky (2004)
7	Clear	Lavie & Tractinsky (2004), Pandir & Knight (2006)
8	Pleasant	Lavie & Tractinsky (2004), Pandir & Knight (2006)
9	Intriguing	Lavie & Tractinsky (2004), Pandir & Knight (2006)
10	Complexity	Schenkman & Jonssons (2000), Lavie & Tractinsky (2004), Pandir & Knight (2006)
11	Enjoyable	Van Der Heijden (2003), Lavie & Tractinsky (2004)
12	Beautiful	Schenkman & Jonssons (2000), Lavie & Tractinsky (2004)
13	Attractive / Appealing	Van Der Heijden (2003), Pandir & Knight (2006)
14	With imagination	Pandir & Knight (2006)
15	Original	Lavie & Tractinsky (2004), Pandir & Knight (2006)
16	Meaningful	Schenkman & Jonssons (2000)
17	Creative	Lavie & Tractinsky (2004)
18	Stylish	Pandir & Knight (2006)
19	With effect	Lavie & Tractinsky (2004)
20	Colourful	Lavie & Tractinsky (2004)

**3. Distinction between ‘perceived’ and ‘required’ attributes of aesthetics:** In an evaluation study, it is not enough to identify the extent to which users perceive aesthetic attributes. The distinction of what is perceived and what is required (i.e. desired according to the users’ perspective) needs to be made. Hassenhal (2004) also makes the distinction between perception of attributes and their evaluation: “*individuals may find a product novel, but not necessarily like it*”. Therefore we asked users to rate the aesthetic attributes in terms of their (perceived) presence and their (perceived) requirement (or need for this attribute) in both web sites.

**4. Task-based user interaction for user testing.** Lindgaard et al (2006) show that visual appeal can be assessed within 50ms, suggesting that web designers have about 50 ms to make a good first impression (halo effect). Tractinsky et al (2006) have replicated this experiment with similar

results. Unlike these approaches, we argue that when aesthetics of interaction are to be evaluated, we should allow users to have interactive experiences via task-based interactions to help them gain a better appreciation of aesthetics and not simply rest on first sight impressions. In this vein, Hassenzahl & Ulrich (2008) have experimentally showed that “*active instrumental goals not only impact experience per se by, for example, inducing mental effort, but also the way subsequent retrospective judgments are formed.*”

Therefore, we selected to organise the user tests with a task-based navigation to the web sites, instead of simply looking at the home page or free exploration. These task-based explorations are often when we are considering choosing an interactive product for use or purchase, and this is also the case with traditional usability evaluations. A total of six tasks were provided to user groups for each web site. These tasks were similar for both web sites, but they could not have been identical since that the scope of each site is different. The selected tasks concerned typical uses of the web sites; for example, the first task was for the online sports newspaper to “go to the homepage, locate and read the (specific news) item of ...”, and for the paint industry to “go to the homepage and locate and read information about business services (a particular link)”. During each task, users were instructed to make observations about each one of the aesthetic attributes they had to assess.

## **EVALUATION STUDY**

### **Goals and evaluation objects**

The goal of the evaluation study was twofold: first, to set up a practical approach for the evaluation of aesthetics of web sites based on principles of the usability testing method and second to assess important dimensions of aesthetics of web sites and investigate them with their designers.

We selected two web sites with distinct aesthetic goals, created by the same design team. Both web sites are widely known in Greece: the first is the web site of a popular sports newspaper (<http://www.sportime.gr>) and the second a corporate web site of one of the largest national paint industries (<http://www.chrotex.gr>). The design team consisted of three professionals: a computer engineer with a ten year experience, a graphics designer with a five year experience and a web developer with a three-year experience in web design and development.

### **Participants and process**

The participants (users) of the evaluation study were 111 students of the department of computer science of the Technical Educational Institution of Piraeus. All of them were proficient users of the web. The 69% were male and the 31% were female with a mean of 20.8 years of age. They conducted the evaluation as part of their course on ‘design innovation’, at their third year of study. These users are a demographically focused target group of both web sites, and they were considered as a major target group for their interest in sports and design. The participants performed the experiment in their computer lab, which was a familiar and friendly environment. The evaluation process included the following steps:

1. The design team was initially interviewed regarding the aesthetic goals of the web sites, comments on the importance of the initial aesthetic attributes identified and to possibly add other attributes that they considered important. They also completed a questionnaire with their ratings, with a 7-point scale from (1) “no significant” to (7) “absolutely significant”.

2. The user evaluation took place in the computer lab. The instructions were given with the usage of a projector. The participants were asked to navigate on the two websites starting with any one they preferred and perform a set of typical tasks. Then, they were asked to evaluate the (perceived) presence of these aesthetic attributes for each specific web site. The participants had also the possibility to write down explanations about their aesthetic judgements as well as to propose ideas for redesign in free form. The participants approximately spent 45 minutes of their 2 hour lesson for the exercise. Their supervisors watched the progress of the experiment (e.g. which web site is evaluated, how their time is divided and so on) through a central PC from their office.
3. The user responses were compared to the designers' views with basic measures of descriptive statistics and the z-test statistical measure for comparing the means of their responses. In this test we wanted to see if there is a difference in perceived aesthetic value between these groups. We used the z-test measure to test this difference, since that we know the value of our population variances and the population is normally distributed. In our case we have a large sample (>30) of 111 users for which we assume that the variance of their responses is that of the larger population, and a small sample of the whole population of the design team consisting 3 designers but for which the variance of their responses is known.
4. The results of the evaluation were summarised and discussed with the design team at a later time.

## Results

We first report on descriptive statistical measures about the initial participants' responses about the importance of the aesthetic attributes selected for web design in general. We asked participants to rate in a 7-point scale (1: low; 7: high) the importance of each aesthetic attribute. Table 2 summarises these results.

Table 2: Mean ratings of the importance of the aesthetic attributes for web design from designers and users (1: low importance; 7: high importance).

	Aesthetic attributes	Design team	Users	
		Mean	Mean	St. Dev.
1	Artistic	4.3	4.7	1.4
2	Harmony/Order	6.0	5.5	1.2
3	Analogy/Symmetry	6.3	4.9	1.4
4	Unity	7.0	5.0	1.3
5	Overall Impression	7.0	5.8	1.2
6	Energetic	5.0	4.5	1.5
7	Clear	5.7	5.9	1.2
8	Pleasant	5.0	5.4	1.3
9	Intriguing	5.0	4.0	1.6
10	Complexity	1.3	2.5	1.5
11	Enjoyable	3.7	5.0	1.4
12	Beautiful	5.3	4.9	1.4
13	Attractive / Appealing	5.3	5.3	1.2
14	With imagination	6.7	5.3	1.4
15	Original	6.3	5.2	1.6

16	Meaningful	7.0	5.6	1.2
17	Creative	6.0	5.4	1.4
18	Stylish	5.7	5.2	1.5
19	With effects/animation	4.7	4.5	1.8
20	Colourful	5.7	5.1	1.6

From user and designer responses we can see that each aesthetic attribute does not contribute at the same degree to each group's view of web site aesthetics. For example, for the design team examined, the aesthetic attributes of 'unity', 'overall impression' and 'meaningfulness' are considered as highly important, while 'complexity' is not important. In addition, the responses of the user group reveal that all aesthetic attributes examined are affecting with a positive matter the overall aesthetic value of a web site, with the exception of complexity (in agreement with the designer group). Complexity has been identified initially by Berlyne's theory of aesthetics (1974), but for web sites it is not important, because web sites are intended to cater for other user needs related to usability, functionality, utility and so on. Complexity is generally not compatible to these needs despite that it may be an important aesthetic attribute for other objects of study like for example music or painting. This is a similar finding to that of Pandir & Knight (2006), who show that complexity is a serious inhibitor of pleasure.

With respect to the evaluation of the aesthetic attributes of the 2 web sites, we have seen a number of results in many dimensions. Table 3 summarizes the data of the evaluation.



Table 4: Perceived presence of aesthetic attributes by designers and users in the two web sites examined.

Aesthetic attributes	1 <sup>st</sup> web site (sportime)						2 <sup>nd</sup> web site (chrotex)					
	Designers		Users		(z-test, p>0.01?)	Designers		Users		(z-test, p>0.01?)		
	Mean	Variance	Mean	Variance		Mean	Variance	Mean	Variance			
1 Artistic	3.3	0.3	3.5	2.1	Yes (p=0.5479)	5.7	0.3	4.9	1.7	Yes(p= 0.0225)		
2 Harmony/Order	6.7	0.3	4.3	1.6	No	5.7	0.3	5.3	1.5	Yes(p= 0.3357)		
3 Analogy/Symmetry	6.0	0.0	4.5	1.3	No	6.3	0.3	5.2	1.4	No		
4 Unity	6.0	1.0	4.6	1.8	No	6.3	0.3	5.2	1.4	No		
5 Overall Impression	5.3	0.3	4.5	1.6	Yes (p=0.0113)	5.0	0.1	5.3	1.7	Yes(p= 0.1649)		
6 Energetic	5.0	1.0	4.2	2.0	Yes (p=0.2017)	4.0	0.1	4.4	1.8	Yes(p= 0.0862)		
7 Clear	6.0	1.0	4.6	2.3	No	6.7	0.3	5.4	1.7	No		
8 Pleasant	4.0	1.0	4.3	2.0	Yes (p=0.6375)	4.3	0.3	5.0	1.9	Yes(p= 0.0616)		
9 Intriguing	3.0	1.0	3.2	2.1	Yes (p=0.1866)	3.0	0.0	3.4	1.8	Yes(p= 0.0520)		
10 Complexity	1.7	0.3	3.9	3.1	No	2.0	1.0	2.8	2.6	Yes(p= 0.1562)		
11 Enjoyable	4.0	1.0	4.0	1.8	Yes (p=0.9756)	3.7	0.3	4.0	2.4	Yes(p= 0.3659)		
12 Beautiful	4.7	0.3	3.9	2.3	Yes (p=0.0240)	3.7	0.3	4.7	1.6	No		
13 Attractive/Appealing	4.3	0.3	3.7	2.0	Yes (p=0.0882)	4.3	0.3	4.5	1.9	Yes(p= 0.5803)		
14 With imagination	2.3	0.3	3.2	2.4	Yes (p= 0.0240)	5.3	0.3	4.3	2.6	No		
15 Original	7.0	0.1	3.9	2.6	No	5.0	1.0	4.7	1.8	No		
16 Meaningful	7.0	0.1	4.5	2.1	No	6.7	0.3	5.1	1.6	No		
17 Creative	5.0	1.0	3.9	2.2	Yes (p=0.0736)	6.3	0.3	4.8	1.9	No		
18 Stylish	4.7	0.3	3.9	2.4	Yes (p=0.0320)	6.3	0.3	4.8	2.2	No		
19 With effects, Animation	5.0	1.0	3.7	2.9	Yes (p=0.0341)	4.3	0.3	3.4	2.8	No		
20 Colourful	5.3	0.3	4.7	2.5	Yes (p= 0.0800)	6.7	0.3	5.7	1.9	No		
Overall score	4.9		4.1			5.1		4.6				

The first result of this evaluation is concerned with the similarities and differences of the perceived presence of the aesthetic attributes examined between users and designers. The two groups have a similar view about the presence of a considerable number of the selected aesthetic attributes: for the first web site this rises to 13/20 attributes, and for the second web site for 9/20 aesthetic attributes. A closer look to the views of the two groups on each aesthetic attribute allows us to reach to detailed interpretations. For example, for the first web site, the design group perceives the attribute of ‘overall impression’ at a value above average (mean: 5.3/7); this is also the case for the user group (mean: 4.5/7). In addition, for the first web site again, the design group perceives the attribute of ‘with imagination’ at a low value below average (mean: 2.3/7), which is also the case for users (mean: 3.2/7).

The two groups agreed about the presence of the following seven aesthetic attributes for both web sites: ‘artistic’, ‘overall impression’; ‘energetic’; ‘pleasant’; ‘intriguing’; ‘enjoyable’; ‘attractive/appealing’. These seven aesthetic attributes are commonly understood by both groups with respect to the design of the examined web sites. For example, we can see that the aesthetic attribute of ‘artistic’ is perceived quite similarly for users and designers for both web sites. For the first web site this attribute is not rated highly (3.3/7 for designers and 3.5/7 for users), while for the second web site the perceived presence of this attribute is considerably higher (5.7 for designers and 4.9 for users). Indeed the first web site has the form of a typical online newspaper (a new portal) and the artistic elements are related simply with the brand identity elements like colour, fonts and logo; this is not the case for the second web site, which follows a non-conservative form in its design including rounded or no borders, semi-formed shapes and more colours and animation.

In addition, it can be observed that users have rated most aesthetic attributes significantly lower than designers. For example, for the first web site we can see that users rate significantly lower than designers the presence of aesthetic attributes like ‘harmony/order’, ‘analogy/symmetry’, ‘unity’ and so on. This can be attributed to the fact that designers might not have been able to distance themselves out of their own design, while they are best informed of practical design and implementation issues that would be rewarding of the final outcome. In addition, the user group probably provided strict judgements to a number of aesthetic attributes due to their high user experience but moderately low design experience.

Another aspect of these results is concerned with which site is the site with most aesthetic value between the two. In this, both groups consider that the second web site presents higher aesthetic value from the first. This is due to the mean overall ratings provided: the designers’ group rated the first site with an overall 4.9/7 and the second with 5.1/7; the user group rated the first site with an overall 4.1/7 and the second with 4.6/7.

Certainly, there was a considerable number of aesthetic attributes of the two web sites that are appreciated differently by users. Users were asked to provide their evaluation regarding comments and ideas with respect to improvements of the aesthetics of the two web sites. Users provided few answers to these free-form questions. These answers mainly involved ‘objective’ issues like: “low resolution and quality of images”; “inconsistent fonts throughout the site”, “need to better combination of colours”, “dead hyperlink”, etc. Users reported that they did not feel confident to make wider proposals regarding aesthetics in the timeframe of the user testing session. These comments were organised and handed over to the design team along with a

description of the quantitative results of the descriptive statistics and factor analysis.

This analysis reveals that different aesthetic attributes become important for different objects of study. In particular, the first web site (sportime) is perceived to emphasise dimensions of classical aesthetics like ‘harmony/order’, ‘clarity’, ‘analogy’, ‘meaning’, etc. in contrast to the second web site that is clearly perceived to emphasise ‘expressive aesthetics’ like ‘artistic value’, ‘intriguing’, ‘enjoyable’, ‘attractive’, etc. This can be also attributed to the fact that the web site is a thematic portal and follows relevant design conventions that are more or less known to the users that evaluated the web site. The second web site was indeed designed to express the object of the paint industry in the web in a more creative approach.

The design team found the results informative and in some aspects surprising and inspiring. Regarding the mean ratings of aesthetic attributes by users, they confirmed that the first site followed a more conventional design than the second. They found that the factors of aesthetic attributes can be a starting point for them to identify ideas and guidelines for the redesign of the web sites when required. They identified that the free-form user responses were useful for the identification of current issues and to set priorities for redesign.

However, the ‘formality gap’ between aesthetic attributes and design options was evident: designers were not sure about how to interpret the low user perception of some aesthetic attributes. Therefore, they identified the need for more qualitative data and examples. Another issue that was identified during the discussion with the design team was the possibility of an automated software tool (a designer decision support system) that would allow the collection and processing of quantitative and qualitative data about user perception of aesthetic attributes as well as the visual presentation of the results.

## **DISCUSSION: RECOMMENDATIONS AND CHALLENGES FOR AN EVALUATION METHOD OF WEB SITE AESTHETICS**

In this section we discuss the more general aspects of the results of the work presented on the basis of the follow-up interviews with users and designers in terms identified recommendations for evaluation practice and remaining challenges.

The main considerations for the evaluation method presented draw upon established practices in usability evaluation and can serve as recommendations for other studies that aim to evaluate web site aesthetics. These recommendations include:

1. Combination of user responses with designer feedback for aesthetic evaluation of web sites. Since that there are no objective attributes or metrics of web site aesthetics, it is essential for any evaluation method to consider the view of the designers during the evaluation. Designers will explicate the aesthetic goals of the product and reflect upon user responses on the basis of their intended aesthetic approach.
2. Identification of aesthetic attributes of web sites from related work and designers’ feedback. Since that there is not a widely accepted set of subjective attributes about the aesthetics of web sites, it is important that the a widely accepted set of subjective attributes about the aesthetics of web sites is employed in combination with the designers’ intended aesthetic goals.

3. Distinction between ‘perceived’ and ‘required’ dimensions of aesthetics, to allow for aesthetic judgements. For each aesthetic attribute, it is important to distinguish users’ perceived presence from users’ requirements. Previous studies have remained to users’ perceived presence of aesthetic attributes; however, if we are to provide aesthetic judgements about the aesthetic value of web sites we have to make this distinction.
4. Task-based user interaction with the object systems. When aesthetics of interaction are to be evaluated, we should allow users to have interactive experiences via task-based interactions to help them gain a better appreciation of aesthetics and not simply rest on first sight impressions

The evaluation of aesthetics of web sites poses many methodological and practical challenges. Tractinsky (2004) remarks that “*the study of beauty in the context of HCI is difficult... Aesthetic matters are inherently complex... Obviously, methodological choices involve tradeoffs in many cases*”. From the experience gained out of this study we outline the following challenges for future work:

1. Make sure that qualitative data are gathered during an aesthetic evaluation that provide reasonable explanations for user responses. Interpretation of user data is an important issue in any type of evaluation and it can turn to a significant challenge for aesthetic evaluation. In our study we approached this issue summarising and matching descriptive responses to their aesthetic perceptions. However we saw that there is a need to provide visual representations of users’ aesthetic judgments to for designers. A direction to address this challenge may be work in the field of design patterns for HCI and interaction design (for example, Tidwell, 2006) that can be related to aesthetic attributes in some way.
2. Automated data collection and processing of user evaluations of their interactive experiences. This development would allow users to perform online evaluations of aesthetic attributes (along with usability issues) and support the collection and processing of quantitative and qualitative data about aesthetic judgements as well as the visual presentation of the results to the design team. A rigorous appreciation of aesthetics of a web site would require many opinions of many user groups especially for large web sites that continuously update their content and services.

## CONCLUSIONS AND FUTURE WORK

The paper presented a method and a case study for the evaluation of the aesthetic value of web sites. The method extends important practices of traditional usability testing and considers the aesthetic goals of web sites as provided by the design team. The evaluation of the two web sites yielded various quantitative appreciations of aesthetic attributes of these two web sites that informed the design team. However for some of these attributes, there was not substantial qualitative feedback on which the design team could build on for potential web site redesign.

The contribution of the paper to the current state of the art of evaluating web site aesthetics can be summarised by the identification of particular elements of the proposed evaluation method that have been marginally discussed in related studies: these include the incorporation of the views of the design team, the requirement to follow established principles of user testing and the need to distinguish between

‘perceived’ and ‘required’ dimensions of aesthetics, to allow for aesthetic judgements. Our experiences out of the evaluation case study have also yielded a number of future improvements on the method and results. We are currently working to apply and refine the proposed method to other cases and to provide users and designers with means to better express qualitatively their aesthetic judgements with the use of web design patterns (Tidwell, 2006). We expect that in the near future the overall picture of research in evaluation of human-computer interactions will be that of considering aesthetics along more traditional goals of web site evaluation, especially usability. Thus, we envisage that particular methods or methodologies that incorporate aesthetic judgments will be further explored.

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