Exploring Attributes of Skins as Potential Antecedents of Emotion in HCI

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Abstract: Following research on the emotional effects of physical artifacts in organizational settings, we suggest that studying emotion in the context of using interactive applications can benefit from looking at how the application is evaluated by users on three distinct attributes: instrumentality, aesthetics, and symbolism. We conducted an exploratory experiment to assess the viability of a subset of this model for the field of human-computer interaction, in the context of users' personalization of PC-based entertainment applications. Users exhibited a variety of tastes when choosing an interface for their application. The results of closed-format and open-format questionnaires reveal that the dimensions of usability, aesthetics, and symbolism are distinct of each other. Each of these dimensions contributed to explaining users' satisfaction and pleasant interaction experience. In line with the premises of *Aesthetic Computing*, the contribution of aesthetics to users' personalization of their computing environments is particularly evident.

1 Introduction

The role of computers in society has evolved and grown significantly from their use in the early days of computing to support well defined organizational goals or complex scientific problem solving while being operated by a handful of experts. Today's computers serve much broader purposes and are operated by a large and diverse user population. This course of development increases the importance of studying the various aspects of human-computer interaction (HCI). Traditionally, the field of HCI has been mainly concerned with the efficiency of accomplishing users' tasks, by ways of improving the motor or the cognitive efficacy of the interaction. Consequently, other aspects of the interaction have been neglected by the HCI academic community (e.g., Muller et al., 1997). One such aspect is emotion (Cockton, 2002).

Users' strive for a more complete and satisfying interactive experience; an experience that not only achieves certain well-defined goals but also involves the senses and generates affective responses (Bly et al., 1998). The growing demand for personalized user interfaces seems to spring from this quest (Blom and Monk, 2003). The desire expressed by users to tailor their applications' appearance according to their tastes is epitomized by the proliferation of skins -- alternative interfaces to commonly used applications -- that allow users to change the appearances of their applications while preserving their functionality. By the year 2000, more than 50 million skins had been downloaded from the major skin sites (Koeppel, 2000). While some argue that skins represent a superficial manifestation of variety seeking, others suggest that the desire is much deeper: "People get attached to their computers... By customizing something that's important to you, you make the world your own." (Ian Lyman, cited in Koeppel, 2000). Koeppel suggests that the need to personalize our immediate environment seems existential. "When you put personalized imagery in a user

interface, the user's relationship to the technology becomes emotional rather than cognitive." (Eric Gould Bear, quoted in Koeppel, 2000). Blom and Monk (2003) propose that personalization of information technology devices affects users cognitively, socially and emotionally. Indeed, recent trends in PC-based application design indicate that “skinnability” has become a common feature in many types of personal computing applications. Applications which range from operating systems to media players and from Web browsers to computer games allow users to alter their original appearance. Consequently, users can better control the look of their computing environment. Moreover, this look can be changed easily and frequently. Thus, it appears that the skinning phenomenon can serve as a fertile ground for research on emotion in HCI.

Interest in the role of emotion in the interaction between humans and their surroundings, including various designed artifacts has been on the rise in recent decades. Examples range from the environment at large (Portous, 1996) to urban planning (Nasar, 1994) and buildings (Maass et al., 2000); from stores (Russell and Pratt, 1980) to consumer products and designed objects in general (Desmet and Hekkert, 2002; Norman, 2004). In the organizational context, researchers have emphasized the importance of physical artifacts in generating emotional response (Rafaeli and Vilnai-Yavetz, 2003). Similar interest appears to have grown significantly in the field of HCI as well (Brave and Nass, 2003). Thus, a special issue of *Interacting with Computers* has dealt with “affective computing” both theoretically and experimentally (e.g., Picard and Klein, 2002)

Based on recent theorizing on physical artifacts and emotions (e.g., Rafaeli and Vilnai-Yavetz, 2003; Norman, 2004), we suggest that interactive applications are evaluated by users on three distinct categories, which elicit emotion towards the application. We then report about an exploratory study that was conducted to assess the viability of this model for

the field of HCI, in the context of users' use of skins to personalize PC-based entertainment applications.

2 Research Framework

Emotion is a relatively short-term reaction to a particular object or event that is relevant to the needs, goals, or concerns of an individual. Emotions are considered a main cause of choice and action (Frijda, 2000; Norman, 2002). This has been demonstrated in a variety of contexts, including those that involve profit making and goal accomplishment (Zajonc and Markus, 1982; Rafaeli and Vilnai-Yavetz, 2003). Recently, the case has been made for the importance of emotion in HCI as well (Cockton, 2002; Brave and Nass, 2002). It has been argued that emotional responses often precede cognitive ones in human judgment, and might have a lasting effect despite contradictory cognitive evidence (Lindgaard and Dudek, 2003).

Recent research into the potential effects of emotions generated by artifacts has yielded several theoretical frameworks. Norman (2002, 2004), suggests a 3-level theory of human behavior that integrates affective and cognitive processes. In each level, the world is being evaluated (affect) and interpreted (cognition). The lowest level processes take place at the Reaction (or visceral) level, which surveys the environment and rapidly communicates affective signals to the higher levels. The Routine (or Behavioral) level is where most of our learned behavior takes place. Finally, the Reflection level is where the highest-level processes occur. The important role of affect in human behavior is that our thoughts normally occur *after* the affective system has transmitted its information.

Desmet (2003) maintains that emotions arise when an individual appraises how a product can influence (positively or negatively) his or her interests. Desmet identifies five classes of product emotions -- instrumental, social, aesthetic, surprise, and interest) that can explain the nature of product emotions (Desmet, 2003). Rafaeli and Vilnai-Yavetz (2003)

propose a model in which physical artifacts in organizations are evaluated according to three dimensions: instrumentality, aesthetics, and symbolism. These three dimensions, in turn, evoke various -- not necessarily intended -- emotions. The three dimensions in Rafaeli and Vilnai-Yavetz's framework are quite similar to the five dimensions proposed by Desmet, especially if we consider that novelty and interest are highly associated with aesthetics (e.g., Berlyne, 1974a). There are also interesting parallels between the framework suggested by Norman and that of Rafaeli and Vilnai-Yavetz. Instrumentality considerations are most likely to take place at the Routine level. Considerations of the artifact's symbolism are likely to occur at the Reflective level. Aesthetic evaluations may take place on all three levels, but there are some hints that first aesthetic impressions are formed immediately at a low level and precede cognitive processes (e.g., Berlyne, 1974b; Zajonc and Markus, 1982; Norman, 2002, 2004). Those first impressions may linger and correlate highly with later evaluations of interactive systems (Tractinsky, Shoval-Katz and Ikar, 2000, Tractinsky, Cokhavi and Kirschenbaum, 2004; Fernandes et al., 2003). Thus, to a large extent, aesthetics sets the tone for the rest of the interaction.

We suggest that applying Rafaeli and Vilnai-Yavetz's model to the HCI context can contribute towards developing a more comprehensive theory of emotion in HCI. We will now discuss each of the proposed artifact dimensions in the context of HCI. Interestingly, one of these constructs, usability, is a HCI cornerstone which has not been generally associated with emotion (Haughe-Nilsen and Galer Flyte, 2002). A second construct, aesthetics, is the subject of a new awakening area of research (e.g. Tractinsky et al., 2000; Hassenzahl, 2004). The third construct, symbolism, has seldom been investigated in the mainstream HCI literature. We suggest that each of these constructs deserve attention in the context of HCI. While Rafaeli and Vilnai-Yavetz suggest processes by which usability, aesthetics and symbolism affect emotion, our empirical investigation has more modest objective, because of its

exploratory nature. Our goal is to establish that users of interactive applications indeed perceive these constructs and are able to distinguish among them, and that these three aspects are associated with general measures of the user experience.

2.1 Usability

Rafaeli and Vilnai-Yavetz, (2003) view instrumentality as the extent to which the artifact contributes to the organizational functioning or to promoting organizational goals. They speculate that instrumental aspects of an artifact can only elicit negative emotions when instrumentality is lacking, but they do not promote positive emotion when instrumentality is adequate.

Adapted to the context of HCI, “instrumentality” fits Nielsen’s (1993) concept of “usefulness” – which comprised of the system’s utility (i.e., the degree to which its functions can potentially advance users’ goals) and it’s usability (i.e., the extent to which the system enables users to achieve those goals). While the field of HCI has mainly stayed away from dealing with the utility aspect of interactive applications, it has warmly embraced the aspect of usability. HCI researchers and practitioners have traditionally emphasized supporting users’ goals in terms of objective performance criteria, such as error rate and time to complete a task (Butler, 1996). Usable products smooth the human-computer interaction, making it efficient and effortless. This, in turn, can potentially enrich the users’ experience and improves their satisfaction. Products that lack in usability often prevent users from accomplishing their goals, frustrate them, and induce negative affect. In accordance with Rafaeli and Vilnai-Yavetz’s theory, Zhang and von Dran (2000) found that usability-related aspects of Web sites were strongly associated with "hygiene" factors (Herzberg, 1966), which caused user dissatisfaction. In line with the traditional notions of HCI design, some suggest that the use of skins might hamper usability because of the use of non-standard, ornamental

(at times cryptic) interfaces (Koeppel, 2000). For example, it may be difficult to locate certain controls on certain skins or to understand how to operate the application. The overwhelming demand for skins suggests that even if this is the case, users are willing to trade-off the loss in usability for gains in other aspects of the interactive experience.

2.2 Aesthetics

Aesthetics plays an important role in our lives. Social scientists have shown that people associate physical appearance with personality attributes (Dion Berscheid and Walster, 1972). Researchers in the area of marketing and consumer behavior came to a similar conclusion, namely, that the aesthetic quality of a product influences consumers' attitudes towards the product. For example, Bloch (1995) claimed that the "physical form or design of a product is an unquestioned determinant of its marketplace success" (p. 16). Economists suggest that physical appearance affects people's earnings (Hamermesh and Biddle, 1994). Natural and man-made landscapes have been linked to emotion through aesthetic perceptions (e.g., Porteous, 1996, Nasar, 1988). Contrary to the indirect effect of instrumentality on emotion, Rafaeli and Vilnai-Yavetz (2003) and Lindgaard and Dudek (2003) suggest that aesthetics is directly linked to emotion through the immediate impact of the artifact on the senses. Similarly, Norman (2004) notes that appearance may have a visceral effect on emotion. Recently, growing evidence has started to emerge, which supports the importance of aesthetics in HCI. This evidence encompasses both hardware and software issues. For example, Apple's iMac was heralded as the "aesthetic revolution in computing" (e.g., Postrel, 2001). HCI researchers have also begun studying the role of aesthetics in interaction design; its effects on the users, and its relations with users' perceptions of other system attributes, including the seemingly orthogonal usability dimension (e.g., Karvonen, 2000, Tractinsky, 1997; Tractinsky et al., 2000). Recently, it was found that aesthetics plays an important role in users' evaluations of Web sites (Schenkman and Jonsson, 2000; van der

Heijden, 2003) and of skins for a PC-based entertainment system (Tractinsky and Lavie, 2002, Hassenzahl, 2004).

2.3 Symbolism

A symbol is a “powerful vehicle for conveying deep-rooted meanings” (Hirschheim and Newman, 1991, p.32) or associations, that might evoke either positive or negative, intended or unintended emotional response (Rafaeli and Vilnai-Yavetz, 2003). While symbolism may be associated with complex and elaborated messages, it can also be communicated by mundane things such as chairs and tables (Rafaeli and Vilnai-Yavetz, 2003). As opposed to aesthetics per-se, effective symbolism depends on a cognitive process in which the individual recognizes a denotative meaning (the content of the formal structure) and infers connotative meaning about it. Thus, for architecture, style represents an important symbolic variable (Nasar, 1994). Interface skinning may be conceived by users as an opportunity to convey various meaning or associations regarding, for example, themselves, their reference groups, and their perceived or aspired status. Moreover, by creating or acquiring skins or by altering common interfaces we make them part of ourselves (cf. Belk, 1988, Blom and Monk, 2003). Thus, good skins, like successful self-gifts are ones that represent the owner’s identity (Schultz Kleine et al., 1995). The symbolic role of artifacts relates to Desmet’s social class of product emotion (Desmet, 2003) and to some of Hassenzahl's hedonic product attributes (Hassenzahl, 2003). Desmet suggests that objects can be associated with user groups or institutions, which are the objects of social appraisal. According to Hassenzahl, people can express their selves through products, and products can represent events, relationships or thoughts that are important to the individual. Similarly, Blom and Monk (2003) suggest that personalization reflects users’ personal and group identity.

3 Method

Despite its prevalence, the skins phenomenon has gained very little attention from HCI researchers (Tractinsky and Lavie, 2002). We feel that this may have to do in no small part with the strong association of the skins' phenomenon with affect – a neglected aspect of HCI. We believe that studying emotions in the context of how users apply and use skins has the prospect of enriching our understanding of both skinning and emotion in HCI. Because of the relatively unexplored nature of these two subject areas, our aim in this study is quite modest. We would like to explore the viability of Rafaeli and Vilnai-Yavetz's framework to the field of HCI by concentrating on users' evaluations and choice of a skin for a popular type of application. We would like to find out whether the three artifact dimensions identified by Rafaeli and Vilnai-Yavetz are meaningful within the HCI context. For this purpose we extend the experimental procedure reported by (Tractinsky and Lavie, 2002) as described below.

3.1 Participants

Sixty undergraduate students (35 male, 25 female, average age of 23) who did not have previous coursework in HCI participated in this study for course credit.

3.2 Procedure, Stimuli and Tasks

The participants were presented with 12 different skins for Microsoft's Media Player (MP) Ver. 7. Among the skins used for this study was the default MP interface. Eleven additional skins were downloaded from Microsoft's Windows Media site (http://windowsmedia.com/mg/skins.asp). The skins were chosen by us arbitrarily for the purpose of this study. We did not evaluate *a priori* any of the skins' attributes or overall appeal. In the first experimental stage, the participants were instructed to experiment with the available skins and to select the two skins (except for the default interface) that they liked the most. In the next stage, the participants performed at least three tasks with each of three MP

interfaces: the two skins that they chose in the previous stage and the default interface. The tasks included changing the speaker's volume, adjusting the MP's equalizer setting, and playing an audio track. The participants were allowed to experiment with these three skins further. After working with each of the three skins, the participants answered a questionnaire regarding each skin's attributes, and described in their own words the reasons that brought them to select that specific skin. The questionnaire was comprised of 15 items as described below. After evaluating the three skins, the participants chose the skin that they preferred the most and explained the reasons for that choice.

3.3 Measures

There were two types of measures in this study. The first type consisted of statements regarding the application's properties. The participants responded on a 7-point agreement scale with 1 indicating strong disagreement with the statement and 7 indicating strong agreement. Four usability statements were adopted from Tractinsky and Lavie (2002). Four aesthetic measures were a subset of the aesthetic measures used in that study. Based on Lavie and Tractinsky (2004), who found that Internet users' distinguish between two aesthetic dimensions, we chose to concentrate on one of the dimensions. That dimension refers to the expressive aspect of aesthetics, as opposed to the other dimension, which centered on orderliness. Because the latter aesthetic dimension is strongly correlated with usability perceptions of the application (Lavie and Tractinsky, 2004), we decided to exclude it from this study in order to facilitate better distinction among the three aspects of the user interface. Five additional items for symbolism were constructed for this study based on the characterization of this construct by Rafaeli and Vilnai-Yavetz. In addition, we measured two items that captured general traits of the user experience: satisfaction and pleasance of experience. These variables are highly associated with emotion (e.g., Westbrook and Oliver, 1991).

In addition to the variables measured by the closed-format items, the participants responses to the open-format questionnaire were coded into four possible categories: usability, aesthetics, symbolism, and an “other” category in the case that a response was not interpretable or did not match any of the previous categories. A measure of the number of reasons given for the choice of a skin was then calculated for each of the three skin aspects.

4 Experimental Results

Of the 12 available skins, 11 were chosen by at least one of the participants in the study. Twelve participants (20%) chose the default skin design as their most preferred skin, while the other 48 participants chose a non-default skin. The fact that some 80% of the participants chose to deviate from the default interface is comparable to the results obtained by Tractinsky and Lavie (2002), and suggests that there is a viable need among users to personalize their application. The selection of 11 different skins highlights yet another facet of personalization – that of multiplicity of tastes and preferences.

<< Insert Figure 21.1 about here >>

The extent to which the various skin attributes played a role in the users’ selections of a preferred skin can be inferred from Figure 21.1. This figure juxtaposes the participants’ mean ratings of the attributes of the default MP style (which all of the participants evaluated) against the mean ratings of attributes of the two alternative skins chosen by each participant. (Recall that the specific chosen skins were not identical for all participants. Thus, in this analysis, “first choice” and “second choice” refer to the participants’ ratings of the skin they chose first and second respectively, regardless of which skins these actually were.) The attributes in Figure 21.1 are organized from left to right according to the following

categories: usability, aesthetics, symbolism, and overall experience. We conducted repeated measures ANOVA for differences between ratings of the default MP and the ratings of each of the alternative skins (as can be clearly seen in Figure 21.1, ratings of the two alternative skins, “Choice 1” and “Choice 2” are nearly identical). There are statistically significant differences at the .001 level between the default design and each of the alternative skins for all of the items in Figure 21.1 except for the three leftmost items. Overall, the default style was slightly favored compared to the other skins in terms of the usability attributes. However, with the exception of the item regarding the skin’s simple design, these differences were not statistically significant. There were, on the other hand, significant differences between the default skin and the other two skins in terms of all other attributes. These differences were most pronounced with respect to the aesthetics attributes. The alternative skins were significantly preferred in terms of specific aesthetic attributes such as creativity, originality, artistry and impressiveness. At the same time, the alternative skins appear to have violated the Holy Grail of usability engineering: simple design. Yet, 80% of our participants chose alternative skins, probably because these participants placed a premium on the aesthetic and the symbolic attributes of those skins.

4.1 Dimensionality of the Model

Our measures have to be assessed for two requirements. First, we need to demonstrate the reliability of the measurement scales of the various skin dimensions (i.e., aesthetics, usability, and symbolism). Secondly, we need to demonstrate the discriminant validity of the scales, that is, that each of the scales indeed measures a separate skin attribute.

To assess discriminant validity, the data gathered from the close-format items for the three skins (the two chosen alternatives and the default design) were subjected to principal component analysis [1].

Three factors were extracted and rotated using the VARIMAX method (see Table 21.1). Items belonging to each of the three dimensions explored in this study (usability, aesthetics and symbolism) loaded consistently on their respective factor with one exception: The item concerning simple design, which was considered *a priori* a usability item, loaded (negatively) on the aesthetics factor. This item was not included in the composite variable scoring that ensued.

<< Insert Table 21.1 about here >>

Based on the factor analysis results, composite scales were constructed for each of the three skin aspects. Table 21.2 presents scale reliabilities and inter-scale correlations. The three scales exhibit high reliabilities. Also evident is a high correlation between the aesthetic and the symbolic aspects of the skin, perhaps reflecting an inevitable association between symbolism and aesthetics (Nasar, 1994).

Table 21.3 shows the results of regression analyses with satisfying experience and pleasant experience as dependent variables and usability, aesthetics and symbolism as independent variables. Each of the three scales contributed significantly to the regression equations, eventually explaining 68% and 59% of the variance in satisfaction and pleasant experience respectively.

<< Insert Table 21.2 about here >>

<< Insert Table 21.3 about here >>

4.2 Open-format Responses

We examined the participants' responses to two free-form questions. The first question was a general one, asking for the main considerations in choosing a PC-based entertainment system such as the MP. Overall, 151 statements were given by 57 participants (an average of 2.65 statements per person). The second question asked the participants about the reasons for choosing their most preferred skin. In response to this question, 133 statements were supplied by 58 of the participants (an average of 2.29 statements per person). For both analyses, two independent judges (both Ph.D. students) classified each statement as belonging to one of four categories: usability, aesthetics, symbolism or "other" (that is, either not interpretable or not belonging to any of the previous three categories). The agreement between the two judges, as measured by Cohen's *Kappa*, was considerably above chance level ($K = 0.815$ and 0.823 for the first and for the second question respectively). Upon reexamination of the disagreements between the two judges, it became clear that most of the disagreements stemmed from statements that were difficult to interpret. Therefore, we did not attempt to reconcile those differences. Consequently, the analyses hereby only use data for which agreement was reached between the judges (134 and 117 statements for the first and for the second question respectively).

For each of the two open questions, we tallied the number of reasons that were related to the design's usability (e.g., "clear functionality"), aesthetics (e.g., "attractive design"), and symbolism (e.g., "favorable image"). The results are presented in Table 21.4. In response to the general question (i.e., the main considerations in choosing a PC-based entertainment system in general), 77 statements were usability-related, 19 were related to aesthetics, 19 to symbolism and 19 statements were categorized as belonging to none of the above categories. Regarding the reasons for choosing their most preferred skin, 53 statements were categorized

as belonging to the usability dimension, 46 statements belonged to the aesthetic dimension, and six to the symbolism dimension.

<< Insert Table 21.4 about here >>

5 Conclusions and Future Work

The purpose of this study has been to assess the suitability to HCI of a model that considers three distinct properties of the artifact in order to study how it affects emotion. For this purpose, we have used both close- and open-format questions. In the context of selecting a skin to personalize one's PC-based entertainment application, the results indicate that all three aspects, namely usability, aesthetics and symbolism can be semantically distinguished from each other and that they all contribute to overall measures of the user experience which are related to emotion. The factor analysis and reliability results (Tables 21.1 and 21.2 respectively) indicate that each of the three aspects can be captured and distinguished from each other. A notable exception is the loading pattern of the "simple design" item. This item, supposedly reflecting the usability dimension (Nielsen, 1993), was not associated with the usability factor. Rather, it was loaded negatively on the aesthetics factor. Recall that we made conscious effort to distinguish between the usability and the aesthetic factors in this study. We accomplished this goal by concentrating on the expressive dimension of aesthetics because the dimension of aesthetics that deals with orderliness was found to be highly correlated with usability (Lavie and Tractinsky, 2004). Yet, at least within the context of this study, simple design appears to be judged more in terms of its lack of creative aesthetics than in terms of its contribution to usability. That is, various design aspects can be consequential for both aesthetics and usability. Designers should therefore be aware of potential trade-offs that arise due to this dependency. However, given the innumerable contingencies that affect

users' interactions with computers, there may be no better solution than to allow users to customize their interfaces in a way that optimize contextual preferences.

The analysis of the closed-format items (see Table 21.3) indicates that the three aspects of the skins accounted for a considerable portion of the variance in the overall measures of the user experience (R^2 = .59 and .68). The skins' usability had the strongest effect on overall satisfaction, followed by aesthetics and symbolism. The pleasantness of the interaction with the skin was affected equally by usability and aesthetics consideration, followed by the skin's symbolism.

The analysis of the open-format questions portrays a similar picture, in which all aspects of the model contribute to users' considerations. Usability aspects are considered paramount by far when users responded to the general question about the most important factors for choosing a PC-based entertainment system. However, when asked specifically about the reasons for choosing a preferred skin, users gave as many reasons that relate to the aesthetics of the skin as to its usability.

Besides users' tendency to provide more aesthetic-, and symbolic related reasons for choosing skins when actual choices are concerned, another interesting aspect of the results is the discrepancy between users' *answers* regarding which factors affect their preferences and their *actual* choice. While the open-ended responses indicate that usability, aesthetics and symbolism affect choice in that order (Table 21.4), analysis of users' choices (Figure 21.1) indicates that they rated the alternative skins higher than the default skin on the aspects of aesthetic and symbolism but not on usability. Since some 80% of the users eventually chose an alternative skin over the default, we tend to believe that their choices were based on aesthetic and symbolic considerations. These results are similar to those obtained by Tractinsky and Lavie (2002). One possible explanation for this is that there was no significant difference in users' estimation of the default skin's usability and the usability of

alternative skins. Thus the participants were able to choose a skin based on the second-, and third-most important aspects (namely, aesthetics and symbolism). Alternatively, users may have tried to provide rational (i.e. usability-related) justification for choices that were based on other grounds. For example, early aesthetic impressions may have subconsciously (e.g., Bargh and Chartrand, 1999) affected the choice of a skin. In any case, the disparity between users' explicit answers regarding the various aspects of the application and the implicit preferences as revealed by their actual choice is intriguing and deserve attention in future research.

The results of this study, combined with those of Tractinsky and Lavie (2002), demonstrate the diversity of users' tastes. The results emphasize users' need to personalize their computing space, and the importance of this personalization for the overall user experience. It also calls into attention the possible discrepancy between what professionals or academicians consider "good design," and what users are looking for in their computing environment. The two may not always overlap: In other domains, laymen evaluations of aesthetic objects were found to be different from those of experts and practitioners (e.g., Getzels and Csikszentmihalyi, 1969; Hekkert and van Wieringen, 1996). The presence of a skins "movement" ensures that, at least in terms of aestheticism and symbolism, users are not subjected anymore to the tastes of a limited group of designers. As such, the movement represents many of the qualities of aesthetic computing (Fishwick, 2003)

5.1 Limitations and Future Research

It is important to note the limitations of this study. First, the type of application being used here -- an entertainment system that is used on a voluntary basis -- appears to stress elements of aesthetics and symbolism. Thus, future research should examine users' reactions to other types of applications in order to assess the generalizability of the three-aspect

framework. Second, because of the experimental setting of this study, users were exposed to only a limited set of possible skins. In the future, we intend to see whether an increased set of alternative skins might enhance the effect of symbolism and aesthetics on users' choices and on their interactive experience. We suspect that given a larger set of skins, users will be more likely to find a match for their tastes on the aesthetic and the symbolic aspects. Third, while this study established the viability of the three aspects' model, we have not looked into the processes that relate these aspects to emotion. In addition, more refined views of usability, aesthetics and symbolism can all enrich our understanding of the user experience. Thus, there is ample room for future research to build on this study's modest beginning. Finally, we have only studied users' preferences given a relatively short exposure to various skins. Future work should concentrate on how these preferences evolve over time.

Regardless of these limitations, this study demonstrates that the range of users' considerations and preferences when interacting with computers expands beyond the usable and the practical towards the aesthetic, the personal and the affective. This is especially the case when considering the emerging wave of personal, popular applications of the type examined in this study, and given the ease with which personalization of the computing environment can now be achieved. The *Aesthetic Computing Manifesto* (Fishwick, 2003) lists the benefits of a cultural, personal, and customized set of aesthetics. This study provides evidence in support of the *Manifesto*'s claims.

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Notes

1. Combining the results for all three skins may violate the assumption of independence of observations. We conducted similar factor analyses for each of the skins (i.e., the Default skin and each user's 1st and 2nd choice), and the results were very similar in all cases, and almost identical to those obtained by the combined dataset. In the interest of space, only the results of the combined data set are presented here.

Figure 21.1: Average ratings of the default interface and of the two preferred alternative skins on the closed-format items. From left to right, items represent three skin attributes (Usability, Aesthetics, and Symbolism) and the overall user experience.

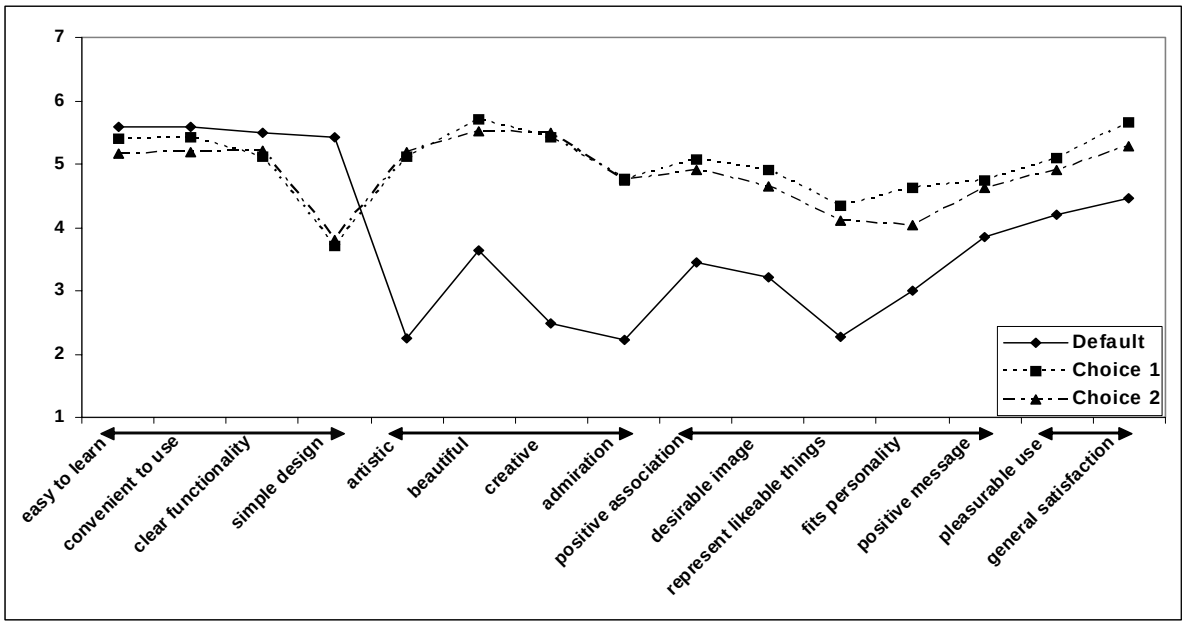

Table 21.1: Rotated factor matrix of responses to items reflecting usability, aesthetics, and symbolism.

Items	*Factor 1* *Aesthetics*	*Factor 2* *Symbolism*	*Factor 3* *Usability*
Artistic design	.877	.314	-.036
Creative design	.860	.390	-.031
Admirable design	.819	.445	-.061
Beautiful design	.727	.462	.129
Positive message about user	.067	.862	.122
Communicates desirable image	.433	.828	.069
Represents likeable things	.525	.757	.020
Creates positive associations	.319	.747	.282
Fits personality	.423	.743	.113
Simple design	-.747	-.034	.295
Convenient to use	-.013	.144	.924
Easy to learn	-.032	.112	.924
Clear functionality	-.137	.086	.834

Table 21.2: Alpha reliabilities (on the diagonal) and inter-variable correlations

	Usability	*Aesthetics*	*Symbolism*
Usability	(.89)		
Aesthetics	.03	(.95)	
Symbolism	.21*	.72*	(.92)
# of Items	3	4	5

* $p < .01$

Table 21.3: Results of regressing Satisfying Experience and Pleasant Experience on three skin attributes: Usability, Aesthetics, and Symbolism.

			Independent Variable		
Dependant Variable	R^2	Adj. R^2	Usability	Aesthetics	Symbolism
Satisfying Experience	.68	.68	.56**	.38**	.23**
Pleasant Experience	.59	.58	.43**	.43**	.22*

* $p < .01$, ** $p<.001$

Table 21.4: Number (percentage) of reasons provided for the open-format questions, tabulated by aspect.

	General Question	*Choice Question*
Usability	77 (57.4%)	53 (45.3%)
Aesthetics	19 (14.2%)	46 (39.3%)
Symbolism	19 (14.2%)	6 (5.1%)
Other	19 (14.2%)	12 (10.3%)
Overall	134 (100%)	117 (100%)