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# Aesthetic Quality of Physical Behavior and its Impact on User Experience

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## **Abstract**

We propose a user experience model that incorporates interaction as an aesthetic quality and discuss the impact of physical behavior on the perceived pragmatic and hedonic quality of software. In an exploratory study we evaluated the effect of physical behavior on user experience.

## **Keywords**

User experience, interaction aesthetics, physical behavior

## **ACM Classification Keywords**

H5.2. [Information Interfaces and presentation] User Interfaces - theory and methods.

## **Introduction**

User Experience (UX) offers an expanded perspective on usability that focuses on how to create outstanding quality experiences rather than preventing usability problems. UX does not only account for emotions, but takes a holistic view on technology by emphasizing the situatedness and temporal character of peoples' experiences [1]: While usability is focused on objective characteristics of a product like efficiency and effectiveness, UX is more concerned with subjective emotions, perceptions and judgements and consequently

highlights the role of factors that influence how users experience product characteristics.

Studies concerned with usability have already shown that the perceptions of a product are as important as its objective qualities: A study on the relationship between aesthetics and usability by Tractinsky et al. [2] has shown that objective qualities of a system are not necessarily related to how a user perceives these qualities. They found a strong correlation between visual aesthetics of an interface and its perceived ease of use and thus conclude: "What is beautiful is usable." While aesthetics is commonly reduced to visual appearance, recent research focuses on the aesthetics of interaction. Petersen et al. [3] highlight the experiential aspect of interaction and point out that aesthetics should not be limited to visual appearance, but should also include interaction with a product. Löwgren [4] notes "products which are essentially equivalent in instrumental terms can be quite different in experiential terms." He proposes the concept of pliability as an experiential quality in interaction design that enhances the experience with a product without modifying its instrumental quality. According to Löwgren, pliability is related to physicality as it "characterizes the extent to which the user perceives an interaction to be fine-grained with a tight coupling between action and outcome, a pseudo-tactile sense of manipulating a malleable digital material" and "seems to facilitate explorative behavior and serendipitous discovery." Agarwala and Balakrishnan [5] observed this effect during the discovery period of the BumpTop evaluation: "users were seen playfully tossing or rearranging items or watching the results of collisions" and this "translated to users becoming proficient at arranging items with subtle and precise movements."

## **Modeling the User Experience of Interaction Aesthetics**

We propose to extend Hassenzahl's UX model [6] to explicitly incorporate interaction as an aesthetic quality. Hassenzahl's model differentiates between pragmatic and hedonic quality: Pragmatic quality (PQ) is related to traditional usability and thus comprises instrumental qualities (e.g. learnability, efficiency) that help users achieve a certain goal. Hedonic quality (HQ) includes any non-instrumental aspect that is appreciated by the user, i.e. aspects that attract on a visceral, behavioral or reflective level and evoke positive emotions. Prior studies have found that pragmatic quality correlates with judgements of goodness and hedonic quality correlates with judgements of both beauty and goodness [7]. Hassenzahl [8] subsequently further distinguishes between hedonic quality stimulation (HQS, e.g. through novelty or challenge) and hedonic quality identification (HQI), where a product enables people to express their identity.

Hassenzahl's model also differentiates between objective quality aspects and the user's perception of these aspects. The perceived qualities of a system are dependent on the product's objective qualities, user characteristics and usage situation. The user ultimately assesses these perceived qualities and forms a judgement of appeal. Even though emotional outcomes are not considered a design goal, the model conceptualizes them as consequences of using software. Emotions are considered to be mutually linked to the judgement of appeal, i.e. an appealing system can evoke positive emotions, which in turn affects the appeal.

While currently aesthetic design is largely focused on the visual design of user interfaces, we believe it needs

to include interaction characteristics as well. The UX model illustrated in figure 1 explicitly acknowledges interaction as a product quality that not only affects pragmatic aspects such as task performance [9]. We hypothesize that interaction characteristics such as physical behavior affect the perceived hedonic quality of a product and by extension a user's judgement of aesthetic quality. While studies have shown that the visual appeal of software remains relatively stable through product usage [7], we hypothesize that interaction aesthetics change both perceived hedonic quality and judgement of aesthetics through usage.

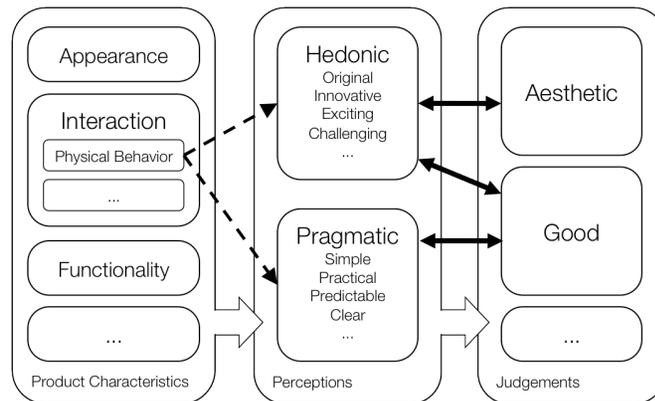


Figure 1: Modified hedonic / pragmatic UX model

### Study Methodology

As an exemplar of aesthetically pleasing interaction characteristics, we evaluated the impact of physical behavior in a small-scale exploratory pilot study. An iPad application for performing card sorting tasks was developed. Participants conducted card sorting tasks with a physical and a non-physical variation and assessed their perceptions using the AttrakDiff2

questionnaire [8]. In addition, participants assessed their judgements of beauty, aesthetics and goodness as independent evaluative constructs on a seven-point semantic differential scale. As the judgement of a product is highly dependent on context [6], participants were presented with realistic card sorting tasks to prevent them from inducing their own usage context. Physical behavior could be enabled or disabled before a card sorting session started. The cards exhibited subtle physical behavior when enabled through the following three effects: Rotation, sliding and collision. Participants were presented with cards spread across the table, containing topics they should categorize. Participants could drag the cards around with a finger, organize them in groups and label them.

Ten volunteer participants (5 female, 5 male, mean age 28,  $SD=3.1$ ) were recruited. The experiment had two testing conditions: physical behavior enabled (physical condition) and physical behavior disabled (plain condition). Using a within-subject design, each participant had to complete a card sorting session for both testing conditions. The sequence of testing conditions per user was counterbalanced to avoid training effects. Preference rankings were collected after participants had finished the sessions.

### Results and Discussion

The influence of physical card behavior on the perception of hedonic and pragmatic qualities as well as the judgement of beauty, aesthetics and goodness was analyzed using paired samples t-tests.

The effect of HQ ratings between physical (HQS,  $M=0.44$ ,  $SD=1.15$ ; HQI,  $M=0.8$ ,  $SD=0.75$ ) and plain condition (HQS,  $M=0.27$ ,  $SD=1.14$ ; HQI,  $M=0.66$ ,

SD=0.83) was significant for both HQS ( $t(9)=3.12$ ,  $p<.05$ ) and HQI ( $t(9)=2.45$ ,  $p<.05$ ). Physical behavior positively influenced both hedonic dimensions. There was no significant effect on pragmatic quality between physical ( $M=1.86$ ,  $SD=0.74$ ) and plain condition ( $M=1.79$ ,  $SD=0.73$ ), indicating that physical behavior did not influence the perception of pragmatic quality.

	Plain	Physical
HQS	0.27 (1.14)	<b>0.44</b> (1.15)
HQI	0.66 (0.83)	<b>0.8</b> (0.75)
PQ	1.79 (0.73)	1.86 (0.74)
Beauty	1.15 (1.78)	1.54 (1.51)
Aesthetics	0.55 (1.70)	<b>1.14</b> (1.67)
Goodness	1.41 (0.94)	1.65 (1.11)

Table 1: Mean ratings (Standard deviation in brackets) on a scale from -3 to 3. Higher ratings are better. Significant differences in bold.

Physical and plain variations were considered equally beautiful (phys.  $M=1.54$ ,  $SD=1.51$ ; plain  $M=1.15$ ,  $SD=1.78$ ) and equally good (phys.  $M=1.65$ ,  $SD=1.11$ ; plain  $M=1.41$ ,  $SD=0.94$ ). Post-use ratings of goodness are primarily based on pragmatic quality, especially when people are in a goal-oriented mode. Since people were focused on a specific task the lack of impact on goodness is not surprising. Even though beauty is primarily based on hedonic quality and both HQI and HQS changed significantly, there was no significant effect of physical behavior. This can be explained by the identical visual appearance of both interfaces. In addition, Hassenzahl concluded that the judgement of beauty does not change with product use [7], which is in line with our results. The effect of physical behavior on aesthetics was significant (phys.  $M=1.14$ ,  $SD=1.67$ ; plain  $M=0.55$ ,  $SD=1.70$ ;  $t(9)=3.27$ ,  $p<.01$ ), indicating

that beauty and aesthetics are indeed different concepts. Our results indicate that physical behavior can also be considered more aesthetic than plain non-physical behavior, albeit not more beautiful. Further research will be necessary to generalize these findings beyond touchscreen interaction and for different application domains and usage modes.

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