

## **PRODUCT MEANING, AFFECTIVE USE EVALUATION, AND TRANSFER: A PRELIMINARY STUDY**

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*Abstract: The first part of this investigation explored the multidimensional nature of product meaning, referring to the variety of connotations and functions a consumer associates with a particular product category. The subsequent experiment examined the moderation effects of product meaning and other attributes of the user on (a) the affective evaluation of an obstructed use interaction, and (b) the transfer of emotion between devices presented as being either of the same or a different brand. Although the failure experience essentially caused frustration, this reaction varied substantially among consumers depending on product meaning, age, and gender. The results also showed that the emotion dimensions of pleasure, arousal, and dominance were affected in distinct ways, and that, in addition to the consumer variables, transfer was mainly dependent on the brand relation. Nevertheless, user frustration did not cause general brand aversion, indicating that poor designs do not unconditionally threaten the customer relationship.*

*Keywords: product meaning, affective evaluation, transfer.*

### **INTRODUCTION**

Engineers, designers, and marketers must expect that every potential user has some preconception and attitude toward their product and its use already at (or even before) the initial interaction with the device. People's pre-encounter beliefs about products are, for instance, encapsulated into the general product values they hold as consumers of certain product categories, as well as concrete experiences they have had earlier as users of related devices. As consumers and users of products, people continuously carry over such experience-based information contents to novel interactions with product devices. Consequently it is natural to assume that these contents incessantly affect the mental representations people construct of products and their use.

Here, the concept of *product meaning* is used to refer to the variety of instrumental and symbolic connotations an individual associates with both tangible and intangible attributes of a particular product or product category. Insight into the origins and nature of product meaning is of great application value to scientists and practitioners alike. Because product meaning reveals how consumers relate to certain products, it may predict how they respond to actual designs, and it allows one to explore the manner and extent to which past experience (e.g., frustrating product encounters) biases future use interaction.

In this context, the current article attempts to investigate the types and dimensions of consumers' product meanings and to link them to people's *affective evaluations* of two concrete devices during their use. The latter part of the analysis addresses two questions that deal specifically with the *carry-over*, or cross-context influence, of the evaluations and experience: (a) the way a consumer's product meaning influences the affect-related evaluation of the use of a device belonging to the same product category, and (b) the way and extent the user's affective evaluation, as expressed by basic emotion dimensions, is transferred from one device to the judgment of another, related one.

*Transfer* is used as the key concept to express the relations between mental representations, relations that stem from the carry-over of individually relevant information contents in apperception (Helfenstein & Saariluoma, in press). On a very general level, transfer can also be described as the phenomenon in which prior experience influences a person's current attempt to understand and cope with an actual learning situation. In the present study this idea is applied to the evolution of people's product representations over related instances of consumption and use. This study is explicitly concerned with the emotion dimension of transfer, namely the carry-over of affective evaluations as contents of consumers' and users' mental representations.

Affective transfer is involved in any psychological process where previously experienced feelings and attitudes toward a situation, object, or task are re-evoked in a current engagement with related "symbols" (Hobson & Patrick, 1995). This includes the transfer of affective connotations to situations or the socio-emotional values attached to an object, as well as the trans-situational transfer of emotional and social skills, attitudes, and values in general (Damasio, 1995). In reviewing transfer literature it becomes easily evident that the Thorndikean tradition, favoring the study of stimuli-bound, cognitive, and senso-motor aspects of learning, has been very influential, especially in the field of Human-Machine Interaction (HMI; Kieras & Polson, 1985; Singley & Anderson, 1989). The current study makes an important contribution to transfer research by focusing on contents that transcend perceptually accessible elements and go beyond cognition and senso-motorical functioning in a confined sense.

As concerns the selection of representational contents examined in this study, product meaning and the affective user experience are both believed to be of great value to the domain of HMI. This assessment takes into account the various efforts of the community to attain a more comprehensive understanding of the user; to promote human-centered approaches to design, engineering and marketing; and to integrate socio-emotion dimensions into HMI research (Saariluoma, 2004). Indeed, I propose that by studying HMI—in particular IT devices—usability concerns (i.e., the instrumental, functional, and ergonomic value of a device) and concerns of "consumability" (i.e., the affective, symbolic, and expressive values of a device as a commercial and marketing product) can be bridged well. This is principally because information technology involves products that are of high concern to users in social

and emotional regards. In addition to this, the development of the IT segment has been very fast and users are continuously compelled to purchase and adapt to new product standards.

The meaning of a product to a person can be seen as closely related to the individual's values in terms of his or her *trans-situational goals* (see Schwartz, 1994) or needs and the degree to which the product possession and use can elicit and satisfy the various functions incorporated in these needs. In dealing with the vast field of human values and needs (e.g., utilitarian, expressive, symbolic, social, ritualistic), it is of great theoretical and eventually practical use if one can identify a few key value dimensions in terms of the meanings and evaluations individuals attach to a particular product or device. The affective and social dimensions of people's relation to products naturally have been subjected to numerous studies in the past. The approaches valued here build on such notions as *meaning* (Csikszentmihalyi, & Rochberg-Halton, 1981; Friedman, 1986; Osgood, Suci, & Tannenbaum, 1957; Richins, 1994), *human values* and *attitudes* (Braithwaite, 1982; Fishbein, 1967; Rokeach, 1973; Schwartz, 1994), *involvement*, *preference*, and *choice* (Cohen, 1983; Kim, 1991; Mittal, 1988; Mittal & Lee, 1989; Zaichkowsky, 1985), and the *self-concept* (e.g., in the study of self-product congruency; Claiborne & Sirgy, 1990; Sirgy et al., 1997; Zinkham & Hong, 1991).

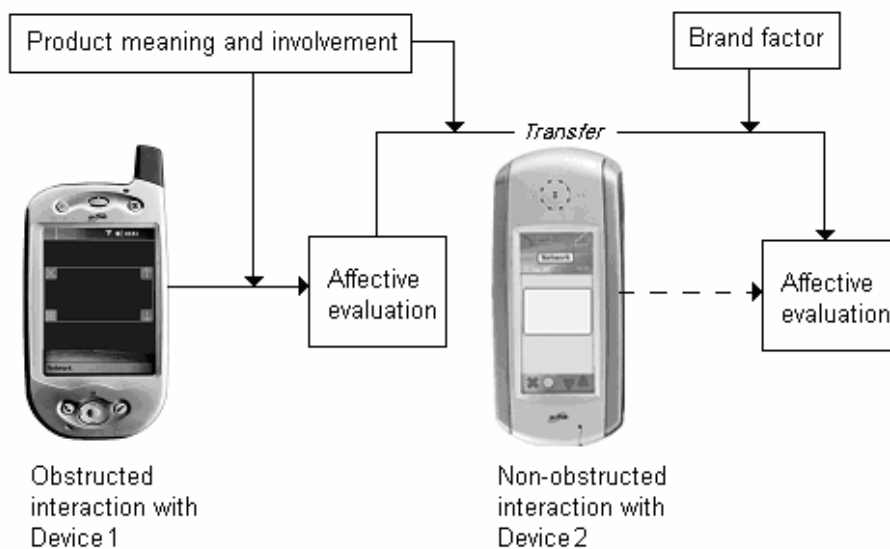
In HMI, the emotion theme has been particularly prevalent within research related to *emotional design* (Jordan, 2000; Norman, 2004) and *affective computing* (see Picard, 1997, for a bibliography). Furthermore, the increase in the pace and degree with which technological aids pervade people's everyday lives has brought more attention to the downsides of the user experience. User frustration, computer anxiety, and technophobia have all been identified as plausible antagonists of effective, efficient, and satisfying use (Beckers & Schmidt, 2001, 2003; Bowers & Bowers, 1996; Bradley & Russell, 1997; Henry & Stone, 1997). Again, this is especially true for transfer settings, for example, the resistance to developmental changes of the technology (Toffler, 1970), the aversion to certain types of systems and applications and attachment to others, and the transfer of negative affective content among different contexts and purposes of IT use. Understandably, prior obstructive learning experiences are generally a significant factor in the evolvment of negative expectations, performance anxieties, and unpleasant experiences in the future, with the quality of past experience being more central than the quantity (Bandura, 1986; Bradley & Russell, 1997; Horwitz, 1986; Miller & Seligman, 1975; Weiner, 1985; Zimmerman, 1994). The present investigation contributes to this perspective on affective transfer in that it involves the element of use interference to create an emotionally more intense and negativity-laden experience.

Whereas the investigation of affective transfer represents a rather uncommon perspective in HMI, both the measurement and representation of product meaning and affective use experience have been very critical issues in nearly all of the above-mentioned studies and research domains. The quest for core psychological dimensions or critical contents in product representation appears to be an especially important theme in consumer research. Allen (2000) offers an overview of the application of such concepts as meaning, values, self-concept, and involvement within consumer psychology, with a perspective on users' product choice behavior (see also Allen & Ng, 1999). Much of the methods used in the current paper must be seen as linked to this type of research. Products are believed to serve psychological functions that embody a person's needs based on his or her utilitarian, affective, and symbolic product values. And these psychological functions are naturally related to the basic dimensions of human experience and behavior: cognition, emotion, and social or environmental relation.

As concerns the measurement and representation of emotional responses during and after use interaction, dimensional and attributional approaches to emotion have been identified as being the most promising for the type of affect-orientated user research pursued here (Osgood, Suci, & Tannenbaum, 1957; Weiner, 1985; Zajonc, 1980). Like a series of other theories related to the dimensional paradigm, Mehrabian's (1995, 1998) Pleasure-Arousal-Dominance (PAD) Emotional State Model suggests that all emotions can be represented in a continuous manner using a limited number of underlying aspects or contents to describe their meaning (Marx, 1997; Russell & Mehrabian, 1977; Schlossberg, 1954; Spinoza, 1677/1883; Traxel & Heide, 1961; Wundt, 1896/1922). The use of Mehrabian's PAD model to measure affective use experiences represents a very generic way to gather self-report-based user data regarding emotions. It is well distinguishable from approaches related to discrete theories of emotion (see Frijda, 1986, and Power & Dalglish, 1998, for overviews) and was intended to contrast common methods where the users' responses to a product is studied in terms of a single attitudinal construct or item, such as satisfaction (Churchill & Surprenant, 1982; Kirakowski & Corbett, 1988; Lindgaard & Dudek, 2003; Shneiderman, 1987; Söderlund, 2003).

### OVERVIEW OF THE STUDY

The study comprised two separate phases of assessment: a pre-experimental phase and an experimental phase. Product meaning and involvement were assessed prior to the experiment in absence of a concrete stimulus, that is, on the bases of questionnaire self-report data alone. The experimental phase of the investigation consisted of virtual interactions with two different emulated mobile phones, interrupted by short self-assessments to capture the elicited affective reactions to the devices. Figure 1 gives an overview of the general design of the study and the relationships between the assessed constructs.



**Figure 1.** Conceptual design of the investigation.

Although much of the investigation was exploratory, there was a clear research agenda concerning the examination of the nature and relations among the various phenomena. The main objectives were (a) to reveal a dimensional character of consumers' product meaning, (b) to characterize the emotional experience of interacting with mobile phone devices in experimental settings and to verify the frustration caused by unsuccessful use, (c) to consider the relative advantages of the PAD emotion dimensions (Mehrabian, 1995, 1998) over direct questions to assess the user's affective evaluation, (d) to identify which aspects of the consumer profile, comprising product meaning, involvement with mobile phones, gender, and age, moderate the type and intensity of the affective evaluation of the phones, and (e) to examine the carry-over of emotional content from the use of one device to a related one.

## PHASE 1: THE QUESTIONNAIRE SURVEY

Beyond the collection of basic socio-demographic descriptives, the pre-experimental questionnaire was intended to reveal how concerned individuals and various consumer groups are with the consumption and use of mobile phones and what kind of general, value-related, and concrete purchase criteria flow into the selection of a consumer electronic product. The collected data served to construct product meaning scales, and subsequently to explore the relationships among different aspects of product meaning as well as their underlying structure.

### Method

#### Participants

Five hundred students at the University of Jyväskylä, Finland, filled in and transmitted the questionnaire within one week after it was uploaded to a University server (63% female; age range: 19-53,  $M = 24.90$ ,  $SD = 5.40$ ; all, except two, of Finnish nationality). Invitations to participate were made through different e-mail lists and students were offered a movie ticket as reward for their participation if they were selected for a later on-campus experimentation.

Unfortunately it is impossible to determine the exact magnitude of the return rate to the questionnaire because the e-mail lists used undergo great fluctuations in subscription and many of the university students are subscribed to more than one of the lists. Estimating that the invitation was sent to 1,000-1,500 students, the success rate laid at 30-50%, without the use of either an instant incentive or a follow-up letter to recipients who didn't fill in the questionnaire.

#### Material and data

The questionnaire consisted of between 53 and 87 items, depending on the person's profile. Divided into a priori defined groups, the core of the items measured (a) the hedonic product relation (5 items), (b) the symbolic and expressive values of the product (9 items), (c) the functional meaning (8 items), (d) the cognizant versus affective mode of product choice (12 items), and (e) the involvement with mobile phones (6 items). The items are briefly described along with the construction of the scales at the beginning of the Results section.

For the construction of these items, the scales from Mittal (1988) on product expressiveness and choice mode, from Zaichkowsky (1985) and Munson and McQuarrie

(1987) on the involvement construct, and Allen (2001) on consumer values were used (see Berkman, Lindquist, & Sirgy, 1997; Bloch & Richins, 1983; Cohen, 1983; Hirschman & Holbrook, 1982; Houston & Rothschild, 1978; Jamal & Goode, 2001; Laurent & Kapferer, 1985; Rokeach, 1973).

## Results

Scree plots of maximum likelihood factor analyses of the items proposed for each of the four product meaning scales (representing hedonic, expressive and symbolic, and functional dimensions, as well as cognizant vs. affective choice mode) suggested that the sets of questions concerning both hedonic and symbolic product meaning can each best be described by a single factor. The functional meaning and choice mode appeared to be more multidimensional in nature, although, here too, the first factor was far more powerful than the others with eigenvalues greater than 1. The latter observation, combined with conceptual considerations, led to the decision to continue pursuing one choice-related and three value-related facets of product meaning. The next challenge therefore laid in the construction of scales that reliably measure these constructs.

Four of the five items proposed to measure product hedonism could be reliably synthesized into one construct with an internal consistency of  $\alpha = .73$  (Chronbach's alpha). The question specifically asking about the importance of the "fun-factor" in product use was left out of the scale construction because of its low communality with the extracted factor (loading  $a < .40$ ). The remaining items captured the consumers' opinions concerning the importance of a product's pleasantness to one's senses, its optical appeal, and the importance of a product being representative of or reflecting upon oneself.

For the symbolic and expressive values of products, the selection of seven items seemed appropriate,  $\alpha = .78$ . Two items needed to be excluded from the scale construction due to their low factor loadings ( $a < .30$ ). These were the resistance to owning a product that everybody owns and the significance of the retailer's opinion. Apparently they assessed slightly different dimensions of symbolic meaning than questions concerning the image and social prestige of a product, the glamour it transmits, the degree to which it is currently in fashion, friends' approval of the product, the feeling of ownership pride, the question about who owns one and who doesn't, and the product's fit to one's self image.

Only three of the eight proposed items on functional meaning allowed for the construction of an acceptably consistent scale,  $\alpha = .56$ . The items were selected based on their loadings ( $a > .40$ ) on the first factor extracted in the factor analysis, eigenvalue = 1.79. The favorability of this scale was underscored by the fact that it included the two core characteristics of utilitarian usability, namely the issues of whether a product is practical and purposeful in use. The third item evaluated the relevance of compatibility to other owned products. The discarded items covered such characteristics of products as its price, extendibility, feature minimalism, simplicity, and multi-functionality.

Ten items were synthesized into a construct measuring the two opposite styles of decision making in consumption: the affective versus cognizant product choice mode,  $\alpha = .74$ . Two items were not included in the reliability analysis due to their low loadings on the first extracted factor in the factor analysis ( $a < .20$ ). In these items students were asked how much they think about themselves when considering products, and it might be that these types of questions address characteristics that are too distant from the product itself.

The affective end of the scale was directly addressed by asking people about their readiness to base their purchase decision on an immediate affective evaluation, a gut reaction of “rightness,” if you will, about the product. Questions focusing on cognizant product relations assessed the importance of calculating clear-cut reasons and the engagement in vigilant, piecemeal, and logic-based search and evaluation of information through consideration of all the features of a product, its pros and cons, and alternative options. The items were marked in the way that a strong agreement with affective choice criteria and low scores on cognizant items were coded into low scale scores, representing the affective pole of the choice code variable. High scale scores therefore reflected a strong cognizant and weak affective mode of choice.

Finally, involvement assessments were best represented by one single dimension. The item analysis yielded a reliability of  $\alpha = .81$ . None of the originally included items needed to be discarded. These assessed the essentiality, usefulness, desirability, and appeal of mobile phones, as well as how exciting the consumer finds them and how concerned he or she is with choosing the right one.

Table 1 contains the distributions of the scores based on the summation of the items included in each of the discussed scales: hedonic meaning, expressive meaning, functional meaning, choice mode, and involvement. Normal distribution can be assumed for each of the five constructs, using a .20-level of significance.

Correlations among the five constructs show that all product meaning dimensions are associated with each other (see Table 2). Concretely, the data suggested a strong association between hedonic and expressive product meaning and a moderate link between a functionalistic and cognizant approach towards products,  $r = .60$  and  $r = .32$ , respectively. At the same time, choice mode was negatively correlated with both hedonic and expressive product meaning. Finally, it appeared that attaching a strong expressive value with consumer electronic products is a better indicator for involvement with mobile phones than is the functional importance of the products.

Additional correlations of the product meaning dimension and involvement with gender and age suggested that women attach generally more hedonic value with consumer electronic products than do men, they are more guided by their affect during purchase decision making, and they tend to be more involved with mobile phones,  $r = .21, p < .01, n = 484$ ;  $r = .18, p < .01, n = 471$ ; and  $r = .16, p < .01, n = 482$ , respectively. A more detailed look into the involvement dimensions showed that women predominantly hold mobile phones to be more essential, appealing, and desirable than men. However, they are by and large of the same

**Table 1.** Distributive Descriptives of the Scales Assessing Product Meaning Dimensions and Involvement

Product Meaning	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Min.</i> <sup>a</sup>	<i>Max.</i> <sup>a</sup>	<i>Min.</i> <sup>b</sup>	<i>Max.</i> <sup>b</sup>
Hedonic	489	18.73	4.37	4	28	4	28
Expressive	473	22.77	6.83	7	42	7	42
Functional	492	17.05	2.38	3	21	4	21
Choice Mode	476	32.70	8.03	10	70	12	64
Involvement	487	30.29	5.47	6	42	8	42

<sup>a</sup>theoretical range; <sup>b</sup>empirical range

**Table 2.** Bivariate Intercorrelations Between Product Meaning Dimensions and Involvement

Product Meaning	Expressive	Functional	Choice Mode	Involvement
Hedonic	.60** (.56**)	-.03 (.20**)	-.27** (-.19**)	.19** (.06)
Expressive		-.24** (-.24**)	-.28** (-.09*)	.28** (.21**)
Functional			.32** (.30**)	-.03 (-.01)
Choice Mode				.05 (.14*)

Note. In parentheses partial correlations.

$n = 451$  ( $n = 446$ )

\* $p < .05$ , \*\* $p < .01$

opinion as are male consumers with respect to the judgment of mobile phones as being useful as such and the concern about owning the right type of mobile phone.

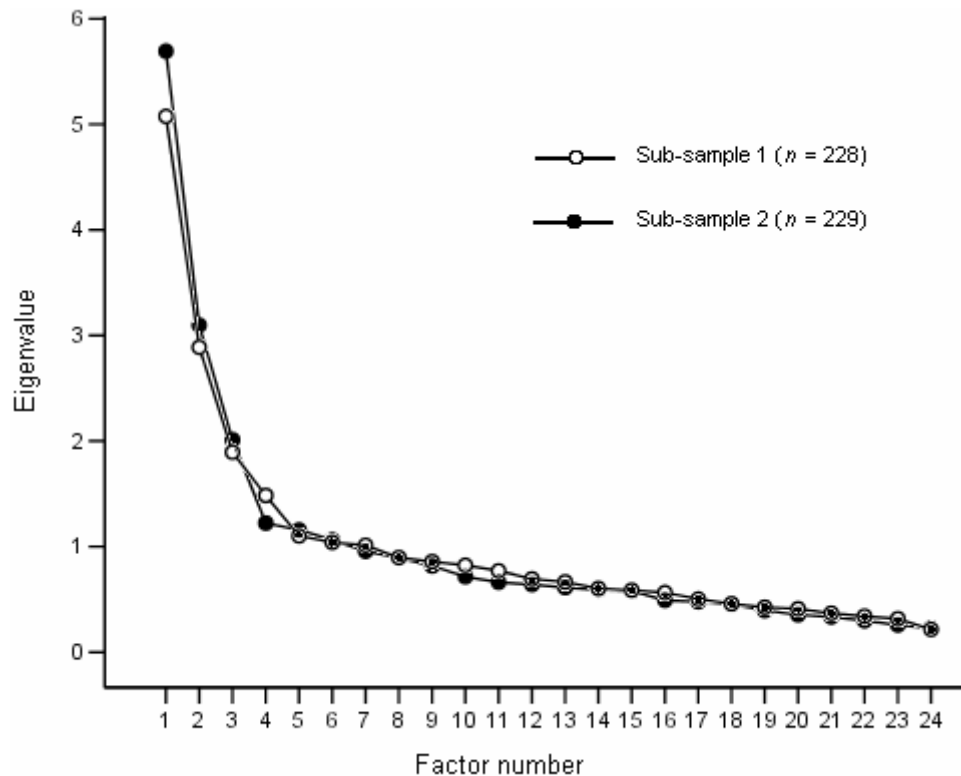
Older people generally indicated that they attached slightly less hedonic and expressive meaning to consumer electronic products,  $r = -.15$ ,  $p < .01$ ,  $n = 479$  and  $r = -.17$ ,  $p < .01$ ,  $n = 463$ , respectively. So, in a sense, their relation to products appears to be more pragmatic. It must be made clear, however, that gender and age together can explain only a very small amount of variability in, for instance, hedonic product meaning (roughly 5%). Many other personal factors, which have not been assessed here, are involved in creating such differences in product representation.

When interpreting the intercorrelations among product meaning variables, two major dimensions seemed to emerge: (a) the aspects that involve socio-emotional values (hedonic and expressive meaning) and (b) those that relate to a product's utilitarian (functional meaning and cognizant choice mode) functions. However, the fact that the variables measuring these two dimensions tend to be negatively correlated suggested a certain mutual exclusiveness between consumers' socio-emotional and utilitarian attitudes. For instance, people who based their product choice more on piecemeal evaluation did seek electronic devices to be mainly functional but found them of less symbolic importance, whereas those who did not choose products in a cognizant way (i.e., the affective appeal of a product predominates) focused more on hedonic and symbolic values.

Factor analyses were performed to shed more light on the dimensional structure underlying the different aspects of product meaning. The random split-sample method was applied, using 50% of the participants to calibrate a factorial model and the other half to evaluate it. The analysis of all 24 questionnaire items that were included in building the four product meaning constructs revealed several factors with an initial eigenvalue greater than 1. Judging from the large drops in eigenvalue after extraction of the first two factors and the smaller, but still considerable, drops after the third and fourth components, a two- to four-factorial design seemed fairly adequate (see scree plot in Figure 2). This conclusion was also supported by the analysis of  $\chi^2$  statistics from the maximum likelihood estimations of the different models<sup>2</sup>, suggesting the three-factorial solution as a good cut-off point,  $\chi^2(207, N = 228) = 401.93$ ,  $p < .01$ .

The evaluation of the model with the second subsample of students revealed a very similar picture (see Figure 2), although, here, the  $\chi^2$  analysis suggested the four-factor model to fit slightly better than the three-factor solution,  $\chi^2(186, N = 229) = 339.77$ ,  $p < .01$  and  $\chi^2(207, N = 229) = 453.86$ ,  $p < .01$ , respectively. Nevertheless, the fourth factor seemed very difficult to interpret





**Figure 2.** Eigenvalue scree plots of Maximum Likelihood factor analyses of the product meaning variables in two random sub-samples.

because no variable loaded exclusively or specifically high (e.g., a correlation above .50) on this dimension.

The three-dimensional model was therefore applied to the complete sample, using a principal component analysis with rotation (see Appendix for factor loadings). Two main observations could be made. First, the three extracted components together accounted for less than half (Component 1: 20%; 2: 13%; 3: 10%) of the variance among the intercorrelations of the 24 original product meaning variables, thus rendering a rather weak model. Second, the items directly assessing the consumers affective approach to products were associated with the large part of other socio-emotional product meaning issues and loaded strongest on Component 1, whereas questions that directly addressed the students cognizant consumer attitudes and behavior loaded on Component 2. The third component seemed to represent the functionality aspect of product meaning.

## Discussion

The consumer data collected in the questionnaire allowed for the construction of four product meaning scales, assessing hedonic, expressive, functional, and cognizant (vs. affective) types of product evaluation. These various aspects were not independent of each other, however, and the values attached to products seemed also to vary slightly between different groups of consumers. In particular, the affective and symbolic relevance of products was stronger for younger and female consumers.

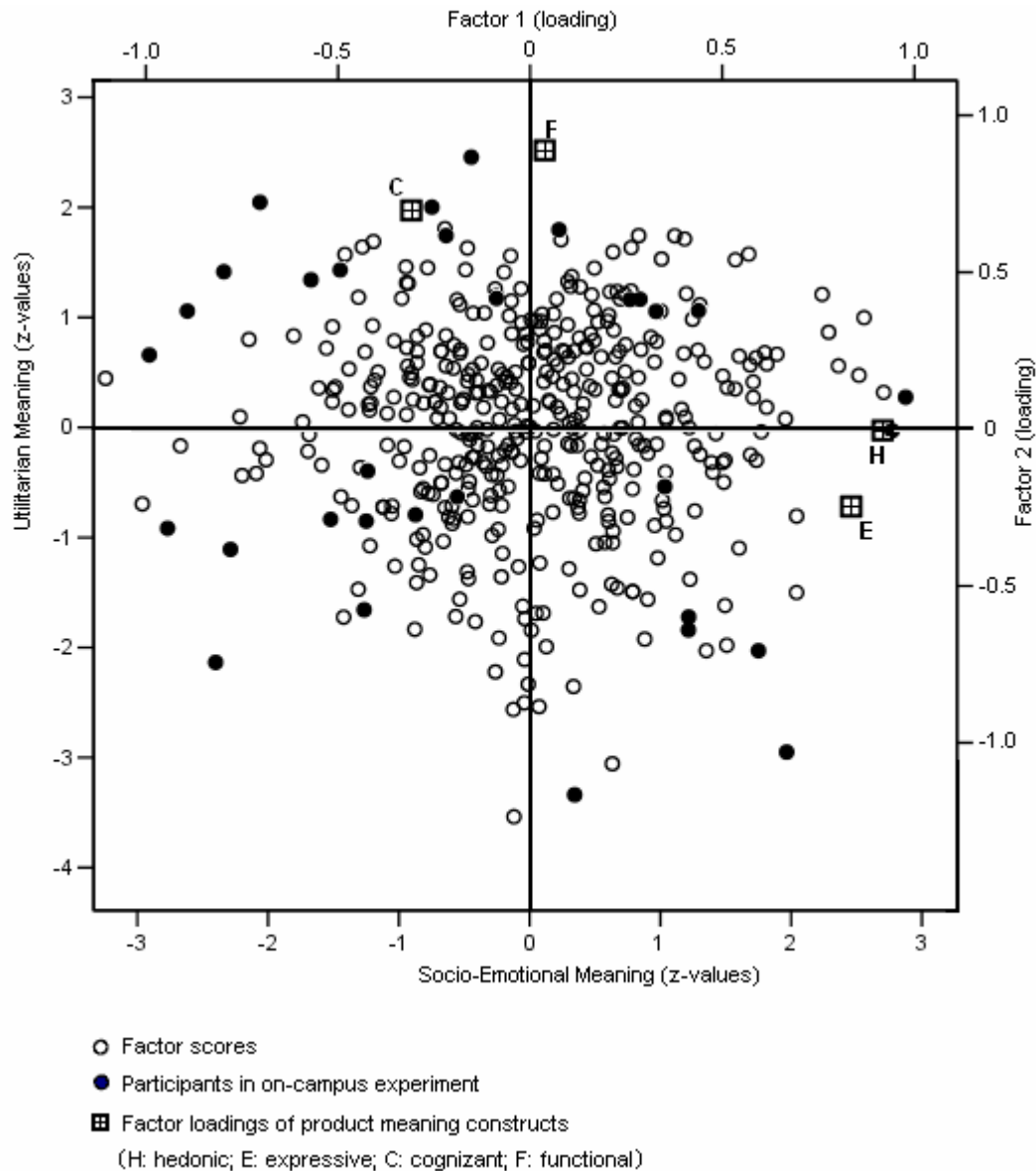
Further factorial analyses of product meaning suggested that it may be problematic to have a single bipolar choice mode variable combining the cognizant and affective factors in product relevance. Rather it appeared that emotion-based evaluation of products and their social significance are somewhat similar issues and, at the same time, independent of rational judgments of products and their utilitarian meaning. The analyses also revealed difficulties concerning the structure, strength, and amount of dimensions that should be assumed when attempting to reduce the issues raised in people's representation of products to only a few dimensions. Very similar problems have also haunted the development of dimensional approaches to other meaning-related constructs, such as emotion (Marx, 1995; Mehrabian, 1995). As in the current study, it appears that between two and four dimensions best represent meaning. Which model is preferred will depend on the particular research question and design.

In preparing the experimental part of the study, some important model-related decisions needed to be made. Because the initially constructed scales proved reasonably consistent and measured product meaning according to an a priori defined four-dimensional model, it appeared statistically and theoretically acceptable to continue using them as basis for the characterization of the consumer profiles. It was further found desirable to develop a minimal model that would include only two major dimensions of product meaning. The feasibility of this approach was underscored by the scree plots of the factor analyses (see Figure 2) and the obvious relationship among socio-emotional product evaluations on the one hand and functional and cognizant evaluations on the other.

## PHASE 2: THE EXPERIMENT

The idea of the experiment was to invite the participation of people with diverse attitudes and approaches toward electronic products in order to examine their affective response to the interaction with virtual designs of two different mobile phones. In order to test for moderation effects of consumer variables on user experience, product meaning shall be reduced to two dimensions only: a *socio-emotional* component (combining hedonic and expressive values) and a *utilitarian* component (combining functional meaning and cognizant product choice). Involvement, gender, and age were included as additional moderators.

Because the experimentally induced emotional transfer between the use and evaluation of the two devices was believed to be related to a wide variety of factors<sup>1</sup>, it proved important to limit the current experiment's focus on one alternation, namely the degree of commercial (i.e., brand name) similarity between the learning and the transfer device. Hence, the participants were made to believe the phones were either of the same brand (*same-brand condition*) or from two different producers (*different-brand condition*). Further, in order to be better able to evaluate the validity of the emotional assessment, it was decided to operationalize an emotionally intense and potentially frustrating user experience by deliberately obstructing the interaction with the first device (Ceaparu, Lazar, Bessiere, Robinson, & Shneiderman, 2004). The core assumption concerning affective transfer was that, based on the failure experience with the first phone, users in the same-brand condition will evaluate the transfer device more negatively (i.e., transfer more of the negative connotations) than users who believe to have received a phone of a different brand.



**Figure 3.** Participants' factor scores and factor loadings of the product meaning constructs on the two extracted components.

## Method

### Participants

Fifteen female and 17 male students of Finnish nationality and with an age range from 19 to 42 ( $M = 25.50$ ,  $SD = 5.80$ ) took part in the on-campus experimentation. Seventeen users were assigned to the same-brand and 15 to the different-brand condition.

In order to preserve the weight of the initial product meaning constructs and their association, participants were selected if their score was in the lowest or highest 15<sup>th</sup> percentile on at least one of two dimensionally related scales, while at the same time not

figuring in the opposite extreme on the second variable. As depicted in Figure 3, this selection is roughly based on a 2x2 matrix with users scoring (a) below average, both on functional/cognizant and hedonic/expressive product meaning items (Group 1), (b) below average on functional/cognizant but above on hedonic/expressive meaning (Group 2), (c) above average on functional/cognizant but below on hedonic/expressive meaning (Group 3), or (d) above average on both dimensions (Group 4).

Out of the 500 students, 118 matched the selection criteria for one of the four groups. (In order, the number of subjects for Groups 1 to 4 were 15, 42, 46, and 15; gender distribution: 61% female, 39% male; age range 19-50,  $M = 25.50$ ,  $SD = 6.20$ .) Fourteen (3 to 5 in each group) did not provide us with contact addresses so they were discarded from the selection. Of the remaining 104, a random subsample of 55 participants was invited for experimentation, driven by the objective to collect an equal amount of experimental data for each of the four groups. A test session could be arranged with 58% of those invited. Six did not respond and four declined our invitation, while 13 individuals did not appear for experimentation due to schedule or geographical problems. The individuals who arrived for the experiment are marked in Figure 3 according to their factorial scores in a two-dimensional representation of the four product meaning scales (see also Phase 2 Results section). Although these scores do not directly correspond to the criteria used for their selection, the scattering reveals that it was hardest to find users who held high values on all product meaning dimensions.

### Stimuli and material

The experimentation took place at the Agora Center in Jyväskylä, Finland, 2 months after the pre-experimental assessment. Users interacted with two virtual mobile phone devices that were emulated on a Dell Latitude notebook. The pressing of the phones' touch screen fields was executed by use of a mouse-controlled pen-shaped cursor.

In order to increase the credibility of the interfaces, navigation menus, and brand names, the designs were partly based on real phones and concept studies found on the Internet (see Figure 1 for the phone covers and Figure 4 for the two invented brand names: i-tel and e.me). Data collected in the questionnaire ensured that the experimental devices did not overtly resemble phones that the participants have owned themselves.

Self-assessment instruments were used at two different instances during the experiment: a postlearning questionnaire after the skills and knowledge had been tested with Device 1 (40 items), and a posttransfer questionnaire after participants completed working with Device 2 (43 items). Both questionnaires assessed the general and specific affective reactions to the devices, measured in two distinct ways: (a) The abbreviated (12-item) version of the PAD Emotion Scales (Mehrabian, 1995, 1998) was used to get a dimensional assessment of users' emotional state; and (b) a variety of statements were designed to capture users' concrete opinions about the phone, its navigation menu, their own emotion and self-efficacy beliefs, as well as their performance and performance attribution.



**Figure 4.** The logos used for the two brand names e.me and i-tel.

The PAD Emotional State Model employed the semantic differential technique, with each dimension (Pleasure-Displeasure, Arousal-Nonarousal, Dominance-Submissiveness) being represented by four adjective pairs. Concerning the direct questions, participants indicated the degree to which they agreed or disagreed with the favoring and rejecting remarks about the phone and its use on 7-point Likert scales

The construction of these items was based on the study of item dimensions in a wide variety measurement approaches, including the Questionnaire for User Interface Satisfaction (QUIS; Chin, Diehl, & Norman, 1988), Software Usability Measurement Inventory (SUMI; Kirakowski, 1996), Computer Satisfaction Inventory (CUSI; Kirakowski, 1987), Usefulness, Satisfaction, Ease-of-Use-Questionnaire (USE; Davis, 1989; Lund, 2001). Other freely available attribution scales, self-efficacy measures, and satisfaction questionnaires were consulted as well.

To the author's knowledge, the current paper features the first attempt to adapt the PAD emotional scale to the Finnish language. Two considerations led to the decision to translate the scale: (a) the fact that the emotion terms used in the original English language scale were very difficult to understand for native Finnish speakers, and (b) the hope that the measurement will find wider domestic and international application in future, especially in the area of user psychology. The test norms were, however, taken from the original PAD manual (Mehrabian, 1998). Three psychologists and two laymen translated the stimuli terms independently, then later agreed upon a single set of emotion expressions.

Finally, video footage of the users' facial expressions was recorded, mainly to support the validity of the frustrating experience (ca. 15 min per participant).

### Design and procedure

The experimental design consisted of one within-subject and one between-subject manipulation. For all participants the use of the first device was deliberately obstructed, while the use of the second device was non-obstructed (*obstruction treatment*). The obstruction intervention was operationalized by instigating implicit modifications to the system's menu tree (i.e., alternation of nodes and changes of their loci). The participants were further split into two groups, representing the same-brand and different-brand conditions (*brand treatment*). This division, although arbitrary in its appearance, was counterbalanced for gender, product meaning, and the used brand logos.

Before the transfer part of the experiment, the participant drew from a cup of allegedly randomly mixed cards one on which it was noted whether he or she needed to continue on a transfer device belonging to a new generation product of the same brand as the learning device belonged, or on a competitor's product. In reality, the user interface and menu of the two devices were the same for all users, except for the brand logos displayed on the virtual covers.

Throughout the experiment participants were engaged in task-guided navigation through text-based, hierarchical user menus (i.e., the type with which most users are familiar from traditional GSM models). For both the learning and transfer parts, users' training on the phone (Device 1: 28 training tasks; Device 2: 9 training tasks) was followed by a brief test of their acquired knowledge and skills (Device 1: 7 test tasks; Device 2: 3 test tasks). After completing the test tasks the participants filled in the questionnaires.

## Results

### Overall device evaluations and performance attributions

The expectation concerning users' affective response to working with Device 1 was to be one of frustration. Mehrabian's (1995) PAD emotion model associates frustrating (e.g., upsetting, distressing, bewildering) experiences with displeasure, arousal, and submission. After computing the participants' z-transformed values on the three emotion scales (i.e., Pleasure-Displeasure, Arousal-Nonarousal, and Dominance-Submissiveness), the prediction was that, on average, participants would score negative on the first and last dimension, while being generally aroused. The means (with standard deviations in parentheses) for all 32 participants were -0.34 (0.47) for Pleasure, -0.07 (0.44) for Arousal, and -0.19 (0.51) for Dominance, with the former and latter ones deviating significantly from zero,  $t(31) = 4.12, p < .01$  and  $t(31) = 2.15, p < .05$ , respectively. The three dimensions were not correlated with each other.

This meant that the obstructed use of Device 1 caused overall displeasure and a feeling of lack of control. It did not, however, substantially arouse people, which the PAD model translates as a mixture of frustration and despair. With scores not exceeding -1.37 (Pleasure dimension) for negative values and 1.04 (Dominance) for positive ones, it is further obvious that users refrained from giving very extreme types of answers about their emotional states. (Kurtosis was positive for Arousal-Nonarousal and Dominance-Submissiveness, and slightly negative for Pleasure-Displeasure.)

Because the use of Device 2 was not obstructed, the expectation was that participants would experience working with the transfer phone as generally more pleasurable and feel more in control. The mean scores revealed that participants felt more positive ( $M = 0.30, SD = 0.38, n = 30$ ), but they were equally aroused ( $M = 0.02, SD = 0.48, n = 32$ ) and did still not feel in charge ( $M = -0.27, SD = 0.63, n = 32$ ). The changes in the emotion dimensions can be discerned from Figure 5. Paired-sample *t*-tests substantiated the increase in positive valence of the affective response,  $t(29) = 7.39, p < .01$ , and that there was no significant difference for Arousal and Dominance. Although the distributions tended to be very peaked and extreme evaluations rare, the PAD scores indicated that users felt generally more pleased and maybe slightly amazed when working with Device 2.

An interesting relation between the pleasure of working with the second device and the experienced arousal was found,  $r = .62, p < .01$ . This interrelation is not typical for the PAD scales but has been documented in other research that focused on specific emotional states (Mehrabian, 1995).

When asked in a more direct manner (i.e., by use of concrete statements), participants did not display many extreme opinions about either of the phones. The discussion of these results is therefore limited to those issues where average judgments deviated significantly from the ideal mean (i.e.,  $M = 4$  on a 7-point scale; see Table 3 for the median scores on these items). Looking at the keenness of working with the devices, users indicated they had been well motivated before performing the test tasks on the learning phone. Remarkably, this high motivation remained unchanged when moved to working with the transfer device, despite the fact that participants quite clearly noted that they did not perform well on the first device. A preliminary look at the effect of the brand manipulation revealed, however, that there was a trend for a difference in motivation about working with Device 2 between the experimental groups,  $t(30) = 1.66, p = .05$ , one-tailed. This difference was mainly due to an increase in



transfer brand, a majority answered that they would be inclined to try such a phone if it were marketed in the near future.

### Moderation effects on affective device evaluation and transfer

The final step in the analysis of the data addressed moderation effects of product meaning, involvement, gender, and age on the user's affective experience and its transfer. Measuring the effects of the product meaning by a variance analytic extreme group design was found problematic because the groups comprising the individuals participating in the experiment were (a) not distinct enough with respect to their product meanings, (b) small (9, 8, 11, and 4 participants in the four groups respectively), and (c) varying in size (see also Figure 3). Hence, a correlative design, checking for dependency of the affective reactions to the devices on consumer personality variables, was preferred.

In order to obtain individual scores for the two product meaning dimensions (socio-emotional and utilitarian aspects), the solution of a rotated two-factorial principal component analysis of the four original product meaning constructs was used. The two extracted components allowed for the explanation of three quarters of the overall variance, with Component 1 (identified as Socio-Emotional Meaning; 48%) being a stronger factor than Component 2 (identified as Utilitarian Meaning; 27%). The loadings read .92 and .84 for hedonic and expressive meaning on Component 1 and .89 and .71 for functional meaning and cognizant product choice mode on Component 2. All variables correlated below .30 with the component they were not associated with. Figure 3 displays the loadings and the scattering of the consumers' factorial scores.

Finally, because the PAD scores appeared the most valid so far (see also Phase 2 Discussion), the moderator analyses were limited to the evaluative dimensions of Pleasure-Displeasure, Arousal-Nonarousal, and Dominance-Submissiveness.

Multiple regressions of the affective evaluation of Device 1 on consumer variables were performed, with involvement entered in Block 1, Socio-Emotional Meaning in Block 2, Utilitarian Meaning in Block 3, and gender and age in Block 4. There were no missing cases. (Table 4 contains the  $\beta$ -coefficients for all models, including those predicting the affective evaluations of Device 2, to which the text refers later. In the text, unstandardized  $B$ -coefficients are presented.)

For the Pleasure-Displeasure dimension, the analysis yielded a significant model with involvement and Socio-Emotional Meaning as predictors,  $B = 0.23$ ,  $pr = .33$ ,  $t(29) = 1.85$ ,  $p = .08$  and  $B = -1.13$ ,  $pr = -.41$ ,  $t(29) = 2.45$ ,  $p < .05$ , respectively. Together these explained 23% of the variance as compared to 28% when including all variables,  $F(2, 29) = 4.20$ ,  $p < .05$ . This result meant that people who attach strong socio-emotional meaning to electronic products in general also reacted more negatively to the frustrating learning experience with Device 1, whereas high involvement with mobile phones in particular seemed to counterbalance this effect. Gender was the strongest of the factors not included in the regression model, indicating that women were slightly more frustrated than men from the use of Device 1.

No significant regression models could be constructed for the remaining two PAD dimensions (Arousal and Dominance), using an alpha level of .05. There was, however, a significant correlation between Arousal and age, with older people tending to be more aroused



**Table 4.**  $\beta$ -Coefficients and  $R^2$  for the Regression Models predicting Pleasure-, Arousal-, and Dominance Assessments When Working with Device 1 and Device 2

PAD-Dimension	P1	A1	D1	Brand	S-EM	UM	I	Sex	Age	Model $R^2$	Total $R^2$
P1	-	-	-	-	-.40* <sup>a</sup>	.14 <sup>b</sup>	.30 <sup>a</sup>	-.17 <sup>b</sup>	-.02 <sup>b</sup>	.23*	.28
A1	-	-	-	-	-.05 <sup>b</sup>	.09 <sup>b</sup>	-.15 <sup>b</sup>	-.18 <sup>b</sup>	.31 <sup>b</sup>	-	.15
D1	-	-	-	-	.14 <sup>b</sup>	-.08 <sup>b</sup>	-.20 <sup>b</sup>	.03 <sup>b</sup>	.01 <sup>b</sup>	-	.07
P2 <sup>c</sup>	.48* <sup>a</sup>	-.10 <sup>b</sup>	-.10 <sup>b</sup>	.30 <sup>a</sup>	-.18 <sup>b</sup>	-.02 <sup>b</sup>	-.10 <sup>b</sup>	-.28 <sup>b</sup>	-.32 <sup>a</sup>	.29*	.39
A2	.50* <sup>a</sup>	-.02 <sup>b</sup>	.13 <sup>b</sup>	-.22 <sup>a</sup>	-.07 <sup>b</sup>	-.26 <sup>a</sup>	-.13 <sup>b</sup>	.01 <sup>b</sup>	-.02	.22	.26
D2	-.02 <sup>b</sup>	.61** <sup>a</sup>	-.02 <sup>b</sup>	-.11 <sup>a</sup>	-.07 <sup>b</sup>	-.13 <sup>b</sup>	-.09 <sup>b</sup>	.13 <sup>a</sup>	.25 <sup>a</sup>	.33*	.36

*Note:* Dashes indicate that analysis for this cell was not applicable or redundant. S-EM = Socio-Emotional Meaning; UM = Utilitarian Meaning; I = Involvement; P1, A1, D1, P2, A2, D2 = Dimensions of Pleasure, Arousal, and Dominance associated with Device 1 and Device 2 respectively.

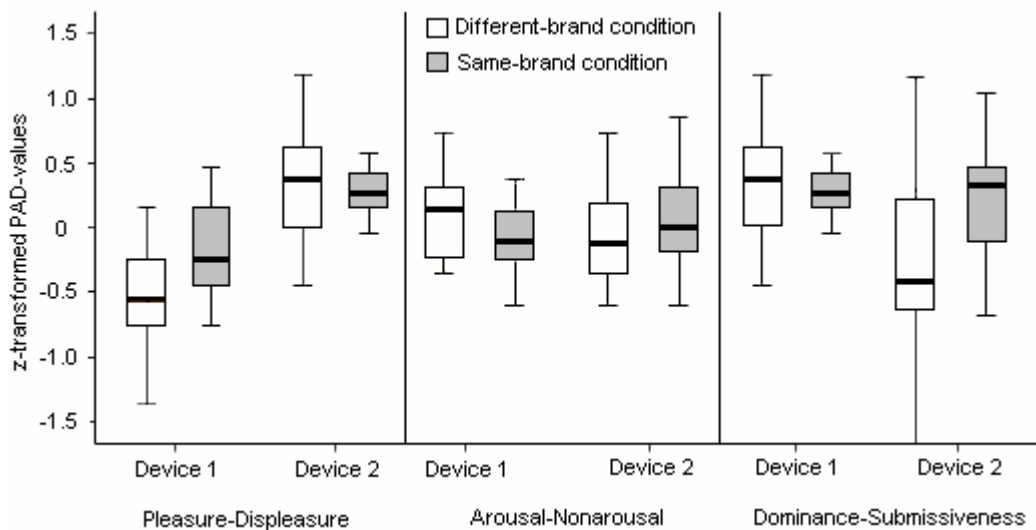
<sup>a</sup>Variable was included in the prediction model. <sup>b</sup>excluded variable. <sup>c</sup> $n = 30$  (for all others  $n = 32$ ).

\* $p < .05$ . \*\* $p < .01$ .

than younger users,  $r = .32$ ,  $p < .05$ . Dominance was negatively correlated with the original choice mode scale,  $r = -.32$ ,  $p < .05$ , indicating that people who judge mobile phones in a cognizant way felt more intimidated by the obstructed learning experience.

Next, the determination of the user's affective evaluation of the transfer device needed to be examined. In particular, the question remained whether differences exist between the users who believed the two phones were of the same brand and those who believed they transferred to a device of a different brand. A preliminary visual analysis of the illustrations in Figure 5 indicated that the increase in pleasure is less steep for participants in the same-brand condition. At the same time they appeared to experience slight increases in arousal and the feeling of control, both of which diminished for participants in the different-brand group.

Correlative and regression analyses were used to identify the main covariates that needed to be controlled in testing for the effects of the brand manipulation (between-subject treatment) and the obstruction treatment (within-subject treatment) on the individual changes in Pleasure,



**Figure 5.** Mean changes in the scores on the three PAD emotion dimensions between the evaluation of Device 1 and Device 2, separated for brand conditions.

**Table 5.** Correlations Between the PAD Emotional Responses to Device 1 and Device 2, Separated by Brand Condition

Device 1	Device 2								
	Pleasure			Arousal			Dominance		
	Total	Brand condition <sup>a</sup>		Total	Brand condition <sup>a</sup>		Total	Brand condition <sup>a</sup>	
Same		Different	Same		Different	Same		Different	
Pleasure	.34*	.30	.50*	.38*	.41	.41	-.04	-.18	.11
Arousal	-.20	.30	-.43	-.11	.49*	-.47*	-.51*	-.50*	-.54*
Dominance	.02	.30	-.09	.08	.31	.02	.03	.22	-.08

<sup>a</sup> $n = 15$  for each of the two brand conditions.

\* $p < .05$ . \*\* $p < .01$ . All one-tailed.

Arousal, and Dominance. Table 5 lists the associations between the affective evaluations of the two devices for the whole sample, and separated for the two experimental groups.

Overall, the pleasure-related evaluation of Device 2, referred to as Pleasure 2<sup>3</sup>, appeared to be dependent upon how enjoyable or frustrating the first device had been found. No such association was found for Arousal and Dominance (see correlations under Total in Table 5). However, when split by brand condition the Pleasure relation was significant only for participants in the different-brand condition. Noteworthy further was the inverse relation within Arousal. Arousal 2 was substantially negatively related to Arousal 1 for users in the different-brand group, whereas this association was positive for participants in the same-brand condition. The data in Table 5 also show an interesting positive correlation between prior Pleasure and Arousal during transfer, and they suggest that Arousal 1 explains more than one fourth of the variance of Dominance 2. These associations were the same for users in both brand conditions.

## Discussion

The users' affective reaction to the obstruction of their initial interaction with the virtual mobile phone was, although moderate, of the expected negative type (i.e., frustration and despair). Concerning the measurement of the user experience, the opaque dimensions of the PAD emotion assessment appeared superior to direct question forms. Participants tended to disguise their feelings of discontent when asked in an overt manner, and rather attributed their emotion to the device as "being frustrating." Nonetheless, the parallel measurement of affective issues through the prompting of concrete statements provided valuable contextual information. An interesting observation with regard to attribution was, for instance, that the users' overall motivation and self-confidence did not clearly decline after the obstructive experience with the first device. In fact, it increased for those who received a new phone of a different brand. This indicates that skilled users having an unsuccessful use interaction do not readily internalize or over-generalize this negative experience to the producer or the product, but consider it a specific characteristic of a particular design.

The effects of failure were, however, not homogeneous, and the assessments of the three emotion dimensions (Pleasure, Arousal, Dominance) were affected in distinct ways by the variables of the consumer profile. Hedonic and expressive product meanings, as well as the level of involvement with mobile phones, appeared to affect the negativity of the affective response. The user's age was most predictive for the level of arousal, and the degree of

cognizant product evaluation influenced the level of the users' feeling out of control. An ideal prototype for a user that is "easily frustrated" was, thus, an older person who is in general less concerned with the type of device in question, but who makes very piecemeal judgments about similar products, and holds these products to be essential for hedonic and symbolic reasons.

Concerning the transfer of the affective evaluation to a new device, the brand modified the involvement of the user's emotion and this was found mainly with regard to the experienced pleasure. Although the feeling of pleasure generally increased when users worked with the nonobstructed device, this effect was substantially weaker for those who received a phone from the same brand. Overall, there was only a slight change in the levels of Arousal and Dominance when users worked with a new phone. Even so, prior arousal appeared to be somewhat decisive for the type of stimulation an individual experienced from the brand of a new device, while the experience of a well-functioning second phone of the same brand increased the feeling of control especially for those who judge products in a functional and cognizant way.

The associations among the PAD dimensions across situations contribute also to the study of adjacent emotional states. In contrast to assumptions related to mood or chronologically based excitation transfer (Zillman, 1983), the results suggest that the emotional carry-over depends on relevant aspects in the way the situations are related to each other (i.e., the brand relation).

Age was generally more significant than gender in moderating people's emotional experience of product use, with older people being more negatively affected by the failure experience. Additionally, older people were more ready to transfer their anxiousness to a new design, especially when it was believed to be of the same brand. The fact that younger users recover more easily from errors was also shown in other research (Dulude, 2002).

## **GENERAL DISCUSSION**

The presented study intended to advance consumer and HMI research on a variety of frontiers. Its accentuation of emotional and social implications of consumption and use is pivotal and reflects wide spread interests in the field (Norman, 2004; Picard, 1997). The investigation addressed key methodological and conceptual domain issues and contributed to a better understanding of the dimensional character and measuring of product meaning and affective user experience. It advanced ideas and insights into how these variables that are often researched in a detached manner within the domains of consumer and user psychology can be studied in an associated way. And finally, it promoted the use of the well-known concept of transfer in a novel context to study the relation between users' affective evaluation of different designs. This type of affective transfer is, for instance, closely related to work on self-efficacy (Compeau, Higgins, & Huff, 1999; Igarria & Iivari, 1995) and an extension to the Technology Acceptance Model (TAM; Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; see also Taylor & Todd, 1995). And on a theoretical level, the focus on emotional aspects encourages the study of nonperceivable contents in people's mental representation, which has so far been largely neglected in traditional transfer research (Helfenstein & Saariluoma, in press; Thagard & Shelley, 2001).

The findings of the consumer inquiry are well in line with other research arguing that products serve a variety of functions pertaining to hedonic, symbolic, expressive, and

functional values, and that the relevance of these various aspects is not equal for all people (Allen, 2000). Two-, three-, and four-factorial models have been discussed as viable alternatives to represent the semantic space of product meaning. The potential of the three-dimensional solution is consistent with well-established findings about the nature of meaning (Csikszentmihalyi & Rochberg-Halton, 1981; Osgood, Suci, & Tannenbaum, 1957) and is taken as evidence that the three basic psychological factors of cognition, emotion, and social reference may indeed compose a hidden structure underlying people's relation to products. The results obviously question the appropriateness of any experiment's chosen approach to differentiate only between symbolic and functional product meaning (e.g., Allen & Ng, 1999; Fournier, 1991), and they demonstrate the difficulties involved in representing emotional and cognitive aspects of product evaluation as opposites on a single dimension. As it was employed in the current investigation, I suggest, however, that the level of detail and exhaustiveness of a particular research aim and design must be considered when deciding upon which model to assume.

The PAD Emotional State Model (Mehrabian, 1995), with scales assessing the three emotion dimensions of Pleasure, Arousal, and Dominance, was easy to use and performed well in revealing the user's affective reactions. Nevertheless, direct questions about the interaction and its affective evaluation did enrich the portrait of the user experience in essential ways, which supports the call for mixed-method approaches (Arhipainen & Tähti, 2003). Obviously, future research with a Finnish version of the PAD instrument is needed for its validation, and I support the use of all three dimensions because each appeared to represent an aspect of distinct relevance to a comprehensive description of the user's affective experience.

Overall, the experimental part of the investigation provided evidence that different meanings of products and other aspects of the consumer profile moderate the affective evaluation of a design and its use in distinct ways, not only with regard to the experience of an obstructive event, but also with respect to the transfer of these connotations to the evaluation of a related device. There was further proof supporting the predicted influence of the brand knowledge upon emotional transfer.

The effect of the brand relation and the found associations between product meaning, age, and affective evaluation all had intuitive validity. And although many of these results are preliminary, it is, for instance, considered a relevant finding that prior frustration may hamper the relationship between a consumer and a brand with regard to the users' acceptance of a future design, but it does not cause actual rejection. The relations between the dimensions of product meaning and emotion were also consistent with the results of previous research (e.g., Kempf, 1999) even though it is conceivable that their discovery in the current study was partly favored by the way the research was designed (i.e., through the selection of participants that score in very disparate ways on the respective dimensions).

Finally, the exploratory character of research definitely intends to instigate further development of the research questions, the design and its measures. This pertains especially to the adopted dimensions of product meaning and emotion, the systematic use of extreme user-group designs, and the inclusion of a variety of alternative transfer relations between different designs.

## ENDNOTES

1. These include (a) artifactual context similarities, such as the chronological adjacency of the measures within a common experimental context, (b) device similarities, such as the correspondences in their (menu) systems, (c) the surface resemblance between the user interfaces, (d) brand associations between the products, as well as (e) the use similarities such as the alikeness of tasks, commonalities in the purpose of interaction, and similarities in the general symbolic and utilitarian functions of the devices themselves.
2. Bollen (1989, p. 256ff.) discusses the size of the ratio  $\chi^2 / df < 2$  to be a good indication for an adequate fit of a Maximum Likelihood solution.
3. All affective evaluations related to the second phone carry henceforth the index 2, while those related to the first phone are followed by the index number 1.

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**APPENDIX***Factor Loadings for the Three-Factorial Model of Product Meaning Variables*

Basis/aspect of product evaluation	Component		
	1: Socio-Emotional	2: Cognizant	3: Functional
Compatibility to ideal self	.726	-.128	.138
Social prestige	.701	-.135	-.099
Pleasantness	.643	-.205	.316
Appearance	.618	-.273	.292
Gut-reaction	.616	.294	.148
Inner reaction	.608	.057	.245
Trend	.562	-.152	-.261
Expensive appeal	.556	-.311	-.099
Pride	.555	-.330	-.089
Reflection of oneself	.533	-.166	.330
Self-expression	.509	-.336	.025
Feel right	.442	-.047	.225
Concrete features	.439	.214	-.156
Friends' approval	.429	-.229	-.290
Vigilant search	.275	.644	.316
Piecemeal evaluation	.316	.640	-.024
Feature pros and cons	.159	.582	.192
Mental evaluation	.008	.543	.323
Rational choice	.394	.501	-.053
Criteria based	.287	.483	-.174
Compatibility	-.185	-.399	.292
Practicability	-.329	-.155	.603
Social reference	.300	-.111	-.548
Effective use	-.253	-.375	.491

*Note:* Three-factorial Principal Component analysis with Varimax rotation converged in 7 iterations.  
*N* = 457.