The Importance of Affective Quality

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Affect (mood, emotion, feelings) is a fundamental aspect of human beings and is found to influence reflex, perception, cognition, and behavior [6,7]. Studies in organizational behavior, marketing, and management have confirmed the strong impact of affect on job satisfaction, decision-making behavior, and consumer shopping behavior. Affective quality is the ability of an object or stimulus to cause changes in one's affect. Limited empirical data in Human-Computer Interaction research suggest that perceived affective or hedonic quality of an interface has a positive impact on users' perceived usability of the system [9-11]. It is discovered that pleasing things work better, are more regularly used, are easier to learn, influence future purchase choices, and produce a more harmonious result; thus affect and emotion have an important place in design; usability and aesthetics are both instrumental in creating pleasurable electronic products [6].

Empirical evidence is scarce on whether perceived affective quality of a system would influence perceived usefulness, which is the degree to which a person believes that using a particular system would enhance his or her job performance [1]. This evidence can be extremely important for a better understanding of the causal sources of user's IT related behavior. Abundant empirical studies in user technology acceptance literature show that perceived usefulness is a stronger and more dominant predictor of user's intention to accept and the actual usage of a system than perceived ease of use. Thus knowing the determinants of these predictors can have strong implications for IT designers, trainers and stakeholders to better strategize their resources and emphases.

Identifying affective qualities of various systems for supporting users' various tasks in different domains or contexts can be daunting. Fortunately, related studies are already on the way. Besides

reporting an empirical investigation on the antecedent role of perceived affective quality on perceived usefulness and ease of use, this paper also briefly describes some existing studies that identify affective qualities.

AFFECT AND PERCEIVED AFFECTIVE QUALITY

Although cognition has been attended much more than affect in the past several decades, researchers in several disciplines realize the importance of affect and emotion. Studies in neuropsychology and social psychology assert that affect or emotion occurs before cognition but also intervenes with cognition [6,7]. According to Norman, affect and cognition can both be considered information processing systems, but with different functions and operating parameters. The affective system is judgmental, assigning positive and negative valence to the environment rapidly and efficiently. The cognitive system interprets and makes sense of the world [6].

Core affect (also known as *Affect*, *Feeling*, *Mood*) is a neurophysiological state that is consciously accessible as a simple, nonreflective feeling. It is considered as an integral blend of hedonic or valence (pleasure-displeasure, the extent to which one is generally feeling good or bad) and arousal or activation (sleepy-activated, the extend to which one is feeling engaged or energized) values [7]. The state of the art research on core affect indicates that core affect is primitive, universal, ubiquitous, and is the core of all emotion-laden occurring events [7].

Affective quality (AQ) is the ability to cause a change in core affect [7]. Whereas core affect exists within the person, affective quality exists in the stimulus. Objects, places and events all have affective quality. They enter consciousness being affectively interpreted. The perception of the affective quality of all the stimuli typically impinges at any one time (how pleasant, unpleasant, exciting, boring, upsetting, or soothing each is), then influences subsequent reactions to those stimuli [7,8]. *Perception of affective quality* (PAQ) is an individual's perception of a stimulus' (e.g., IT's) ability to change his or her core affect, which is normally measured by the same dimensions of core affect: valence and activation [8]. This perception thus influences subsequent reactions this person would have to the stimulus [7].

USER ACCEPTANCE OF TECHNOLOGY

User evaluation or user acceptance of information technology is considered as volitional behavior and has been primarily studied with a rational/cognitive orientation [1]. Abundant existing studies

on user IT evaluation and technology acceptance have constantly verified that perceived usefulness (PU) has a strong impact on behavior intention (BI) to use the IT; perceived ease of use (PEOU) has an impact on PU; PEOU can have some impact on BI (although such impact is not always consistent); and BI is a strong indicator of actual use behavior. There are several studies such as [11,12] that touched upon some affect and emotional concepts.

Venkatesh [12] studied emotion via computer anxiety (an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers) as one of the determinants of perceived ease of use. The study examined the direct impact of general computer anxiety on PEOU, and found that computer anxiety's impact on PU is mediated by PEOU. In investigating factors influencing the usage of a generic portal website in Netherlands, van der Heijden [11] introduces a new construct named "perceived visual attractiveness" that is measured by the following three items: "Overall, I find that the site looks attractive," "The lay-out of the site is attractive," "The colours that are used on the site are attractive." van der Heijden finds that perceived visual attractiveness has significant positive impact on PU, PEOU, and perceived enjoyment [11]. This concept of visual attractiveness is close to the pleasant dimension of PAQ. One may speculate that PAQ, which is broader than the perceived visual attractiveness, may have positive influence on PU and PEOU.

Despite these recent efforts on bringing affect and emotion concepts into user acceptance studies, most of the existing studies are based on the assumption that human beings are rational and would behave based on logical information-based thinking. Very often the affective aspects are less central or focal in these studies. Even when affective constructs are studied, they are positioned in either parallel or consequent roles with other constructs (vs. antecedent role), and there is a lack of careful definitions and thorough examination of important affective constructs, which may have to do with the less developed status of affect and emotion studies [6]. Due to the above limitations of current studies, it is unclear whether affect plays a role in an individual's evaluation, reaction, acceptance and use of IT in various contexts for various purposes.

Our main position is that a user's immediate and reflexive affective reaction to IT, namely the perceived affective quality (PAQ), has a positive impact on his or her consequent cognition-oriented evaluations on using the IT, such as perceived usefulness (PU) and perceived ease of use (PEOU) of the IT, which in turn can influence a user's behavioral intention to use the IT.

EMPIRICAL INVESTIGATION

A field study was conducted to collect empirical data. PAQ is measured by the instrument validated by Russell and Pratt [8]. PU, PEOU, and BI were adopted from Davis' original instrument.

Subjects were 203 students in a major northeastern university in the US. Among the subjects, 63% were male, 45% freshmen and sophomore, 35% juniors and seniors, 20% master students, 53% White, 25% Asian/Pacific Rim, and 22% other ethnicity. The technology studied was the university's homepage that students would use on a voluntary basis.

The researchers went to twelve classes that had access to the university website by each student during class and recruited the subjects on a voluntary basis. The questionnaire directed each subject to use a Web browser to open the university's homepage to explore it for several minutes and see whether this site can be useful for his or her college life. Then the questionnaire continued with measures of PAQ, PU, PEOU, BI, as well as a section on demographics.

Confirmatory factor analyses were conducted and followed by the structural equation modeling (SEM) technique to test the relationships among the constructs. For confirmatory factor analysis, all the factor loadings for the four latent variables are significant at the 0.001 level and greater than .70, which is considered acceptable. The reliabilities (inter-consistency) of the construct measures were examined through Cronbach coefficient alpha and all met the .70 guideline. The goodness-of-fit of the SEM model were assessed through a combination of fit indices. The Bentler's Comparative Fit Index (0.9829), the Bentler & Bonett's NFI (0.9560), and the Bentler & Bonett's Non-Normed Index (0.9762) are all larger than .90 (the guideline is that they should exceed .90, and the closer to 1 the better). The RMSEA (0.0544) is less than .06 (the guideline is that it should not exceed .06). The overall chi-square test is significant (χ^2(56) = 89.5145, p = .003), but the ratio of Chi-Square over its degrees of freedom is (89.5145/56) is 1.6, less than 2. All measures indicate acceptable goodness-of-fit of the model.

Figure 1 depicts the empirical model with path coefficients and percentages of variances in variables explained. The result indicates that PAQ has a significant positive impact on both PU and PEOU. It does not have a direct impact on BI; its effect on BI is fully mediated by PU and PEOU. Consistent with many technology acceptance study results, PU has a significant positive

impact on BI; PEOU does not significantly affect BI; and PEOU has a significant impact on PU. The empirical evidence supports our position that a user's immediate and reflexive affective reaction toward an IT has a positive impact on his or her consequent cognitive reactions toward using the IT.
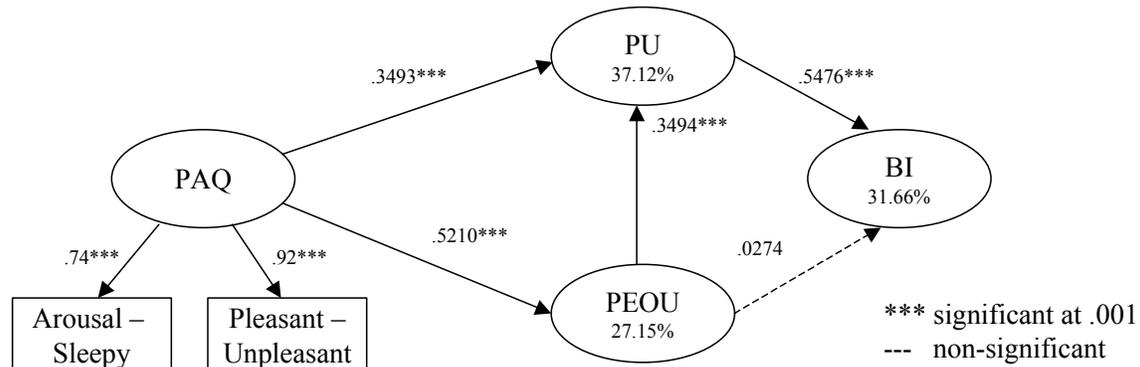

Figure 1. The Empirical Model

DESIRABLE AFFECTIVE QUALITY

Knowing that PAQ is more fundamental and important in determining the ultimate outcome of user's evaluation and use of IT has implications to design. Naturally, the next two questions are: (1) is it possible to manipulate affective qualities and thus to influence users, and (2) what are the affective features that would yield high PAQ.

Abundant studies in psychology identify the properties of external stimuli that can evoke or elicit certain human emotions to be in a targeted core affect state. In the computing environment, Kim and colleagues classified the specific emotional dimensions users normally experience while viewing diverse homepages, identified the design factors that professional designers frequently use when developing emotionally evocative homepages, and empirically confirmed that the identified emotional dimensions can be reliably explained by the selected design factors. They concluded that it is possible to manipulate the design factors of the interface in order to induce a target emotion [2].

Users utilize IT for various purposes and in various contexts. Research is much needed to identify specific affective features for specific types of IT, or to verify whether there are universal affective features that apply to any types of IT for supporting any types of user tasks. Fortunately, researchers have already started working on identifying affective qualities over the years. Table 1 lists a limited number of existing studies with corresponding IT and context studied along with the

identified affective quality. One should note that not every study defines and uses the same affective constructs in the same ways. Hedonic quality [5], perceived aesthetics [10], and perceived visual attractiveness [11] are concerned with the hedonic/valence dimension of PAQ of the websites or other artifacts. First impression [3,9] emphasizes a user's immediate and reflexive reaction toward IT that often are affectively interpreted. Secondary emotion refers to "emotion elicited by external stimuli" [2], which is equivalent to the core affect influenced by PAQ of the stimuli. Therefore, although these studies do not use exactly the same terminology, they all touch upon the affective quality concept as introduced in this paper.

More studies are needed to validate, expand, synthesize, and generalize these results. In addition, much research is needed to develop validated instruments for measuring perceived affective quality. Lavie and Tractinsky [4], in developing a measurement instrument of perceived web site aesthetics, identified two dimensions of user aesthetic perception. The classical aesthetics dimension emphasizes orderly and clear design and is closely related to many of the design rules advocated by usability experts. The expressive aesthetics dimension is manifested by the designers' creativity and originality and by the ability to break design conventions. These two dimensions seem to be consistent with empirical evidence in other studies as shown in Table 1.

Study	IT and Context	Affective Construct	Affective Quality/Features
Kim & Moon, 1998 [2]	Cyber-banking systems	"First impressions, immediate feelings"	Title, menu, main clipart, and color
Kim et al. 2003 [1]	Homepages	"Secondary emotions"	Shape, texture, and color of title, menu and main images
Mundorf et al. 1993 [3]	Screen-based information service	"Hedonic quality"	Color, graphs, and music
Schenkman & Jonsson 2000 [4]	Telecommunication, electronics or other companies websites	"First impression"	Beauty, mostly illustrations versus mostly text, overview, and structure
Tractinsky et al. 2000 [5]	ATM machine	"Perceived aesthetics"	Layout
van der Heijden 2003 [6]	A generic portal website in Netherlands	"Perceived visual attractiveness"	Layout, and color

Table 1. Identified Affective Quality

CONCLUSION

This study empirically investigates the antecedent effect of users' perceived affective quality of an IT on users' cognitive evaluations of it. Despite some limitations such as using a particular user group (college students) in a particular context for a particular IT (university homepage), it brings up an examination of a predicting factor of user's technology use intention that has not been

widely recognized. This new predictor, perceived affective quality, is more fundamental as it has positive impacts on the well-known predictors such as perceived usefulness and perceived ease of use. Our study shows that PU and PEOU mediate the impact of perceived affective quality on intention to use IT. IT use intention has been robustly tested to predict IT use behavior, which should be of a kin concern for IT designers who want their products to be eventually accepted and used. This can lead practitioners to adjust their focus and effort accordingly when designing information technologies to support user tasks. IT designers or IT acquirers should pay attention to not only the usefulness (match IT to tasks or jobs), and ease of use (has been the long time goal of HCI), but also affective quality (evoke and elicit emotional reactions). With this understanding, IT designers and acquirers can invest on identifying affective qualities of various systems for supporting users' various tasks in different domains, thus producing better systems that are more likely to be accepted and used by the intended users.

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