LOVE AT FIRST SIGHT OR SUSTAINED EFFECT? THE ROLE OF PERCEIVED AFFECTIVE QUALITY ON USERS' COGNITIVE REACTIONS TO INFORMATION TECHNOLOGY

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Abstract

This research examines the impact of primitive affective reactions to information technology on subsequent cognitive reactions and behavioral intention on IT use, and the potential change of such impact over time. We ground our work in theories of psychology and information systems and propose a theoretical model in which the user's perceptions regarding the affective quality of an IT influences cognitive reactions and behavioral intention to use IT. The model was validated by surveys in two field studies of 226 and 196 college students, respectively, who were asked to evaluate a course management system, WebCT. The first study occurred during weeks 3 and 4 of the spring 2004 semester, when subjects were getting familiar with WebCT for their classes. The second study ran during weeks 11 and 12 of the same semester, when WebCT had been used quite intensively in the classes. The theoretical model is supported by both studies, indicating that the impact of perceived affective quality persists, even when subjects' familiarity with and use of the IT increases. Our research identifies perceived affective quality as another, more-fundamental, and sustained source of user intention of IT use that has not been widely recognized yet. From a theoretical perspective, this research breaks the conventional cognition-driven paradigm of studying user reactions to technology and calls for attention to affect and emotion in examining people's everyday, normal interactions with IT. Practically, the research provides empirical evidence for IT designers, trainers, and stakeholders to better strategize their resources and emphases.

Keywords: Affect, emotion, perceived affective quality, perceived ease of use, perceived usefulness, behavioral intention, individuals' reactions to technology

Introduction

Affect, mood, and emotion are fundamental aspects of human beings and are found to influence reflex, perception, cognition, social judgment, and behavior (Brief 2001; Forgas 1995; Forgas and George 2001; Russell 2003). Affect and emotion are not as well understood as cognition and, therefore, terminology is still a problem (Forgas 1995; Norman 2002). In this paper, we use *affect* as a neutral term commonly understood to represent mood, emotion, and feelings in general. This is consistent with several researchers' notions of affect (Brave and Nass 2003; Russell 2003). We define and clarify important terms when necessary in order to make statements clear.

Although cognition has been studied much more than affect in the past few decades, researchers in several disciplines have realized the importance of affect and emotion (Brave and Nass 2003). Studies in organizational behavior, marketing, social psychology, and management have confirmed the strong impact of affect on job satisfaction (Weiss et al. 1999), decision-making behavior (Mittal and Ross 1998), consumer shopping behavior (Childers et al. 2001), and attitude change or persuasion (Petty, DeSteno and Rucker 2001). Brave and Nass (2003) reviewed extensively the effects of affect on attention, memory, performance, and assessment.

In the Information Systems discipline, user evaluation or user acceptance of information technology is considered volitional behavior (Bagozzi 1982) and has been studied primarily with a cognitive orientation (Davis 1989; Goodhue 1995; Venkatesh et al. 2003). This line of research is heavily influenced by the cognition–attitude–behavior paradigm proposed in the theory of reasoned action and the theory of planned behavior (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975). Although affect, affectivity, playfulness, enjoyment, emotion, and motivation are touched upon in some studies (Agarwal and Karahanna 2000; Thatcher and Perrewe 2002; Venkatesh 2000; Webster and Martocchio 1992), the affective aspects are less central or focal in most of them, with some exceptions, such as studies on emotional usability (Kim et al. 2003), aesthetics (Lavie and Tractinsky 2004; Tractinsky et al. 2000), computer playfulness (Webster and Martocchio 1992), flow (Finneran and Zhang 2003; Ghani 1995), and users' holistic experiences of cognitive absorption in technology acceptance (Agarwal and Karahanna 2000). Even when some affective constructs are studied, other important constructs escape scrutiny, and researchers fail to agree on definitions.

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. Further, if affect does indeed play a role, researchers must still discover what aspects of affect should be examined, what relationships affect may have with other commonly studied user acceptance constructs, whether the role of affect is due to novelty or short-lived impression or persists over time, and how to design affect-friendly systems that will be more beneficial to users.

This research attempts to address some of these issues by exploring relevant affect concepts and their impact in the IT field. The objective of this research is threefold. First, based on the advancement of psychology and organizational behavior studies on affect, we introduce several fundamental and important affective concepts into Information Systems and human-computer interaction (HCI) studies: *core affect, affective quality,* and *perceived affective quality* (Russell 2003). Second, we examine the impact of some affective constructs on users' cognitive reactions to IT. This second objective parallels studies of individuals' evaluation and acceptance of IT, but from a different angle, primarily by examining the affective cause on cognitive beliefs and behavior intention. That is, we attempt to break the conventional cognition–attitude–behavior paradigm and examine an alternative one. To do so, we propose a theoretically supported model that posits perceived affective quality as an antecedent of cognitive beliefs and behavior intention. We validate this model empirically, using two field studies. The third objective is to test whether perceived affective quality has a sustained effect when users' familiarity with and use of IT increases. In the IT environment, the initial impact of affective reaction is important, but so is the sustained impact during continued use of the IT. It is hopeful that the two field studies can provide some empirical evidence to support this third objective.

Theoretical Support and the Research Model

Important Affective Concepts

In order to avoid the confusion caused by everyday use of the term *emotion*, several fundamental concepts were introduced by Russell (2003) and will be used in our research.

Core affect is a neurophysiological state that is consciously accessible as a simple, nonreflective feeling that is an integral blend of hedonic or valence value (pleasure–displeasure, the extent to which one is generally feeling good or bad) and arousal or activation value (sleepy–activated, the extent to which one is feeling engaged or energized) (Russell 1980, 2003). Core affect has also been called affect (Watson and Tellegen 1988), mood (Morris 1989), and feeling (Russell 2003). The key aspect of this concept is that it is free of objects and, therefore, free of any implied cognitive structures. Core affect is considered to be primitive, universal, and ubiquitous; it is the core of all emotion-laden events. To varying degrees, it is involved in most psychological events and is what makes any event "hot" (i.e., emotional) (Russell 2003). The concept of core affect is similar to what some psychologists call *primary emotions* (Damasio 1994, in Brave and Nass 2003).

Affective quality is the ability to cause a change in core affect (Russell 2003). 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 (Russell 2003).

Perception of affective quality (PAQ) is an individual's perception of an object's ability to change his or her core affect. It is a perceptual process that estimates the affective quality of the object. It begins with a specific stimulus and remains tied to that stimulus (Russell 2003). Perception of affective quality has been called other terms such as evaluation, automatic evaluation, affective judgment, affective reaction, and primitive emotion, and it is considered a ubiquitous and elemental process (Cacioppo et al. 1999; Russell 2003; Zajonc 1980). Perception of affective quality is regarded as the second most primitive concept after core affect; together, they define everything else (Russell 2003). It is worth noting that core affect can change without reference to any external stimulus, and a stimulus can be perceived as affective quality with no change in core affect—as when a depressed patient admits that the sunset is indeed beautiful but cannot alter a persistently depressed mood (Russell 2003).

The contributing factors to a person's core affect can be numerous, either internally (factors within the person) or externally (stimuli in the environment). From an HCI perspective, we are interested in the connection between a person's affect and the possible affect-eliciting quality of an information technology. Perceived affective quality is a construct that makes such a connection. In addition, one thing that is very attractive or affect evoking to one person may not be so to another. Perceived affective quality reflects this subjectivity. It is about a person's primitive affective reaction to an IT, while perceived usefulness (PU), perceived ease of use (PEOU), and behavior intention (BI) are a person's cognitive reactions to an IT. Thus in this research, we study affect's role in IT by examining perceived affective quality of IT and its relationships to other well-studied constructs. This emphasis on perception of affective quality as a primitive affective reaction to IT distinguishes our research from other studies that may consider some affective or emotional aspects such as computer anxiety, perceived enjoyment, and satisfaction, which can all be considered affective reactions (that is, secondary emotions) to IT but are at a secondary or higher level than PAQ. Next, we present Russell's emotional episode, which plays an important role in our hypotheses development.

Emotional Episode

Russell's prototype of emotional episodes illustrates the relationships among core affect, PAQ, particular emotions, related cognitive deliberations, and behavior preparation. Russell (2003) presented a cognitive structure that specifies the typical ingredients, causal connections, and temporal order for each emotion concept. The following are brief descriptions of the steps in the prototypical case. (Interested readers are encouraged to read the details in Russell 2003.)

(1) An external stimulus as an antecedent is perceived in terms of its affective quality.

(2) It dramatically alters core affect.

(3) Core affect is attributed to the stimulus, thus the person has this salient experience: "That object is making me feeling the way I feel now."

(4) The perceptual–cognitive process continues, assessing such qualities of the object as its future prospects, its relevance to one's goals, its causal antecedents, and so on.

(5) Action is directed at the object—the object is a problem (or opportunity) that requires a behavioral solution. The specific action taken depends on an assessment of current circumstances and resources, the creation of a goal, and the formation of a plan to reach that goal.

(6) Facial, vocal, autonomic changes occur.

(7) In addition to the conscious experience already mentioned (e.g., core affect and perception of the object's affective quality), there is a flood of metacognitive judgments.

(8) The person experiences a specific emotion (e.g., anger, fear, anxiety, etc.).

(9) The person deliberately attempts self-control based on categorizing oneself. This is the emotion regulation stage. (Russell 2003)

In this causal connection and temporal order of an extensively processed emotional episode, the primitive affective reaction (step 1) occurs before and influences the rest of the steps, including cognitive evaluation (step 4), plan for action (step 5), and the latter progression of the emotional episode.

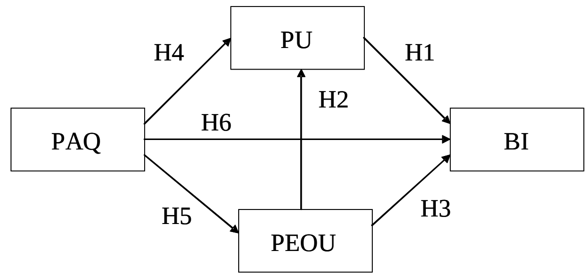

Figure 1. Theoretical Model

A Model of Individual Reactions to Technology

A user's interaction with and evaluation of an IT is a substantive process that involves both affective and cognitive components. In this research, we focus on the primitive affective reaction to IT rather than the secondary emotions that accompany extensive processing (as demonstrated by Russell's emotional episode). PU is defined as the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context (Davis et al. 1989). PEOU is the degree to which the prospective user expects the target system to be free of effort (Davis et al. 1989). Behavior intention is defined as the strength of one's intention to perform a specified behavior (Fishbein and Ajzen 1975). All three concepts, PU, PEOU, and BI, are cognitive judgments people have regarding IT. Based on Russell's emotional episode, our main position is that a user's primitive affective reaction to IT, namely PAQ, has an impact on his or her consequent cognitive reactions such as PU and PEOU, as well as on BI.

Figure 1 depicts the key constructs and relationships of the proposed model. As abundantly shown in empirical studies in psychology and IS literature (Ajzen 1991; Davis 1989; Venkatesh et al. 2003), behavior intention is a strong indicator of behavior. We keep intention as the final outcome in our model for parsimony reasons. The relationships in Figure 1 are explained in detail next, along with the development of the hypotheses.

Hypotheses Development

Existing studies on technology acceptance have consistently verified that PU has a strong impact on BI, PEOU has an impact on PU, and PEOU can have some impact on BI (Davis 1989; Venkatesh and Davis 2000; Venkatesh et al. 2003). Thus the following hypotheses hold:

H1. Perceived usefulness of an IT has a positive effect on behavioral intention to use the IT.
H2. Perceived ease of use has a positive effect on the perceived usefulness of the IT.
H3. Perceived ease of use has a positive effect on the behavioral intention to use the IT.

In Russell's emotional episode, step 4 is about assessing an object's future prospects and its relevance to one's goals. PU is directly linked to one's goals in using an IT (increasing one's job performance). This means that PAQ should have an impact on PU. There is limited empirical evidence in the IS and HCI literature to support the PAQ ➔ PU link. In investigating factors influencing the usage of a generic portal website in the Netherlands, van der Heijden (2003) introduced a new construct, *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," and "The colors that are used on the site are attractive." Van der Heijden found that perceived visual attractiveness has significant positive impact on PU, PEOU, and perceived enjoyment. This perceived visual attractiveness concept concentrates more on the valence quality of the Website. Nevertheless, it is close to the PAQ concept. One may speculate that PAQ, which is broader than the perceived visual attractiveness, should have a positive influence on PU. On the other hand, PAQ has more than just the valence quality. A person can be either positively or negatively aroused. Whether PAQ together as one construct has a positive or negative impact on PU (or PEOU and BI) is yet to be explored. Thus we have the following hypothesis:

H4. Perceived affective quality has an effect on perceived usefulness of the IT.

The appraisal stage in step 4 of Russell's prototype indicates that, on the principle of mood congruency, judgments and information congruent with core affect are more accessible. A person perceiving IT to be pleasant and interesting, and thus possessing a positive core affect, would be more likely to perceive IT as easy to use than hard to use. Limited empirical evidence in IS and HCI supports this assertion. Tractinsky et al. (2000) discovered a strong correlation between a system's perceived aesthetics and perceived usability. In their study, perceived aesthetics is used in a sense very similar to the valence dimension of perceived affective quality; perceived usability is equivalent to perceived ease of use. The strong aesthetics–usability relation was further confirmed when aesthetics was identified to be composed of classic and expressive aesthetics dimensions (Lavie and Tractinsky 2004). Van der Heijden also found that perceived visual attractiveness has significant positive impact on PEOU.

H5. Perceived affective quality has an effect on perceived ease of use of the IT.

Russell's prototypical case indicates that a plan for action is formed after the perception of affective quality. This plan of action is the behavior intention concept. In an early study, hedonic quality (color, graphs, and music) of screen-based information service was found to have significant impact on enjoyment and acceptance. (It is worth noting that there were no other constructs between hedonic quality and acceptance or enjoyment; Mundorf et al. 1993.) Hall and Hanna (2004) found that perceived aesthetics has a direct impact on behavior intention, although it is noted that this study did not have any judgments on using IT as a mediator. Both theoretical and limited empirical evidence point out that PAQ should have an impact on BI, although it is unclear whether this impact is direct or mediated by other constructs. Nevertheless, we hypothesize that PAQ has a direct impact on BI.

H6. Perceived affective quality has an impact on behavior intention to use the IT.

In addition to the above hypotheses, we are also interested in knowing whether the effect of PAQ changes as the subjects' use of IT increases. Most psychological studies on affect and its relation to cognition are limited to one-time or isolated events. It is unclear whether there are certain changes when one's experience with an object changes. We do not have theoretical support for this idea, thus we take an exploratory view on this research interest and hope our two empirical studies can shed some light on it.

Research Design and Data Collection

The research model and hypotheses were tested in two field studies using the survey method, with college students from a major northeastern university in the United States as subjects. The constructs in Figure 1 were measured using multi-item scales drawn from previously validated instruments. PAQ was measured by the instrument developed by Russell and Pratt (1980). PU and PEOU were measured by Davis' (1989) original instrument. BI was measured using the items adopted by Agarwal and Karahanna (2000). Appendix A lists the constructs and their measures.

The two studies were designed in such a way that the instrument, sample population, target technology, and data collection procedure were identical, and the data collection time points were 7 weeks apart. Due to some complications during survey administration, we were not able to trace the same subject through both studies, thus were not able to take advantage of repeated measures. In this paper, we treated the two samples as independent samples of the same population pool, even though there was a large overlap between the two samples (76 percent participants in Study 2 also participated in Study 1). Due to the relatively complex instrument (a total of 31 items for the constructs) and the 7-week duration, subjects would not remember what they did in the first survey, thus there would not be any carryover effect in the second.

The target IT was a course management system, WebCT, that the instructors used for classes. After interviewing the instructors, only those classes that used WebCT as an integral and necessary part of the course were selected for this research; thus, use of WebCT was mandatory for the students. In these classes, WebCT was used for class notes and assignments distribution, grade posting, and bulletin board for discussions and broadcasting class news. Some classes also used WebCT for group projects and peer evaluations of assignments. Although WebCT is packaged software, instructors can customize it to have a distinct look and feel, functionalities, structures, and organization of content. In addition, the college had upgraded WebCT to a new version right before the survey semester started. The new version has a quite different look and functionalities. Thus, even though most participants had used earlier versions of WebCT in previous semesters, a particular class site could be considered novel to the students.

Study 1 Data Collection

Typically it takes a class 2 weeks to stabilize, because students add and drop classes at the beginning of a semester. Thus most instructors do not assign substantive projects via WebCT during the first 2 weeks. During weeks 3 and 4 of the spring 2004 semester, the authors went to 18 classes and recruited the subjects on a voluntary basis. Each subject was given a questionnaire to complete during class time. In each class, subjects were asked to evaluate the WebCT site that was used by this class. The second column of Table 1 summarizes the data collection and subject demographics.

Study 2 Data Collection

Data was collected during weeks 11 and 12 of the same semester, when all classes had been using WebCT extensively. The authors went to 13 out of the 18 classes in Study 1 to collect data. This time, unlike the first study, subjects were given candy bars at the time surveys were distributed as an appreciation of their participation in the research. The demographics in this study and other related information are summarized in the third column of Table 1. T-tests or χ^2 tests were conducted on demographic items between the two studies and the results are shown in the last column of Table 1, which indicates that these two samples have no difference in demographics except (1) the reported months of using WebCT and (2) the reported months of using similar course management systems. A possible reason for the second difference is that many students were taking courses during the semester that were offered by other colleges that utilized another course management system, Blackboard. Table 2 shows the descriptive statistics of the constructs.

Table 1. Data Collections and the Demographics of the Subjects

	Study 1	**Study 2**	**t- or χ^2 test**
Data collection time	3^{rd}–4^{th} weeks	11^{th}–12^{th} weeks	
Number of classes subjects were from	18 (9 G, 9 UG)	13 (7 G, 6 UG)	
Number of usable responses	226	196	
Age (avg, std.)	24.1, 6.6	25.1, 6.8	t(399) = –1.61, p = .11
Gender (male%, female%)	64%, 36%	63%, 37%	χ^2(1) = 0.03, p = .86
Ethnicity (%) White Asian/Pacific Rim Other	57% 22% 21%	55% 26% 19%	χ^2(6) = 6.86, p = .33
Years of using computers (avg, std.)	11.2, 4.0	11.9, 4.5	t(392) = –1.75, p = . 08
Years of using the Web (avg, std.)	7.6, 2.4	8.0, 2.2	t(406) = –1.64, p = .10
Months of using WebCT (avg, std.)	12.2, 10.9	14.5, 11.8	**t(381) = –2.00 , p = .05***
Months of using similar systems (avg, std.)	6.0, 9.4	8.9, 12.1	**t(312) = –2.53 , p = .01****
Hours per week on WebCT for this class (avg, std)	2.3, 3.0	2.4, 3.5	t(362) = –0.36, p = .72
Hours per week on WebCT for all classes (avg, std.)	4.1, 5.1	4.6, 4.8	t(349) = –0.96, p = .34

Table 2. Descriptive Statistics of Constructs

Construct	**Study 1**		**Study 2**	
	Mean	**Std.**	**Mean**	**Std.**
PAQ				
Arousal	0.43	1.04	0.34	1.05
Sleepy	–0.64	1.10	–0.52	1.08
Pleasant	0.60	1.02	0.51	1.00
Unpleasant	–1.03	1.32	–0.98	1.25
PEOU	1.87	1.08	1.96	0.99
PU	1.15	1.31	1.10	1.35
BI	1.93	1.14	1.80	1.25

Data Analysis and Results

PLS (partial least squares, PLS-Graph 03.00) was utilized due to its advantages of minimal demands on measurement scales, sample size, and residual distributions (Chin et al. 1996; Fornell and Bookstein 1982). It is also appropriate for predictive testing, rather than testing a well-developed theory (Barclay et al. 1995; Chin 1998). Given that the model in Figure 1 has never been tested in its entirety, we chose PLS.

The two studies were analyzed independently. First, measurement models were estimated by using a method of repeated indicators known as the hierarchical component model (Lohmoller 1989) because PAQ is a second order factor that has four dimensions: arousal, sleepy, pleasant, and unpleasant qualities. Second, structural models were estimated by using factor scores for PAQ's four indicators derived from the first stage. Other IS studies have employed similar procedures (e.g., Agarwal and Karahanna 2000).

Measurement Models

The models were examined for convergent and discriminant validity (Hair et al. 1998). Convergent validity was assessed by reliability of items, composite reliability of constructs (Werts et al. 1974), and average variance extracted (AVE) (Fornell and Larcker 1981). Discriminant validity was assessed by examining cross-loadings and the relationship between correlations among constructs and the square root of AVEs (Chin 1998; Fornell and Larcker 1981).

Reliability of items was assessed by examining each item's loading on its corresponding construct. A common rule of thumb suggests that the item loading should exceed .70. However, .50 is acceptable for new applications or situations when other items measuring the same construct have high reliability scores (Barclay et al. 1995; Chin 1998). PLS analysis results for both studies showed that two items (PAQA1 and PAQA 5) for arousal quality exhibited item loadings lower than .50. They were dropped from further analyses and the models were reestimated. The results are shown as shaded in Table 3. All item loadings except one (PAQA2 in Study 2) were above 0.5, and most were much higher than 0.7, indicating adequate reliability of items. PAQA2 in Study 2 was included because it exhibited an acceptable loading score (.73) in Study 1, and we intend to keep as many items as possible from the original scale to maintain the integrity of the original research design (Barclay et al. 1995), as well as the comparability of the results with Study 1 that used the same scales. This is consistent with the decisions in other IS studies utilizing PLS (Keil et al. 2000; Yoo and Alavi 2001).

Composite reliability is recommended to be at .70 or higher. Table 4 shows the composite reliability of each construct for both studies, all largely meeting the criterion. AVE measures the amount of variance that a construct captures from its indicators relative to the amount due to measurement error (Chin 1998). It is recommended to exceed .50. As shown in Table 4, all the constructs met this guideline in both studies.

AVE is also suggested to serve as a means of evaluating discriminant validity (Fornell and Larcker 1981). The square root of the AVEs should be greater than the correlations among the constructs, which indicates that more variance is shared between the construct and its indicators than with other constructs. As shown in Table 4, the shaded numbers on the leading diagonals are the square root of the AVEs. Off-diagonal elements are the correlations among constructs. All diagonal numbers are greater than the off-diagonal ones, indicating satisfactory discriminant validity of all the constructs in both studies. Another criterion for discriminant validity is that no measurement item should load more highly on any construct other than the construct it intends to measure (Chin 1998). An examination of cross-factor loadings (Table 3) showed that all items satisfied this guideline for both studies.

Table 5 shows the outer model loadings in the model context, indicating that all four constructs have satisfactory indicator loading in both studies.

Structural Models

We used a bootstrapping technique to obtain the corresponding t–values for the path coefficient estimates. Figure 2 shows the results for the two studies. PLS does not use model fit indices. The explanatory power of a structural model could be assessed by the R^2 values (variance accounted for) in the dependent latent variables. In Study 1, 46.0 percent of the variance in BI is explained by the model; 37.3 percent in PU by PAQ and PEOU together; and 26.8 percent in PEOU by PAQ. In Study 2, 38.2 percent of the variance in BI is explained by the model; 36.6 percent in PU by PAQ and PEOU together; and 21.1 percent in PEOU by PAQ.

Table 3. Factor Analysis Results

	Study 1							Study 2						
	PAQA	PAQS	PAQP	PAQU	PEOU	PU	BI	PAQA	PAQS	PAQP	PAQU	PU	PEOU	BI
PAQA2	0.73	–0.15	0.48	–0.15	0.27	0.33	0.23	0.40	0.04	0.37	0.05	0.11	0.13	0.17
PAQA3	0.69	–0.24	0.44	–0.18	0.27	0.34	0.22	0.87	–0.40	0.55	–0.36	0.29	0.37	0.27
PAQA4	0.76	–0.05	0.55	–0.13	0.13	0.33	0.19	0.77	–0.20	0.50	–0.13	0.16	0.30	0.16
PAQS1	–0.20	0.73	–0.13	0.45	–0.21	–0.24	–0.23	–0.44	0.75	–0.29	0.43	–0.22	–0.24	–0.21
PAQS2	–0.14	0.84	–0.26	0.68	–0.30	–0.26	–0.40	–0.21	0.81	–0.26	0.61	–0.24	–0.19	–0.30
PAQS3	–0.08	0.59	–0.03	0.37	–0.14	–0.10	–0.18	–0.24	0.74	–0.08	0.36	–0.27	–0.17	–0.21
PAQS4	–0.14	0.85	–0.21	0.64	–0.26	–0.24	–0.33	–0.19	0.84	–0.22	0.58	–0.26	–0.16	–0.28
PAQS5	–0.21	0.66	–0.30	0.55	–0.27	–0.16	–0.19	–0.25	0.60	–0.28	0.50	–0.27	–0.15	–0.24
PAQP1	0.40	–0.29	0.78	–0.44	0.46	0.38	0.30	0.51	–0.39	0.84	–0.51	0.47	0.47	0.43
PAQP2	0.47	–0.20	0.79	–0.31	0.37	0.36	0.23	0.47	–0.28	0.75	–0.44	0.27	0.38	0.40
PAQP3	0.50	–0.29	0.80	–0.44	0.31	0.44	0.37	0.52	–0.23	0.84	–0.37	0.26	0.41	0.32
PAQP4	0.62	–0.09	0.78	–0.20	0.33	0.35	0.23	0.58	–0.15	0.73	–0.20	0.16	0.35	0.26
PAQP5	0.66	–0.12	0.71	–0.18	0.32	0.36	0.21	0.50	–0.07	0.72	–0.15	0.13	0.29	0.24
PAQU1	–0.25	0.62	–0.37	0.83	–0.35	–0.40	–0.35	–0.31	0.62	–0.47	0.86	–0.42	–0.36	–0.43
PAQU2	–0.17	0.68	–0.35	0.86	–0.38	–0.30	–0.36	–0.25	0.56	–0.40	0.89	–0.37	–0.30	–0.37
PAQU3	–0.06	0.56	–0.25	0.79	–0.37	–0.24	–0.27	–0.09	0.43	–0.22	0.72	–0.24	–0.21	–0.25
PAQU4	–0.23	0.66	–0.45	0.88	–0.36	–0.41	–0.38	–0.32	0.62	–0.43	0.89	–0.38	–0.33	–0.39
PAQU5	–0.17	0.63	–0.37	0.89	–0.38	–0.38	–0.40	–0.21	0.57	–0.38	0.87	–0.37	–0.28	–0.31
PEOU1	0.26	–0.23	0.36	–0.27	0.85	0.37	0.33	0.31	–0.33	0.33	–0.39	0.85	0.45	0.37
PEOU2	0.21	–0.28	0.31	–0.33	0.89	0.37	0.34	0.17	–0.27	0.23	–0.29	0.83	0.29	0.31
PEOU3	0.31	–0.29	0.45	–0.39	0.90	0.53	0.38	0.24	–0.24	0.31	–0.35	0.87	0.53	0.35
PEOU4	0.31	–0.34	0.50	–0.50	0.91	0.50	0.43	0.25	–0.30	0.34	–0.42	0.89	0.51	0.44
PU1	0.44	–0.29	0.49	–0.44	0.52	0.94	0.64	0.41	–0.23	0.51	–0.34	0.49	0.92	0.51
PU2	0.38	–0.24	0.41	–0.38	0.46	0.93	0.63	0.34	–0.21	0.45	–0.36	0.46	0.90	0.50
PU3	0.44	–0.29	0.46	–0.39	0.46	0.92	0.62	0.41	–0.25	0.44	–0.32	0.50	0.90	0.49
PU4	0.44	–0.19	0.43	–0.28	0.41	0.88	0.54	0.34	–0.19	0.40	–0.26	0.45	0.89	0.53
BI1	0.21	–0.28	0.28	–0.36	0.34	0.52	0.80	0.24	–0.28	0.35	–0.34	0.38	0.54	0.89
BI2	0.30	–0.32	0.33	–0.37	0.38	0.68	0.92	0.34	–0.33	0.47	–0.45	0.42	0.55	0.93
BI3	0.25	–0.38	0.31	–0.36	0.39	0.52	0.90	0.15	–0.27	0.33	–0.32	0.35	0.42	0.87

Table 4. Composite Reliability and Correlations of Constructs

(a) Study 1

	# of items	Composite Reliability	AVE	PAQA	PAQS	PAQP	PAQU	PEOU	PU	BI
PAQA	3	0.77	0.53	0.73						
PAQS	5	0.86	0.55	–0.21	0.74					
PAQP	5	0.88	0.60	0.67	–0.27	0.77				
PAQU	5	0.93	0.72	–0.21	0.75	–0.42	0.85			
PEOU	4	0.94	0.79	0.31	–0.33	0.47	–0.43	0.89		
PU	4	0.96	0.84	0.46	–0.28	0.49	–0.41	0.51	0.92	
BI	3	0.91	0.77	0.30	–0.37	0.35	–0.41	0.42	0.66	0.87

(b) Study 2

	# of items	Composite Reliability	AVE	PAQA	PAQS	PAQP	PAQU	PEOU	PU	BI
PAQA	3	0.74	0.50	0.71						
PAQS	5	0.87	0.57	–0.35	0.75					
PAQP	5	0.88	0.60	0.66	–0.31	0.78				
PAQU	5	0.93	0.72	–0.28	0.67	–0.46	0.85			
PEOU	4	0.92	0.74	0.29	–0.33	0.36	–0.43	0.86		
PU	4	0.95	0.81	0.41	–0.24	0.50	–0.36	0.53	0.90	
BI	3	0.93	0.81	0.29	–0.33	0.44	–0.42	0.43	0.56	0.90

Table 5. Outer Model Loadings

Construct	Study 1	Study 2
PAQA	0.69	0.74
PAQS	–0.71	–0.72
PAQP	0.81	0.82
PAQU	–0.79	–0.79
PEOU1	0.85	0.85
PEOU2	0.89	0.83
PEOU3	0.90	0.87
PEOU4	0.91	0.89
PU1	0.94	0.92
PU2	0.92	0.90
PU3	0.92	0.90
PU4	0.89	0.89
BI1	0.80	0.89
BI2	0.92	0.93
BI3	0.90	0.87

Note: All loadings are significant at .001 level.

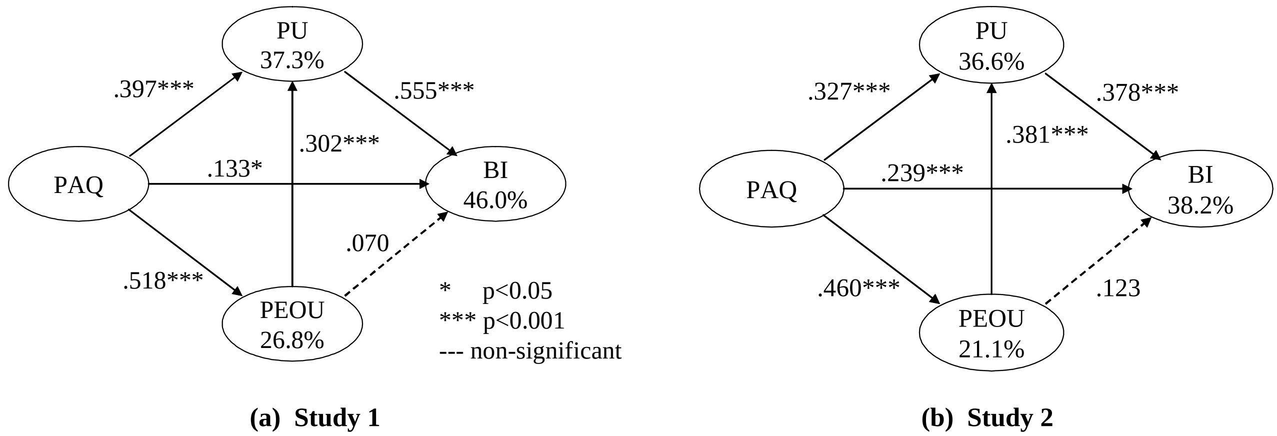

Figure 2. A Summary of PLS Analysis

Table 6. Hypotheses and Results

Hypothesis	Study 1	Study 2	Direction
H1: PU ➔ BI	Supported	Supported	+
H2: PEOU ➔ PU	Supported	Supported	+
H3: PEOU ➔ BI	Not Supported	Not Supported	n/a
H4: PAQ ➔ PU	Supported	Supported	+
H5: PAQ ➔ PEOU	Supported	Supported	+
H6: PAQ ➔ BI	Supported	Supported	+

Table 6 summarizes the hypotheses and the PLS analysis results. PEOU does not have a significant impact on BI in either study. This is no surprise because many technology acceptance studies indicate that this linkage is situational and not always significant (Venkatesh et al. 2003). Despite H3, the two empirical models confirm the theoretical model. In general, regardless of the increased use of WebCT, PAQ significantly and positively affects PU, PEOU, and BI. Interestingly, as the use of WebCT increased, PAQ's impact on BI became stronger, increasing from a significance level of .05 to .001. The PAQ ➔ BI path is statistically significant, indicating that PU and PEOU partially mediate PAQ's impact on BI.

In order to test how much PAQ contributed to BI above and beyond what PE and PEOU did, a supplemental analysis was conducted by removing the PAQ ➔ BI link. The results show that PAQ contributed to 1.0 percent and 4.0 percent variance in BI over and above that explained by PU and PEOU for Studies 1 and 2, respectively. Another supplemental analysis was conducted to test how much variance in PU PAQ explained above and beyond what PEOU did. This was performed by removing the PAQ ➔ PU link from the structural models. The results show that PAQ contributed to 11.5 percent and 8.4 percent of PU's variance over and above that explained by PEOU for Studies 1 and 2, respectively.

Discussion and Conclusion

This research addresses the importance of considering affect in studies of individual reactions to technology. It delineates a particular affective construct, perceived affective quality, as the concept to study the individual's affective reaction to IT. It proposes a theoretical model where PAQ is an antecedent to PU, PEOU, and BI. The model is empirically validated using two field studies. This study further discovers PAQ's long-lasting effect with continued IT use.

There are several limitations in the current research. The sample, the context, and the target IT are specific to university students and their use of WebCT for classes. This may limit the generalizability of the results to some other contexts, although Agarwal and Karahanna (2000) argue that this limitation should be tolerable for this type of study.

Although we utilized previously validated instruments, not all the measured items loaded to the intended constructs. Our data confirmed the robustness of the PU, PEOU, and BI instruments. We also validated the relative robustness of the pleasant, unpleasant, and sleepy quality measures. However, two items, *forceful* and *intense* for Arousal quality, did not load as expected and had to be dropped from further analysis. The original instrument (Russell and Pratt 1980) was for affective quality attributed to environments, broadly defined. It was claimed to work well for measuring perceived affective quality of natural and man-made environments or situations. Thus it would be reasonable to apply it to measure WebCT. Our experience and results of using it call for further development and validation of appropriate affective instruments that are targeted specifically to IT. One other future research effort will test alternative models to explore other potential impact and relationships PAQ has with other constructs.

This research is one of the few studies to our knowledge that considers the antecedent effect of users' affective reactions to IT on users' cognitive reactions. It introduces a theoretically supported examination of a predicting factor of user's technology use intention that has not yet been addressed. This new predictor, perceived affective quality of an IT, is more fundamental as it has significant impact on the well-known predictors such as perceived usefulness and perceived ease of use, and even directly on behavior intention itself. By introducing PAQ into technology acceptance studies, this research breaks mainly the cognition–driven angle that has dominated IS and HCI research for the past decades. Our approach examines the formation of behavior intention and cognitive beliefs from the primitive affective reaction users have to IT. It contributes to novel thinking about individuals' holistic reactions to IT studies, and theoretical development of the affect aspect of IT acceptance. Because IT is everywhere and impacts people's lives in every possible way, the awareness of the importance of affect has become strong in recent years, as evidenced by several recent studies in the IS and HCI fields (Agarwal and Karahanna 2000; Cockton 2002; Kim et al. 2003; Lavie and Tractinsky 2004; Rozell and Gardner 2000). It is, therefore, very important to have a theoretically and empirically supported understanding of the relationships between affective constructs and other important IT acceptance constructs.

From a practical perspective, better understanding of the antecedents of user behavioral intention to IT use can guide IT designers, trainers, and stakeholders to better target users' important needs. This study sheds new light on the potential contributing factors of IT use intention. IT designers or IT acquirers should pay attention not only to usefulness and functionality (matching IT to tasks or jobs), and ease of use or usability (the long time goal of HCI), but also to affective quality, which is found to significantly and continuously influence both perceived usefulness and ease of use, and to influence behavior intention directly. With this understanding, IT designers and acquirers can adjust their focus and effort accordingly to invest in identifying and designing 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 better used by the intended users.

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Appendix A. Constructs and Measures

All items were measured using seven-point Likert scales: –3 for strongly disagree, 0 for neutral, and 3 for strongly agree.

Perceived Affective Quality	Arousal quality PAQA1 intense PAQA2 arousing PAQA3 active PAQA4 alive PAQA5 forceful	Sleepy quality PAQS1 inactive PAQS2 drowsy PAQS3 idle PAQS4 lazy PAQS5 slow
	Pleasant quality PAQP1 pleasant PAQP2 nice PAQP3 pleasing PAQP4 pretty PAQP5 beautiful	Unpleasant quality PAQU1 dissatisfying PAQU2 displeasing PAQU3 repulsive PAQU4 unpleasant PAQU5 uncomfortable
Perceived Ease of Use	PEOU 1 PEOU 2 PEOU 3 PEOU 4	It is easy for me to become skillful at using WebCT. Learning to operate WebCT is easy for me. I find it easy to get WebCT to do what I want it to do. I find WebCT easy to use.
Perceived Usefulness	PU1 PU2 PU3 PU4	Using WebCT has enhanced my effectiveness in class. Using WebCT has enhanced my productivity in class. I find WebCT is useful in my study. Using WebCT has improved my performance in study.
Behavior Intention to Use	BI1 BI2 BI3	I plan to continue using WebCT this semester. I intend to continue using WebCT in the future in other classes if possible. I predict my use of WebCT to continue in the future.