Effects of Emotions and Self-Efficacy on Technology Usage Behavior

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***Abstract*--An information system can be a valuable resource for a company. Everyday usage of the system realizes the benefits for the company. Recent research has focused on technology adoption and the concept of "intention to use". In this study, employing psychological theories, we explain reasons affecting habitual usage behavior. A model for predicting habitual technology usage is developed and analyzed in detail. The results show that self-efficacy has a tight statistical and theoretical dependency with usage level, and a positive emotion seems to increase usage level as well.**

I. INTRODUCTION

Many kinds of information systems are widely used in companies as part of usual activities of the working day. Since a lot of money and time is invested in implementation and maintaining these systems, the key question is how to get most out of its usage. Reaping the benefits requires active, efficient and versatile usage of information system. The aim of this study is to describe how certain factors derived from psychological theories can explain the level of information system usage.

The starting point for the study is found in the technology acceptance model (TAM) [15]. The model is assumed to be advantageous in explaining and predicting information system usage behavior, because it has been widely applied in explaining the different modes of usage level even outside the adoption process [10]. However, as its name suggests, the technology acceptance model is at its strongest in explaining the phase of adoption. In this study, we expect that in the adoption phase, the user is analyzing the information system more consciously compared to the later phase of automatic usage representing a state of steadiness where the user makes decisions about the usage more unconsciously and is guided by internalized models of behavior. However, this phenomenon is difficult to study since unconscious and intuitive thinking is extremely hard to observe. Besides, dynamics of conditioned and socialized behavior may even be unfamiliar or inaccessible for a person himself. Studies have reported that even if a person has knowledge about discursive tools for conceptionalizing them, the task still remains uneasy. To overcome these obstacles, we considered emotions as the best indicator for unconscious patterns of thinking. In other words, we presume that emotions affect the habitual usage behavior of an information system.

The role of emotions has recently received an increased attention in the academic IT usage research [11]. Ortiz de Guinea et al. [11] call for empirical research that would place an emphasis on unplanned and unreasoned action. The agree on the fact that continuing IT use may encompass potential non-rational inputs such as attitudes, feelings, awareness of satisfaction and other affective or emotion-related concepts. Emotional responses lead either to approach or avoidance behavioral intention.

Plutchik's classification of primary emotions has been analyzed in consumer research to understand its reliability and validity [8]. Plutchik's psycho-evolutionary theory of emotion [12] assumes that emotions are developed and dropped by an evolutionary process; emotions that we feel today have been beneficial for human race during the evolution. We assume that benefits of emotions to individual and groups are realized by adjusted behavior. According to Plutchik, the existence of any emotion presupposes the prior occurrence of a cognition or evaluation. The emotion affects behavior by producing certain kind of action; some of equivalences between a feeling and behavior, categorized in positive and negative emotions, are listed in Table 1.

It is presumed that positive emotions encourage interaction with the environment, such as examining and sharing, while negative emotions often lead into turning down the object of inspection. To further extend our understanding about habitual usage of information systems, we designed a research setting that would reveal possible relations between emotions, self-efficacy and usage level.

TABLE 1. RELATIONS BETWEEN EMOTION AND BEHAVIOR BASED ON [12].

	Feeling	Behavior
Positive Emotions		
	Joy	Courting, mating
	Anticipation	Examining, mapping
	Trust	Grooming, sharing
Negative Emotions		
	Surprise	Stopping, alerting
	Sadness	Crying for help
	Disgust	Vomiting, pushing away
	Fear	Running away
	Anger	Biting, hitting

We employed as a test case a IT network maintenance company, mainly due to the fact that we had a good access with this company and the company representatives had a similar interest to understand more deeply how to improve the level of usage and thus reap the benefits from the IT system investments. The study focused on routinely used task maintenance system and data was gathered via a web survey. In the analysis, we followed methods typically used in the technology acceptance research, i.e. PLS path modeling.

II. THEORETICAL BACKGROUND

In order to get the employees to adopt the usage of the system, the utilization of the system has to be routinized. Routines are standardized actions that are based on unconscious activity. When a person is performing a routine, he does not have to face complex cognitive challenges. This absolves him to devote his attention to solving problems in the substance of the work task [14].

If an employee is forced to think about problems concerning the system use, it requires whole conscious attention of the person. However, the employee's focus should not lie on the system use itself but on managing the tasks he is responsible for. Whenever the employee is forced to devote her full attention to the use of the system, the system is probably too complicated and of poor usability, since the attention and energy should be on managing the work task, not coping with the information system. Complexity and poor usability may result in negative attitudes towards the system and low self-efficacy in the system use.

In general, the employee has often no complicity in the acquisition of a system within the organization; the decision on purchase having been made by the organization, and the system is simply made available for the employee. Thus, she is either invited or compelled to use the system in the working environment where specific tasks have to be managed. The system use can be made a norm or imperative for the workers and even the employee's contract may be at risk if she does not comply with the instructions given by the management.

If the regular use of the system is made obligatory in the company, the employee is expected to adopt the system sooner or later. The regularity of use is naturally dependent on the task the employee is supposed to perform within the organization, whether she is a mechanic or a work supervisor. Moreover, users differ from each other because they have different routines and also different kinds of attitudes towards the system. The level of voluntary use of the system can be determined by the users themselves, once the minimum level of usage and other possible requirements concerning the system usage set by the organization are fulfilled.

In this study, we presupposed that there is a minimum standard of usage level applied in different occupational groups. It was presumed that all respondents' experience in the system use corresponds to the minimum standard level defined in the organization. It is also assumed that the respondents use the system at least as much as it is demanded in the organization. One central question is, then, what makes the users to use the system below the standard level of use or, further, what makes them confine themselves to the minimum standard of use.

In the long run, system usage becomes a habit by its nature and habits are regularized by external stimuli and conditions. However, the concept of a habit does not fully clarify the intention to start using a system, which is also driven by unconscious emotional endeavor. A person attempts to seek his way to actions that gives him pleasure, while actions causing negative and uncomfortable experiences are typically avoided. Traditional theory of cognitive dissonance proposes that people have a motivational drive to reduce dissonance [3, 6] and, according to the adaptive preference formation [6], by dismissing and criticizing troublesome tasks or features of a task, the person is more prone to give up on actions and things he conceives of unattainable or unmanageable. The role of concrete benefits – pros and cons of an intention to act – becomes emphasized in conscious thinking, while emotions play a more determining role in routine work operating on the unconscious level of awareness.

Self-efficacy is a generally applied term in psychology characterizing the experiential dimension of the ease of use, and it deviates from the perceived ease of use, a concept that could possibly be applied in this kind of a study. However, self-efficacy relates better to the routine tasks, while the ease of use is rather a conscious estimation of the user experience after a short-term experience of the system use. Finding its roots in the social cognitive theory, as described by Bandura [3], self-efficacy describes the load of a system on a person when he has been using a system for a longer period of time. An efficacy expectation is "the conviction that one can successfully execute the behavior required to produce the outcomes." [2] Perceived self-efficacy arises from diverse sources of information originated in direct and mediated experience, such as performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. In the initial stage of getting acquainted with a new system, the system is mentally more taxing job in the conscious level, but, if continued, the strains put over by the system are predominantly of unconscious sort. Nevertheless, low self-efficacy and negative emotions may have dependencies, as the lack of learning experiences may result in low self-appreciation. The dependencies can be identified and analyzed in the data. Based on the above description, we developed the following research model that is presented in the Fig. 1.

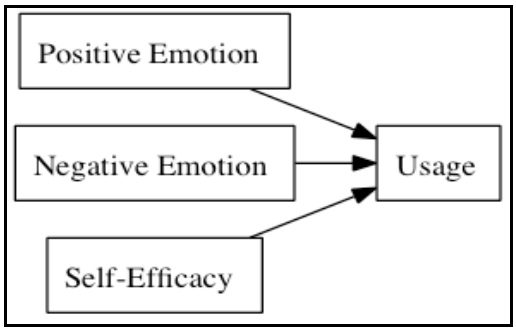

Figure 1. The developed research model.

In our model, both positive and negative emotions are taken into consideration. In previous studies, (see e.g. [5]) positive and negative emotions have been observed to be independent from each other. As is well known, work satisfaction and dissatisfaction are also driven by different factors [9]. Therefore, the primary question is how we individually relate emotions to reality. The asset in measuring emotions is that we do not have to understand the users' individual desires and expectations or reactivity in using the system. Instead, the user himself provides us with the evaluation of the personal experience. In the model, we presume the intensity of emotions being dependent on the power of action.

One way to understand the model is to regard it as a modification of theory of planned behavior (TPB) for habitual behavior [1]. Conscious processing of TPB, such as attitudes and social norms, are replaced with unconscious processing (positive and negative emotions). We assume that cognitions related to system usage arouse a number of emotions. These emotions cause cognitive dissonance that is minimized by adjusting behavior (within external limits).

Some reservations have to be made, though. It is possible that negative thoughts towards the system use may even increase the usage, as difficulties may demand more efforts to get familiarized with the system, and thus during longer period, this activity makes system more easy to use. A recipients' high usage of the system may also be a result of menaces, threatening or imperative from the management.

III. MEASUREMENT

Our empirical analysis concerns a single case located in a single company. The case company's main business is IT-network maintenance. The business activities consist of many business units operating in several geographical areas in Finland. A survey was conducted in the case company in autumn 2010. The survey was deployed on the Web, and 247 persons were asked to participate. Those who had not responded were reminded twice via email after a week and two weeks of time. Finally, 86 responses were received. The respondents represent different roles in the value chain of IT network maintenance, including variations in vertical specialization, i.e. both field-force and shift-managers. Summary of the some respondent background information is presented in Table 2.

TABLE 2. BACKGROUND INFORMATION OF THE RESPONDENTS.

Respondents' Background Information		N	%
Age	20–30 years	18	20.9
	31–40 years	19	22.1
	41–50 years	24	27.9
	51–60 years	17	19.8
	Missing	8	9.3
Gender	Male	74	86.0
	Female	8	9.3
	Missing	4	4.7
Role	Field worker	63	73.3
	Shift manager	17	19.8
	Other	3	3.5
	Missing	3	3.5
Earlier use experience of similar system	Yes	51	59.3
	No	33	38.4
	Missing	2	2.3

IV. METHOD AND RESULTS

The intention of was to use the same techniques that have been used in technology acceptance modeling in order to receive results comparable to prior studies. Analysis was carried out using R-environment and plspm-package [13] in practice this means PLS path modeling. Table 3 presents internal validity of construct, and for all variables the values are in the acceptable level (> 0.70).

TABLE 3. CONSTRUCT VALIDITY

Construct Validity		
	Cronbach's alpha	DG.rho
Positive Emotions	0.72	0.84
Negative Emotions	0.89	0.92
Self-Efficacy	0.86	0.91
Usage Level	0.72	0.84

Table 4 presents correlations and we can see that model seems to be working. However, self-efficacy and usage level have some very high correlation values which is somewhat alarming.

Table 5 shows that especially NE1 and N2 cannot be estimated with good accuracy. From Appendix A we can see that these items are related to emotions such as surprise and sadness.

High correlation between self-efficacy and usage is evident from Table 6 that describes correlations among latent variables.

From Table 7 we can notice that AVE of usage is greater than correlation between self-efficacy and usage (Table 6), this is a bad sign typically.

TABLE 4, CORRELATIONS BETWEEN MANIFESTED AND LATENT VARIABLES

CORRELATIONS BETWEEN MVs AND LVs				
	Positive Emotions	Negative Emotions	Self-Efficacy	Usage
Positive Emotions				
PE1	**0.82**	-0.14	0.08	0.22
PE2	**0.76**	-0.03	0.18	0.24
PE3	**0.82**	-0.23	0.16	0.23
Negative Emotions				
NE1	0.14	**0.49**	-0.02	0.02
NE2	-0.06	**0.62**	-0.08	-0.03
NE3	-0.06	**0.86**	-0.09	-0.08
NE4	-0.10	**0.95**	-0.35	-0.30
NE5	-0.26	**0.94**	-0.20	-0.20
Self-Efficacy				
SE1	0.10	-0.19	**0.92**	0.70
SE2	0.25	-0.18	**0.81**	0.52
SE3	0.14	-0.35	**0.91**	0.63
Usage Level				
UL1	0.36	-0.10	0.47	**0.70**
UL3	0.22	-0.29	0.68	**0.90**
UL4	0.11	-0.20	0.53	**0.79**

TABLE 5, CONFIDENCE INTERVAL FOR LOADINGS

CONFIDENCE INTERVALS FOR LOADINGS					
	Original	**Mean.Boot**	**Std.Error**	**perc.05**	**perc.95**
PE1	0.82	0.78	0.21	0.54	0.93
PE2	0.76	0.75	0.19	0.58	0.92
PE3	0.82	0.77	0.20	0.49	0.91
NE1	0.49	0.48	0.31	-0.21	0.88
NE2	0.62	0.59	0.27	-0.07	0.84
NE3	0.86	0.78	0.20	0.33	0.94
NE4	0.95	0.87	0.17	0.46	0.96
NE5	0.95	0.85	0.17	0.50	0.96
SE1	0.92	0.92	0.02	0.89	0.95
SE2	0.81	0.81	0.07	0.66	0.91
SE3	0.91	0.91	0.02	0.86	0.94
UL1	0.70	0.69	0.13	0.48	0.83
UL3	0.90	0.90	0.03	0.85	0.93
UL4	0.79	0.78	0.09	0.63	0.91

TABLE 6, CORRELATIONS BETWEEN LATENT VARIABLES

CORRELATIONS BETWEEN LVs				
	Positive Emotions	**Negative Emotions**	**Self-Efficacy**	**Usage Level**
Positive Emotions	1.00	-0.16	0.17	0.29
Negative Emotions	-0.16	1.00	-0.28	-0.25
Self-Efficacy	0.17	-0.28	1.00	0.71
Usage Level	0.29	-0.25	0.71	1.00

TABLE 7, SUMMARY OF INNER MODEL

SUMMARY OF INNER MODEL						
	LV.Type	MVs	R.square	Av.Commu	Av.Redun	AVE
Positive Emotions	Exogen	3	0.00	0.64	0.00	0.64
Negative Emotions	Exogen	5	0.00	0.63	0.00	0.63
Self-Efficacy	Exogen	3	0.00	0.78	0.00	0.78
Usage Level	Endogen	3	0.53	0.64	0.34	0.64

V. CONCLUSIONS

The developed and tested model to explain usage level of information system with three variables (positive emotions, negative emotions, and self-efficacy) seems to work pretty well and it has a good prediction accuracy, indicated by R^2 value (.53). However, there seem to be also some limitations as has been demonstrated with the presented statistics above. Key issues for further studies might include another testing with different data set in order to validate whether the identified potential problems may be due to the developed research model or a bit too small number of responses in current data set.

We can conclude that self-efficacy has a very tight statistical and theoretical dependency with usage behavior. In addition, we can see that a positive emotion seems to increase usage level but negative emotions seem to be only pretty loosely connected, at least in this sample. We assume that understanding the role of positive emotions in the habitual system usage is essential information for managers. Besides, it is necessary for further system usage research to pursue a more diversified understanding of the effect of positive and especially negative emotions on system usage. In future, due to tightening schedules and increasing demands for efficacy, it will be a crucial asset for companies to be able to design IT systems that are emotionally as slightly encumbering as possible.

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APPENDIX A: ITEMS FOR RESEARCH MODEL CONSTRUCTS

Constructs	Items	
Positive Emotion	PE1	Tasks management system makes me feel joy.
	PE2	Tasks management system makes me feel anticipation.
	PE3	Tasks management system makes me feel trust.
Negative Emotion	NE1	Tasks management system makes me feel surprise.
	NE2	Tasks management system makes me feel sad.
	NE3	Tasks management system makes me feel disgust.
	NE4	Tasks management system makes me feel fear.
	NE5	Tasks management system makes me feel anger.
Self-Efficacy	SE1	I can surely use basic functionality of the system.
	SE2	I can always solve problems related to the system usage.
	SE3	I don't trust to myself when I'm using the system.
Usage Level	UL1	I use all functionalities of the task system.
	UL2	I use system actively.
	UL3	I use system very little or not at all.

All items were measured on a 7-point Likert scale (where 1=strongly disagree, 2=moderately disagree, 3=somewhat disagree, 4=neutral, 5=somewhat agree, 6=moderately agree and 7=strongly agree).