Openness to Experience: An HCI Experiment

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Abstract

Today's market continues to introduce many and different information communications technologies. As a result, end users are faced with a variety of interfaces which they need to learn and use in a short period of time. The motivation to learn a new interface is subject to many variables most importantly is level of computer competencies, and openness to experience. The aim of this study was to explore end-users' overall computer competencies, competencies using software with graphical interfaces and openness to experiencing new software interfaces. In a controlled experiment, participants were asked to perform five tasks using an image editing icon based interface software for the first time. We identify possible personality trait construct in modeling better interfaces.

Keywords: User Interfaces, computer competencies, openness to experience, performance

Introduction

End-users in today's digital world have to utilize a variety of information and communications technologies (ICT) to perform basic daily tasks. In fact, during the same day a typical North American end-user would utilize office applications for word processing, spreadsheet, and presentations, as well as mobile applications and internet applications (email, forums and chat), many of which have been designed with significantly different interfaces. Information systems managers, designers and software developers need to understand how end-users adapt to the ever changing environment of the ICTs and how they interact with them. End-users' performance and acceptance of new ICTs usage depends strongly on various constructs mainly computer skill, beliefs and self efficacy.

The issue of computer-user interface has been a major topic among computer related industries during the last two decades. There have been a significant amount of human-computer interfaces (HCI) related works as it applies to the management of information system's (MIS) field, however most of them were within the context of end-user training and in a corporate setting (Davis, Bagozzi, & Warshaw, 1992; Marcus, 2000; Shneiderman, 1998; Shneiderman & Plaisant, 2004). Due to today's daily technology-

related demands there is a need to better understand the role that different user interfaces play in end-user performance and acceptance. It is recognized that acceptance of a new ICT is dependent on behavioral and personality traits such as perceptions, attitudes, openness to experiment or ones willingness to simply try new things.

In this study, we consider the factors that tend to affect the user's performance with regards to human-computer interface. That is, factors contributing to the user's behaviors in terms of clicking on buttons, icons or menus are addressed. The paper reports the results of an exploratory study of end-user on openness to experience as it relates to the end-user's overall computer competencies in general and graphic competencies in specific, while using an icon based software. In personality trait study, the psychologists have posited prominent model called the five-factor model of personality. This theory consists of five personality trait constructs in describing personality. These five different factors are referred to as the "Big 5" (Digman, 1990). The five factors were derived from factor analyses of a large number of self- and peer reports on personality-relevant adjectives and questionnaire items. One of these five dimensions is named 'Openness to Experience' by the researchers (Costa & McCrae, 1992, Digman, 1990). Openness encompasses a general disposition that is receptive to entertaining new and challenging facets of cultural life, as well as personal thoughts and emotions (Costa & McCrae, 1992). We believe that such a personality trait affects the end-user preference of software interface type. The main contribution of this research to HCI studies is to further investigate the relationship between interface design and openness to experience.

Openness to Experience

In many ways, we are all similar but when faced with the same situation different people might act very differently. Personality psychologists have been trying to classify these tendencies to feel or behave a certain way into organized models of personality (trait theories). The goal of the theory has been to find a small number of independent dimensions called factors (traits) that would account for as much of the variation in personality as possible. Cattell (1990) generally is credited with an original short list consisting 16 traits (Sixteen Personality Traits). The list consists of Reserved/Outgoing; Less intelligent/More intelligent; Stable, ego strength; Emotionality/neuroticism; Humble/Assertive; Sober/Happy-go-lucky; Expedient/Conscientious; Shy/Venturesome; Tough-minded/Tender-minded; Trusting/Suspicious; Practical/Imaginative; Forthright/Shrewd; Placid/Apprehensive; Conservative/Experimenting; Group-dependant/Self-sufficient; Undisciplined/Controlled; Relaxed. Cattell (1990) identifies these traits by considering Allport and Odbert's (1931, 1936) 17000 words and reduced them to 171 traits. On these 171 traits, observed and behavioral data was collected. The final 17 trait list was produced using these data and conducting factor analysis to them (Gray, 1999).

There is a tradeoff between including enough factors in the model to make it explanatory enough and keeping the model simple. A good example of a factor is Eysenck's (1959, 1975) extraversion: a person who is outgoing and cheerful is classified as high in extraversion, while someone who keeps mostly to himself/herself would be less extraverted (more introverted). This is independent of whether the person is responsible, conservative or, say, aggressive, because these behaviors are determined by different traits.

Many psychologists have tried to reduce many traits to few essential ones. Amongst the best known essential trait approaches are: Cattell (1990) (16 traits), Eysnck (1955, 1975) (3 traits) and Costa and McCrae (1992) (5 traits). The Five Factor Model is currently the most widely accepted trait theory and has been independently arrived at by many different studies. On one hand, this shows that the model is robust; on the other hand, because each researcher used slightly different definitions and names for each factor, several versions of the Five Factor Model exist, all with subtle differences from one another (McCrae & Costa, 1997; McCrae & John, 1992).

The Five Factor Model was argued to be robust because it can provide a strong basis to interpret most other personality models. This interpretation is not perfect. Not all other models cover all the five areas while some models may have factors beyond the Big Five. Table 1 presents a brief summary of different studies interpreting the models discussed above in terms of the Five Factor Model (Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993):

Table 1. Different five factor model studies.

Five Factor Model	Eysenck	Cattell's five higher-order factors	MBTI
Neuroticism	Neuroticism	Anxiety	--
Extraversion	Extraversion	Extraversion	Extraversion-Introversion
Conscientiousness	Psychoticism	Self-control	Judging-Perception
Agreeableness		Toughness/Will?	Feeling-Thinking
Openness to Experience		Independence	Intuition-Sensing

We note that MBTI (Myers-Briggs Type Indicator**)** is a personality test to assist a person in identifying their personality preferences. It was developed by Katharine Briggs and her daughter Isabel Briggs and follows from the theories of Carl Jung laid out in his work.
There is certainly not one single personality type which would form ideal information to a literate person. On the contrary, different personality traits may prove useful in different situations. An understanding of how different traits come into play in information search would increase our understanding of users of information services as well as the acceptance of information systems. To that effect, the aim of this study is to reflect over individual differences in information behavior with a particular focus on how and why personality traits (more specifically openness to experience) relate to human computer interface design. We are primarily interested in the relationship between openness to experience and computer/graphic competencies. This interest stems from our belief that person with a personality trait closer to “Openness to experience” is more likely to accept new interfaces. In past studies, a person whose personality trait is closely associated with openness to experience was shown to have a tendency to agree with having an active imagination, is original, and values artistic, as well as aesthetic experiences (Costa& McCrae, 1992) hence be more accepting to use a software with an iconic type of interface.

Methodology

Subjects and Procedure

Students from a School of Business in a Canadian University were asked to use a commercial off-the-shelf photo editing software. Specialized software was selected for this study such that its interface is completely iconic. The experiment was conducted as follows:

1. Students were given an appointment to perform the experiment. The experiment was performed in a controlled environment with the same moderator running the experiment in the same room, on the same computer and with the same software version, for the same period of time.
2. The moderator would then give the student an information sheet and would ask him/her to read it carefully. This sheet explains what the experiment is all about and in general what would the student be required to do.

3. The moderator would then give the student an instructions sheet which asked him/her to complete 5 tasks. Two tasks were simple and of general nature and three were of specific nature to graphics. These tasks entailed opening a file containing a picture, converting the colored picture to black and white, flipping the picture horizontally, adding noise to the picture and finally saving it in JPG format. While the student was doing the tasks, the moderator was logging the time at which he/she completed each task.
4. Upon completion of the tasks, the student was asked to complete a questionnaire containing 12 items about their experiences with the software.

Questionnaire

Validated constructs adopted from different relevant prior research work (Davis et al., 1989) were operationalized such that the wording of the items in the questionnaire was changed to account for the software used in the study. All the items used were measured using a 7-point likert-type scale and are shown in the figures below. The items used are: Openness to experience (OE): I would be motivated to try the latest version of my favorite software, or even a different company version and I would feel uncomfortable if I wear the latest in fashion clothing. In previous studies, similar questions such as "I see myself as someone who is original, comes up with new ideas", or "I see myself as someone who values artistic, aesthetic experiences" were used (Llewellyn & Wilson, 2003). Computer competencies (CC): My general computer skills are: (Novice – Expert). The number of Internet sites I usually visit is (small – very large) and I have (little – considerable) knowledge about at least one of the following software products: MS Word for windows, MS Excel, Word Perfect for windows, Visual Basic. Graphic competencies (GC): My computer graphic skills are: (Novice – Expert) and I am familiar with at least one of the following software: MS Encarta (or other encyclopedias), Kai power tools, Fractal Design Painter, Fractal Design Dabbler, Softimage Digital Studio.

Data Analysis & Discussion

Demographics

A total of 33 undergraduate students in the John Molson School of Business, Concordia University, participated in this study. The age of students ranged from 18 to 34 years old (76% of their age was between 18 to 24 years old and 24% of them were between 25 to 34 years old, and none were more than 35 years old). The students reported high proficiency in English. The scale of the proficiency in English is from 1 (I manage) to 7 (I am very comfortable). The highest proficiency in English was reported by 52% of the students, and 30% of the students reported the proficiency level of 6. The subjects' educational background was distributed as follows. The 64% percent finished CEGEP (Junior College), 18% of them finished high school, and the rest were doing their second university degree.

Perceived Computer Knowledge

In Figures 1 and 2, we report subjects' perceived familiarity with computer related skills. These figures are representative of two of the questions measuring the construct "Computer Competency".

In general, most of the students claimed to be familiar with the Internet environment. Forty six percent of the students reported that they visit many Internet site regularly (Figure 1). Moreover, more than 90% of them reported that they have considerable knowledge (greater then 4 with the scale ranging from 1 (little) to 7 (considerable)) about more than one of Microsoft Word, Microsoft Excel, Word Perfect for windows, and Visual Basic.

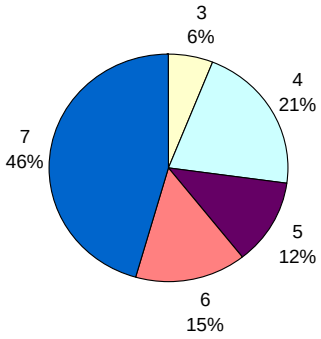

Fig 1: Knowledge of Internet sites.

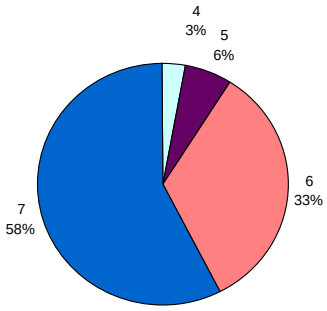

Fig 2: Knowledge of MS office application.

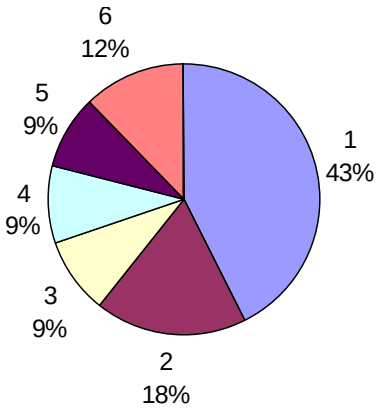

Fig 3: Knowledge to computer graphic.

Forty three percent of the students reported to have no knowledge of computer graphics software (Figure 3); however the remaining 57% indicated that their knowledge on computer graphics in general ranges from very little to expert level.

Factor Analysis

We can broadly classify factor analysis into exploratory and confirmatory. Exploratory factor analysis (EFA) is a method of discovering the number and nature of latent variables (factors) that explain the variation in a set of measured variables. Its purpose is to determine how many underlying factors are necessary to explain most of the correlations in the data; to determine the relationship through rotation between each of these underlying factors with each of the observed variables in a meaningful way so that the factors can be interpreted and named; to weed out observed variables that do not tend to measure well the underlying factors shared by the other variables; to propose blocks of variables that may be subsequently be used to create a simple sum scale and to propose a confirmatory factor analysis model (Field 2000; Hair, Anderson, Tatham, & Black, 1998).

In this study, exploratory factor analysis was run using maximum likelihood (MI) analysis with varimax rotation as well as a scree plot to assess the factor structure. For this method to provide statistically reliable results, underlying distribution need be multivariate normal. We used only the univariate check for some of the variables but for more statistically sound text one can apply skewness and kurtosis test proposed by Mardia (1974). Three factors identified through the exploratory factor analysis (each with an eigenvalue greater than 1.0) were selected as the best data reduction strategy. The factors were carefully named as Computer Competency (CC), Graphic Competency (GC), and Openness to Experience (OE). These three factors emerged with Cronbach's coefficient alpha ranging from 0.65 to 0.88 (0.67, 0.85, 0.65, respectively). And they accounted for 70% of the variance. With a cutoff of 0.5, 3 items were removed from the loading and table 2 presents the final accepted loading for the three constructs.

Table 2: Factor loading

Variable	Graphic Competencies	General Computer Competencies	Openness to Experience
OE1	0.036	0.078	**0.616**
OE2	0.367	0.208	**0.577**
CC1	0.660	**0.540**	0.246
CC2	0.277	**0.832**	0.098
CC3	0.199	**0.527**	0.299
GC1	**0.979**	0.123	-0.123
GC2	**0.555**	0.077	0.292
Eigenvalue	1.992	1.525	1.050

Computer Competency

The response of the students to the items measuring computer competencies is given on Fig. 4. The figure shows that students in general (90%) seem to feel that they have a good amount of knowledge in using Microsoft applications and close to 70% reported that they visit a large number of internet sites. With respect to general computer competencies few (4%) rated themselves as experts with approximately 65% claiming to have a reasonable computer competencies level.

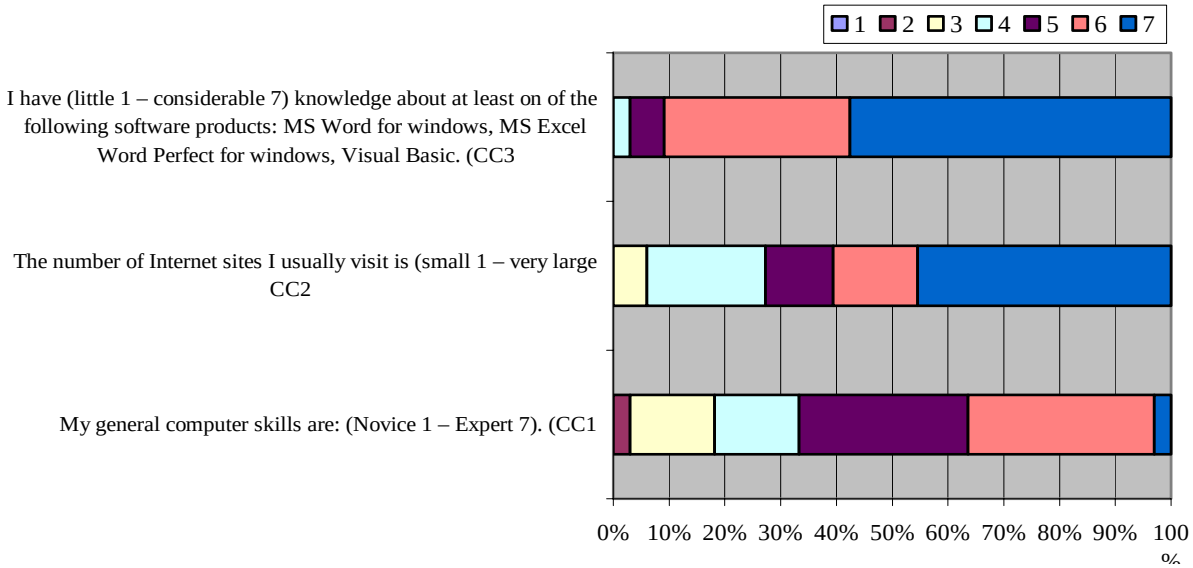

Fig 4: Response to computer competencies

Graphic Competency

The response of the students to the items measuring graphics competencies is given in Fig. 5. In general, students did not rate their computer graphic competencies high. Close to 80% of the students felt that they are a little or not at all familiar with graphics and image editing software such as MS Encarta, kai's power tools, fractal design painter/dabbler and softimage digital studio.

When asked to rate themselves in relation to general computer graphics skills, we found that the same percentage of the students felt that they were beginners at best. What is interesting is that none of the students claimed to be experts in computer graphics skills.

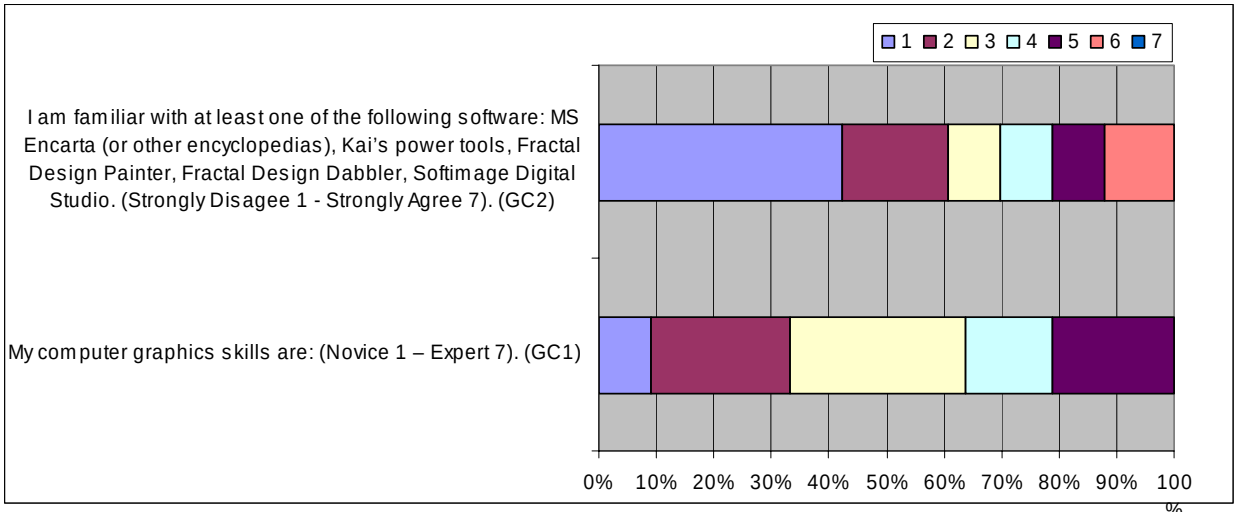

Fig 5: Students' response to GC

Openness to Experience

Openness to experience is a measure of depth, breadth and variability in a person's imagination and urge for experiences. The factor relates to intellect, openness to new ideas, cultural interests, educational aptitude and creativity as well as an interest in varied sensory and cognitive experiences. People with a high openness to experience have broad interests, are liberal and like novelty. The preservers with low openness to experience are conventional, conservative and prefer familiarity (Howard & Howard, 1995).

The response of the students to the items measuring openness to experience is given in Fig 6. These items attempt to measure the propensity or level of willingness that an individual would be willing to perform some tasks that may be out of their norm. This construct was measured using two items where one is non-technology related and the other is. What is interesting is that both items load acceptably on one factor, which is indicative that they belong together as measuring the same construct. In specific, the feeling of being comfortable to wear the latest in fashion clothing and being motivated to try new software measure the same construct.

To that effect, questionnaire results further confirm that association. Close to 60% of the students reported that they feel comfortable wearing the latest in fashion clothing. Approximately the same percent of the students also reported that they are motivated to use the latest version of their favorite software. These results seem to suggest that openness to experience in the ICT context can also be measured using non-ICT related items. This may be attributed to the possibility that the same behavioral mechanisms are in place and identify the feeling of comfort and openness to try new things irrelevant of what they are. It may be interesting to consider possible gender differences to this question. We did not perform the difference test due to small sample size.

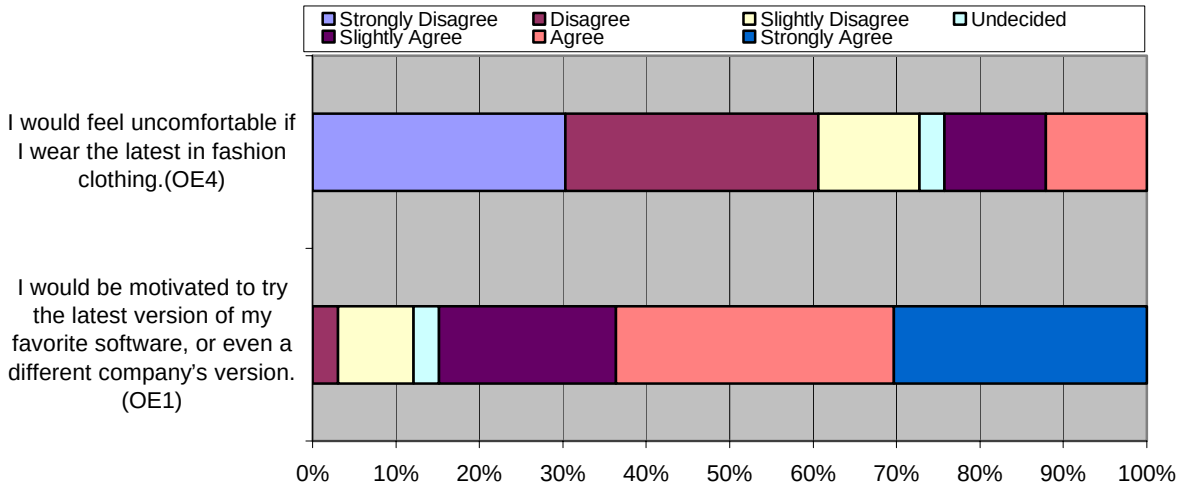

Fig 6: Students' response to openness to experience.

Influence of Competencies on Openness to Experience

As a final set of analysis we have regressed both computer competencies and graphic competencies on openness to experience as shown in Fig. 7. The influence of general CC on OE is approximately 30% more than that of GC. Additionally, the OE explains 10% of the variance from CC and only 4.5% that of GC.

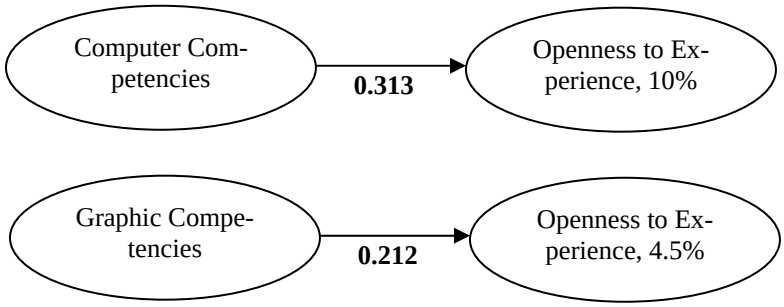

Figure 7: PLS Results for Icon Based Interface

It is evident that more research is needed to identify better items to explain and help us understand openness to experience in the ICT domain and from an HCI perspective. This field of research is ignored and has few published studies. Most of us experience numerous emotions when we are faced with trying new ICTs. One of the first things we experience is the level of difficulty to learn to use this new ICT (such as a mobile phone). Subsequently, it seems that our decision to adopt followed by our satisfaction is strongly dictated by our openness to experience/experiment and corresponding attitude.

Conclusion

It is shown that information behavior of interface usage could be connected to one of the personality dimensions, openness to experience in big five personality theory. Possible explanations for

how personality traits can be a factor influencing the design of computer interfaces is discussed. It is posited that openness to experience as a personality trait can be used as one of the factors in explaining why icon based interface matches well with users with high scores on openness to experience in personality tests. Although this is an exploratory study, it shows a good promise toward developing how understanding of different personality traits can be used to increase the understanding of users of information systems and the designing of acceptable and useable interfaces.

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Biographies

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