Mood Independent Programming

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ABSTRACT

Motivation – The motivation behind this study is to improve the programmer's coding and debugging performance by considering their moods.

Research approach – This study will use an empirical research approach that involves the use of un-controlled and controlled experimentation.

Findings/Design – The main findings suggest that there is a possible effect of moods on the performance of the programmers' coding and debugging activities.

Take away message – Moods may have an impact on programmer's performance. It may be possible to detect moods on the basis of information regarding the programmer's use of the keyboard and mouse, and to integrate them into development environments that can improve programmer performance.

Keywords

Programmers, Moods, affect, emotions, integrated development environments

INTRODUCTION

Key contributors for the software industry are highly motivated, creative and enthusiastic individuals such as software engineers, programmers and testers. The quality of the software industry highly depends on the quality and performance of the work of these individuals. Humans can make errors, which can be a cause of project failures as indicated by Ko and Mayers (2005). Therefore, we could gain from systems that are designed to prevent or reduce errors. The aim of this research is to improve programmers' performance by considering their moods when they are working. Objectives include establishing a relation between programmer's mood and their coding and debugging performance; detecting moods of the programmers by recording their use of the keyboard and mouse; proposing development environments that are capable of mood recognition and giving suggestions to improve performance.

Expected Contributions

This research may contribute by finding a link between the moods of the programmers and their coding and debugging performance. It may also contribute by showing that development environments that are able to recognize user's moods can help programmers by suggesting different actions to overcome problems that relate to these moods.

Literature review

In daily life, humans have various moods and emotions. These human moods might have an influence on performance and quality of our daily work. Positive and negative moods may have an effect on various aspects of human life among them being reasoning (Chang and Wilson, 2004), creativity (Russ and Kaugars, 2001), behaviour (Kirchsteiger et al., 2006) and information processing (Armitage et al., 1999). Research suggests that reasoning and logic are important parts of programming. Jones (2003) suggested that testing alone is not sufficient to verify the validity of a computer program, unless there is a possibility to reason about computer programs. Damasio (1995) argued that emotions are interrelated with reasoning. The impact of moods on reasoning is also evident from the work of Blagrove and Akehurst (2001). A considerable amount of research has focused on moods and performance, but there appears to be very little research that studies the impact of moods on the performance of IT professionals (Shaw, 2004). Current research in psychology is studying the effects of moods on performance, but the impact of moods on the performance of IT professionals seems not to have been considered (Khan et al, 2006).

There seems to be a strong case that moods have an effect on the overall behaviour of humans. For example, Armitage, Conner and Norman (1999) showed that there are effects of mood on problem focus approach and on the health-related behavioural decision making. Bohner et al. (1992) also showed that subjects were not influenced by content as well as context information when they were in a good mood, but they used both content and context information while they were in a bad mood.

Detecting moods through behaviour is one of the objectives of this research. Many research projects have explored computer systems that can recognize user's emotions (Nasoz et al, 2003). There are various physiological measures for mood, including measuring heart rate, blood pressure, etc (Shapiro et al, 2001), but these require attaching equipment to different body parts that might be interruptive for a programmer working in a professional environment (Zimmermann et al, 2003). An alternate is to record keyboard and mouse use; however,

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limited work has been done in this area with the exception of Zimmermann et al. (2003). Although Zimmerman's work has not presented any empirical results, it shows the opportunity for detecting moods from keyboard and mouse behaviour. Peres (2004) stated factors as well as working environments that might influence shortcut usage.

IDE/SDE (Integrated/Software Development Environments) help programmers by generating appropriate warning and error messages based on the computer language syntax as well as on some of the logical fallacies and warning conditions. An IDE is a set of tools containing at least support for coding with some other tools, whereas Meta SDEs have both coding support as well as helping tools (Mancoridis, 1993). IDE/SDE are already being used in some advanced concepts like: requirement's traceability as in Bell-Northern Research IDE (Macfarlane and Reilly, 1995); for automatic design and implementation of Fuzzy logic controllers (FLC)(Kim and Cho, 1997); for simulation and modelling (Kennedy and Raistrick, 2000), etc. However, can these environments further improve performance by considering the mood of the programmer? Several software applications can recognize affects (moods) and can take actions accordingly; for example enhancing presence and co-presence in learning environments, enhancing tele-presence in telemedicine environments and enhancing driver perceptions of presence (Nasoz et al, 2003). Although currently there seems to be no existing mood recognition system that uses keyboard and mouse movements, there might be a possibility of combining such a system with IDEs to detect moods and help programmers.

Regulating moods before performing a task can improve performance (Totterdell and Leach, 2001). The environment might be able to detect syntax or logical errors due to some particular mood. On discovering a particular mood, the system might be able to help programmers by making them aware of the kind of the mood they are in and provide advice to take suitable actions.

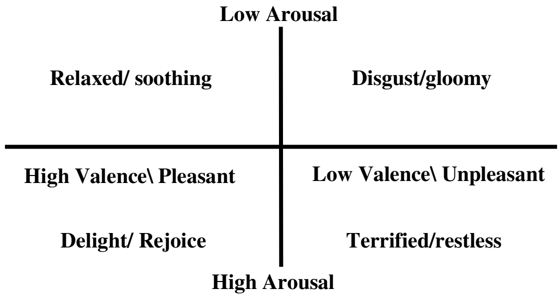
RESEARCH APPROACH

This study uses an empirical research methodology that starts by using three a priori hypotheses: (1) Moods affect programmers' performance; (2) Programmer behaviour on keyboard and mouse can help in their mood recognition; (3) and Development environments can improve programmers' performance by considering their moods. SAM (Self Assessment Manikin) devised by Lang (1985) is used for measuring moods of the participants in the studies. Morris (1995) found high correlations (of 0.94) for both arousal and valence dimension when SAM was used in their studies and considered it a very reliable mood assessment measure.

Hypothesis I - Experiment I

Programmers' mood might affect their performance. The first part of this conducted study examines the impact of moods on programmer's performance. The general approach of the experiment was to evoke particular moods and ask programmers to solve a number of debugging tasks. Examining the performance on these tasks provided an insight into how mood effects debugging. The study used a two dimensional valence arousal model to describe the moods of a programmer. The use of two-dimensional models to study moods is gaining increased acceptance (Thayer et al, 1994). To invoke a particular mood, the study used four movie clips for each quadrant of valence/arousal dimensional model and a neutral mood movie clip as reference point in the centre. A mood validation procedure was conducted on 15 movie clips. These movie clips were selected (Khan et al, 2006) to represent the mood in the outer most positions of the four quadrants in valence arousal model and validated in two phases.

Fig.1. Valence and Arousal Dimensions



To measure coding/debugging performance, a coding and debugging MCQ (Multiple Choice Questionnaire) was prepared with initially 24 questions from Deitel et al. (2000). Three computer science lecturers rated the difficulty level of each question as Easy, Medium or Difficult and 12 questions were selected for the further study.

Procedure

Participants were invited by posting requests on programming forums, invitations through emails, or by personal invitations. All the participants took an online test of debugging and coding questions in two phases. After inputting data and signing a consent form, an introductory sample of a movie clip, coding/debugging questions and a mood rating questionnaire were displayed so that they could get acquainted with the test. After completion of the training, they watched movie clips that were randomly selected either from a neutral or one of the mood quadrants. Subsequently, they were asked to complete a debugging/coding test that was followed by a mood rating questionnaire. The second phase started immediately, repeating the sequence, but with an opposite movie clip. If participants watched a neutral movie in the first phase, then in the second phase they were shown a mood inducing movie clip and vice versa. Participants rated their moods on a mood rating questionnaire using SAM (Lang, 1985).

Participants

A total of 75 participants completed the experiment. Three out of 75 participants indicated that they had done the experiment at least twice. Therefore the analysis was done on 72 cases in which participants took the experiment for the first time. Five participants were females. Ages ranged from 18-44 years with a mean of 26.31 and SD of 5.23. Programming experience ranged from 0.5-25 years with a mean of 4.81 years and SD of 5.55. Participants included 80.6% professionals, 8.3% postgraduates, 5.6% undergraduates, 4.2% PhD students, and 1.4% hobby programmers. Of the participants 58.3% used C/C++, 23.6% used C#, 11.1% used Java and 6.9% used Visual basic dot net.

Results

Although multivariate analyses on the data failed to find a significant effect for valance dimension, the results for the arousal dimension were encouraging enough to study them in detail. Two separate one-way ANOVAs were conducted with arousal as independent variable. The results of the ANOVA on the number of correct answers in the debug test revealed an almost significant effect (F (1, 70) = 3.33, p = 0.072) for arousal. Participants gave more correct answers after seeing high arousal movie clip (M = 3.09, SD = 1.75) than after seeing the low arousal movie clip (M = 2.37, SD = 1.60). Performance after seeing the neutral movie clip was somewhere in the middle (M = 2.88, SD = 1.56). Likewise a significant effect (F (1, 70) = 6.26, p = 0.015) for arousal was also found by a one-way ANOVA on the number of questions where participants did not need the maximum time set for questions. After seeing the high arousal movie clip (M = 4.21, SD = 1.63) participants more often gave an answer and pressed the 'Next question' button than after seeing low arousal movie clip (M = 3.11, SD =2.05). The performance after seeing the neutral movie clip (M = 4.00, SD = 1.68) again is in the middle of high and low arousal movie clip.

Experiment 2

There seems to be a possibility of arousal effects on programmer's coding and debugging performance through online experiments, but repeating this experiment in a controlled environment might reveal more information about this effect. Factors such as background noise or other distraction were not controlled in the online experiment. A controlled experiment, which is currently being carried out, would remove these noise factors. This experiment has similar procedural stages as the online experiment. Currently, 35 participants have participated in the test.

FUTURE RESEARCH PLAN

Future experiments will test the second hypothesis; mood recognition is possible from programmer's use of the keyboard and mouse; and the third hypothesis, will test if an IDE can improve programmers' performance by considering their moods.

Hypothesis 2

An application for the PC is under development, which will record programmers' keyboard strokes and mouse movements. Mood-rating questionnaires will popup after every 20 minutes to record valence and arousal. The application will not record the actual keys, but the type of keys such as alphabetical, numerical or functional. The key categorization is to ensure user's security and secrecy with additional options allowing the user to stop the popup with the mood questionnaire and to stop logging for a specific time. User can also view their recording logs. This software will be installed on programmers' computers and their behaviour on keyboard and mouse will be recorded for 8-10 days. Afterwards, correlations between mood questionnaire results and keyboard/mouse behaviour will be examined to extract potential behavioural mood measures.

Hypothesis 3

The last step in this research will be to design IDE's or to modify existing IDE's for enabling mood recognition. This research proposes to make these environments capable of suggesting performance improvement tips to programmers.

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