The Motivation/Attitude-Driven Behavior (MADB) Model in E-Learning and the Effects on Mouse Dynamics

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ABSTRACT

This paper presents the application of Motivation/Attitude-driven Behavior (MADB) model proposed by Wang (Wang, 2007a) in the e-learning context. The authors’ work demonstrates how mathematical models and formal cognitive processes is developed based on menu search task. The effects of menu design on stress perceptions, motivation and attitudes during the search tasks are being examined. The correlations between emotion (stress perception), motivation, attitude, decision, behavior and mouse behavior are studied. The authors’ findings are consistent with what was proposed by Wang. They also found that behavior is significantly correlated to mouse dynamics, such as mouse speed, mouse idle duration and mouse left click rate. Generally strong behavior strength results in slower mouse movements. The significant effect of behavior on mouse dynamics may be caused by motivation and decision, but not attitude and stress perception.

KEYWORDS

Attitude, Behavior, Decision, E-Learning, Menu Design, Menu Search, Motivation, Motivation/Attitude-Driven Behavior (MADB) Model, Mouse Dynamics, Stress Perception

INTRODUCTION

Experiential and affective computing are important in cognitive computing and it would be good to develop an effective construct to measure a users’ cognitive performance and emotions so that an automated adaptation can be done to improve the user’s experience when using an e-learning system. In this research, we are interested to examine how formal cognitive processes during menu search task in an e-learning environment can be modeled and measured by considering a student’s stress perception, motivation, attitude and behavior, based on the Motivation/Attitude-driven Behavior (MADB) model proposed by Wang (Wang, 2007a). His research demonstrated how the MADB model was applied in a software engineering organization, but we envisage the model can also be fit into the e-learning environment. We would like to examine the effects of menu design on learners’ stress perceptions, motivation and attitudes during the search tasks, and to determine the correlations of the learners’ stress perceptions and cognitive states to their mouse behaviors. If significant correlations between the student’s behavior and his/her mouse dynamics can be found, then we strongly believe that there is a high potential to compute the student’s cognitive processes based on mouse dynamics analysis.
Cognitive load theory emphasizes devising effective instructional procedures to enhance learning based on the understanding of human cognitive process working with long-term and short-term memory. It also studies how cognitive process relates to attention. Wang et al (Wang, Patel, & Patel, 2013) defined attention as a perceptive process of the brain, which individual selectively concentrates or focuses the mind and proper responses on external stimuli, internal motivations, and/or threads of thought. According to them, attention is triggered by all five primary sensory receptors (vision, hearing, smelling, taste and touch) but it is dominantly manipulated by the vision sensory receptor. Attention can also be triggered by derived internal senses of position, time, and motion at the sensation layer. Cognitive performance could also be affected by emotional, motivational and attitude factors. Wang (Wang, 2007a) defines emotions as a set of states or results of human perception that interprets the feelings on external stimuli into either pleasant or unpleasant category. Unpleasant or negative emotions could inhibit necessary resources being recruited for further cognitive process by human mental, which prevent optimal skill execution (Beilock & Ramirez, 2011). While motivation and attitude can drive individual’s cognitive behavior, and triggers the transformation from thought into action. Therefore, motivation has considerable impact on behavior and influence the ways a person thinks and feels (Westen, 1999). Due to these reasons, emotional and motivational factors should be considered when developing instructional procedures in a learning environment, to ensure that the learners are always ready to accept and execute demanding learning tasks.

To assess or measure cognitive load and emotions, the common approaches include subjective methods, physiological tests and task performance-based measurement (Kirschner, 2002). Subjective methods such as surveys, require users to perform self-assessment on their mental effort or emotion. This is simple but they often prone to erroneous and unreliable results. Physiological measurements provide higher accuracy in measuring mental activities and emotions by collecting biological data such as heart beat rate and body temperature, but they could be obtrusive, and the equipment are usually expensive and need special setup. Task performance-based method is an objective and standardized measure of individual’s task performance, cognitive ability, aptitude, emotional functioning, etc. (Anastasi, 1954). In a task-specific environment, user stress levels can be changed according to demand and control (Karasek, 1979). Misfit between job demands and individual capabilities intensifies the stress effect (Rijk, Blanc, Schaufeli, & Jonge, 1998). Task-performance-based method is usually used for socio-psychological research, but it is usually done using social science approach, which lacks automated cognitive computation and emotion detection. Other emotion detection methods include audio/visual analysis such as facial expressions recognition. Although they produce promising accuracy, they can be computationally expensive and intensive. To produce a construct that is able to quantify cognitive load and emotion, using a low cost, non-invasive, computational feasible and fully automated solution, some research examines the potential of using mouse or keystroke dynamics. The results do not only demonstrate great potential in developing such solution, but also present comparable promising accuracy as compared to the existing methods. For instance, a research by Wahlström et al (Wahlström, Hagberg, Johnson, Svensson, & Rempel, 2002) and Heiden et al (Heiden, Lyskov, Djupsjöbacka, Hellström, & Crenshaw, 2005) show that users would demonstrate increased psychological and physiological reactions using a computer mouse if they work under time pressure, verbal provocation and precision demand. Pusara and Brodley (Pusara & Brodley, 2004) used mouse dynamics to detect anomalous behavior through user’s mouse movements. Tsoulouhas et al (Tsoulouhas, Georgiou, & Karakos, 2011) found that mouse activities are affected by boredom induced by lengthy presentation of a course on computer screen. They reported that mouse movement speed, inactivity occurrences and durations, and movement directions would change significantly when the students claimed boredom. Two recent studies by Lim et al (Lim, Ayesh, & Stacey, 2014a, 2014b) investigated how keyboard and mouse dynamics are affected by mental arithmetic or typing.
Language Independent Recognition of Human Emotion using Artificial Neural Networks
www.igi-global.com/article/language-independent-recognition-human-emotion/1564?camid=4v1a

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