Implementing Psychological Parameters in a Web-based Appraisal System

Zacharias Lekkas, Nikos Tsianos, Costas Mourlas
Department of Communication and Mass Media
University of Athens Athens, Greece
{ntsianos,mourlas)@media.uoa.gr, zlekkas@gmail.com

Panagiotis Germanakos
Department of Management and MIS
University of Nicosia
Nicosia, Cyprus
pgerman@cs.ucy.ac.cy

George Samaras
Department of Computer Science
University of Cyprus
Nicosia, Cyprus
cssamara@cs.ucy.ac.cy

***Abstract*— For many years people have been trying to measure differences between individuals. Over the course of time, a combination of developments in statistical know-how and the evolution of thought within psychology enabled the refinement of measures, and subsequently the assessment of more specific factors in the field of individual differences like different kinds of ability, affect and personality. This knowledge has been used in many areas within psychology and at the same time the advancement of technology has enabled the development of web-based appraisal systems that measure specific factors relevant to specific situations. This paper presents the theory behind a web-based assessment system and some first experimental results that will lead to the design of the web environment.**

Keywords: e-assessment, e-testing, affect, personality, psychometrics

I. INTRODUCTION

Web-based information systems are increasingly being used for learning and training applications. Computers are becoming better and more sophisticated every day. They can already perceive information related to user needs, preferences and characteristics [1, 2]. One possible implementation of a Web-based system's interface that can appraise human characteristics is through the use of a series of online tests that can assess the abilities and properties of the user [3]. E-assessment is the use of information technology for any assessment-related activity. Due to its obvious similarity to e-learning, the term e-assessment is becoming widely used as a generic term to describe the use of computers within the assessment process. E-assessment can be used to assess cognitive and affective abilities using e-testing software.

A web-based assessment system usually measures verbal and quantitative abilities but in order to acquire a more solid impression of the users' potential we include in addition some purely psychological constructs that help us measure terms like personality and affect. It does not measure a person's knowledge of specific fields of study and only minimal computer skills are needed. The Verbal section measures a user's ability to read and comprehend written material, to reason and evaluate arguments. Two types of multiple-choice questions are used in the verbal section, Reading Comprehension and Critical Reasoning. The Quantitative section measures a person's ability to reason quantitatively, solve quantitative problems, and interpret graphic data. Two types of questions are used in the quantitative section, Problem solving and Data sufficiency. Both types of question require basic knowledge of Arithmetic, Elementary algebra and commonly known concepts of geometry [4].

The use of psychometric data is considered a valuable tool for the evaluation of the individual. Psychometrics is an area of Psychology concerned with the systematic testing, measurement and assessment of aptitudes and personality. Psychometric assessments are used to complement less formal and more subjective methods to help teachers or managers reach more widely informed and objective judgements about people. We believe that by putting a special emphasis in the psychometric abilities of the user we will be able to examine a hidden but very important aspect of his behavior and performance.

II. THEORETICAL BACKGROUND

The concepts of personality and affect underpin psychology's attempt to identify the unique character of individuals. The terms describe properties of behavior which concern the individual's typical ways of coping with life events [5]. An in-depth model that grasps the complexity of these underlying concepts is the first purpose of our research. Instead of selecting one area of implementation we are trying to combine these three levels of analyses (verbal, quantitative and psychological) and form a typology that will help us circle effectively the cognitive and affective mechanisms of the brain. In order to apply a purely psychological construct to a digital platform we adjust the various theories concerning cognition and emotion having in mind to make our model flexible and applicable to users' profiles, needs and preferences. The verbal and quantitative sections of the appraisal system are straightforward and cannot be significantly manipulated since they are easily quantifiable [6]. In order to manipulate the parameters in the psychological section according to user characteristics, our research has to go through the stage of extracting quantified elements that represent deeper psychological and affective abilities. The latter cannot be directly used in a web environment, but a numerical equivalent can define a user characteristic. Apart from the standard personality questionnaire we developed a theory

and a corresponding battery of questionnaires for the concept of Affect. Our psychological model of Affect has two base elements:

a. Emotional Arousal is the capacity of a human being to sense and experience specific emotional situations. An effort to construct a model that predicts the role of specific emotions is beyond the scope of our research, due to the complexity and the numerous confounding variables that would make such an attempt rather impossible. We focus on arousal as an emotional mechanism and not on a number of basic emotions because emotional arousal can provide some indirect measurement of general emotional mechanisms since it manages a number of emotional factors like anxiety, boredom effects, anger etc.

b. Dispositional affect is an affective state that lasts longer than an emotion and is not as specific as an emotion can be. Dispositional affect is a stable trait and tendency towards positivity or negativity. Individuals with positive Dispositional affect tend to be cheerful and energetic and experience positive moods across a variety of situations as compared to people who tend to have low energy and be melancholic. Individuals with negative Dispositional affect have a negative view on self and tend to be distressed and upset in relation to people who are calm and relaxed.

Apart from that, our model would be problematic without a regulatory mechanism of affect. For this reason we constructed the measure of Emotion Regulation that is comprised from terms like emotional intelligence, self-efficacy, emotional experience and emotional expression. Emotion regulation is the way in which an individual is perceiving and controlling his emotions. Individuals attempt to influence which emotions they have, when they have them and how they experience and express them [7]. By combining the affective state of the individual with his regulatory mechanism we can reach into a conclusion of how affect influences his performance and the outcome of his behaviour.

III. EXPERIMENTAL RESULTS

In the first step of our research we examined the immediate and synchronous affective user reactions and behaviour which are covered in our model by the terms of emotional arousal and emotion regulation [8, 9]. We hypothesized that by combining the level of arousal of an individual with the moderating role of emotion regulation, it is possible to clarify, at some extent, how affectional responses of the individual hamper or promote learning procedures. It was proposed that an individual with high emotion regulation would usually have low arousal levels because of his ability to control and organize his emotions [10].

In the next step we were interested in clarifying the role of dispositional trait affect which is a global and general mood (positive or negative) and its relationship with the construct of emotion regulation. After the construction and standardization of our instruments we are currently trying to find the weighting, the importance and the implications of dispositional affect [11, 12]. The results of the experiments conducted within a learning environment, as we hypothesized, show that the two notions of dispositional affect and emotion regulation were found to be as hypothesized significantly statistically different. This means that in general a user with high regulation ability has a tendency towards positive mood and the opposite, a user with low regulation ability is resilient to negative mood [13, 14].

A significant finding is that the affective state of the user is having an effect on his score (Table 2 and Graph 1). Participants with positive affect perform better than participants with negative affect. Overall we can say that affect is greatly related to performance. Of equal importance is the notion of regulation that acts as a moderating factor to negative affect and as a reinforcement to positive affect [15].The participants, after the completion of the learning course, took an exam on the subject that they were taught, with their scores indicating their academic performance in terms of efficient information processing and consolidation of the newly acquired information.

IV. DISCUSSION

Psychometric in-depth knowledge was never applied and used properly in Information Technology. Emotions influence the cognitive processes of the individual, and therefore have certain effect in any setting. Again, bibliographic research has shown that negative affect is often correlated with performance [16], as well with performance in computer mediated learning procedures. We believe that by combining the level of arousal of an individual with the moderating role of emotion regulation, taking into consideration his mood and disposition it is possible to clarify, at some extent, how emotional responses of the individual hamper or promote learning procedures. We intend to use all these methods of measurement, as the main direction of our work, controlling at the same time correlated variables like verbal and quantitative ability [17].

E-assessment is becoming widely used. It has many advantages over traditional (paper-based) assessment. The advantages include lower long-term costs, instant feedback to users, greater flexibility with respect to location and timing, improved reliability (machine marking is much more reliable than human marking) and enhanced question styles which incorporate interactivity and multimedia. There are also disadvantages. E-assessment systems are difficult to establish and not suitable for every type of assessment (such as extended response questions). Therefore, in relation to psychological concepts the main expense is not technical; it is the cost of producing high quality assessment *items* that are able to circle effectively the complexity of the human nature.

REFERENCES

[1] Cingil I., Dogac A., & Azgin A., (2000), "A broader approach to personalization", *Communications of the ACM*, Vol. 43, No. 8

[2] Kim W., (2002), *Personalization: Definition, Status, and Challenges Ahead*, Published by ETH Zurich, Chair of Software Engineering JOT, 2002, Vol. 1, No. 1.

[3] Picard, R.W. (1997). *Affective Computing*. MIT Press, Cambridge.

[4] The e-Assessment Association http://www.e-assessment.com

[5] Kline, P. (1993). *Personality. The Psychometric View*. Routledge, London.

[6] Kline, P. (2000). *Handbook of Psychological Testing*. Routledge, London.

[7] Lewis, M. & Haviland-Jones, J.M. (2004). *Handbook of emotions* (2nd Ed.). New York: The Guildford Press.

[8] Lekkas Z., Tsianos N., Germanakos P., & Mourlas C. (2007) " Integrating Cognitive and Emotional Parameters into Designing Adaptive Hypermedia Environments ", *Proceedings of the Second European Cognitive Science Conference (EuroCogSci'07)*, Delphi, Hellas, May 23-27, 2007, pp. 705-709.

[9] Tsianos N., Lekkas Z., Germanakos P., Mourlas C., & Samaras G. (2008) " User-centered Profiling on the basis of Cognitive and Emotional Characteristics: An Empirical Study ", *Proceedigns of the 5th International Conference on Adaptive Hypermedia and Adaptive Web-based Systems (AH 2008)*, Hannover, Germany, July 28 - August 1, 2008, Springer-Verlag Berlin Heidelberg, LNCS 5149, pp. 214-223.

[10] Germanakos P., Tsianos N., Lekkas Z., Mourlas C., & Samaras G. " Realizing Comprehensive User Profile as the Core Element of Adaptive and Personalized Communication Environments and Systems ", *The Computer Journal*, Special Issue on Profiling Expertise and Behaviour, Oxford University Press.

[11] Kim, J, Gorman, J. (2005). "The psychobiology of anxiety". *Clinical Neuroscience Research*, 4, 335-347.

[12] Spielberger, C. D. (1972). Conceptual and methodological issues in anxiety research. In C. D. Spielberger (Ed.), *Anxiety. Current trends in theory and research (Vol. 2).* New York: Academic Press.

[13] Salovey, P., & Mayer, J. D. (1990). "Emotional intelligence". *Imagination, Cognition and Personality*, 9, 185±211.

[14] Schunk, D. H. (1989). "Self-efficacy and cognitive skill learning". In C. Ames & R. Ames (Eds.), *Research on motivation in education*. Vol. 3: Goals and cognitions (pp. 13-44). San Diego: Academic Press.

[15] Lerner, J. S., & Keltner, D. (2000). "Beyond valence: Toward a model of emotion specific influences on judgment and choice". *Cognition and Emotion*, 14, 473–493.

[16] Cassady, C. C. (2004). "The influence of cognitive test anxiety across the learning–testing cycle", *Learning and Instruction*, 14 (pp. 569–592).

[17] Bechara, A., Damasio, H., & Damasio, A. R. (2000). *Emotion, decision-making, and the orbitofrontal cortex*. Cerebral Cortex, vol. 10, pp. 295–307.