

Using EEG Frontal Asymmetry to Predict IT User's Perceptions

Christos N. Moridis, Vasileios Terzis, Anastasios A. Economides, Anna Karlovasitou, Vasileios E. Karabatakis

Corresponding author: bterzis@otenet.gr

Information Systems (IS) community is increasingly interested in employing neuroscience tools and methods in order to develop new theories concerning Human-Computer Interaction (HCI) and further understand IS acceptance models. The new field of NeuroIS has been introduced to address these issues thoroughly (Riedl et al., 2010). NeuroIS researchers have proposed encephalograph (EEG), among other neuroscience instruments, as a valuable usability metric, when used effectively in appropriately designed experiments (Riedl et al., 2010). Moreover, numerous researchers have shown that relatively greater left EEG frontal activity is associated with positive affect and approach related motivation, and that relatively greater right EEG frontal activity is associated with negative affect and withdrawal-related motivation. Based on the aforementioned evidence, this study aims to integrate frontal asymmetry with Technology Acceptance Model (TAM) (Davis, 1989). Particularly, we assumed that frontal asymmetry might predict users' perceptions regarding Usefulness and Ease of Use in context of Computer Based Assessment (CBA). Furthermore, we hypothesized that frontal asymmetry might also define users' Perceived Playfulness. Importantly, gender specific differentiations were also examined as part of the research methodology. This research in progress aims to contribute to the investigation regarding the correlation among IS acceptance constructs and brain activity (e.g. Dimoka and Davis, 2008).

We used Perceived Usefulness, Perceived Ease of Use and Perceived Playfulness, since Computer Based Assessment Acceptance Model (CBAAM) highlighted them as the most important determinants of students' behavioral intention to use a CBA (Terzis & Economides, 2011).

EEG frontal Asymmetry is actually the difference between left frontal vs. right frontal activation. Previous studies indicated that the difference of alpha frequency in frontal cortex is associated with individual's positive vs. negative perceptions regarding the stimuli (Davidson, Taylor, and Saron, 1979). Particularly, greater scores indicate greater left frontal activity (1). For example, a value of 0.3 is actually a strong 30% right side asymmetry and therefore considerable left side activation.

Right - Left

Right + Left (1)

Students' experience during CBA could provoke positive or negative perceptions. These perceptions are

formulated by the system's ease of use, usefulness and playfulness. Therefore, we would expect that students, who had a higher sense of usefulness, ease of use and playfulness during their interaction with the system would also have greater left frontal activation. Thus, we supposed that higher left vs. right frontal activation would be positively related with students' perceptions regarding usefulness, ease of use and playfulness while answering the questionnaire after the end of the CBA. Therefore, we hypothesized that (Figure1):

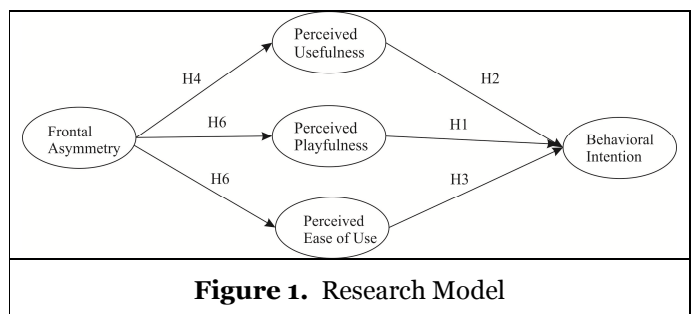


Figure 1. Research Model

The experiment consisted of eighty two (43 males and 39 females) undergraduate students that used a Computer-Based Assessment (while being connected to the EEG) in the context of an introductory informatics course. Results confirmed our hypothesis as well as points of theory about gender differences concerning Information Technology (IT) acceptance variables. This is the first study to suggest that frontal asymmetry could serve as a valuable tool for examining IT acceptance constructs and better understanding HCI.

REFERENCES

- ❖ Davidson, R. J., Taylor, N., & Saron, C. 1979. *Hemisphericity and styles of information processing: Individual differences in EEG asymmetry and their relationship to cognitive performance*. In: Abstracts of the Papers Presented at the Eighteenth Annual Meeting of the Society for Psychophysiological Research. *Psychophysiology*, 16, 197
- ❖ Davis F.D. 1989. "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quarterly* (13), pp. 319 – 340.
- ❖ Dimoka, A., and Davis, F.D. 2008. "Where Does TAM Reside in the Brain? The Neural Mechanisms Underlying Technology Adoption". *ICIS 2008 Proceedings*. Paper 169.
- ❖ Moon, J., & Kim, Y 2001. "Extending the TAM for a world-wide-web context," *Information and Management*, (38:4), pp. 217–230.
- ❖ Riedl R., Banker R.D., Benbasat I., Davis F.D., Dennis A.R., Dimoka A., Gefen D., Gupta A., Ischebeck A., Kenning P., Möller-Putz G., Pavlou P.A., Straub D.W., vom Brocke J., Weber B. 2010. "On the foundations of NeuroIS: reflections on the Gmunden Retreat 2009," *Communications of the AIS* (27), pp. 243–264.
- ❖ Terzis, V., Economides, A. A. 2011. "The acceptance and use of computer based assessment," *Computers & Education*. (56:4), pp. 1032-1044.