

Psycho-physiological Methods in Information Science: Fit or Fad?

Heather O'Brien, University of British Columbia

Jacek Gwizdka, University of Texas at Austin

Irene Lopatovska, Pratt Institute

Javed Mostafa, University of North Carolina at Chapel Hill

Abstract

This interactive session focuses on the use of psycho-physiological methods in information science research. Through presentations, demos, and interactive discussion we will discuss and observe pragmatic issues of implementing these methods in IS and analyzing the data they generate. We will also examine the “fit” of these methods of measuring IS concepts and phenomenon, their reliability and validity, and the need for greater knowledge exchange amongst IS researchers to guide the effective use of these methods.

Keywords: psycho-physiological methods; methodological heterogeneity; measurement

Citation: O'Brien, H.L., Gwizdka, J., Lopatovska, I., Mostafa, J. (2015). Psycho-physiological Methods in Information Science: Fit or Fad?. In *iConference 2015 Proceedings*.

Copyright: Copyright is held by the author(s).

Contact: h.obrien@ubc.ca, jgwizdka@acm.org, ilopatov@pratt.edu, jm@unc.edu

1 Introduction

In an effort to solve practical problems of information selection, organization, and availability for effective use, Information Science (IS) is characterized by a high degree of interdisciplinarity [3; 11; 12]. Defined as the “integration of knowledge and/or methods from various disciplines brought together to address an issue or problem” [8 p. 9], IS interdisciplinarity manifests itself in several ways, including publication data [9], hiring experts from other disciplines [11], and methodological heterogeneity [5].

This interactive session focuses on methodological heterogeneity, specifically the adoption of psycho-physiological approaches in IS. Psycho-physiological methods have been applied in psychology, human-computer interaction, and health sciences for some time, but are relatively “new” for IS. Our goal is to examine the inherent opportunities and challenges in the use of these methods, and to examine their application and relevance to IS research. This session will appeal to those who are interested in methods generally, or who have or are considering applying physiological methods in their own work. Our intention is to create a community to support the implementation of psycho-physiological methods in IS to further work in this area and to create standards of practice for collecting and analyzing physiological data in information contexts.

2 Psycho-physiological Methods and Measures

One could argue that all methods employed in IS are interdisciplinary, due to our relative youth as a discipline, and the range of disciplinary backgrounds in iSchools. For instance, qualitative approaches (e.g., content analysis, interviews) were previously established in sociology, while experimental studies that use observation and surveys were derived from psychology. These and other methods are mainstays in IS, though some – such as ethnography - have shown increased application only within the past thirty years [4].

Most recently, psycho-physiological methods have been adopted in the investigation of IS phenomena, including emotion [10], interest and information relevance [1; 2; 6; 7; 13] and cognitive variables, such as mental effort [6]. Psycho-physiological methods include measuring brain activity (i.e., *neurophysiological*), skin conductance, muscle movement and heart rate to gauge visceral reactions to stimuli or situations, and tracking eye movements. Collectively these measures allow researchers to continuously monitor bodily and mental reactions below an individual's conscious awareness without interrupting task performance. They may be considered more objective compared to self-report methods (e.g.,

questionnaires). However, they require specialized knowledge, training, and equipment to employ. As such, specific topics for greater discussion within the IS community include:

- What *concepts of interest* are psycho-physiological methods best suited to measure?
- *Equipment* (e.g., eye trackers, electrodermal sensors) may be considered uncomfortable for participants and financially out-of-reach for some researchers, yet is becoming increasingly streamlined and more commercially available. What should researchers be looking for in selecting software and equipment?
- Psycho-physiological methods require *specialized signal processing knowledge* and *familiarity with highly complex data acquisition equipment*. Researchers must be able to deal with disparities in properties of data from different sources (e.g., different time scales).
- People react differently to stimuli, and it is not possible to “map” psycho-physiological responses to specific emotions (e.g., happiness), or cognitive processes (e.g. mental effort). We must examine how to *interpret this data* in meaningful and valid ways.

3 Agenda

This 90-minute participatory session will involve:

- Conducting demos and providing examples from previous studies;
- Facilitating discussion around the fit and application of psycho-physiological methods in IS.

Structure of the session:

1. Introductions and frameworks for the session (O'Brien; 20 minutes):
 - What are neurophysiological methods?
 - What are the applications of these methods in IS?
 - What are the inherent challenges and benefits of their use in our research?
2. Demo session (50 minutes);
3. Interactive discussion (15 minutes);
4. Wrap up (5 minutes)

The *demo session* will feature separate stations focused on pragmatic issues:

- *Mostafa* will demo data samples generated by physiological measuring devices (based on state-of-the-art tools). He will show one/two tools for skin conductance and/or heart rate based on a few test scenarios. He will then demonstrate how to capture, and format the data, and perform some basic analyses using the data.
- *Gwizdka* will focus on eye tracking data processing and modeling reading patterns in relation to search tasks. He will then show differences in eye movement patterns on Web pages (text documents) of different relevance degrees.
- *Lopatovska* will describe the use of facial recognition software for capturing emotion and the interpretation of this output.

The *discussion session* will focus on:

- Opportunities and challenges observed in the demo session;
- Issues of reliability and validity in the application of physiological methods;
- Fit of physiological methods to IS and phenomenon of interest in the discipline;
- The need for standards of use and fostering a community of practice.

4 Conclusion

The disciplinary composition of IS is changing and research problems continue to grow in complexity, due in part, to the changing nature and influences of technology. As such, we are actively looking for appropriate methods to tackle them. Psycho-physiological methods offer unique opportunities for measuring phenomena of interest that may deepen our understanding of information users and systems. While the topic of methodological heterogeneity in IS is not new, it is important to revisit the subject as new methods enter the discipline and present new opportunities and challenges.

Our intent is to engage the audience in active participation through the demos, and in conversation about the potential for and issues inherent with these methods. We also propose a broader discussion about the “fit” of these methods in IS, the relationship between subjective and physiological measures, and issues of reliability and validity.

Increasing the repertoire of methods employed may improve and corroborate existing IS models and theoretical frameworks, and allow us to develop predictive models. However, it requires open dialogue about the caveats of psycho-physiological methods and a forum for knowledge exchange that will enhance the rigor of their use and lead to discipline-specific standards.

5 References

- [1] Ajanki, A., Hardoon, D., Kaski, S., Puolamäki, K. & Shawe-Taylor, J. (2009). Can eyes reveal interest? Implicit queries from gaze patterns. *User Modeling and User-Adapted Interaction*, 19(4), 307–339.
- [2] Arapakis, I., Lalmas, M., Cambazoglu, B. B., Marcos, M-C. & Jose, J. M. (2014). User engagement in online News: Under the scope of sentiment, interest, affect, and gaze. *Journal of the American Society for Information Science and Technology*, DOI: 10.1002/asi.23096
- [3] Bates, M.J. (2007). Defining the information disciplines in encyclopedia development. *Information Research*, 12(4).
- [4] Case, D.O. (2008). *Looking for Information. 2nd ed.* Bingley, BD: Emerald Publishing Group.
- [5] Cronin, B. (2012). The waxing and waning of a field: Reflections on information studies education. *Information Research*, 17(3).
- [6] Gwizdka, J. (2014a). News Stories Relevance Effects on Eye-Movement. *Proceedings of ETRA'2014*. (pp. 283–286). New York, NY, USA: ACM.
- [7] Gwizdka, J. (2014b). Characterizing relevance with eye-tracking measures. In *Proceedings of the 5th Information Interaction in Context Symposium (IliX '14)*. ACM, New York, NY, USA, 58-67.
- [8] Holland, G.A. (2008). Information science: An interdisciplinary effort? *Journal of Documentation*, 64(1), 7-23.
- [9] Lariviere, V., Sugimoto, C.R. & Cronin, B. (2012). A Bibliometric: Chronicling of library science's first hundred years. *Journal of the American Society for Information Science and Technology*, 63(5), 997-1016.
- [10] Lopatovska, I. & Arapakis, I. (2011). Theories, methods and current research on emotions in information science, information retrieval and human-computer interaction. *Information Processing and Management*, 47(4), 575-592.
- [11] Saracevic, T. (2009). Information science. In M.J. Bates and M.N. Maack (Eds.) *Encyclopedia of Library and Information Science* (pp. 2570-2586). New York: Taylor & Francis.
- [12] Shera, J. H. & Egan, M.E. (1953). A review of the present state of librarianship and documentation. In S.C. Bradford (ed.) *Documentation. 2nd ed.* (pp. 11-45). London: Crosby.
- [13] Villa, R., & Halvey, M. (2013). Is relevance hard work?: Evaluating the effort of making relevant assessments. *Proceedings of SIGIR'13*. (pp. 765–768). New York, NY: ACM.