From General to Specific: Understanding Individual Characteristics and their Relationship with Neural Recordings during Media Consumption

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ABSTRACT

Neurophysiological methods and recording techniques are increasingly being embraced to enhance business intelligence about consumers’ behavior. Researchers have found evidence linking individual characteristics with variations in mental processing and user literacy for neurally-controlling computer interfaces. The work presented here seeks to better understand the relationship between individual characteristics and neural activations as recorded by electroencephalography (EEG) while participants viewed certain types of media online. A study conducted with 21 right-handed individuals demonstrates that the individual characteristics of smoking, hand dexterity, and experience playing certain types of video games correlate with neural activations in the frontal lobe, reflecting arousal and engagement. These correlations indicate the need to control for particular participant characteristics when conducting studies using neurophysiological recording techniques and expand considerations for incorporating such novel, yet insightful tools into the business intelligence practice.

KEYWORDS

Business Intelligence, Decision-Making, Decision Neuroscience, Electroencephalography, Individual Characteristics, Informational Systems, Media Consumption, Neuroeconomics, Neuromarketing, NeuroIS

INTRODUCTION

Various fields of business are increasingly embracing neurophysiological methods and recording techniques to better understand consumers, end-users, and their behaviors. Such information is a cornerstone for driving decisions by managers in the form of business intelligence and analytics (Davenport, 2010; Wixom & Watson, 2010). Within the information systems (IS) field, researchers are using such techniques to validate theories (Dimoka et al., 2012; Dimoka, Pavlou, & Davis, 2011), to better understand trust (Dimoka, 2010), technology acceptance (Dimoka & Davis, 2008), and enhance human-computer interaction (HCI) (Riedl, Randolph, vom Brocke, Léger, & Dimoka, 2010). Outside of IS, researchers in other fields of business, such as marketing and economics, are also utilizing neural recording techniques to better understand behavior and decision-making (Camerer, 2005; Lee, Broderick, & Chamberlain, 2007; Sanfey, Loewenstein, McClure, & Cohen, 2006). These insights into consumer behavior may support managers’ decision-making as they are gathered, stored, and analyzed (Bose, 2011). However, such insights based on neurophysiological data may not yet be incorporated into “[business intelligence] for the masses” (Negash, 2004, p. 182).
as is more likely with other common forms of data such as that collected using psychometric tools or gleaned from spreadsheet files.

With the increase in using neurophysiological techniques, researchers have found evidence linking individual characteristics with variations in mental processing about trust (Riedl, Hubert, & Kenning, 2010), behavior as a result of felt emotions (Leger, 2014), and user literacy for control of computer interfaces using neural input where some individuals have greater innate controllability than others (Allison & Neuper, 2010; Randolph, 2007, 2012). Characteristics are considered to be a person’s demographic and physiological traits, as well as his/her experience. These characteristics can vary across many dimensions. Differences based on characteristics such as gender, age, dexterity, and even hair color correlate with various recordings of neural activity (Randolph, Moore Jackson, & Karmakar, 2011; Randolph & Moore Jackson, 2010). With such findings, similar considerations should also hold for individual characteristics and their relationship to neural activations when assessing human mental states. Although neurophysiological recording techniques are built upon generalizations of the human brain, significant individual differences in brain patterns also exist, such as by gender, and have been found relevant to research in a variety of decision-making sciences (Ariely & Berns, 2010).

Studies in both IS and marketing often examine online interactions and perceptions by individuals when visiting websites considering factors such as culture and design on the user’s experience (Cyr, Head, Larios, & Pan, 2009; Sia et al., 2009). However, most studies do not examine the internal thoughts of the user through neural recordings which may uncover differences from self-reports or researcher observations. Thus, these neural recordings are seen to provide complementary data (Tams, Hill, Ortiz de Guinea, Thatcher, & Grover, 2014). With the increased bandwidth and capabilities of the Web, more individuals are consuming media online rather than in the more traditional setting of a living room with a television set (Morrison & Krugman, 2001; Zickuhr, 2010). Neural techniques have been applied in these traditional settings (Weinstein, Appel, & Weinstein, 1980), but these techniques may also prove useful when used to examine differences in online media consumption. This and other types of data may be beneficial as sources of competitive advantage for firms seeking to differentiate themselves from others in the industry (Foley, 2010). Further, such information may contribute to the accuracy and completeness needed for information quality, a key component of IS success (DeLone & McLean, 1992; Nelson, Todd, & Wixom, 2005).

As researchers in fields such as economics, marketing, and IS grow in appreciation of how neurophysiological techniques may be used to not only provide business intelligence, but also enhance their research, they should also grow in understanding the impact individual characteristics may have on experimental setup and data interpretation. The following sections describe media consumption, electroencephalographic (EEG) recording techniques, individual user characteristics, and how they relate. This work describes a study that explores the relationship between individual characteristics and neural activations of participants while viewing a music video and a television show on a laptop computer. Such relationships should be considered when attempting to responsibly leverage neurophysiological tools and techniques to enhance business intelligence.

MEDIA CONSUMPTION

Media consumption is a key factor of interest for practitioners and scholars in a variety of fields as media consumption has been shown to impact the way individuals interact with the surrounding world (A. M. Rubin, 1983). Marketers and advertisers must understand audience consumption and behavior regarding media as it may impact the way consumers engage with advertising content (Lin, 1994; Smith & Krugman, 2009). Content providers must also understand this engagement, especially in the
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