

# THE POTENTIAL OF USING NEURO-IS TO UNDERSTAND CONSUMER'S APPROACH-AVOIDANCE MOTIVATION IN ONLINE GROCERY RETAIL

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## ABSTRACT

There is a request for research to examine consumer-purchasing behavior in online grocery retailing. By definition, behavior includes both cognition and observable responses. Neuro-Information Systems (NeuroIS) is a framework that offers a reliable measurement of consumer behavior, through direct observation of the brain using neuroscientific techniques. This paper discusses a potential application of using electroencephalography (EEG) to measure approach-avoidance motivation in online grocery retail contexts. A review of the literature on approach-avoidance, web atmospherics, and frontal asymmetry is conducted, to form appropriate linkages between theory and its application to the online grocery context. Additionally, this paper provides an example for exploring the potential of NeuroIS in an online setting, to demonstrate potential benefits when it comes to understanding and predicting consumer motivation in an online grocery retail context.

## KEYWORDS

*Online grocery retail, applied NeuroIS, approach-avoidance motivation, frontal asymmetry, EEG, neurophysiological tools*

## 1. INTRODUCTION

In spite of the continued growth in electronic retailing, online grocery retail is still lagging behind other e-retail categories such as consumer electronics, books, and music. While grocery shopping accounts for a large proportion of consumer spending, it has struggled to make a successful transition to the online domain. According to a recent survey by PricewaterhouseCoopers (2016), when asked about purchases over the last 12 months, 42% of the global sample stated that they do not buy groceries online. Furthermore, 55% of global respondents mostly preferred buying groceries in-store versus 11% for online via PC (the highest and lowest values for any category). Consequently, grocery retailing showed highest percentage of actual buying in-store (72%) and the lowest percentage of buying online via PC (11%). These findings suggest that buying groceries online might not fit into existing behavior patterns of consumers, or that there might be some behavioral changes required for consumers to shift their grocery buying behaviors to the online domain. Clearly, there is a need to better understand and predict consumer behavior in this context.

Previous research indicates that convenience is the most salient motivation for buying groceries online, however, there is little consensus regarding other motivating factors (see Rohm and Swaminathan 2004;

Morganosky and Cude 2000; Ramus and Asger Nielsen 2005). Others studies might provide some explanation for such discrepancies, as previous experiences with online grocery shopping have an impact on consumer attitudes (Mortimer et al. 2016; Hansen 2008). Other variance could be attributed to the fact that online grocery shopping is considered to be highly influenced by situational factors (Hand et al. 2009; Huang and Oppewal 2006). Therefore, consumer attitudes and intentions might not be adequate to examine consumer motivation in the context of online grocery retail. Purchase intentions/attitudes can differ from behavioral data. Additionally, behavioral data can also vary when there is an actual interaction with information technology. Thus, it might be appropriate to examine consumer motivation in the online grocery context combining neurophysiological and behavioral science methods.

Neuroscientific approaches enable a more comprehensive understanding of processes that affect human behaviors. Information systems research examines human decision-making and behavior in several interactive e-commerce contexts. Neuro-Information Systems (NeuroIS) is a relatively new subfield in information systems literature that is based on the idea of using cognitive neuroscience theories, methods and tools in information systems research (Dimoka, Pavlou, and Davis 2011, 2007; Riedl et al. 2010). NeuroIS contributes to the theoretical understanding of the design, development, use, and impact of information technologies and practically relevant variables (Müller-Putz, Riedl, and Wriessnegger 2015). Therefore, NeuroIS can be a beneficial approach to increase understanding and prediction of consumer motivation within the online grocery-retailing context.

Approach-avoidance motivation is a concept that has the possibility to bridge the connection between NeuroIS and the online grocery retail context. Approach-avoidance describe the major systems that motivate behaviors in reaction to classes of appetitive (rewarding) and aversive (punishing) stimuli (Corr 2013). Multiple systems of approach-avoidance have been studied in the brain (see Elliot 2008 for an extensive review). Substantial research demonstrates that approach and avoidance motivational tendencies can be indexed by electroencephalographic (EEG) asymmetry over the prefrontal cortex (Harmon-Jones, Gable, and Peterson 2010). Using neurophysiological tools, such hidden mental processes can be objectively measured to inform IS research (Dimoka, Pavlou, and Davis 2011). Specifically, we propose that measuring approach-avoidance using frontal EEG asymmetry will better predict consumer purchasing behaviors in online grocery retail.

Within online retailing, frameworks of web atmospherics have operationalized approach-avoidance responses as the outcomes of shopping behaviors (Eroglu, Machleit, and Davis 2001; Dennis et al. 2009). However, approach-avoidance response have been measured using survey questionnaires, which can be vulnerable to subjective influences (e.g., Dimoka, Pavlou, and Davis 2011). Here is where NeuroIS can contribute, as one of the major arguments for using neurophysiological tools in IS research is to measure objective data directly from the human body (Dimoka, Pavlou, and Davis 2011; Dimoka et al. 2010).

To the best of our knowledge, no studies have used neurophysiological tools to understand consumers' approach-avoidance motivation in an online grocery retail setting. Therefore, the aim of this paper is to discuss how NeuroIS can be used to understand consumers' approach-avoidance motivation in an online grocery retail situation. This should provide a valuable contribution for both researchers and practitioners that seek to understand and predict customer behaviors in this context. This rest of this paper consists of three parts. The first part provides a discussion of the concept of approach-avoidance, web atmospherics, and frontal asymmetry related to approach/withdrawal tendencies. The second part is a discussion of the potential of using neurophysiological tools to understand consumers' approach-avoidance motivation in the grocery-retailing situation. Finally, a concluding section with implications for research and practice is given.

## **2. THE POTENTIAL OF NEURO-IS**

Approach-avoidance is a central underlying premise in many areas of psychology (Elliot 2006). Approach-avoidance mechanisms are fundamental and integral to almost all reactions (psychological or physical) towards environmental stimuli (Elliot 2008, 2006; Elliot and Covington 2001). Approach-avoidance has been extensively used in the analysis of motivation and behavior (cf. Elliot 2008). Approach motivation may be defined as the energization/direction of behavior by/toward, positive stimuli (objects, events, possibilities), whereas avoidance motivation may be defined as the energization/direction of behavior by/away from, negative stimuli (objects, events, possibilities) (Elliot 2006).

Within the study of consumer behavior, approach-avoidance has been used quite often in retail research (Arnold and Reynolds 2012). The prominent use of the approach-avoidance has been used in the study of atmospherics in retail settings. Literature on retail environments draws its theoretical foundation from environmental psychology and the Stimulus-Organism-Response (S-O-R) paradigm (Turley and Milliman 2000; Sautter, Hyman, and Lukosius 2004). These approaches emphasize the influence of the environment on an individual's behavior. The Mehrabian and Russell (1974) environmental psychology model has been used to investigate the influence of atmospheric cues on behavior. Using this model, Donovan and Rossiter (1982) conducted the earliest empirical study examining the influence of retail store environments on consumer behavior. Since then, considerable evidence has been generated which verifies that there is a significant impact of retail environment on shopping behaviors (Turley and Milliman 2000; Eroglu, Machleit, and Davis 2003).

Eroglu, Machleit, and Davis (2001, 2003) have provided the conceptual and empirical support for the extension of S-O-R model to electronic retailing. In this model, the atmospheric elements (the stimulus) that affect the internal (affective and cognitive) states of an organism that result approach-avoidance responses. Their taxonomy for online environmental cues is broadly divided into high-task relevant cues and low task relevant cues, based on how they affect the completion of the shopping task (Eroglu, Machleit, and Davis 2001). High task-relevant cues comprise of content related to the actual shopping goals (pictures, price, description, ratings, etc.). Low task-relevant cues comprise of content, which is unrelated to the main shopping goal (fonts, layouts, borders etc.). High-task relevant cues are utilitarian in nature as they help the shopper achieve his or her shopping goal, while low-task relevant cues are considered more hedonic or experiential (Eroglu, Machleit, and Davis 2003). Several authors have extended and modified this taxonomy to encompass a wider range of components (Sautter, Hyman, and Lukosius 2004; Vaiciukynaite and Gatautis 2013).

Regardless, of the additions or adaptations made to this model, approach-avoidance responses have been inferred from answers to questionnaires, hence measuring behavioral intentions and not behavior. Donovan and Rossiter (1982) state that all responses to an environment can be regarded as approach or avoidance behaviors. Approach behaviors relate to a willingness or desire to move toward, stay in, explore, interact in, perform in, and return to the environment. Avoidance behaviors relate to the opposites of the above: deteriorated performance, dissatisfaction, feelings of anxiety or boredom, unfriendliness to others, and a desire to leave the environment and not return. This statement highlights two important points; firstly, it confirms that there are multiple types and levels of approach-avoidance responses towards atmospheric stimuli (Elliot 2008). Secondly, approach-avoidance behavior can be operationalized in a number of ways (e.g., time spent, amount spent, degree of exploration, degree of communication etc.). Within an online retail grocery setting, these can be either time spent on websites (exploration), click rates, or leaving ratings, comments (interaction). Thus, we propose that frontal asymmetry index of approach-avoidance might be a more reliable way to operationalize consumers' approach-avoidance responses to web atmospheric variables that might influence their purchase behavior.

One of the neuroscience tools proposed by NeuroIS researchers is the EEG, which is regarded as a valuable usability metric, when used effectively in appropriately designed experiments (Riedl et al. 2010). An EEG measures electrical activity from the brain using non-invasive electrodes placed on the scalp (see Müller-Putz, Riedl, and Wriessnegger 2015 for more information on the tool). Previous research has provided significant support for the approach/withdrawal framework that is used to analyze and connect EEG asymmetries in the frontal cortex with approach-avoidance motivation (Davidson 1998, 2004). This approach/withdrawal framework, approach-related tendencies are reflected by the relative higher activity in the left frontal cortex and the converse being true for withdrawal-related tendencies (Davidson 1992). Frontal EEG activity is measured at resting trait levels (dispositional factors) and state-related activation (factors related to temporary responses – e.g. emotional factors) (Coan and Allen 2003). This model has found significant support in literature, and therefore, provides a valuable source for the interpretation of EEG data recording frontal hemispheric asymmetries.

### **3. USING NEURO-IS TO UNDERSTAND APPROACH-AVOIDANCE MOTIVATION WHEN CONSUMERS SHOP FOR GROCERIES ONLINE**

The proposed method/approach to understand the impact of situational variables on consumers approach-avoidance motivation, will be similar to the approaches discussed in Cherubino et al. (2015) and Bagdziunaite

et al. (2014). These publications use a combination of portable EEG and eye-tracking equipment to measure consumer responses in the physical retail store settings. Frontal asymmetry is used to measure the motivational tendency, and eye-tracking measures what the participant focuses on. Additionally, the strength of arousal, experienced during the purchasing process, can be measured using electro-dermal reaction (EDR) similar to Groeppel-Klein (2005). Using these methods together can allow for real-time measurement of consumer responses to environmental stimuli throughout the duration of their shopping journey in the online grocery context.

Evidence confirms that the asymmetric engagement of the frontal parts of the brain are related to motivation (Harmon-Jones, Gable, and Peterson 2010). It must be emphasized that frontal asymmetry is a response to motivational direction and not affective valence (Harmon-Jones 2003; Harmon-Jones 2004). With affective valence being the positive or negative emotional value assigned by an individual to any stimulus (i.e., pleasant or unpleasant). Similarly, Berkman and Lieberman (2010) found that frontal asymmetry was related to action motivation and not stimulus valence. They found stronger activation of the left frontal cortex during approach actions, but not for pleasant versus unpleasant stimuli. For example, in the online grocery context, a consumer might have a strong affective stance against meat products, but has to buy them for guests when hosting dinner parties. The resulting frontal asymmetry will indicate the actual purchasing tendency and not the affective evaluation.

Studies have demonstrated that frontal asymmetry holds substantial promise in the application of consumer behavior research. In advertising frontal asymmetry has been used a diagnostic tool to evaluate between alternatives creative ideas (testing advertisement effectiveness) (Ohme et al. 2010). Frontal asymmetry can measure significant differences in neurophysiological reactions between similar stimuli that respondents cannot clearly describe using verbal reports (Ohme et al. 2010, 2009). Within the context of online grocery retail, using the approach mentioned previously, website design alternatives can be examined on a continuous basis such as the entire duration spent navigating a website when shopping for groceries online.

Miller and Tomarken (2001) found that monetary incentives have an impact on frontal asymmetry. They demonstrated that higher potential monetary gains affected stronger left frontal cortex activation (i.e., approach motivation). Ravaja, Somervuori, and Salminen (2013) used frontal asymmetry to predict consumer choice. They found that relatively greater left frontal activation (i.e., approach motivation) predicted higher likelihood of purchase of groceries (national brand vs private label brands with varying price levels). For the context of online grocery retail, the effectiveness online promotions (e.g., online flash sales, offers, digital coupons) can be examined, and the likelihood of purchase can be better understood and predicted.

Environments whether physical or virtual influence consumer behavior (Turley and Milliman 2000; Eroglu, Machleit, and Davis 2003). Which, in turn, influence multiple types and levels of approach-avoidance responses to atmospheric stimuli. This holds several implications for understanding consumer behavior, as multiple systems of approach-avoidance might be operating simultaneously. This supports the argument for using the NeuroIS framework because these multiple systems might not adequately be accessed by self-reporting measures. NeuroIS can greatly benefit researchers and practitioners by measuring consumer's observable neural responses. This paper suggest examples on how to complement existing sources of data with brain data (Dimoka et al. 2010), by using atmospheric models of web retailing with approach-avoidance measurements using frontal EEG asymmetry. However, as no single method can provide a comprehensive understanding, a triangulation of multiple methods might increase the existing predictive power of frontal asymmetry (i.e., Ravaja, Somervuori, and Salminen 2013) by for example combining with self-report and biometric (e.g. eye-tracking) methods.

## 4. CONCLUSION

The aim of this paper is to discuss how NeuroIS can be used to understand and predict consumers' approach-avoidance motivation in the online grocery retail context. From this discussion, we have demonstrated that the NeuroIS framework has the potential to reliably measure approach/withdrawal motivational tendencies using frontal EEG asymmetry. The benefits of this approach is that neurophysiological measurements of motivation are not subject to the same inconsistencies that plagued previous measures of consumer motivation in online grocery retailing. Furthermore, this measure of approach-avoidance motivation can be utilized during real-time interaction with online grocery retail websites. Limitations of this approach can be attributed to

experimental design, as poorly designed experiments will result in poor data. EEG measures electrical activity, so artifacts are an inherent part of the data. These can be effectively dealt with using a variety of methods (cf. Müller-Putz, Riedl, and Wriessnegger 2015).

By using NeuroIS, research on online atmospheric variables within online grocery retail can be progressed further. Especially since previous approaches in the study of atmospherics have generated mixed results. The task for future research is to develop an organizing conceptual framework to examine the influence of environmental variables using frontal asymmetry. To practitioners, this approach will be useful to evaluate between alternative website designs, and examine approach-avoidance related to online promotions and cues present on their websites. Using such an experimental approach will allow for effective manipulation in an applied context. In particular, frontal EEG asymmetry is a potentially viable index to predict consumer behavior by measuring approach/withdrawal motivational tendencies. Therefore, NeuroIS, which is based on psychological, biological and psychophysical approaches, has the potential to expand our understanding and prediction of consumer behavior in the online grocery retail context.

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