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The promise and perils of the peripheral psychophysiology of emotion in retailing and consumer services

Mathieu Lajante*, Riadh Ladhari

Research Centre on Retailing and Digital Marketing, Faculty of Business Administration, Laval University, Quebec, Quebec, Canada G1V 0A6

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ABSTRACT

In this paper, we call for a peripheral psychophysiology approach in order to fully unlock the potential of affective neuroscience in retailing and consumer services. We assume that using peripheral psychophysiological measures of embodied cognition and emotion such as facial EMG and skin conductance responses would greatly contribute to a novel understanding of consumers' judgements, decision-making, and behaviors. To do so, it is necessary to overcome the difficulties formerly encountered in applying psychophysiological methods in marketing in order to contribute to an emerging stream of applied peripheral psychophysiology research. Accordingly, we answer three fundamental questions (*What? How? When?*). Afterward, we discuss three critical points (*perils*) researchers should carefully consider when applying peripheral psychophysiology measures in retailing and consumer services research.

1. Introduction

A large body of experimental evidence documents that emotions and subsequent attitudes are primarily implicit, which means they can occur outside of a consumer's conscious awareness (Lee et al., 2018). To date, both marketing scholars and neuroscientists have stressed these important limitations of human consciousness and have addressed why marketing researchers should consider implicit affective processes as well (Plassmann et al., 2015; Lee et al., 2018). Nevertheless, to the best of our knowledge, few studies have embraced the use of neuroscientific models and methods in retailing and consumer services to disentangle implicit and explicit emotional processes at the store. However, we believe that concepts and methods from affective neuroscience can greatly improve our understanding of the nature of emotion in retailing and its effects on individuals' attitudes and behaviors. Specifically, we submit that the study of emotion in retailing and consumer services should be updated and clarified using psychophysiology.

Psychophysiological measures have gained some popularity in the last decade in academic research and business practices (Plassmann et al., 2012, 2015; Agarwal and Dutta, 2015; Boksem and Smidts, 2015; Çakir et al., 2018). The psychophysiological techniques can accurately assess consumer decision-making processes and reactions to environment stimuli, such as the effects of the retail setting environment (e.g., ambient scent, music, and color) on in-store shopper behavior. For instance, psychophysiological measures are shown to be appropriate for predicting the

power of future market performance for new products (Baldo et al., 2015), emotional processes for different pricing levels (Somervuori and Ravaja, 2013), advertising effectiveness (Venkatraman et al., 2015; Krampe et al., 2018), and purchase decision (Çakir et al., 2018). Psychophysiological measures have the potential to overcome limits of self-report measures and observable behavioral measures by directly accessing consumers' mental processes such as emotion, cognition, and the interaction between them (Plassmann et al., 2012; Agarwal and Dutta, 2015). Somervuori and Ravaja (2013, p. 479) contended that:

“Psychophysiological measures can potentially add a new dimension to the understanding of emotional processes—a dimension that researchers cannot necessarily tap if they only record behavioral responses. Their use may lead to a more complete and objective understanding of consumer desires, and may consequently assist companies to adjust their strategies.”

Despite the interest in psychophysiological methods, their use in marketing and retailing research is still relatively limited for many reasons. First is the lack of methodological details and validity issues related to the use of psychophysiology in consumer research. Most of the applied psychophysiological studies do not provide methodological information regarding how they process, record and quantify, and interpret physiological signals, which prevents a comparison of findings and an assessment of methods' effectiveness. Second, psychophysiological research heavily used central psychophysiological measures, such

* Correspondence to: Faculty of Business Administration, Laval University, Canada.

E-mail address: Mathieu.Lajante@fsa.ulaval.ca (M. Lajante).

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as functional magnetic resonance imaging (fMRI), which are prohibitively expensive, invasive, and time consuming, compared to peripheral psychophysiological measures. It is now well established that embodied cognition and emotion emerge from the bodily interactions with the environment through the senses (Krishna and Schwarz, 2014). Therefore, measuring the activation of the peripheral nervous system (as compared to the central nervous system) is particularly well suited for studying interactions of psychological and physiological processes that are relevant for understanding how consumers process sensory information. Third, the ecological validity, which refers to the relationship between the real world and the traditional laboratory test environment is questionable when using central psychophysiological measures.

In order to positively contribute to the rise of the psychophysiological approach in retailing and consumer services, particularly with the use of peripheral psychophysiological measures, we propose some conceptual and methodological issues that should be taken into account when investigating consumers' embodied cognition and emotion. Accordingly, this paper consists of two sections. In the first section, we answer three questions centered on the importance of an implicit emotional experience: what is psychophysiology? How can a psychophysiology perspective advance research on emotions in retailing and consumer services? When is psychophysiology relevant for studying emotions in retailing and consumer services? In the second section, we discuss the perils of missing three important points when dealing with psychophysiology in retailing and consumer services research: the *So what?* question, the methodological transparency, and the ecological validity.

2. What is psychophysiology?

In the third edition of the Handbook of Psychophysiology, Cacioppo et al. (2007, p. 4) defined psychophysiology as “*the scientific study of social, psychological, and behavioral phenomena as related to and revealed through physiological principles and events in functional organisms*”. In other words, psychophysiology uses various physiological variables with the goal of addressing psychological research questions (Hot and Delplanque, 2013). Applied to marketing research, psychophysiology aims to go further in understanding consumers' psychological processes (e.g., emotions) through their physiological correlates (e.g., facial expressions of emotion) to investigate the effect of physical or virtual point-of-purchase marketing (e.g., sensory stimuli) on consumers' behaviors (e.g., purchase intent).

Psychophysiology is not categorically different from neuroscience which was used in marketing in the last few years (e.g., Smidts et al., 2014; Plassmann et al., 2015). However, it is noteworthy that within this stream of literature, the authors mainly focused on brain-imaging techniques such as fMRI or EEG, then putting aside other physiological measures. One explanation of this focus is that the brain and the central measures are at the frontline of popular expectations when referring to neuroscience. And fMRI techniques appear as the “gold standard” of neuroscience measurement (Cui et al., 2011): 60–85% of neuroeconomics research used only brain-imaging techniques (Kable, 2011). Nevertheless, this narrow focus on central nervous system measures may lead to overlook more affordable methods for investigating consumers' emotional experiences. Accordingly, we submit that *peripheral* rather than *central* psychophysiological measures are more affordable for marketing researchers and moresuitable for managerial applications. And we think researchers should update and clarify the study of emotion by adopting a peripheral perspective.

Compared to central measures, peripheral psychophysiological measures (PPM) are non-invasive, wireless wearable, cost-effective, and rather straightforward to record with only skin-mounted (surface) electrodes. Afterward, measuring the peripheral nervous system activation through a wide range of body signals is particularly well suited to study interactions of psychological and physiological processes that

are relevant for understanding how consumers process information. Indeed, specific organs can be targeted in order to understand how emotional episodes inform consumers' judgement and how they use bodily information as any other formal information for decision-making processes (Krishna and Schwarz, 2014). This “embodied cognition” approach is based on the principle that PPM are indirect evaluations of brain activity as it is assumed that our organism is under the control of the central nervous system (which includes the brain, the cerebellum, and the spinal cord). Accordingly, body activation by environmental or interoceptive stimuli results from information issued by the central nervous system and conveyed to it by the peripheral nervous system which includes the somatic nervous system and the autonomic nervous system. On the one hand, the somatic nervous system is further divided into sensory (e.g., feeling the temperature in the room) and motor (e.g., smiling by contracting zygomatic) functions. On the other hand, the autonomic nervous system regulates “involuntary” organs and is further divided into the sympathetic nervous system (related to stress and exciting activities) and the parasympathetic nervous system (related to relaxation and inhibited activities).

The afore-described perspective of the embodied mind—where the brain and the body are fundamentally entangled—leads to four basic principles with which researchers need to grapple to reap the full benefits of PPM in retailing and consumer services (adapted from Potter and Bolls, 2012, p. 24–35):

- The brain is “embodied”: it is an organ fully connected to the entire body through the peripheral nervous system. Accordingly, psychophysiology assumes that “*cognition depends on the kinds of experiences that come from having a body with particular perceptual and motor capacities that are inseparably linked and that together form the matrix within which reasoning, memory, emotion, language, and all other aspects of life are meshed*” (Thelen et al., 2001, p. 1).
- The work of the brain and the body happens over time: embodied cognition and emotions are dynamic processes. It is important to emphasize the central role of time since it has significant influence on experimental design, the property of selected stimuli, signal recording and analyzing, and the interpretation of the results. As stated by Lang et al. (2009, p. 186), “*dynamic systems increase and decrease in an analog, not a digital, fashion. Therefore, thinking leads to changes which occur over the course of milliseconds or seconds, whose impacts on the biological and physiological systems grow and wane with the vagaries of thought*”. This is, in fact, one of the main reasons why describing an emotion as an “episode” is more relevant than a “state”.
- The body's primary job is to keep itself alive: using PPM in retailing and consumer services must not obscure the principle of homeostasis (Bernard, 1878). Although PPM correlated to marketing stimuli allow us to investigate cognitive and emotional processes, the primary goal of these physiological reactions is to keep our organism in balance and alive. In order to distinguish physiological responses related to external stimuli (e.g., music in the store) from physiological reactions related to internal body processes (e.g., maintaining constant body-temperature), researchers need to process properly the signal of PPM. Especially, signal processing allows researchers to divide the recorded signal into tonic and phasic components. The tonic component is related to homeostasis processes while the phasic component is related to external stimulation (see Fig. 1).
- Cognitive processes can be inferred from bodily reactions: the basic principle of psychophysiology is to identify a correlation between psychological processes and physiological responses. However, a tangled brain and body complicate the identification of such correlations since several body processes (e.g., respiring, digesting, regulating)—in addition to psychological processes—can contribute to the elicitation of a single physiological response. In order to address this issue, researchers in marketing should follow two rules. First, it is of the utmost importance to anchor the research question and the

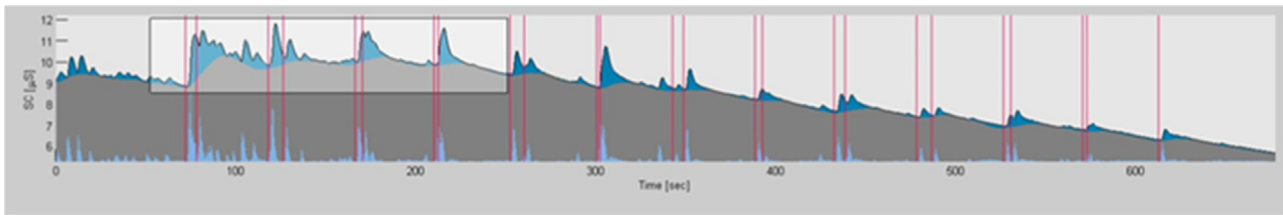


Fig. 1. Tonic and phasic components of skin conductance signal. The tonic activity (grey component) varies slowly over time and aims for thermoregulation process. The phasic activity (blue component) varies sporadically in response to external stimulus onset marked by triggers in red lines (extracted from Ledalab software; Benedek and Kaernbach, 2010; Lajante et al., 2012). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

experimental design in a specific conceptual framework that will help to hypothesize and give meaning to the physiological responses. Then, it is necessary to supplement the PPM with other data collection methods such as self-report methods and behavioral methods. Therefore, marketing researchers could triangulate data and correct misconceptions.

Several PPM are available for evaluating peripheral nervous system activation during emotional episodes (for a review, see: Wang and Minor, 2008; Droulers and Lajante, 2015). In particular, facial electromyography (facial EMG) and skin conductance responses (SCRs) are two well-documented methods for investigating the somatic nervous system and autonomic nervous system activations respectively (Lajante et al., 2012, 2017). Facial EMG is a method for recording and quantifying the electrical activity produced by the muscle fibers of activated motor units (Clancy et al., 2002). Facial EMG provides a sensitive, precise, and continuous analysis of emotional valence that cannot be matched by other methods. As pointed out by Cacioppo et al. (1986, p. 261), “the neural activation of the striated muscles results in muscle action potentials that can be detected using EMG even when there are no perceptible muscle contractions”, which is a great advantage compared to the cloud-based online facial analysis through computer vision such as FaceReader® software. Surprisingly, and even though it is commonly used in psychophysiology, only few studies have been carried out in marketing to underline how facial EMG can provide valuable information on consumers’ emotional experience (Wang and Minor, 2008). Among these studies, facial EMG has been used to examine the valence of emotional responses to commercial ads (e.g., Hazlett and Hazlett, 1999), to non-commercial ads (e.g., Bradley et al., 2007) as well as to radio ads (Bolls et al., 2001), and to investigate the emotional processes underlying purchase behavior (Somervuori and Ravaja, 2013). Globally, results from the identified studies appear consistent with those emerging from psychophysiological ones: exposure to positive stimuli elicits facial EMG responses over the cheek region (*zygomaticus major* muscles), while exposure to negative stimuli elicits EMG responses over the brow region (*corrugator supercilii* muscles) (for a review: see Droulers and Lajante, 2015). SCRs refer to the variability of the electrical properties of the skin in response to the secretion of sweat by the eccrine sweat glands. These glands have a wide distribution over the palms of the hand and the soles of the feet, and are very responsive to psychologically relevant stimuli. They are under the control of the autonomic nervous system whose orders are transmitted by the central nervous system such as the limbic structures (hypothalamus, cingulate gyrus, and hippocampus) involved in emotional responses (Boucsein, 2012). Today, there is a broad consensus that SCRs are markers of relevant events associated with a significant increase of physiological arousal during emotional episodes (Andreassi, 2007; Dawson et al., 2011; Sequeira et al., 2009; Boucsein, 2012). In marketing, researchers used SCRs as PPM of emotional arousal to investigate the efficiency of commercial ads (e.g., Peacock et al., 2011), merchandising (Groepel-Klein, 2005), video game ads (Micu and Plummer, 2010; Gangadharbatla et al., 2013; Maxian et al., 2013), as well as price

framing (Somervuori and Ravaja, 2013). Broadly speaking, PPM such as facial EMG and SCRs provide at least three main advantages for researchers in retailing and consumer services. First, as continuous measures, PPM allow to track consumers’ emotional episode throughout the consumption experience and to identify affect-laden events. Second, PPM allow shedding light on automatic and/or unconscious consumers’ emotional processes in addition to the self-reported subjective feelings. Third, PPM “help to confirm the existence and strength of the initial spontaneous emotional reaction, the base of the subsequent feelings and judgements” (Micu and Plummer, 2010, p. 139). Accordingly, PPM might improve the investigation of consumers’ emotion in retailing and consumer services—a point we discuss further in the next section.

3. How can a peripheral psychophysiology perspective advance research on emotions?

The importance of emotional processes is reflected by current emotion research, which has shown how erroneous it is to try to study any aspect of human thought or behavior without addressing emotions (Lerner et al., 2015). This “affective revolution” has led researchers to recognize that there has been an under-appreciation of the role of implicit affect and automatic processing in current retailing and consumer services theories. Indeed, emotions are not only consciously experienced. But they can also be rapid, automatic, and even not always available for report; they can comprise unconscious evaluations in response to stimuli and give rise to more explicit processes and their outcomes, such as judgements and all kinds of behaviors. One of the most prominent sources of implicit affect derives from the consumers’ point-of-purchase experience. Following a dynamic process, affect-laden events elicit consumers’ emotional episodes, that encompass both neuropsychological and psychophysiological correlates, which shape subsequently consumers’ judgements, action readiness (e.g., approach-withdrawal tendencies), and behaviors. Moreover, since consumers’ goals are subjective and situation-dependent, virtually any point-of-purchase event can elicit emotional responses. Although a large body of research has investigated the role of consumers’ emotions in retailing and consumer services (Das and Varshneya, 2017; Helmefalk and Hultén, 2017), studies that measure emotional reactions and their subsequent effects with nonverbal methods are scarce, which suggests a methodological myopia. The overdependence on self-report methods, such as interviews and questionnaires, is questionable, especially for investigations of the power of emotional reactions to explain consumption experience. However, an emotion is an episodic, dynamic, and recursive process, physiologically rooted, that cannot be reduced to its conscious dimension (Sander et al., 2005). Therefore, focusing only on the conscious emotional experience and forgetting the underlying unconscious emotional processing just highlight the tip of the iceberg. Hence, we argue that PPM will help researchers to advance research on emotion in retailing and consumer services. Especially, we pose that peripheral psychophysiology is not only a matter of *methods*, it is also a question of *concepts*. As such, peripheral psychophysiology should be

thought of as an interpretive framework that sheds new light on existing problems, as well as raising questions that might not be raised otherwise. Moreover, concepts and theories from psychophysiology and affective neuroscience help to hypothesize and interpret the role of physiological responses in retailing and consumer service research. We define in the following points what an emotion is and how PPM can enable to go further in understanding consumers' emotional influence in retailing and services research through four main requirements.

3.1. Emotion is a multicomponent process

An emotion has long been associated with the presence of a high physiological activity. For instance, James (1884) postulated that an emotion is the consequence of physiological reactions (peripheralist approach). In contrast, Cannon (1927) postulated that physiological reactions are the consequence of an emotional episode (centralist approach). Whatever the debate about the sequence, physiological reactions are correlated to an important event and serve to energize the organism in order to prepare an adaptive behavioral reaction (Aue, 2009). And we support that a strong understanding of emotion is critical to succeed in applying PPM retailing and consumer services research. Based on an evolutionary perspective, an emotion is a dynamic process related to utilitarian benefits. We define it as “a dynamic episode that involves a process of continuous change in all of its subsystems (i.e., the components of emotion) to adapt flexibly to events of high relevance and potentially important consequences” (Grandjean et al., 2008, p. 485). The onset of an emotional episode is supported by five components: a cognitive (evaluation of the surrounding environment), an autonomic (system activation and regulation), a motivational (preparation and direction of action), a motor expressive (communication of reactions), and a subjective feeling (subjective experience) component (Sander et al. 2005). Each of these components provides specific information that cannot be accessed by another. Moreover, there is no “gold standard” for measuring emotion (Mauss and Robinson, 2009) since the choice of the method depends on the targeted emotional component. It does not mean that the five emotional components always need to be tested as a whole, at one time. Rather, researchers should first consider the managerial question and the role of emotion as an informative index of consumers' experience. Therefore, they will be able to identify the relevant component of an emotion and the suitable method for measuring it. A such, considering the multi-componential nature of emotional episodes would help to fully exploit the consumers' nervous whole system. Although the upsurge interest of neuroscience in marketing has led some researchers to only focus on the brain, it must be reminded that neuroscience means the study of both the central and the peripheral nervous system. Therefore, measuring the autonomic nervous system by means of SCRs (emotional arousal) or the somatic nervous system by means of facial EMG responses (emotional valence) is also relevant to investigate the consumers' emotional responses related to consumption experience.

3.2. Emotion is an event-related process

An emotional episode is elicited and dynamically patterned by the occurrence of an event, which is appraised by consumers as goal relevant, goal congruent/incongruent, positive/negative and novel/familiar (Moors et al., 2013). However, an emotion is energy intensive and all the stimuli do not require to elicit emotional responses all the time. In order to preserve our cognitive and physiological resources, the brain automatically sorts information in the environment and selects the relevant other that can have a positive/negative impact on the individual's well-being. The outcome of this appraisal process will subsequently determine the nature of the emotion. Therefore, if the consumers are passively exposed to marketing stimuli, they will likely feel an “aesthetic” emotion. If they are instead actively engaged in a task (e.g., decision making) with potential important consequences, they

will likely feel a “utilitarian” emotion. Aesthetic emotions are described as “aesthetic” because they are “triggered in situations that usually have no obvious material effect on the individual's well-being and only rarely lead to specific goal-oriented responses” (Scherer and Zentner, 2008, p. 596). Aesthetic emotions are not completely disembodied. But the physiological reactions are not oriented toward adaptive action tendencies and so display low amplitudes. Because aesthetic emotions are more reactive than proactive, physiological changes relate to the intrinsic qualities of the stimulus, whatever the context—a chocolate cake remains intrinsically pleasant even though you go on a diet and perceive it as goal-obstructive for your summer plan. In a context of research in retailing, eliciting an aesthetic emotion will help to understand what the consumers like, independently from any context. In contrast, the main function of “utilitarian” emotions is to prompt adaptive individual behaviors—including several alternative action tendencies—in response to the occurrence of an event with important consequences for the consumer's interests. Therefore, eliciting a utilitarian emotion will help to understand what the consumers want, depending on the context. The distinction between aesthetic and utilitarian emotions is of the utmost importance to determine whether physiological measures are useful and to draw reliable market predictions. Investigating consumers' liking does not necessarily require physiological measures since aesthetic emotions can be seized by self-report methods. Conversely, investigating consumers' wanting involves physiological measures since utilitarian emotions are ephemeral, automatic and oriented toward action tendencies.

3.3. Emotion is a subjective process

The elicitation and differentiation of an emotional episode is based on appraisal, the continuous, recursive subjective evaluation of an event (Scherer, 2009). Accordingly, the aforementioned componential approach of emotion attaches great importance to the subjective feelings component, which serves as the basis for the conscious representation of emotional processes (“the subjectively experienced feelings of emotion”; Zentner et al., 2008, p. 497). The subjective feeling component represents a central component of emotion that integrates all the underlying emotional processes such as the activation of physiological and expressive components (Grandjean and Scherer, 2008). Does it mean that self-report methods are more suitable than physiological ones in the context of retailing and consumer services research? This is not the right question to ask. Instead, researchers should first determine the nature of the emotional episodes they expect to study. Let us consider the study of emotions elicited by point-of-purchase advertising. According to Lajante (2015), the passive exposure to such advertising is likely to elicit aesthetic emotions that should be studied as feelings. This is consistent with Aaker et al. (1988) who acknowledged that consumers' subjective feelings would be more appropriate for investigating advertising effectiveness. In his study, Lajante (2015) has shown that subjective feelings serve as a mediator between the physiological responses of emotion elicited by a TV commercial (i.e., both facial expressions and skin conductance responses) and attitude toward the commercial. In such situations, the self-report method for measuring consumers' subjective feelings appears as a relevant approach to investigate aesthetic emotions. However, consumer researchers should remember that almost any affect-laden event in the consumption environment can elicit a large range of emotions among consumers. Therefore, basic emotion theories might be too restrictive according to their limited set of discrete emotions or affect programs (e.g., Scherer and Ellgring, 2007). And then they would not be suitable for investigating emotions in retailing and consumer services. In contrast, the componential approach of emotion “consider[s] the possibility of an infinite number of different types of emotion episode” (Scherer, 2009, p. 1316) driven by the recursively generated appraisal results. Therefore, self-report methods for measuring emotions should be updated. Finally, it is important to note that it is not suitable to directly compare PPM

and self-report measures of emotion: they are not activated at the same time, are not based on the same physiological substrates, and do not measure the same emotional component.

3.4. Emotion is an action-readiness process

Contrary to aesthetic emotions, utilitarian emotions are bonded to the action-readiness aspect of emotion: they adaptively prepare the individual's behavior in order to react to the occurrence of an event with important consequences for his interest. The influence of emotions on the automatic forming of action tendencies has already been the subject of several studies. For instance, [Chen and Bargh \(1999\)](#) showed that the sequential evaluation of two emotional stimuli (anchor stimulus and target stimulus) resulted in a faster motor response under congruous experimental conditions than under incongruous experimental conditions. The results of this study notably showed that the participants pulled a lever faster (positive motor predisposition) than they pushed it (negative motor predisposition) and vice versa. [Duckworth et al. \(2002\)](#) later replicated these results. These authors notably showed that in an experimental condition of approach (pulling the lever), the participants' responses were faster in reaction to the evaluation of unknown positive valence stimuli than to the evaluation of unknown negative valence stimuli. Conversely, their results showed that in an experimental condition of avoidance (pushing the lever), the participants' responses were faster in reaction to the evaluation of new negative valence stimuli than to the evaluation of unknown positive valence stimuli. [Duckworth et al. \(2002\)](#) concluded that the automatic forming of attitudes in response to an emotional evaluation of a new stimulus had direct and immediate consequences on the behavioral tendencies of approach and avoidance. Afterward, [Rotteveel and Phaf \(2004\)](#) showed that the evaluation of a positive (negative) valence stimulus generates faster approach (avoidance) motor responses than the evaluation of a negative (positive) valence stimulus. These studies highlight the action-readiness process behind emotional episodes. In such high-involvement situations, an emotion is a dynamic process oriented toward the forming of a predisposition to action. Therefore, researchers interested in the action-readiness aspect of an emotion should study it from the motivational component of the emotion by means of electrophysiological measurement with millisecond accuracy. Moreover, they should consider emotional episodes and their physiological correlates as a transitional process oriented toward action. As we mentioned earlier, an emotion is a mediating process and it would be more relevant to identify a behavioral response as a dependent variable in order to investigate how emotions shape consumers' behaviors.

4. When is peripheral psychophysiology relevant in retailing and consumer services?

Emotions management is of the utmost importance for retailers and service marketers (e.g., [Chebat and Michon, 2003](#); [Dennis et al., 2010](#); [Das and Varshneya, 2017](#); [Helmefalk and Hultén, 2017](#)). Emotions have a vital role in influencing consumers' judgements, behaviors, and actions (e.g., [Gaur et al., 2014](#)). They are markers, moderators, and mediators of consumer responses ([Bagozzi et al., 1999](#)). PPM can advance research on emotions in retailing and consumer services by providing new insights, theories, and concepts that would shed light on emotional episodes, and new methods to investigate such emotional episodes and their consequences on consumers' judgements and behaviors. Many research domains would benefit from the use of PPM.

Research on retailing investigates how the physical environment such as a retail store may involve the consumer in an emotional, social, and physical interactional process. Shopping is both a functional activity (utilitarian) and a recreational activity (hedonic and social). The environmental psychology focuses on the interplay between people and their surrounding environment (e.g., natural environment, built environment or social environment). [Mehrabian and Russell \(1974\)](#)

introduced pleasure, arousal, and dominance as three independent emotional states to describe people's responses to environmental stimuli. This model (known as SOR: Stimulus - Organism - Response) has been applied and empirically assessed in physical retail settings to examine the effect of in-store atmospherics on shoppers' emotional reactions and approach-avoidance behavior (e.g., [Donovan and Rossiter, 1994](#); [Chebat and Michon, 2003](#); [Kaltcheva and Weitz, 2006](#); [Helmefalk and Hultén, 2017](#)). This stream of research reports that arousal elicited by retail environmental cues such as music, color, and ambient scents triggers pleasure and in-store approach behavior. However, the previous endeavors have been mostly based on self-report measures or experimental design using hypothetical scenarios and self-report measures. They assess emotional reactions at the retrospective, global level, once the shopping or service experience is over. These methods do not appraise the in process emotions and their effect on the global perception of the service performance or the purchase experience ([Dubé and Menon, 2000](#)). PPM (e.g., Facial EMG) enable academic researchers and retailers to assess, in real time, emotional responses to multi-sensory atmospherics (e.g., atmospheric conditions, interior design, decoration, signal, special layout, and functionality). For instance, it is well known from behavioral and self-reported measures that warm colors capture attention and attract customers. PPM improve our knowledge about the emotional process that mediates between warm color perception and customer approach behavior (e.g., number of purchased items, time spent in store, and speaking to salesperson). PPM provide alternative and complementary ways for an assessment of the emotional reactions to environmental stimuli.

Second, PPM provide new insights for understanding the consumer decision-making process for ethical food products' purchase (e.g., green consumption and fair-trade consumption). Two issues limit the use of conventional measures. First, due to social desirability, respondents may overestimate their purchase and consumption of ethical products. Social norms increase respondents' tendency to over-report socially desirable behaviors. Second, intuitive and subconscious processes significantly influence consumers' attitudes and ethical buying decisions. Ethical consumption is motivated by an amalgam of rational, emotional, and social factors ([Lin and Huang, 2012](#); [Ladhari and Tchegtina, 2015](#)). The role of affective and cognitive processes and their interactions in influencing consumers' attitudes, choices, and actual behavior for responsible or ethical products (e.g., green products, fair trade products, ecological restaurants or hotels, and ecological packaging) are a vital avenue for future research. The role of emotions in ethical and sustainable consumption is an understudied topic of research ([Ladhari and Tchegtina, 2015](#)).

In the restaurant sector, PPM might provide insights about patrons' perceptions of a meal offer in menus. They could assess patrons' reactions to price options, meal images, meal ingredients, symbol options, layout options, visual background or the reactions to different musical background (style and tempo). Restaurant managers may apply both PPM and self-report measures (survey) to get greater insight.

5. Perils

5.1. The So what? question

The *So what?* question is a leitmotiv when applying PPM. Pros and cons sometimes overstate their arguments about the relevance of using PPM in consumer research and the benefit of such studies. In order to overcome this issue, we share three practical pieces of advices in order to avoid the *So what?* question from entering the picture again.

Basically, psychophysiology aims to go further in understanding how consumers process marketing information related to consumption experience, and how this information processing affects subsequent consumption behaviors. Therefore, psychophysiology does not overshadow the basic goal of consumer research that is "*research in which the consumption context plays a prominent role in the theorizing*" ([Deighton,](#)

2007). It should rather help to figure it out through physiological correlates of psychological processes. In a classic experimental approach, PPM help to test a consumer research theory—where independent and dependent variables are supposed to be consumption-related variables—by shedding light on automatic and unconscious psychological processes. Accordingly, PPM allow marketing researchers to overcome the classic behaviorist approach (S→R) by opening the “black box” of the embodied mind. Therefore, it is important to consider psychological processes and their physiological correlates as mediators rather than dependent variables. Otherwise, there is a risk of falling again into a behaviorist design where PPM show very limited benefits in marketing.

The importance of properly defining the research question and hypothesizing about the role of the consumers’ psychological processes at stake bring us to another critical point. Here we assume that the research question should guide researchers to identify the nature and type of data to be collected. And then to select the appropriate data collection methods. It might be that PPM cannot respond to the research question and then make no improvement to the marketing theories. Instead, such a skewed approach may move the field of *measurement* forward and intensify the criticism about the relevance of psychophysiology in marketing crystallized around the *So what?* question. However, there is a paradox here. Indeed, assuming that PPM are not always relevant in consumer research might seem inconsistent with the claim that psychological processes and their physiological correlates are always at stake when investigating consumers’ behavior. Actually, the solution lies in the definition of applied psychophysiology in marketing that we introduced in the first section of this paper. We assumed that applied psychophysiology in marketing aims to go further in understanding consumers’ psychological processes through their physiological correlates in order to investigate the effect of point-of-purchase marketing on consumers’ behaviors. Implicitly, this means that there is already an effect between A (marketing stimuli) and B (consumers’ behavior). Afterward, PPM will help to go beyond this behaviorist SR perspective by opening the “black box” of embodied mind to understand which psychological process is at stake. In other words, PPM cannot help to identify a relationship between A and B. But rather it explains *why* A influence B. If former studies did not show a causal link between A and B, nor do the PPM. Therefore, we suggest that researchers should adopt a two-step approach when considering PPM in consumer research. A first study—based on classic methods such as self-report techniques—should test the main effect of the research model, such as establishing a causal link between marketing independent variables and consumers’ behavior dependent variables. Then, a second study will help to shed light on consumers’ emotional or cognitive processes to answer the question *why*, and explain how consumers process marketing information and how the results of this processing affect subsequent judgements and behaviors.

5.2. The methodological transparency

Applying PPM in marketing is not a new trend. Actually, some “pioneers” started to implement such methods in marketing in the early 60’s (e.g., Krugman, 1964; Kohan, 1968). This interest for measuring consumers’ physiological responses was first explained by the well-documented limitations of self-report methods. Later, the growing interest for emotion in marketing led researchers to use alternative methods such as PPM in order to investigate consumers’ emotional reactions to various marketing and consumption contexts. However—and despite the numerous benefits of psychophysiology—very few studies are based on PPM to investigate consumers’ embodied cognition and emotion in retailing and consumer services (for a review, see Droulers and Lajante, 2015).

There are probably several reasons explaining why there are so few peripheral psychophysiological investigations in marketing and why such a methodological approach is still a challenge for researchers. Here we assume that one of the main reasons is the lack of

methodological details regarding how researchers record and process the physiological signals. Actually, it is surprising that methodological aspects have not yet received sufficient critical evaluation while several authors have stressed over time the importance of demonstrating the reliability and validity of PPM in marketing (e.g., Cacioppo and Petty, 1985; Poels and Dewitte, 2006; Wang and Minor, 2008; Watson and Gatchel, 1979). For instance, Wiles and Cornwell (1991) have highlighted the link between the spread of psychophysiological knowledge and the need for methodological rigor. And they mentioned that “*progress toward developing valid physiological measures is thwarted when questionable procedures are implemented [...] A clearer understanding and acceptance of psychophysiological techniques will only come about as evidence of validity and reliability is documented by investigators. Information on any form of reliability or validity has rarely been reported for psychophysiological techniques used in measuring affective responses*” (p. 266–267). A similar observation was formerly made by Kroeber-Riel (1979, p. 248) who claimed that “*psychophysiological methods have fallen into disrepute as a result of such inadequately designed and poorly interpreted studies*”. The question of methodological transparency was also loudly debated in the journal *Psychology and Marketing* between David W. Stewart and Sidney Weinstein. According to the first, PPM “*remained unvalidated as measures of consumer response*” (1984, p. 44) since authors applying these techniques in marketing had failed to properly demonstrate their reliability and validity. Yet in response, Weinstein et al. (1984) wrote an extensive and well-documented response (authors addressed seven topics in an attempt to correct misconceptions) and concluded that “*distortion, whether deliberate or inadvertent, and casuistry have no place in research or reviews of scientific literature*” (p. 94). Finally, Cacioppo and Petty (1985) shut down the debate in the same journal by suggesting “*alternative conception of the psychophysiological enterprise*” (p. 115) in their well-named paper “*Physiological responses and advertising effects: is the cup half full or half empty?*”.

Researchers should have endorsed the aim of full and continual methodological transparency since these old former debates, thus improving the reliability and validity of PPM in marketing. However, recent overviews about the methodological issues observed in the marketing literature show it is still an ongoing concern (e.g., Lajante et al., 2012, 2017). Therefore, we indicate that measurement reliability and validity—and subsequent confidence in the results—greatly depend on how clearly the procedures for recording (e.g., skin preparation, sensors placement, sampling rate), processing (e.g., noise reduction/filtering, rectification, linear envelop calculation, phasic activity calculation), and quantifying (e.g., phasic responses quantification: mean score, amplitude, area under the curve or RMS) the physiological signals are. Such methodological details could be overly technical and perhaps beyond what the readership of marketing journals could digest. However, it is the *sine qua non* for development of PPM in marketing. First, it allows providing transparency pledges about reliability and validity to some who accuse the neuroscience approach to be obscure, ineffective, and not guaranteed. Then, it encourages the comparison of studies and their replication.

5.3. The ecological validity

As for any experimental method, PPM are related to several limitations that need to be addressed. Among others, ecological validity appears as one of the most critical limitations when applying PPM in marketing. There is some disagreement among psychologists, concerning the ecological validity definition and relevance, which has not permitted the development of standardized tests that can be applied to neuroscience studies conducted in a laboratory. However, Franzen and Wilhelm (1996) argue that ecological validity is “*a complex concept that can be conceptualized as involving both verisimilitude, or extent of similarity to relevant environmental behaviors, and veridicality, or degree of accuracy in predicting some environmental behavior*”. Accordingly, experiments designed with ecological validity in mind (the verisimilitude approach)

might be more efficient at predicting consumers' behaviors (Spooner and Pachana, 2006).

Several aspects may impair the ecological validity of results based on PPM in marketing. We address here only the two most critical: instrumentation bias and field versus lab settings. Instrumentation bias refers to the effect of the measurement method on participants' reactions and responses. For instance, measuring emotional valence by means of facial EMG involves putting multiple sensors on the consumer's face. Do these sensors have any effects on consumers' spontaneous reactions? Probably yes. However, we need to consider two important points here. First, facial EMG, as any other PPM, is an implicit measure since participants do not know either the purpose of such measures nor how to control them consciously. Second, sensors are now very small, almost imperceptible (less than 5 mm in diameter), and connected to a wireless preamplifier. As such, participants are free to move and shift as they would probably do in a more natural situation. This ambulatory perspective raises the second question about the field versus lab settings.

Nowadays, almost all the psychophysiological studies in marketing have been conducted in lab settings. First, a large amount of psychophysiological studies in marketing aimed to investigate consumers' emotional responses to advertising (Wang and Minor, 2008; Lajante, 2015). In this context, it is easier to make a lab experiment similar to a natural exposure to a TV screen in a living room, thus improving the ecological validity. Second, many psychophysiological studies in marketing have been conducted between the 80's and the mid 2000's, when ambulatory signal acquisition systems were scarce and expensive, thus limiting the opportunity of selecting field studies. However, there are also two more highly technical reasons explaining the prevalence of lab

experiments that researchers should take into account when applying PPM in a field experiment. The first technical reason is that conducting psychophysiological studies in a lab setting allows controlling the external factors that may corrupt the recorded signal (e.g., brightness and temperature of the room; uncontrollable stimulation such as sudden noise; social interactions). As we mentioned earlier, physiological responses are under the control of multiple internal and external factors. Therefore, controlling the environment is of significant importance for inferring psychological processes to physiological responses. Experimental stores might be a good trade-off for improving the ecological validity while preserving the internal validity of PPM and results. The last, but not the least, technical reason explaining the prevalence of lab experiments is the issue of triggers. Triggers are electrical pulse conveyed to the recorded signal to mark the stimuli onset/offset along the experiment (see Fig. 2).

Schematically, in a lab experiment, participants are exposed to the screen of a first computer, which controls both the sending of triggers and the stimuli presentation. A second computer records the digitalized physiological signal and the triggers. Thus, these triggers allow making the link between the events appearing on the first computer and the related physiological signal recorded on the second computer (see Fig. 3). Offline, when processing the raw recorded signal, the triggers help to identify the time course of the physiological signal related to specific stimuli and then to quantify the phasic response.

Since physiological signals are very fast, short, and versatile (time scale: millisecond), it is crucial to apply triggers to the recorded signal in order to calculate the related phasic responses. Otherwise, it would be very risky to attribute a physiological response—and its underlined psychological process—to a specific stimulus. This case illustrates how

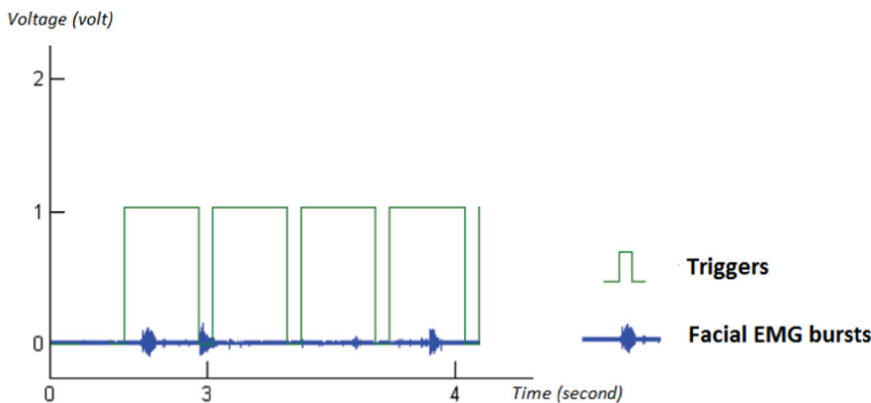


Fig. 2. Examples of triggers (adapted from Lajante, 2015). The electrical pulse marks the onset and the offset of stimulus presentation and allows identifying the signal portion of facial EMG related to the stimuli. For instance, the facial EMG burst at the third second of recording is not related to any event since it is detected outside the bounds of the trigger. Without the recording of triggers for marking stimulus presentation, this burst could have been taken into account during signal analysis, overestimate the effects and skew the results.

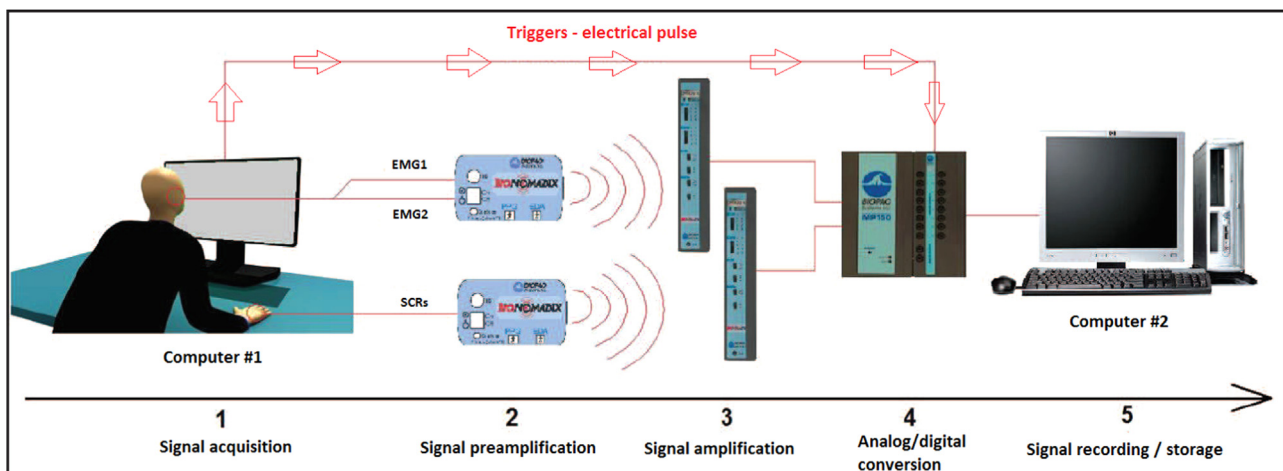


Fig. 3. Peripheral psychophysiology measurement setup (adapted from Lajante, 2015).

difficult it would be to correlate a physiological response to a specific event in a field experiment, while there is no control over external factors, and the time course between the onset of stimulus presentation and the elicitation of physiological response.

6. Conclusion

Consumer research has been torn between two opposite observations for several years now. On the one hand, most of the data collection methods, analyses, and models continue to rely heavily on rational input and conscious recall. On the other hand, it is noteworthy that unconscious emotional processes also influence consumers' judgement and decision-making processes (Penn, 2006). In order to deal with this paradox, some researchers have seen an upsurge of interest in psychophysiological measures of emotion. However, the adoption rate of these measures in the academic literature remains low. Although it is hard to say that psychophysiological measures are underused since they are very specialized methods, it appears clearly that they are still part of "those approaches that have not yet broken through in terms of usage" (Grit Report, 2016, p. 13). This is probably due to the discrepancy between expected and experienced outcomes when trying to implement such measures to investigate the role and the influence of emotion on consumers' judgements and behaviors. Indeed, despite neuromarketing being hailed as the new holy grail of consumer research and while physiological measures are increasingly accessible now, researchers still find it difficult to get advanced insights and profitable solutions from them.

In this paper, we stressed several research areas that could be considered when applying a combination of both traditional measures and PPM in retailing and consumer services. The recent development of ultra-portable systems and wireless neuro-technology provides consumer neuroscientists with a wide range of alternatives of non-invasive tools (e.g., Khushaba et al., 2013). Parsons and Descatoires (2016, p. 105) contend that: "Technology is allowing us to become much more 'scientific' in our approach to understanding shoppers. For example, neuromarketing and physiological measures are allowing us to bridge the assumption gap between what goes 'in' from marketing and what comes 'out' in terms of shopping behavior. Importantly, these measures are starting to make us rethink the preference models we rely on for many retail marketing thoughts". The new technology tools increase the range of possible PPM applications in physical and online retailing.

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Mathieu Lajante is an Assistant Professor of marketing at Laval University, Canada. His research specialities are the role of emotion in persuasion processes and consumers' action tendencies as well as the use of psychophysiological techniques in consumer research. His work has been published among other in the *Journal of Advertising Research*, *Journal of Neuroscience*, *Psychology*, and *Advances in Consumer Research*.

Riadh Ladhari is a Full Professor of Marketing at Laval University, Canada. His current research is focused on retailing and consumer services, digital marketing, globalization and cross-cultural studies, and responsible marketing. His work has been published in refereed journals such as *Journal of Business Research*, *Psychology & Marketing*, *Journal of Cleaner Production*, *Journal of Retailing and Consumer Services*, *International Journal of Consumer Studies*, *Journal of Service Management*, *Managing Service Quality*, *International Journal of Hospitality Management*, *International Journal of Contemporary Hospitality Management*, *Australasian Marketing Journal*, and *Journal of Financial Services Marketing*.