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Unravelling the Consumer Brain: The Role of Emotion in Purchase Behavior

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Unravelling the Consumer Brain: The Role of Emotion in Purchase Behavior

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by

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Abstract

The present research used electroencephalography (EEG) measures to examine the neural mechanisms of purchase behavior. Specifically, this study examined how affective priming influences a purchase decision when brand and price are varied. Participants were presented with Yes/No purchase decision trials for 14 different grocery products- seven national brand and seven private label products- while EEG activity was recorded. Price was increased or decreased relative to a base reference price. Prior to product onset, an emotional prime was flashed. The prime was a positive, negative, or neutral image from the International Affective Picture System (IAPS). Main behavioral results showed that fewer products were bought following a negative prime relative to positive or neutral, regardless of brand type or price. Event-related potentials (ERPs) locked to the product onset revealed very early effects of emotion (VEEEs), consisting of differential brain activity between positive/negative and neutral primes at posterior sites around 125 ms. Although the positive prime did not appear to have an overall behavioral influence, this result indicates that its emotional content was still captured at the neural level. A late positive complex (LPC), which reflects an association with positive outcome, was observed between 650-1000 ms at fronto-central sites. Main LPC results showed increased LPC activity for purchase trials following a positive prime. Overall, the results are consistent with similar research and show that buying decisions are malleable. The present research is among the first to demonstrate the effect of emotional priming on purchase behavior, and offers insight on some of the brain processes that drive purchase decisions, not all of which are manifested at the behavioral level.

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In a society based on consumerism, whether or not we buy a product is a decision we make countless times in our daily lives. From the grocery store to the shopping mall, we are presented with an endless array of products and must face the task of deciding which one we want to purchase. The whole process may last only seconds, but the complex neural mechanisms that underlie this procedure are still largely unknown and form part of an exciting area of research in the budding field of consumer neuroscience, also known as neuromarketing.

Traditional economic theory holds the assumption that decision making solely involves rational thought and directly links explicit knowledge with the subsequent behavioral decision. In other words, we only do what we are consciously aware of (Naqvi, Shiv, & Bechara, 2006). Historically, the simple axiomatic utility model in microeconomics explains the process of decision making as having one unique correct answer, independent of subjective internal criteria (Mograbi & Mograbi, 2012). In addition, this approach to studying consumer decisions, often referred to as rational choice theory, assumes that consumers hold well-defined preferences that do not depend on contextual factors (Bettman, Luce, & Payne, 1998).

In recent decades, however, an overwhelming amount of evidence has shown that this traditional economic model is flawed and/or incomplete (e.g. Tversky & Kahneman, 1981; Camerer, Loewenstein, & Prelec, 2004; Gehring & Willoughby, 2002). In reality, decision making can be largely driven by psychological factors, based on the notion that the human brain is value-oriented. Under this integrative framework, rather than being purely rational, a consumer choice is modulated by at least two opposing psychological elements: the immediate pleasure of acquiring a product and the simultaneous displeasure of paying for it. Thus, all purchases are the result of a combination of the consumer's desire and price (for a review, see Mograbi & Mograbi, 2012). Based on this paradigm, the assertion can be made that buying decisions are malleable (Schwartz, 2004). For instance, rather than holding well-defined existing preferences, consumers often spontaneously construct them using whatever information is available in the moment (Bettman, Luce, & Payne, 1998). Furthermore, research in the fields of neuroscience and behavioral economics has shown that the processes that govern the evaluation of an object and decision making are largely unconscious, and affect plays a pivotal role in guiding actions (Gratch, Clore & Palmer, 2009). In other words, decision making not only involve cold calculations based on explicit knowledge, but also more subtle, implicit processes that depend critically on emotion (Naqvi, Shiv, & Bechara, 2006). These findings are in line with Bechara and Damasio's (2005) somatic marking concept, which postulates that our brains use interoceptive emotional signals to map anticipated outcomes prior to making a decision. In other words, emotions play a crucial role in guiding our decision making (Ravaja, Somervuori, & Salminen, 2012; Ravaja & Somervuori, 2013).

There is a considerable amount of research that specifically examines how emotion influences subsequent behavior, using a technique known as affective priming (e.g. Neumann & Lozo 2012; Aguado, Garcia-Gutierrez, Castaneda, & Saugar**,** 2007; Fockenberg & Koole, 2008, Zhang, Li, Gold, & Jiang, 2010; Werheid, Alpay, Jentzsch, & Sommer, 2005). Priming itself has been defined as an implicit memory process in which previous exposure to a stimulus influences the response to a subsequent stimulus (Schacter, 1992)**.** It is thought to be an implicit process in the sense that subjects may not be aware of the relationship between prime and target, but nevertheless show performance biases that indicate that features of this relationship are processed at some level (Weiskrantz, 1997). Recent research has indicated that virtually any psychological reaction can be primed. Importantly for the current discussion, priming has been shown to influence people's emotions (Chartrand, van Baaren, & Bargh, 2006; Fockenberg & Koole, 2008). In general, the affective priming literature has demonstrated that affective primes can influence subsequent behavior (e.g. Zhang, Li, Gold, & Jiang, 2010; Werheid, Alpay, Jentzsch, & Sommer, 2005**)**. For the most part, these studies have focused on tasks such as lexical decisions and emotion identification. For example, Neumann and Lozo (2012) instructed subjects to determine the emotional content of a certain picture. Just prior to the target picture, they were presented a brief masked emotional prime of an image displaying either fear or disgust. Because the image was shown briefly and masked, it was not consciously perceived by the participant. The results showed that faster and more accurate responses were obtained on trials where target and prime were congruent (i.e., of the same emotion), even though subjects were never consciously aware of the prime. However, there is very little research directly examining influence of emotions, via affective priming, on the decision to purchase a product.

Taken together, on the one hand, there is the concept that consumer purchase decisions are largely driven by emotions. On the other hand, there is the affective priming technique that enables researchers to manipulate and study emotions in a controlled setting. Merging these two concepts could have powerful implications. As noted by Mograbi & Mograbi (2012):

"if psychological (and specifically, emotional) factors can influence economic and purchase decision by their own natural processing, it is highly probable that manipulation of these factors could be profoundly effective in eliciting the prospected effects wanted by those people interested in influencing consumers' decisions."

With this in mind, the present study aimed to examine just how emotion can be manipulated, via affective priming, to influence purchase decision. In their literature review, Mograbi and Mograbi (2012) report that, specifically on the subject of affective priming and purchasing decisions, very few studies have been conducted so far. One such study by Steffen, Jansma, and Rockstroh (2009), examined the influence of affective primes on the decision to rent an apartment. Participants were exposed to masked primes (pictures of faces expressing either happiness or anger) followed by pictures of apartments with prices, after which they had to decide whether they would rent it or not. Results indicated an advantage of exposure to prime relative to no-prime condition in terms of faster reaction times, but with no significant difference between happy and angry primes. In addition, ERP results showed increased N2 activity, indicative of response certainty, for trials following a positive prime. However, a major limitation of this study is that an emotionally neutral control condition was not included. It is possible that faster reaction times with primes simply reflected a general effect of facial-expression processing, regardless of emotional valence of the stimuli. Another potential drawback of this study is that facial expressions (angry or happy) were used as affective primes. This is not always ideal; as Knutson and colleagues (2007) discuss, a stimulus might be "emotional" in the sense of being semantically related to emotion, but not elicit any real response. In other words, simply showing faces of others expressing happiness, anger, or fear does not mean the viewer will also feel those same emotions. As an alternative, the present study selected various images from the International Affective Picture System (IAPS). These images have been standardized over hundreds of ratings to invoke a range of emotions in the viewer. For humans, who are highly visual creatures, pictures are able to accurately represent many of the most arousing affective events. Thus, using images, emotion can be safely probed and studied in the laboratory (Bradley & Lang, 2007). Three sets of images were selected for the present study: positive, negative, and a set of neutral pictures as a control. Another advantage of this image database is that, given the wide range of images and averaged ratings, researchers are able to control for the intensity of the particular emotion. The present study used only highly arousing images, in the interest of obtaining a maximal effect (Ihssen, Heim, & Keil, 2007).

In addition to using affective primes, this study also manipulated brand type (national vs. private) and price (cheaper vs. more expensive relative to the actual price of the product). This resembles the design done by Ravaja, Somervuori, and Salminen, (2012)**.** Their study examined the role of frontal EEG asymmetry on purchase decisions. Their results revealed that relatively greater left frontal activation, an index of approach- related emotions, could predict an affirmative purchase decision. This association was stronger for national brands and lower prices. The key difference with the present study is the addition of affective primes to examine exactly how the elicited emotion interacts with brand and price to influence a purchase decision. The inclusion of these additional variables (i.e. brand type and price) is an important component of the study because real-world consumers use a variety of cues to evaluate product quality, and, therefore, the use of multiple independent variables is necessary for valid empirical tests (Rao & Monroe, 1989).

As Ravaja and Somervuori, (2013) discuss, one reason for the lack of research on emotions and pricing is that, in the past, researchers have had to rely on self-reports and observed behavioral measures. These methods may be problematic because they rely on the participant’s ability to reconstruct emotions and thoughts, or on the observer’s ability to identify the emotions. The use of psychophysiological measures (e.g. fMRI, EEG) in neuroeconomic research has enabled researchers to tap into a new dimension of studying the consumer at the level of the brain, which may lead to a more complete and objective understanding of consumer behavior.

Research on the neural mechanisms underlying purchase behavior has predominantly utilized functional magnetic resonance imaging (fMRI) to map structural activations in the brain during various economic and purchasing tasks. Undoubtedly, this method has made invaluable contributions to the field of consumer neuroscience (e.g. Knutson, Rick, Wimmer, Prelec, & Loewenstein, 2007; Knutson, Fong, Bennett, Adams, & Hommer, 2003; Piech, Lewis, & Parkinson, 2009; Paulus & Frank, 2003). However, although fMRI offers strong spatial resolution, its' temporal resolution with regard to brain activity is poor. This is important to consider when examining the perception and evaluation of a product at the neural level. In an fMRI study involving financial decisions, Knutson and Bossaerts (2007) mention the need for improved temporal resolution in this area of research. Electrophysiological measures, such as electroencephalography (EEG) , provide excellent temporal resolution, and enable researchers to pinpoint differential neural activity between purchase and non-purchase decisions within milliseconds (Jones, Childers, & Young, 2011). The present study used event-related potentials (ERPs), derived from EEG, to examine the neural underpinnings of purchase behavior and how emotions alter the neural temporal dynamics of decision making.

In the present study, participants were presented with a product and its associated price, and were instructed to make a Yes/No purchase decision while EEG activity was recorded. For each trial, the product was either a national brand or private label, and the price was increased or decreased relative to a base reference price. Prior to product onset, an emotional prime was flashed.

Predictions

The present study aimed to bridge the gap between the affective priming literature and the consumer neuroscience literature examining purchase decisions. The lack of research in this particular area made formulating precise predictions difficult. However, gathering relevant evidence from various studies, the following predictions were made for both behavioral and electrophysiological data.

Behavioral Predictions

When studying the influence of emotion on cognitive processing, Gratch, Clore, & Palmer (2009) found that, in general, positive affective information provides a green light and negative affective information provides a red light for *currently activated* thoughts and inclinations. In the present study, prior to the experiment, participants were instructed to imagine that they are in a grocery store because they *need* certain products. Therefore, their current inclination, presumably, should be to buy. Based on this notion that positive affect enhances a current inclination while negative affect disrupts it, and on the assumption that participants are entering the experiment with a buying mindset, the emotional primes should produce a differential effect with respect to purchase/no-purchase decisions. Specifically, trials containing a positive prime should enhance the purchase inclination, and should result in more purchases. Conversely, trials containing a negative prime should disrupt this inclination and should result in more no-purchase decisions. It has been suggested that brand associations are stronger and more positive for strong, familiar (i.e. national) brands compared to weak or unfamiliar (i.e. private label) brands (Hoeffler & Keller, 2003). In other words, consumers have strong, pre-existing emotional-motivation factors for national brands based on previous experience. Conversely, as research from Ravaja, Somervuori, and Salminen (2012) suggests, private-label products may not be marked by strong positive or negative feelings; rather, brand associations for private-label products are more neutral. Thus, private-label products should be more malleable and susceptible to the influence of the emotional primes, whereas national products should be more robust to the influence of priming due to pre-existing associations and brand familiarity. This yields the first hypothesis:

Behavioral prediction 1: Overall, negative emotional primes will result in fewer purchase decisions, while positive and neutral primes will result in more purchases. This effect will be stronger for private-label products compared to national brands.

Each product used in this study was presented at various price levels that were incrementally cheaper or more expensive than a reference price (i.e. normal selling price) for that particular product. Recent empirical research has suggested that low price levels elicit greater positive emotions relative to high price levels (Ravaja & Somervuori, 2013). Based on this evidence, we predicted an inverse relationship between price and brand/prime influence. That is, as price increases, it is likely that the influence of brand or prime will be less and less effective. Thus:

Behavioral prediction 2: At high price extremes, fewer products will be purchased, regardless of prime or brand type.

Prospect theory, first proposed by Kahneman and Tversky (1979), defines a value function over gains and losses from a reference point. In the context of pricing, the idea is that a price decrease from a reference point represents a “gain”, while a price increase from a reference point represents a “loss”. According to traditional prospect theory, a loss has more of an impact than a gain, and this phenomenon is known as loss aversion. Findings from Ravaja and Somervuori (2013) suggest that all price changes are more critical for national brand products than for private label products. That is, consumers are likely to display stronger gain-seeking behavior for a price decrease in national brands compared to a price decrease in private brands. In this scenario, quality perception also plays a role. Namely, a decrease in price for a strong, familiar brand is seen more as a gain, whereas a decrease in price for a weaker, unfamiliar brand may be simultaneously perceived as a decrease in product quality (Ravaja & Somervuori, 2013; Hankuk & Aggarwal, 2003). By the same token, however, these authors suggest that a loss (i.e. price increase) has more of an impact with national brands than with private labels. Because strong, well-known brands offer familiarity and package more meaning, emotional processing plays a larger role (Schaefer, Berens, Heinze, & Rotte, 2006; Biel, 1992). As a result, a price increase may be more painful for national brands, and so loss aversive behavior may be stronger. Therefore, using the normal selling price as a reference point, we predicted the following:

Behavioral prediction 3: At prices lower than reference, more national brand products will be purchased. However, at prices slightly higher than reference, relatively more private label products will be purchased.

Reaction time was also analyzed in the current study, as it can be used as an indirect measure of response certainty (e.g., Steffen, Jansma, & Rockstroh, 2009). As mentioned previously, in general, consumers tend to have strong, pre-existing brand associations for national products, while private-labels are less known and more ambiguous (Hoeffler & Keller, 2003). Pre-existing brand associations should facilitate decision making, regardless of the outcome of that decision, and so the following prediction was made:

Behavioral prediction 4*:* Overall, reaction time will be faster for national brands, and slower for private labels.

Electrophysiological Predictions

In addition to studying overt behavior, electrophysiological measures enable the examination of cortical processes during decision making at the millisecond level. In order to examine the neural temporal dynamics of purchase decisions, the current study employed the use of event-related potentials (ERPs) derived from electroencephalographic (EEG) data. Emotional responses to stimuli may stem from various sources in the brain and may develop through multiple stages (e.g., Scherer, 2001, 2010). Several ERP findings have supported the notion of multi-component emotion processing (e.g., Grandjean and Scherer, 2008; Sander, Grandjean, & Scherer, 2005).

There is an increasing amount of research that has reported very early emotional effects (VEEE) in ERPs prior to 200 ms after stimulus onset. For example, Begleiter, Gross, and Kissin (1967) associated simple graphic patterns with words that were emotionally positive, negative, or neutral. When subjects later viewed the patterns, a modulation of early visually evoked potentials was observed, which was most pronounced for negative words. Similarly, studies have reported emotional effects on specific visual components, such as the P1 and N1 (Montoya et al., 1996; Hofmann et al., 2009). However, VEEEs are not necessarily restricted to specific components; rather, they may be reflected by modulations of unspecified early time windows prior to 200 ms after stimulus onset (e.g., Schacht et al., 2012). In the present study, emotional primes were flashed for 200 ms just prior to product presentation, and ERPs were time-locked to product stimuli onset. Given that priming effects are known to spill over and influence subsequent activity (for a review, see Mograbi & Mograbi, 2012), we predicted that positive and negative primes would induce VEEEs for the subsequently presented products. Thus:

Electrophysiological prediction 1: Relative to neutral, positive and negative primes will result in differential modulations of early components (i.e. prior to 200 ms) following product onset.

An ERP component that is often studied in emotion research is a large, slow positive wave known as the late positive complex (LPC). Its onset is usually around 300 ms and lasts for several hundred milliseconds. The LPC is thought to reflect emotional or motivational significance, with enhanced amplitudes for emotionally-relevant stimuli, such as faces or words (e.g., Cuthbert et al., 2000; Herbert & Kissler, 2008). However, in their review, Sutton and Ruchkin (1984) report that this waveform involves a whole complex of positive components that can vary in latency, scalp distribution, and functional role, depending on experimental design. For example, Schacht and colleagues (2012) found that association with a positive outcome elicited an enlarged LPC. Specifically, participants learned to associate previously unknown Chinese words with monetary gain, loss, or neither. In the test session, they had to distinguish the learned stimuli from novel distractors. A modulation of the LPC was reported, with larger amplitudes to words associated with positive outcome. The decision to purchase a product heavily involves consideration of the outcome, (e.g. losing money but gaining a new product, or conserving money with no product gain, etc.). With this in mind, the present study adopted this conceptualization of the LPC as an index of positive outcome association, examining its modulation as it pertains to the evaluation and purchase decision of a product.

As previously mentioned, private label products have been reported to be more neutral (Ravaja, Somervuori, & Salminen, 2012) and should be expected to be more susceptible to the influence of emotional primes compared to national brands. In line with our behavioral predictions, while the immediate reaction to the presentation of a national brand will normally be met with pre-established affective associations (based on previous experience), the initial neural response to an unfamiliar private-label product will more resemble a blank-slate. Thus, the influence of the emotional prime should be more pronounced for the more malleable private label products compared to the more resistant national brands. Because positive emotion is thought to enhance the participant's current inclination to buy (see Behavioral Hypothesis 1), the onset of a private label product following a positive prime should, initially, be associated with a positive outcome. Conversely, negative emotion is disrupting this inclination, so no such association should be found on negative prime trials. This lead to our next prediction:

Electrophysiological prediction 2*:* A larger LPC will be observed for positive-primed private labels compared to positive-primed national brands, whereas negative-primed products will not differ between private and national brands.

Following this notion, when the consumer decides to purchase a product, presumably it is because they have linked their decision to buy with a positive outcome. In line with this idea, Ravaja & Somervuori (2013) found that positive emotions are related to greater purchase intent. Thus, the positive outcome associated with the decision to buy should be augmented by the presence of a positive emotional prime effect. In other words, on trials where participants decide to buy, a positive prime should result in an enhanced LPC prior to the behavioral response. This lead to our final prediction:

Electrophysiological prediction 3: On trials that result in an affirmative purchase decision, a relatively larger LPC will be observed for positive primes compared to neutral and negative purchase trials.

Methods

Participants

Participants were 34 students from the College of William and Mary, in Williamsburg, Virginia (18 male, 16 female). They ranged from 18 to 22 years of age (*M*= 19.1 years, *SD*= 1.02 years) and were expected to reflect the diversity of the William & Mary student body. All participants were assessed for color blindness and had normal or corrected to normal visual acuity.

Design

The study protocol was approved by the Protection of Human Subjects Committee at the College of William and Mary. The design replicates the study done by Ravaja, Somervuori, & Salminen (2012) with the addition of an affective prime. A 7 (Product Category) X 2 (Brand) X 15 (Price) X 3 (Prime) within-subjects design was employed.

Seven product categories were selected: coffee, cookies, peanut butter, chips, orange juice, toothpaste, and dish soap detergent. For each product category, two brand types were selected: one national brand product and one store-labeled product (total of 14 different products). We selected product categories from which two products could be used that are virtually equal in all other aspects (e.g., packaging size and shape) except for product wrapping and brand. The selected national brand products were the market leaders of that product category. A corresponding generic store-brand product was selected from the private label category.

The price variable included 15 different price levels based off a selected reference price. The selected reference price was the normal selling price of that product at a local grocery store. The price increase and corresponding decrease levels were 3%, 6%, 10%, 25%, 40%, 60%, and 75% of the reference price.

The affective primes were images taken from the International Affective Picture System (IAPS). Images were selected from 3 categories: positive, negative, and neutral. Specifically, images depicting joy were used as the positive emotional prime, and threatening images were used as the negative prime. 56 images of each prime type were used. The positive and negative images were sorted from greatest to least according to valence and arousal, and the top 56 of each category were selected.

Stimuli were presented on a computer using Presentation Version 16.2 (Neurobehavioral Systems Inc.). In degrees of visual angle, products were presented as portrait at a width of 12.8° and height of 21.46° (except for toothpaste and cookies, which were presented as landscape at a width of 22.6° and height of 17.52°) , and primes were presented at a width of 23.0° and height of 17.3°. The distance between the screen and the participant was set at 57 cm, maintained with a chinrest.

Procedure

In the laboratory, the participant was first briefed on the nature of the task. The participant then filled out an informed consent form and a form containing basic demographic information. A 64-channel electrode cap was fixed onto the participants' head before he/she was led into a dimly lit experimental chamber. Prior to the experiment, the participant read a set of instructions aimed at establishing a buying mindset. The participant was instructed to imagine he/she was at a grocery store on a typical budget because he/she needed to buy certain snacks and household supplies. Importantly, the participant was also instructed to treat each trial as a unique grocery store visit. Each product and its price was to be evaluated carefully before quickly deciding whether or not he/she would buy it in real life by pressing one button for Buy and a different button for Not Buy. Participants were instructed that the task-relevant pictures of the products would be preceded by another picture, irrelevant for decision. A trial consisted of a fixation cross that varied in duration (300-700 ms), followed by the affective prime that was flashed for 200 ms. Following the prime, a 50 ms blank screen mask was inserted prior to target onset, which was the product image with its associated price (see Figure 1, Appendix). 96 trials per condition were randomized over a series of 12 blocks, for a total of 1,152 trials. Upon completion of the experiment, the participant was debriefed and received course credit for their participation.

EEG Data Collection and Analysis

The EEG system used was the actiCHamp (Brain Products, Gilching, Germany), with a total of 64 channels. All electrodes were applied using SignaGel electrode gel. During the data collection, electrode impedances were kept below 5 kΩ. The signal was recorded in reference to channel Cz, and a ground electrode was located on the forehead. To facilitate artifact detection, ocular movements were recorded with electrodes placed on the outer canthi of the left and right eyes which were used to derive horizontal electrooculogram (HEOG). Vertical electrooculogram (VEOG) was derived as the average of the Fp1 and Fp2 electrodes. The data collection was controlled by BrainVision PyCorder software (Brain Products, Gilching, Germany), and all signals were sampled at a rate of 1000 Hz.

After the recordings, BrainVision Analyzer software (Brain Products, Gilching, Germany) was used to analyze the data. The EEG data were re-referenced to the algebraic average of electrodes placed on the left and right mastoids. The data were band-pass filtered (0.1 Hz-30 Hz) using a zero-phase shift Butterworth filter (12 db/oct). For each trial, the EEG data were segmented into epochs starting 500 ms before product picture onset and persisting 1000 ms after product picture onset. The data was baseline corrected at -100 ms to 0. Ocular artifacts were corrected via standard regressive methods using the HEOG and VEOG (Gratton, Coles, & Donchin, 1983). For artifact removal, all epochs containing activity outside the range of -85 µV to +85 µV on any of the scalp channels were detected and removed from further analysis. Segments were then averaged based on trial type to form participant averages. Via visual inspection of the waveforms, maximum differential activity between affective primes was evident at channel Pz for the 100-150 ms time window, so that channel was selected for statistical analysis. Late Positive Component (LPC) effects were examined in the time window of 650-1000 ms post-stimulus onset at channel FCz, where maximal effects were observed. This late time window was also selected on the basis of maximal observed activity.

Statistical Analysis

To analyze the proportion of products purchased as the dependent measure, a repeated-measures ANOVA was conducted with the factors Brand (national, private), Price (15 levels), and Prime (negative, positive, neutral). For statistical power in the ERP and reaction time analysis, price levels were collapsed into two levels relative to the reference price: price increase and price decrease. ERP amplitude and reaction time were then analyzed with repeated-measures ANOVAs with the factors Brand (national, private), Price (increased, decreased), Prime (negative, positive, neutral), and Purchase Decision (purchase, no purchase).

Results

Behavioral Results

Proportion purchased. As can be seen in Figure 2 (Appendix), as predicted, a significant main effect of Prime was found, F (2, 31) =4.36, p= .022, where negative primes resulted in fewer Buys compared to positive and neutral primes. However, contrary to our expectation, a significant Prime x Brand interaction was not found, i.e., the affective primes seem to have influenced purchase decision regardless of brand type. Figure 3 (Appendix) shows a significant main effect of Price, F (14, 19) = 9.88, p= .000, where more products were bought at decreased prices, but fewer products were bought as price increased, supporting our hypothesis. However, again contrary to our prediction, a significant Brand x Price interaction was not found, reaching only marginal significance, F (14, 19) = 2.24, p= 0.052.

Reaction time. Figure 4 (Appendix) shows that, in line with our predictions, a significant main effect of Brand was found, F(1, 22) =13.55, p= 0.001, indicating that participants responded faster overall for national brands (M=950.83 ms, SE= 62.14 ms) compared to private label products (M= 1012.32 ms, SE= 69.48 ms). An unexpected significant Price x Purchase interaction was found, F (1, 22)= 12.64, p= 0.002. Specifically, as Figure 5 (Appendix) depicts, participants were approximately 28 ms faster to make a purchase decision at a decreased price relative to increased price, whereas they were approximately 88 ms faster to make a no-purchase decision at an increased price relative to a decreased price. Another interesting unexpected finding was a significant Prime x Brand x Price 3-way interaction, F (2, 21) = 3.68, p= 0.043 (see Figure 6, Appendix). For positive primes, participants were faster to respond for national brands compared to private labels by about 47 ms at price decrease, and by about 112 ms at price increase. Neutral primes showed a similar pattern: participants were faster to respond for national brands compared to private labels by about 31 ms at price decrease, and by about 54 ms at price increase. For negative primes, participants were faster for national brands compared to private labels by about 124 ms at price decrease. However, at price increase, there was virtually no difference in RT between brand type (M= 997.49 ms, SE=72.46 ms for national, M= 997.52 ms, SE= 68.28 ms for private).

ERP Results

Very Early Emotional Effects (VEEE). This analysis used difference waves in order to determine any maximal difference between the emotional primes and the neutral prime. A significant effect of Prime was found, F (2, 30)= 7.01, p=.003 in the early time window of 100-150 ms post-stimulus onset at channel Pz. This differential modulation was found in the mean amplitude of neutral primes compared to both positive and negative primes during this time window. Positive prime amplitude (M= -2.438 ± 0.833 µV) and negative prime amplitude (M= -2.380 ± 0.885 µV) were more positive relative to neutral prime amplitude (M= -3.311 ± 0.819 µV). The difference waves are depicted in Figure 7, and the non-difference waves are depicted in Figure 8 (Appendix).

Late Positive Complex (LPC). A significant Prime x Brand interaction was found, F (2, 20) = 7.71, p= .003 (see Figure 9, Appendix). As predicted, positive-primed private label products displayed a larger mean amplitude (M= 5.391 ± 0.926 µV) compared to positive-primed national brand products (*M*= 3.732 ± 0.920 μV), while negative-primed private label and national brand products did not differ in mean amplitude (private: *M*= 3.713 ± 0.915 μV; national: *M*= 3.832 ± 0.924 μV). Neutral private label products also differed in mean amplitude (*M*= 5.134 ± 0.914 μV) compared to neutral national brand products (*M*= 4.294 ± 0.897 μV).

Another unexpected finding was a significant Brand x Purchase interaction, F (1, 21) = 4.79, p= .040 (see Figure 10, Appendix). Private label no-purchase trials showed a larger mean amplitude (*M*= 5.226 ± 0.901 μV) compared to private label purchase trials (*M*= 4.266 ± 0.968 μV), whereas national brand products showed no difference in mean amplitude between purchase and no-purchase trials (Purchase: *M*= 4.026 ± 0.952 μV; No-Purchase: *M*= 3.879 ± 0.867 μV).

A significant Prime x Purchase interaction was found, F (2, 20) = 5.07, p= .017 (see Figure 11, Appendix). In line with our predictions, purchase trials following a positive prime showed a larger mean amplitude (*M*= 4.903 ± 0.912 μV), compared to both negative purchase trials (*M*= 3.735 ± 1.103 μV) and neutral purchase trials (*M*= 3.800 ± 0.962 μV).

Discussion

The aim of the present study was to manipulate emotion via affective priming to examine how emotion interacts with brand type and price to influence purchase decision at both the behavioral and neural level.

Behavioral Hypothesis 1 suggested that negative primes would result in fewer buys, while positive primes would result in more buys relative to neutral. It was further predicted that this effect would be stronger for private label products than for national brands. Findings indicate that emotional primes did to seem influence purchase behavior, although this appears to be restricted to the negative primes. Specifically, flashing a negative (threatening) image prior to product onset resulted in fewer buys, compared to flashing a neutral image or a positive image. These findings, in part, support and extend the research done by Gratch, Clore, & Palmer (2009), in which negative affective information disrupts any currently activated thoughts and inclinations. Importantly, this negative priming effect on purchase decision did not depend on brand type, i.e. both private labels and national brands were affected equally by the negative primes. Considering the previous research that has indicated that comfort and brand familiarity are defining factors often offered by national brands that largely guide purchase decision (e.g. Ravaja, Somervuori, & Salminen, 2012), the current findings may have important implications. Being that negative primes were observed to have an equally strong effect on both brand types, this suggests that negative emotional primes may have the ability to override pre-existing national brand influences, at least temporarily. Further research involving a wider breadth of products and brand types is needed to explore these preliminary findings.

Behavioral Hypothesis 2 suggested that, at high price extremes, fewer products would be purchased regardless of prime or brand type. Price was found to have a significant main effect regarding purchase behavior, but this effect included both high and low price extremes. A very clear inverse relationship was observed; products presented at the lowest prices resulted in the greatest number of purchases, which steadily declined as price gradually increased. In other words, price extremes influenced purchase behavior regardless of brand or prime type. The importance of this finding is that, within the context of this study, of the three factors that influence purchase decision (prime, brand type, price), price may be the strongest of all three, and may be the ultimate deciding factor when contemplating a purchase.

Behavioral Hypothesis 3 suggested that, at prices lower than reference, more national brand products would be bought, while at prices slightly higher than reference, relatively more private label products would be bought. However, this was not the case in our findings, as this effect only reached marginal significance. It is possible that a significant result could be obtained by using more expensive products, as this would augment perceptions of quality and may increase both loss aversive and gain seeking behavior for national products (Rao & Monroe, 1989; Ravaja, Somervuori, & Salminen, 2012).

Behavioral Hypothesis 4 predicted that reaction time would be faster for national brands and slower for private labels. Such an effect was confirmed; overall, responses to national brands were significantly faster compared to responses to private labels. Importantly, however, the results also indicated that negative primes significantly altered this effect. For both positive and neutral primes, participants were faster to respond for national products and slower to respond for private label products. This pattern was the same whether the products were presented at an increased price or a decreased price. This is consistent with the notion that , in general, consumers tend to have strong, pre-existing brand associations for national products, so this should facilitate the speed of their decision making, while private labels are more ambiguous and should therefore take longer to reach a decision (Hoeffler & Keller, 2003). With negative primes, this pattern (faster RT for national and slower RT for private) was observed only at decreased price. With negative primes at *increased* price, brand type made no difference, i.e., participants took equally as long to respond. Reaction time is often used as an indicator of response certainty (e.g., Steffen, Jansma, & Rockstroh, 2009). Because at increased price, both positive and neutral primes displayed a clear pattern, and only negative primes were shown to disrupt this pattern, it is reasonable to assume that this equal slowing of RT between national brands and private labels is due to the presence of the negative prime and not due to the presence of higher prices. Thus, at higher prices, negative primes were able to evoke uncertainty in the participant in such a way that national brands and private labels were no different from each other. Again, this finding implies that negative primes were able to, at least temporarily, override the pre-existing influence of national brands. However, the influence of price must also be considered, since this effect of negative prime was only found at increased price level. Research from Ravaja and Somervuori (2013) indicate that the combination of lower price levels and national brands elicit greater positive emotions. The current findings suggest that, in the absence of a decreased price, negative emotional primes had a strong impact and were able to attenuate the influence of national brands, effectively making the participant equally as uncertain as with a private label product. However, with the presence of lower prices, the impact of the negative prime seemed to be overridden, and normal reaction time differences between national brands and private labels were restored. This further supports the idea the price may be the most influential of these three factors, and the most important for purchase decision making.

Another unexpected result with reaction time involved price and purchase decision. Namely, if a price was decreased, participants were faster to respond with an affirmative purchase decision. Conversely, if a price was increased, participants were much faster to decline purchase. These findings are in line with the aforementioned concepts of gain-seeking behavior and loss aversion (e.g., Ravaja & Somervuori, 2013), in which consumers have a strong tendency to avoid losses (an increase in price from a base reference) and to seek gains (a decrease in price from a base reference).

Electrophysiological Hypothesis 1 suggested that, relative to neutral, positive and negative primes would result in differential modulations of early components (i.e. prior to 200 ms) following product onset. These very early emotional effects (VEEEs) were obtained, appearing as a more positive modulation for positive and negative primes relative to neutral in a time window between 100-150 ms. The time window of the observed VEEE is similar to the one reported by Schacht and colleagues (2012). These findings support the notion that priming effects spill over and influence subsequent brain activity (e.g., Mograbi & Mograbi, 2012). Thus, the effects of emotional prime that later influenced purchase decision appear to impact the brain very early in processing the product. Interestingly, although positive primes did not seem to significantly influence purchase decision at the behavioral level(compared to neutral), these findings suggest that the emotional content of the positive prime was still captured early on at the neural level, and did influence the processing of the product early in the time course.

Electrophysiological Hypothesis 2 suggested that a late positive complex (LPC), thought to index an associated positive outcome, would be larger for positive- primed private label products compared to positive-primed national brands, whereas negative-primed products would not differ in LPC amplitude between brand type. In line with these predictions, positive-primed private label products showed an enlarged LPC compared to positive-primed national brands. Conversely, for negative primes, there was no difference in LPC amplitude between private and national brands.

Behaviorally, unlike negative primes, positive primes did not appear to be strong enough to override other factors (such as brand type) and influence purchase decision on the behavioral level. However, we also found that positive primes elicited a VEEE, suggesting that the emotional content of this prime was still captured at the neural level. Private label products have been reported to be more neutral (Ravaja, Somervuori, & Salminen, 2012), and thus more susceptible to the influence of emotional primes. The current findings, then, may suggest that the more malleable private label products, immediately following a positive prime, were initially associated with a positive outcome, resulting in an enhanced LPC. In contrast, strong, familiar national brands, which are already "emotionalized" (Ravaja & Somervuori, 2013) seem to be more robust to the positive primes. The pre-existing emotions connected with national brands are based on individual experience (Ravaja, Somervuori, & Salminen, 2012), so it is likely that any positive outcomes associated with a national brand were attenuated over many participants, resulting in a comparatively smaller LPC.

Given that no result showed a higher number of purchases for private labels following a positive prime, this was taken to indicate that the positive prime was not able to sustain its initial effect. Instead, other factors sometimes associated with unfamiliar products, such as lower quality (Hankuk & Aggarwal, 2003) may have been brought to mind, resulting in a mixed subjective response. This conscious inspection of feelings towards the product, referred to as the "how-do-I-feel about-it?" heuristic (Pham, 1998; Pham et al., 2001) would have likely required more time for unfamiliar private labels compared to the already-familiar national brands. This is supported by the RT results previously mentioned, which showed that participants took longer to respond for private labels following a positive prime compared to national brands following a positive prime. Increased LPC amplitude was not observed for negative primes, and again no difference between brand types was found. Interestingly, this may indicate that , even at the neural level, negative primes are shown to reduce differences between private labels and national brands.

Electrophysiological Hypothesis 3 suggested that purchase trials would elicit a relatively larger LPC for positive primes, compared to neutral and negative purchase trials. Our results confirmed this hypothesis. This is consistent with findings from Ravaja and Somervuori (2013), who found that positive emotions are related to greater purchase intent. Previous research has also found that participants are more certain in their response following a positive prime (Steffen, Jansma, & Rockstroh, 2009). Our behavioral results indicate that positive primes are not able to directly drive purchase decision. However, these LPC results for purchase trials suggest that, when participants had the intention of purchasing a product , exposure to a positive prime strengthened the expected positive outcome of the purchase. This information could be useful for sales managers interested in consumers who are hesitant about a purchase, for example.

An unexpected LPC result was also found. Specifically, on no-purchase trials, private labels showed a larger LPC compared to purchase trials for private labels. In contrast, for national brands, there was no difference observed between purchase and no-purchase trials. If LPC amplitude is thought to index association with a positive outcome, one might question why no-purchase for a private label would be most strongly associated with a positive outcome. This finding is taken to be a direct reflection of the loss aversion phenomenon previously described. In studying consumer purchase behavior around a normal selling price, research has shown that loss aversion is stronger for private label products, while gain-seeking behavior is a stronger tendency for national brands (Ravaja & Somervuori , 2013). However, as a whole, consumers weigh losses more heavily than gains (Ravaja, Somervuori, & Salminen, 2012). This would mean that, although consumers are drawn towards gain-seeking behavior for national brands, it may be that avoiding the risk of an ambiguous product and saving money is perceived by the brain as a better outcome. Thus, these findings provide evidence for the preponderance of loss aversion at the neural level.

Limitations of the present study must be considered. Firstly, the early ERP components locked to product onset may have been distorted by previous ERP activity stemming from the prime. However, the VEEEs analyzed were not restricted to a specific component; rather, any differential activity between the emotional and neutral primes reflected the effects of the emotional valence of those images. Secondly, future studies in this area might offer a monetary incentive in order to engage the participant more effectively to the task. In addition, the influence of prime on purchase behavior was restricted to the negative primes. However, the present study specifically used threatening images in order to elicit a particular negative response (i.e. fear), while the positive primes were more generalized. Future studies might use more specific positive primes, such as images reflecting affluence or power, which may prove to be more effective in influencing purchase behavior.

In summary, this study is a good example of how psychophysiological measures may be applied in marketing and pricing research. The work presented here shed light on some of the neural processes that drive purchase decisions, not all of which were manifested at the behavioral level. Results from this study provide preliminary support for using the LPC as an index of associated positive outcome, and suggest that it may be a useful component in consumer neuroscience research. Perhaps most importantly, this study showed that negative emotional primes, specifically containing threatening images, were able to directly influence purchase decision. This is among the first studies to demonstrate this effect, which opens up both opportunities and challenges. The present research used fear-inducing primes; as previously mentioned, future studies may explore a wider range of emotions by using images that induce other specific responses, such as disgust. Alternatively, the effects of other types of images, such as erotic images, may be explored. In addition, the present study used supraliminal priming, and showed that the influence of an affective prime on purchase decision can occur without awareness of the relationship between prime and product. Future studies in this area may choose to mask the affective prime so that it becomes subliminal, meaning that viewers would not consciously perceive the image, and would not even be aware of its presence. In other words, subliminal primes have the potential ability to direct a purchase decision without the viewer's conscious control. Applications of this research would raise a host of ethical implications in terms of marketing and advertising, and may require the action of regulatory bodies and agencies (Mograbi & Mograbi, 2012). If this is the case, electrophysiological research in this area of consumer neuroscience, similar to the present work, will be critical to better our understanding of these techniques and their role on consumer behavior.

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Appendix

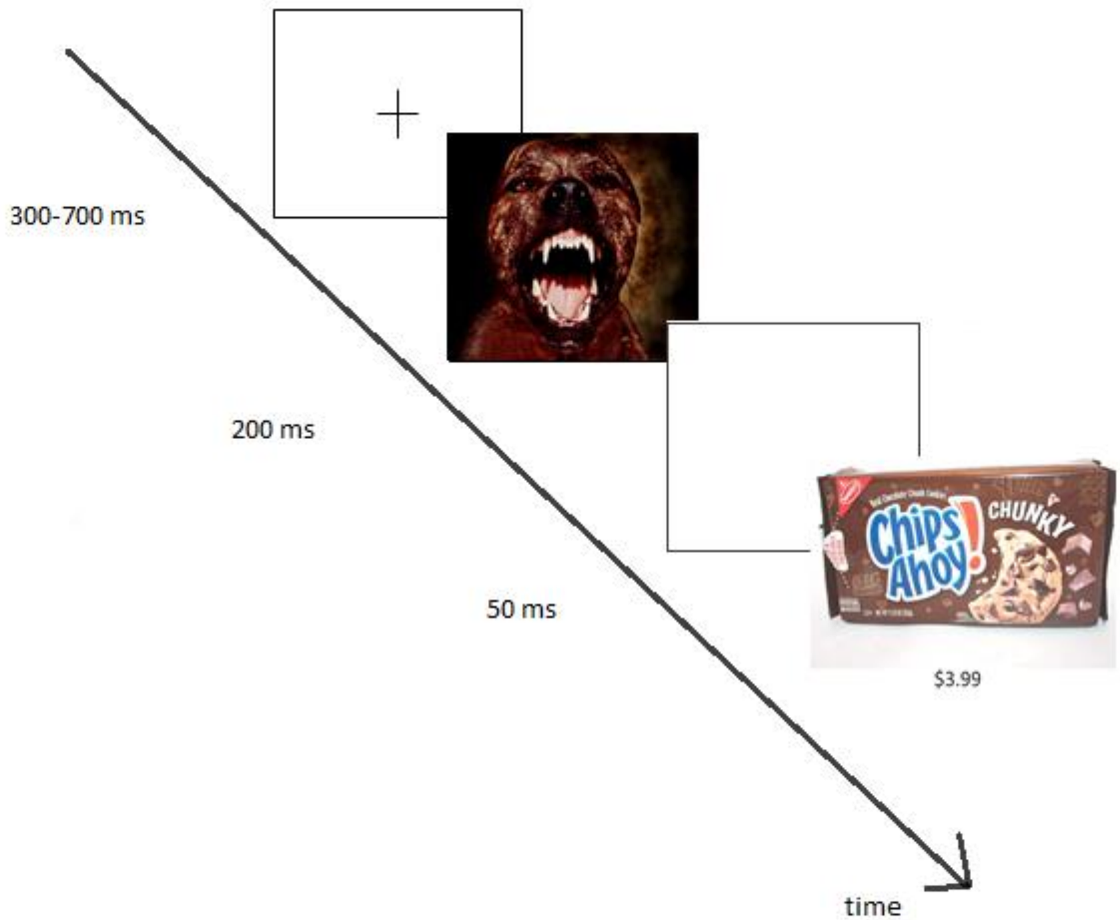

Figure 1. Illustration of one trial condition. Participants see consecuetively the following: (a) The fixation cross for 300 to 700 ms at random, (b) an affective prime (positive, negative, or neutral) for 200 ms, (c) a mask for 50 ms, (d) the product (either national or private brand) and its' associated price. The product image remained on the screen until the participant responded with either (1) purchase or (2) no-purchase.

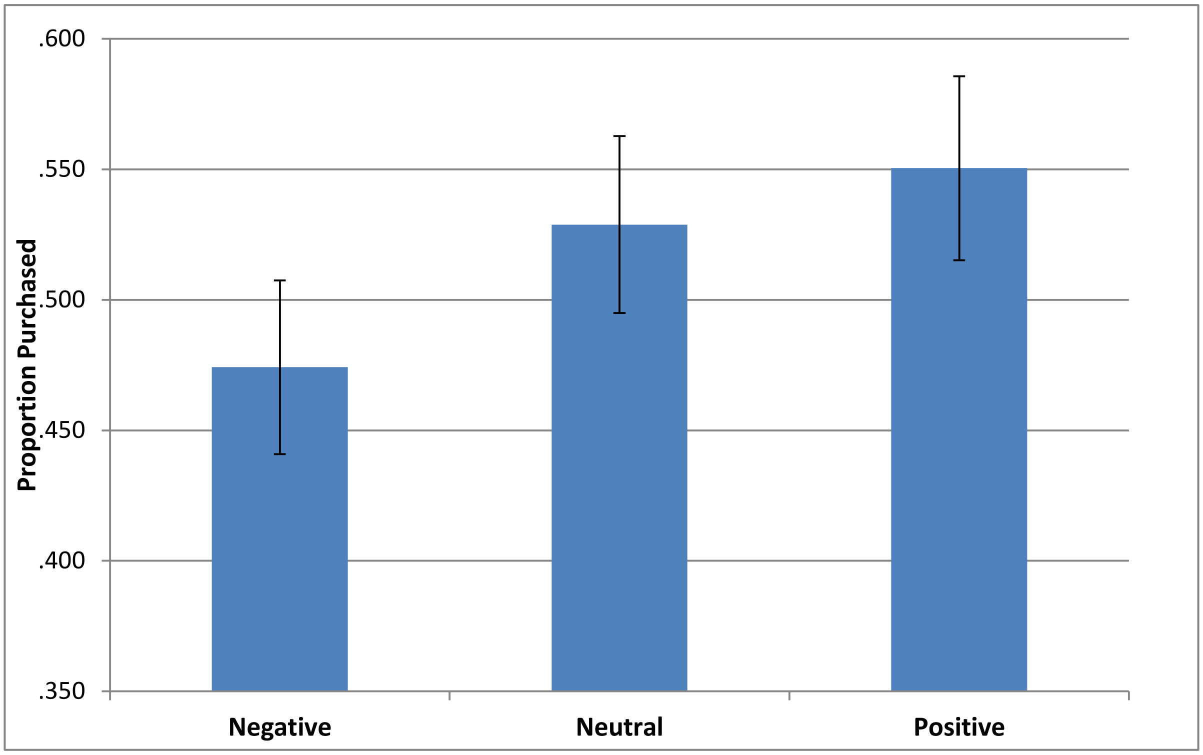

Figure 2. Main effect of prime on purchase decision. Overall, negative primes resulted in significantly fewer purchases compared to neutral and positive primes.

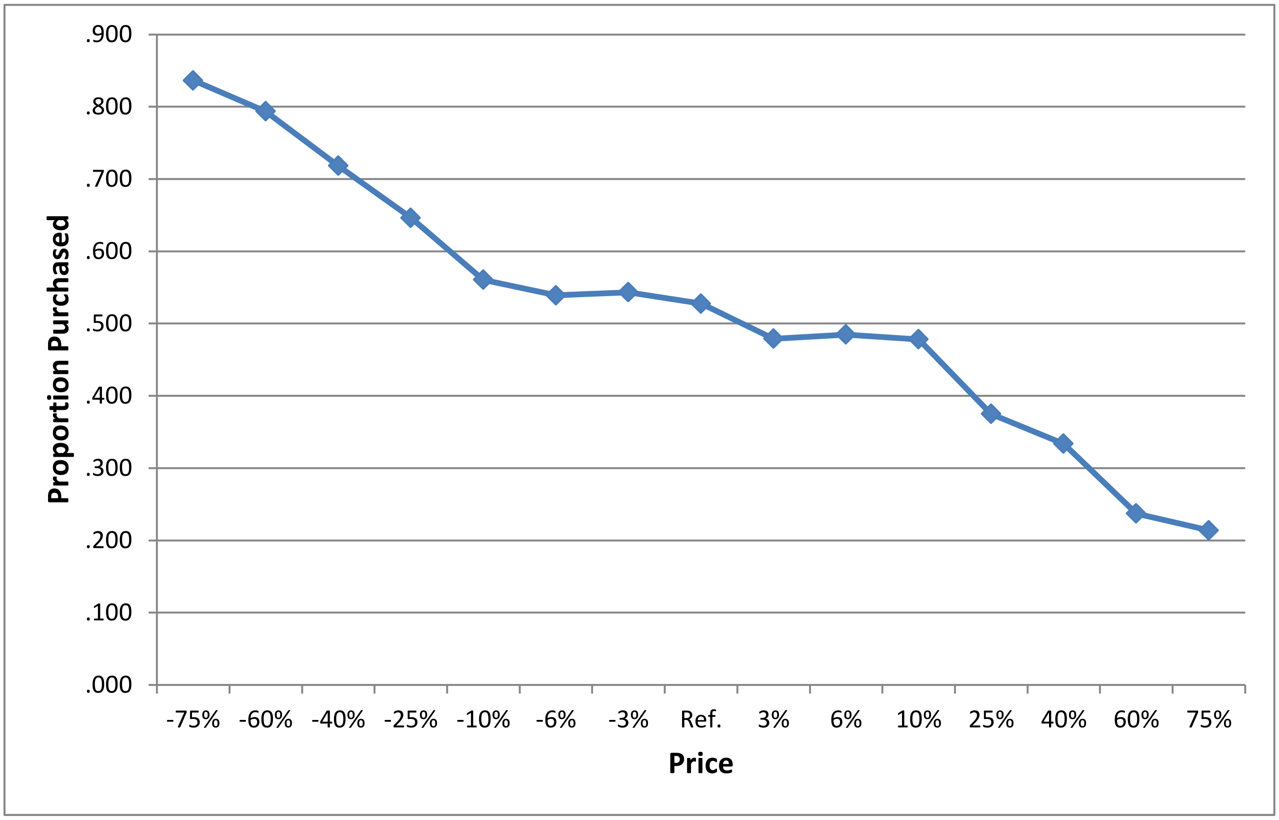

Figure 3. Main effect of price on purchase decision. At low price extremes, participants made more affirmative purchases decisions. As price increased, fewer and fewer affirmative purchase decisions were made. Brand type and prime did not affect this overall trend.

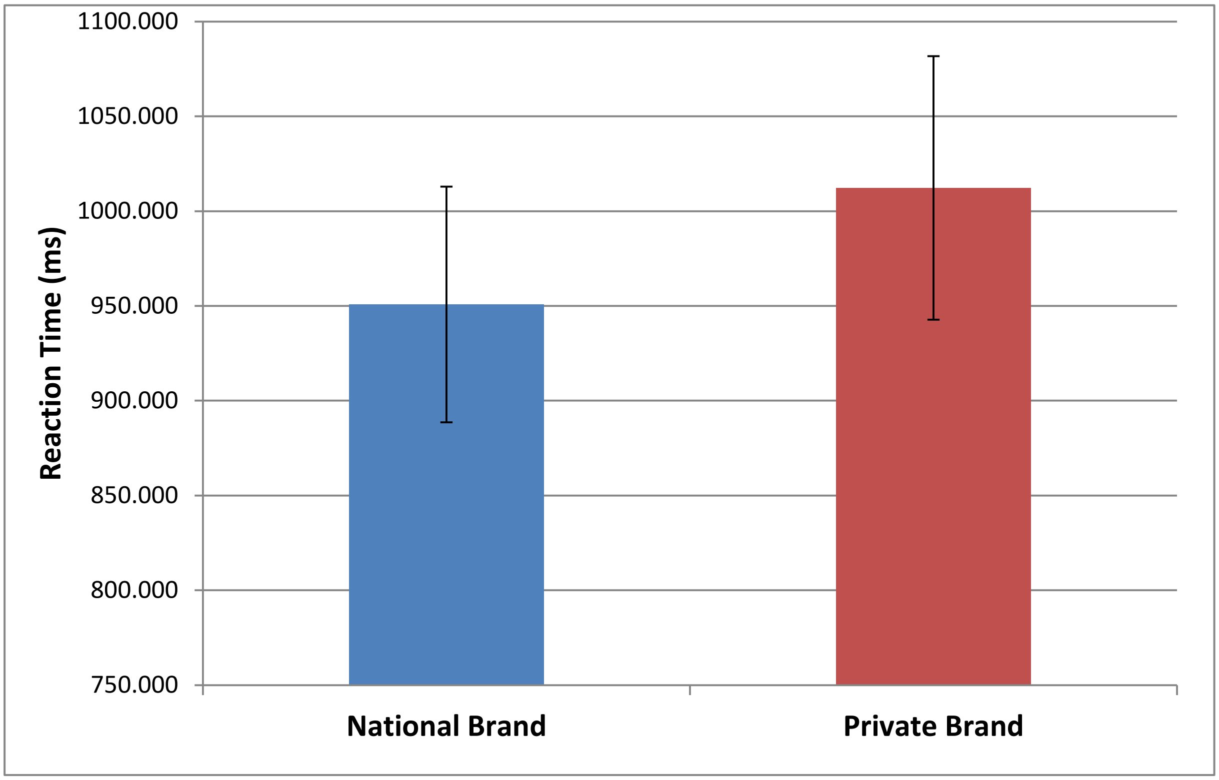

Figure 4. Main effect of brand type on reaction time. Overall, regardless of purchase decision, participants were faster to respond to national brands compared to private label brands.

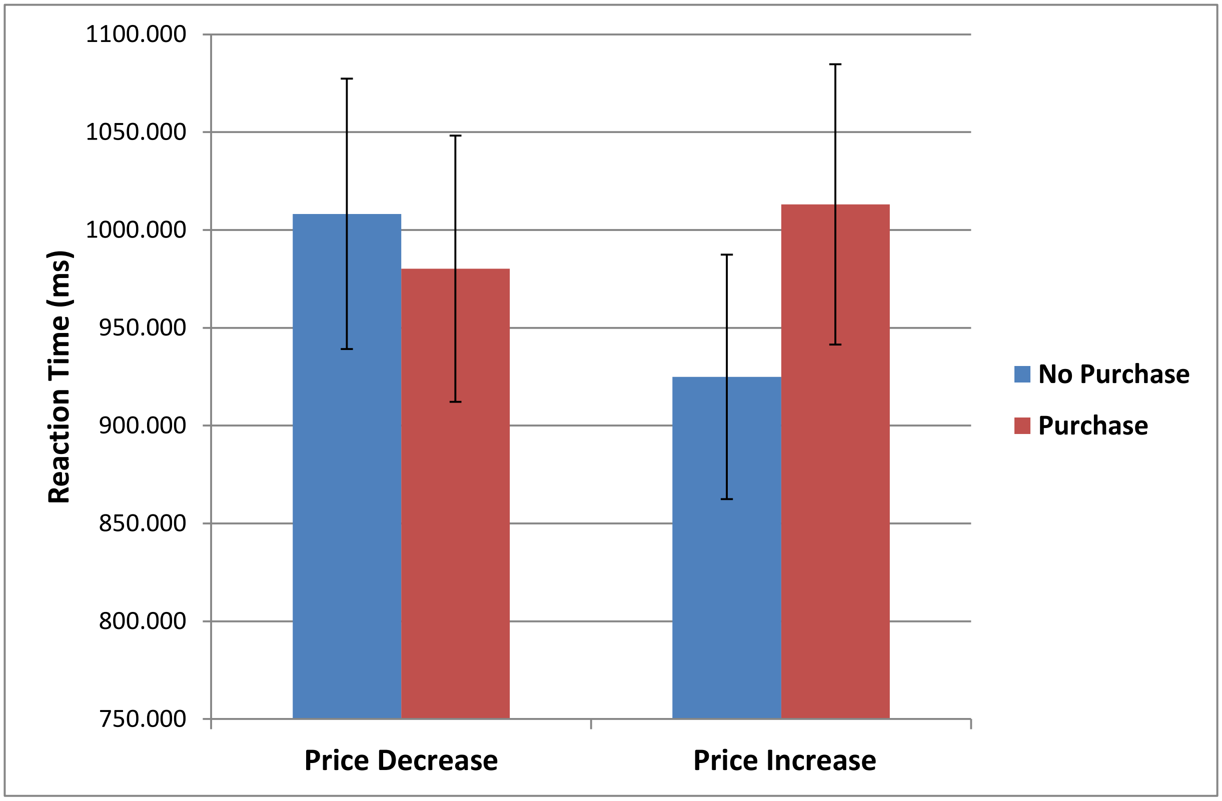

Figure 5. Price by purchase interaction. At decreased prices, participants were faster to make an affirmative purchase decision. At increased prices, participants were faster to make a no-purchase decision.

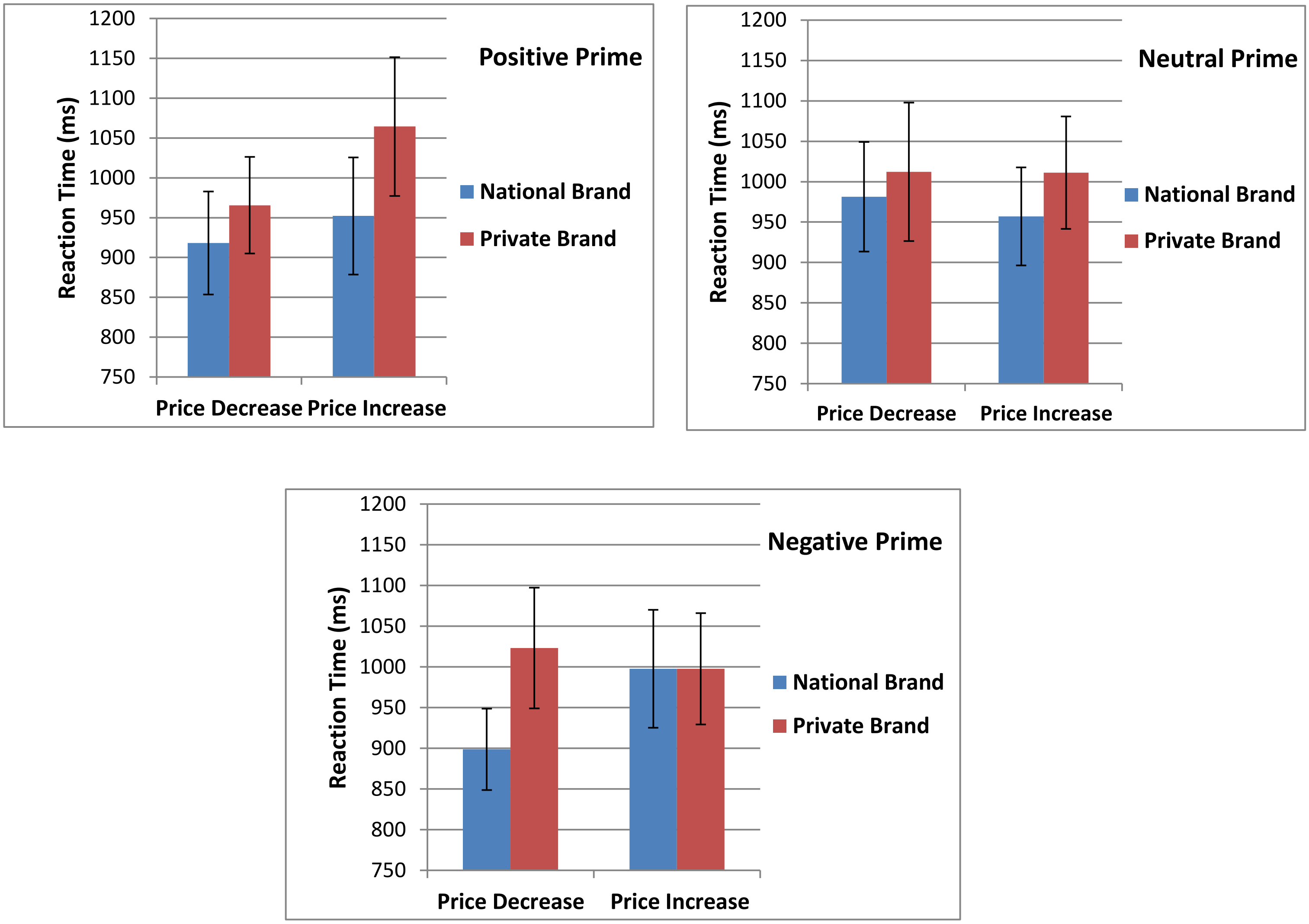

Figure 6. Comparison of reaction time for all three primes with both brand types and price levels. Following a positive or neutral prime, participants responded faster to national brands and slower to private brands at both increased price and decreased price. Following a negative prime, this pattern was also seen at decreased price. At increased price, no difference in reaction time was observed between national and private brands.

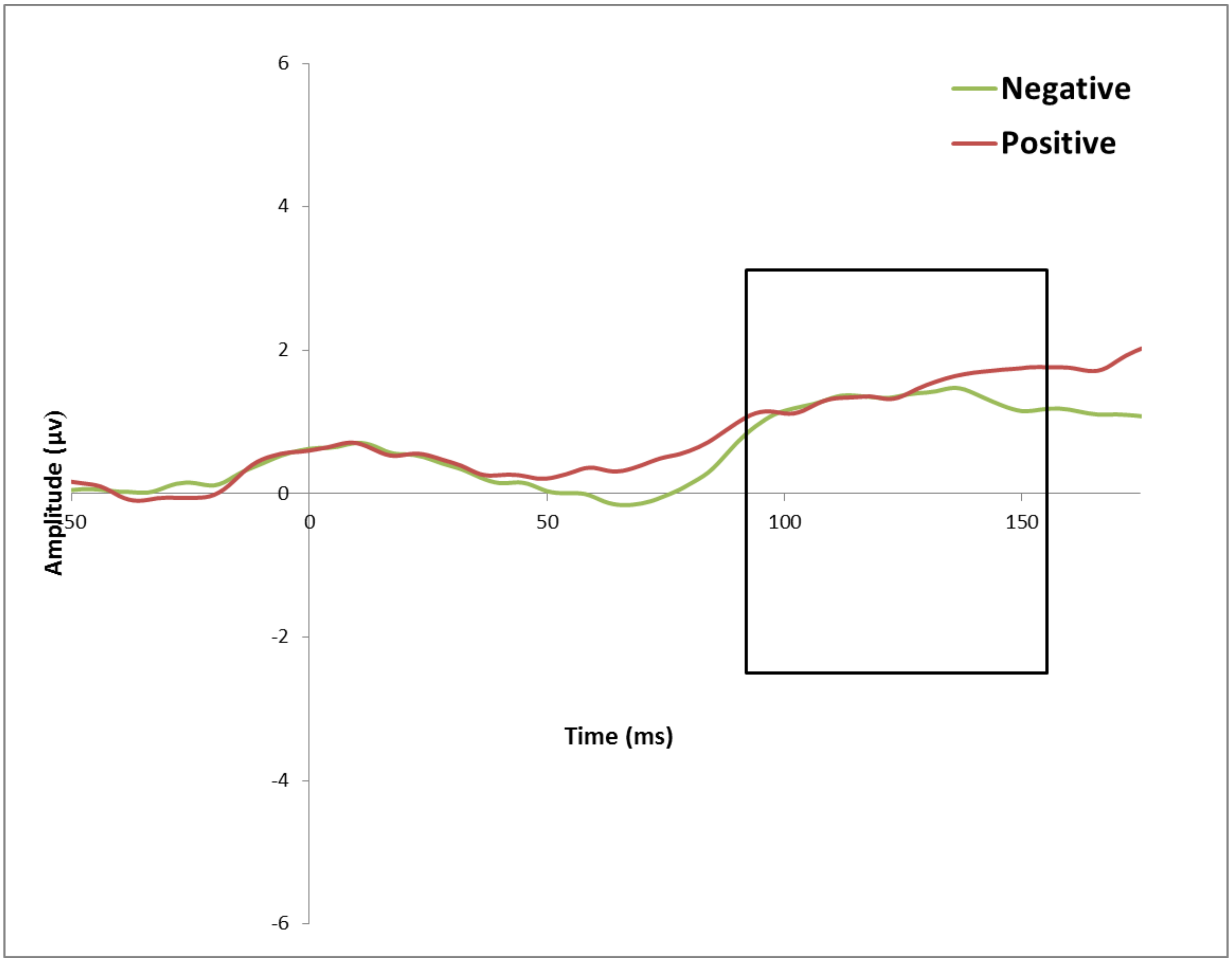

Figure 7. Early effects of emotional prime on ERPs- Difference waves. Grand average ERPs at Pz electrode are depicted, subtracting the neutral prime from the emotional primes and plotting the difference waves. Significant differential modulation between positive/negative primes from the neutral prime (i.e. zero baseline) appeared in the 100-150 ms time window.

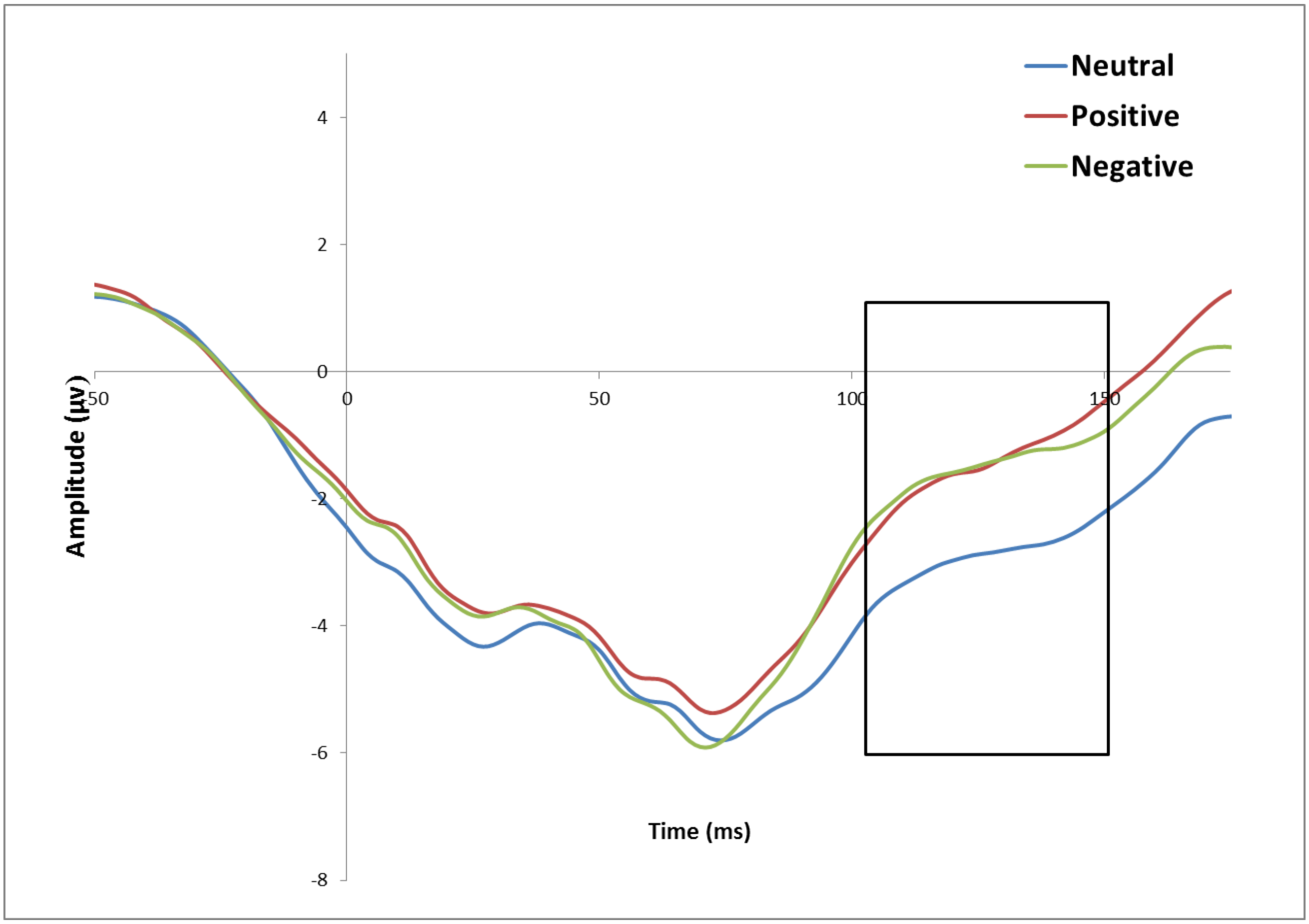

Figure 8. Early effects of emotional prime on ERPs- Non-difference waves. Grand average ERPs at Pz electrode are depicted, contrasted for positive, negative, or neutral primes. Significant differential activity between neutral vs. positive and negative primes appeared in the 100-150 ms time window.

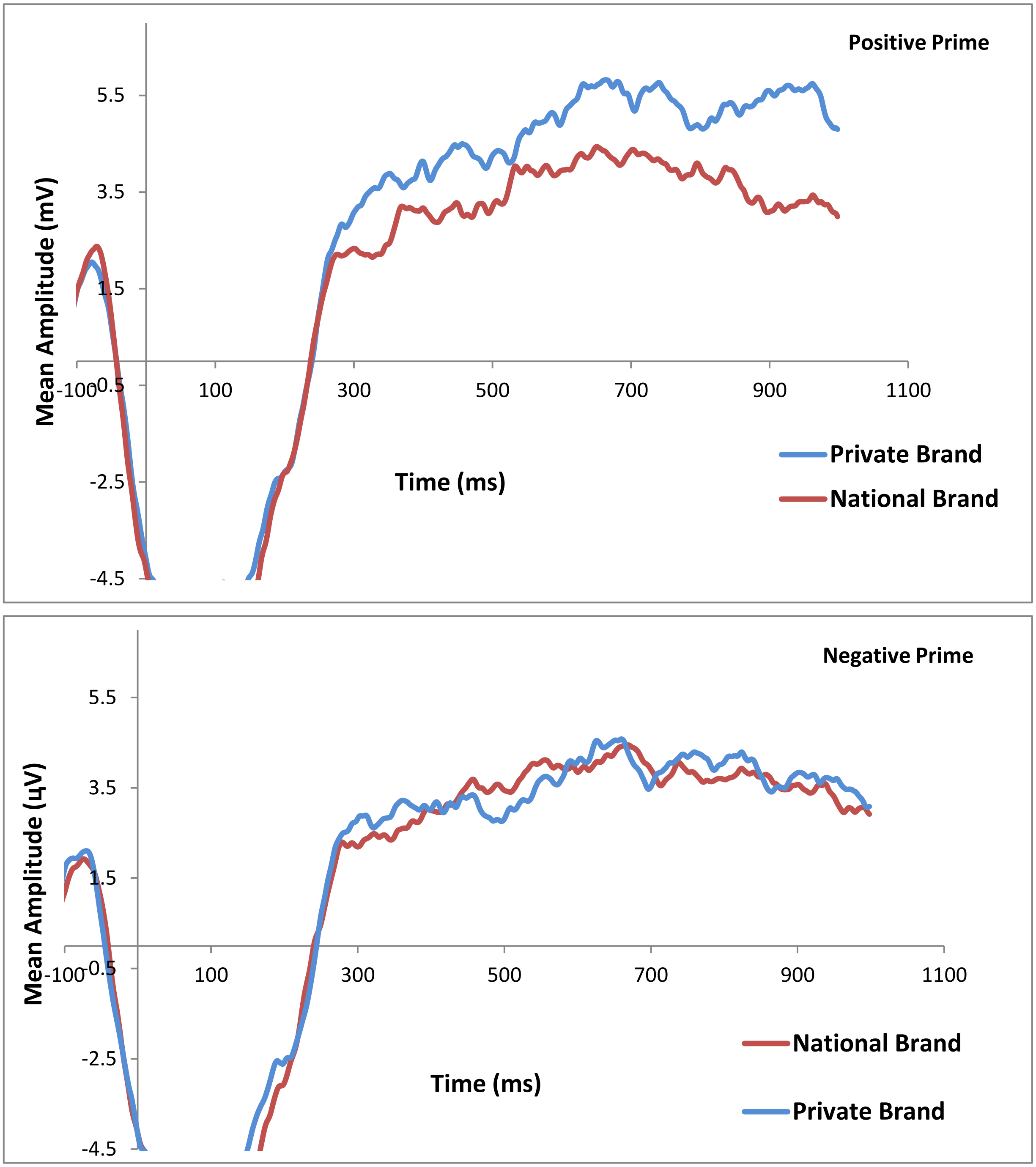

Figure 9. Effect of prime and brand type on late positive complex (LPC) amplitude. Both top and bottom panels depict grand averages of ERPs at Fcz electrode measured at 650-1000 ms time window. Top panel: following a positive prime, LPC amplitude was increased for private brands compared to national brands. Bottom panal: following a negative prime, no difference in LPC amplitude appeared between brand type.

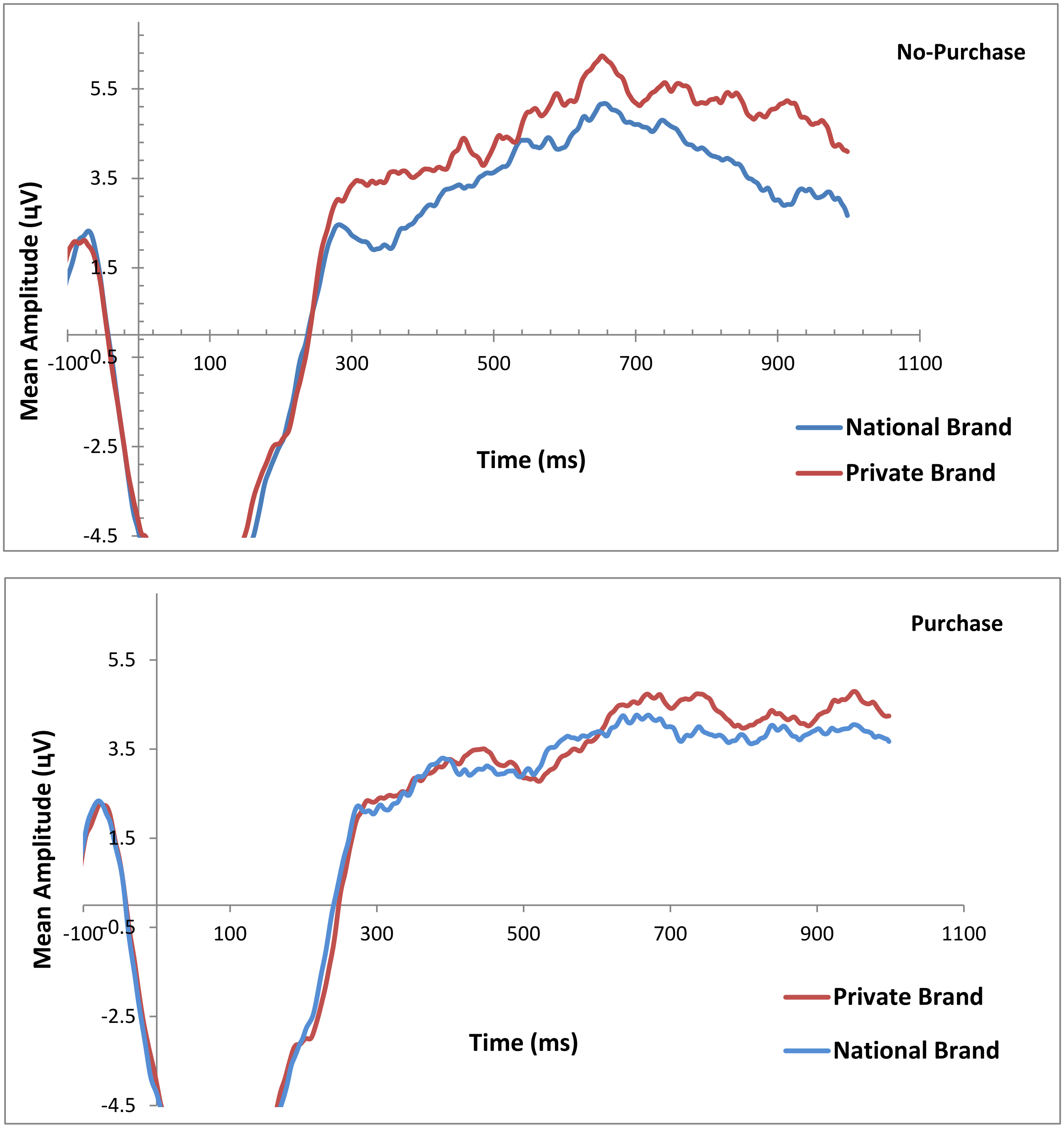

Figure 10. Effect of purchase decision and brand type on late positive complex (LPC) amplitude. Both top and bottom panels depict grand averages of ERPs at Fcz electrode measured at 650-1000 ms time window. Top panel: on no-purchase trials, private brands elicited a larger LPC compared to national brands. Bottom panel: on affirmative purchase trials, no difference in LPC amplitude between brand type was observed.

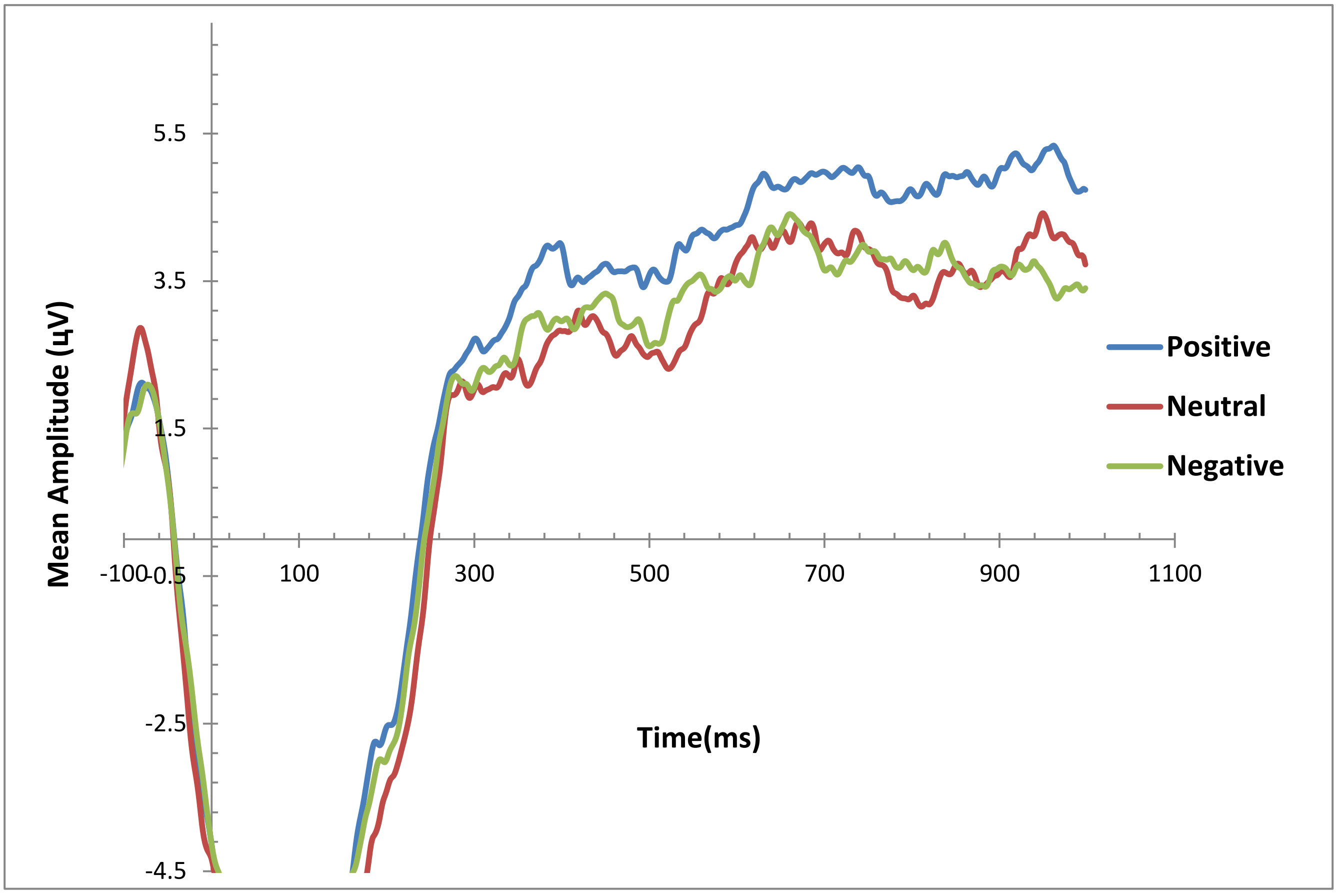

Figure 11. Effect of prime and purchase decision trials on late positive complex (LPC) amplitude. Grand average ERPs at Fcz electrode are depicted, contrasted for positive, negative, or neutral primes, measured at 650-1000 ms time window. Affirmative purchase decision trials preceded by a postive prime showed an increased LPC amplitude compared to affirmative purchase decision trials preceded by a negative or neutral prime.