Saving the Day: The Relationship between Emotion and Purchase Intent in Television Advertising

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In this consumer neuroscience study, we demonstrate that neuroscience measures of emotion/motivation are associated with traditional self-report measures of purchase intent. Specifically, combinations of electroencephalographic (EEG) motivational-valence measurements provide a reasonable linear predictor of self-rated purchase intent. This association plays out through a temporally patterned sequence of shifts from withdrawal to approach motivation that take place over the course of viewing a television commercial. The data for our study was acquired from a group of 520 South African consumers who viewed 42 television commercials drawn from a range of industries.

INTRODUCTION

In terms of global trends, the market research industry is undergoing drastic shifts: there is growing interest and adoption of research tools that utilise methods from the cognitive and neurosciences (Plassmann, Venkatraman, Huettel, & Yoon, 2015). These methods include neuroimaging, electrophysiology, and reaction-time based approaches (Silberstein & Nield, 2012; Ohme, Reykowska, Wiener, & Choromanska, 2009; Gattol, Sääksjärvi, & Carbon, 2011). With increasing penetration of what have become known as *implicit measures*, researchers and marketing executives alike are turning their attention to nervous system processes with the objective of gaining greater understanding of consumer behaviour.

While there is ample evidence to substantiate the claim that emotion plays a critical role in economic decision-making (Camerer, Loewenstein, & Prelec, 2005), there are still many unanswered questions relating to brain-based measurements of emotion and subsequent consumer behaviour. It is still not clear, in a definitive sense, how neuroscience measures of emotion are linked to changes in establish market research metrics such as self-report indices of purchase intent. In terms of structuring advertising materials, are there certain regions of a television commercial

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(TVC) that are more important than others in terms of motivating consumers toward a purchase? There are studies that deal with connections between the neural manifestations of emotion and subsequent decision-making, product preferences, and appraisals of perceived product quality (Ravaja, Somervuori, & Salminen, 2012; Silberstein & Nield, 2012), but there is less evidence verifying the role varying levels of emotion plays in the success of a TVC.

In this study we set out to understand how: (1) a TVC creates an ebb and flow of positive and negative emotions and (2) how the temporal sequence of these emotions motivate consumers towards purchasing a product or service.

CONCEPTUAL BACKGROUND

How do TVCs motivate consumers towards a purchase?

Prospect theory shows that a prospect of a loss has more influence on the choices we make than a prospect of a similar magnitude gain (Kahneman & Tversky, 1979). An expansion of this loss aversion principle is formalised in the *attention-allocation model* (Yechiam & Hochman, 2013). The theory associated with the attention-allocation model posits that losses have distinct effects on human performance, arousal, frontal lobe activation and behaviour: losses lead to a strong orienting response and facilitate an increase in the attention allocated to an experimental task. Moreover, the *negativity bias* proposes that negative information exerts a greater influence on our moods and thoughts than positive information (Ito, Larsen, Smith, & Cacioppo, 1998). A concrete example of this is in the media wherein there is a leaning to favour negative news content in order to attract audiences (Trussler & Soroka, 2014). It would therefore seem theoretically correct that a TVC could utilise *loss aversion* or negative imagery as a motivating and attention-orienting factor. However, it would be arguably useless in a marketing communication to focus exclusively on loss or negativity to motivate a consumer towards a purchase, as they are likely to appraise the brand/product as aversive and subsequently avoid the brand/product altogether.

Loss, aversion, or any form of conflict introduced into a TVC must inevitably be resolved by delivering a subsequent promotional message, wherein the brand/product is the catalyst for the resolution of the conflict. When the brand/product is heralded as the hero, positive emotional sentiment develops, but most importantly, such heroics on the brand's part are interpreted by the viewer as an emotional reward. Certainly many TVCs that have used this approach have yielded market place success; however, there is no scientific evidence to verify the role of emotion in this regard.

Distinguishing between wanting and liking and their role in motivation

Although the terms wanting and liking may seem synonymous, fundamental differences that are of importance to our research exist between the two concepts. Kent Berridge (n.d) defines liking as "an objective process of positive hedonic reaction that underlies subjective sensory pleasure." In our view, liking refers to the hedonic quality of a brand or product. When an individual claims to like something, they are typically referring to a subjective hedonic evaluation of the item, i.e. how much pleasure they perceive the item is likely to bring them. Wanting on the other hand involves decreasing one's distance from an incentive—a motivational factor. Thus, when an individual wants something, we refer to the motivational value or incentive salience of that item. As Thomas Ramsøy (2014) puts it, "We can define "wanting" as the unconscious approach and avoidance evaluations related to items, organisms and events."

Liking for a product is a psychological property that can remain fairly constant over time, despite shifts in motivational state. For example, one may like Coca-Cola, but will at different times feel more or less motivated to seek it out. The differentiation between the two constructs is further supported by neuroscientific evidence. Recent scientific advances in neuroimaging have shown that these different psychological states are represented within different neural substrates (Berridge, Robinson, & Aldridge, 2009). Furthermore, Dai, Brendl, & Ariely, (2010) showed that people can have concurrent neural representations of an objects likability versus its motivational (or incentive) value.

Frontal Alpha Asymmetries and human motivation

The lateral orbital regions and the ventromedial regions of the prefrontal cortex (PFC) of the brain as well as the most anterior portion of the temporal lobes have been directly implicated in various aspects of human motivation (Iversen, Kupfermann & Kandel, 2000). The orbital prefrontal surfaces and temporal poles share dense connections and are known to play an important role in the assignment of emotional value to objects (Hasan et al., 2009). When decision-making components are built into experimental designs that test emotional/motivational processing, orbital-temporal networks work in conjunction with dorsolateral regions in order to achieve the goals set out by the experiment (Rosenbloom, Schmahmann & Price, 2012). The dorsolateral prefrontal cortex (DLPFC) plays a fundamental role in higher-cognitive function, specifically decision-making. For instance, Davidson et al (2004) have showed that greater left-sided prefrontal activity—including DLPFC activation—may be associated with approach-related, goal-directed action planning, with these effects particularly pronounced during periods of anticipation and planning; the right PFC is understood to be involved in a system facilitating withdrawal behaviour from aversive stimuli (De Pascalis, Cozzuto, & Alessandri, 2013).

It is possible to measure the relative contribution of right and left prefrontal regions through an electroencephalographic (EEG) measurement. Specifically, activity in the alpha band is thought to reflect neural activation: a decrease in alpha-band power is related to neural activity and vice versa (Davidson, Ekman, Saron, Senulis, & Friesen, 1990, Klimesch, 1999). Thus, using electrodes placed over the left and right frontal regions and comparing the difference within the alpha band between the left and right hemisphere electrodes, one can assess the change in prefrontal activity while participants interact with marketing materials.

The EEG frontal alpha asymmetry measure has been shown to be a diagnostic tool in examining the potential of advertisements to generate approach related behaviour (Ohme, Reykowska, Wiener, & Choromanska, 2010; Pizzagalli, Sherwood, Henriques, & Davidson, 2005; Ravaja et al., 2012). For instance, Ravaja et al (2012) found that pre-decision EEG alpha asymmetries could predict the purchase decisions of consumers within their sample: relatively higher levels of left frontal activation (higher approach motivation) were associated with a higher likelihood of purchasing a product. They also found that higher perceived product quality and need were associated with relatively greater left frontal activation during the pre-decision period. Silberstein & Nield (2008) found higher left lateral prefrontal activity during the branding moments in a television advertisement for participants who subsequently changed their choice from a competitor product to the advertised product. Ramsøy (2014) reports on an in-store study, wherein the occurrence of higher left prefrontal activity was found to be, "predictive of increased likelihood of subsequent product purchase. That is, the asymmetry score was significantly, even dramatically, higher when consumers looked at products that they subsequently purchased compared to when they looked at products they did not buy." Ramsøy reports that they could predict a purchase decision to an accuracy of over 90% using only a 500 milliseconds segment of data that formed part of a larger dataset recorded while a consumer navigated an in-store environment. A recent study, however, found the asymmetry method to only be a moderate predictor of ad elasticity—the percentage change in sales due to a 1% change in the self-report measure being utilised—and did not explain a higher variance in advertising response beyond traditional research methods (Venkatraman et al., 2015). However, this study was limited to aggregated data over the course of the entire TVC and did not look at the impact of different levels of asymmetry, in isolation or in combination, at different points during the ad.

Using the above mentioned frontal asymmetry measure, we attempt to assess the level of statistical association between frontal asymmetry measures within the first and last 10 seconds of a TVC with self-rated purchase intent (SRPI). We chose TVCs as the ideal stimulus to test this association as they have a relatively consistent structure and temporal format. TVCs tend to conclude with branding, product information and benefits, and begin with openings that build a need or emotional connection with the audience. This allowed us to measure a uniform stimulus, as opposed to a print or online advertisement that can have more variable responses among an audience depending on the order in which they view the various elements of the ad. EEG's high temporal resolution provides us with the benefit of being able to analyse different time regions of the ads. We can therefore examine different combinations of the frontal asymmetry measurements in order to ascertain which sequences best correlate with SRPI.

Hypotheses

We tested the following hypotheses:

i. TVCs that induce higher self-rated purchase intent will be associated with higher left frontal activation (approach) during the last 10 seconds of a TVC.

ii. TVCs that induce higher self-rated purchase intent will be associated with higher right frontal activation (withdrawal) during the first 10 seconds.

iii. TVCs that induce higher self-rated purchase intent will be associated with a higher *combination* of left frontal activation (approach) during the last 10 seconds of the commercial and higher right frontal activation (withdrawal) during the first 10 seconds of the TVC.

iv. TVCs that with a higher *combination* of left frontal activation (approach) during the first 10 seconds of the commercial and higher right frontal activation (withdrawal) during the last 10 seconds of the commercial will not be related to self-rated purchase intent.

v. TVCs that induce higher self-rated purchase intent will have higher left frontal activation (approach) throughout.

METHODS

Participants

Each of the 42 ads were tested with a sample of 20-30 respondents. Each respondent was chosen to match the demographics of the TVCs target audience. This resulted in a final total sample of 520 participants—some of the participant groups watched 2 or more of the 42 advertisements we selected for analysis in this study.

Stimuli

In order to test our theory, we randomly chose 42 TV commercials that were tested over the 2014/2015 period. Ad length varied from 30 seconds to two minutes: over half the ads were 30 seconds long, while the majority of the remaining ads were 60 seconds in length. In order to ascertain what an effective means of communication was, independent of industry, we chose brands that covered a range of categories from FMCG to telecoms and insurance.

Data Acquisition

Electroencephalography

EEG data were acquired using gtec sahara, active, dry electrodes and a g.USB amp. g.Recorder software was used for digital signal acquisition. A low-density montage with 12-channels: (Fp1-Fp2-F3-Fz-F4-F7-C3-Cz-C4-F8-P3-P4) overlying the prefrontal, frontal, central, and parietal regions was used. A right mastoid reference was used for recordings. Impedance was kept below 5kΩ. Data were acquired at a sampling rate of 512Hz and digitised to 24-bit resolution. An on-line butterworth band–pass filter was applied (0.5 – 30 Hz). Stimuli were presented via E-Prime® using custom scripting, such that the presentation of an audio-visual file was tagged in the continuous EEG recording. Data were stored off-line for further analysis.

Self-rated Purchase Intent Measurements

After viewing the commercials, respondents were asked to complete a questionnaire which explored their rational assessment of the commercial including the SRPI question phrased as follows, “Do you think the ad would make you more or less likely to purchase (*x product*) in future?”. Purchase intent has previously been shown to have a strong ability to predict advertising elasticity—percentage change in sales due to a 1% change in the advertising measure being utilised (Venkatraman et al, 2015).

Data-processing

The data were high-pass filtered (HPF) at 2Hz and scanned for gross movement artefact. A 2 Hz high-pass filter (HPF) was chosen as the experiment elicited a great deal of eye-movement due to *saccades* and the *visual-grasp reflex*, which was evidenced by low-frequency band-power increases. A 2Hz HPF was also used in previous related research conducted by Vecchiato & Babiloni (2011). The data was submitted to an adapted infomax ICA algorithm. A *discrete wavelet transform* (DWT) was applied to the independent components through which low-frequency and high-frequency information that had significant similarities to the artefactual data (in terms of their higher-order statistics) were removed from the decomposed components. The components were reconstructed using an *inverse discrete wavelet transform* (iDWT) and all components were projected back onto the scalp to provide a clean artefact free dataset. The method was based on algorithms proposed in Castellanos & Makarov (2006) and Ghanderharion & Erfanian (2010).

The data were segmented 2 seconds prior to the onset of each TVC so as to avoid any distortion at the edge of the signal owing to filter order requirements. The data were filtered into consumer specific alpha bands determined by the consumer's peak alpha frequency (Klimesch, 1999). After filtering, the 2 second leading and trailing edges were discarded. The time-domain signals on the left frontal region (Fp1, F3, F7) and the right frontal region (Fp2, F4, F7) were then rectified to yield magnitude over time within each pass-band. The magnitude data were then square to yield spectral power within the time-domain. This was repeated for the advertisement data and for the baseline (eyes-open) data. The left and right hemisphere single-channel timeseries data were then averaged to yield the left frontal and right frontal alpha power timeseries for each ad. The right hemisphere timeseries was then subtracted from the left to yield uncorrected asymmetry measurements. The advertisement asymmetry timeseries was baseline-corrected by setting the mean to zero using a z-score standardisation, with parameters set using the eyes-open baseline asymmetry distribution. The baseline-corrected asymmetry measures were then down-sampled to a sampling rate equal to the frame-rate of the video files used for stimulus presentation (25Hz). This provided a time-resolution of the brain's electrical activity in relation to the stimulus. This was repeated for each advertisement.

Statistical Analyses

Pre-processing

The EEG timeseries were then segmented into blocks for the first and last ten seconds of each timeseries. The mean level of approach and withdrawal was extracted from the segmented blocks. In the instance of assessing hypothesis 5, the average level of approach was taken across the entire advertisement. All variables were normally-distributed and did not require any further transformation. These variables were then standardised to unit-variance using a z-score representation for each of the variables. In the instance where combinations of approach and withdrawal at the start and end of the TVC were considered, as in hypothesis 3 and 4, a mean of the approach/withdrawal combination from the start/end were taken and these were then standardised to unit variance. SRPI scores were standardised to unit-variance prior to fitting the models.

Analysis

We used 5 separate linear mixed-effects regression models with random intercepts to test five hypotheses regarding the linear relationships between SRPI and different features extracted from the alpha asymmetry timeseries data. The alpha asymmetry data was divided up to yield 5 continuous predictors of SRPI. Our hypotheses were assessed by testing the statistical significance of the slope coefficient within each model. The slope coefficient offers a measure of linear association between the two variables. To calculate R-squared for each model we used methods proposed by Nakagawa and Schielzeth (2013). All the models were validated by testing normality of residuals, residual outliers, and heteroscedasticity of residual variance.

RESULTS

The significance tests for each slope coefficient from for each of the five models are presented in Table 1.

Table 1. Hypothesis tests on the slope coefficient within each model (Dependent Variable= SRPI)

	Coefficients	*SE*	*t*
Hypothesis - 1	0.373	0.134	2.791**
Hypothesis - 2	-0.503	0.140	3.522**
Hypothesis - 3	0.755	0.163	4.635***
Hypothesis - 4	0.082	0.220	0.372
Hypothesis - 5	0.339	0.147	2.306*

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

1. Approach-related motivational tendencies in the last 10 seconds of an advertisement (Hypothesis 1) were significantly associated with SRPI, explaining 14.6% of the variance within the model $R^2 = .146$, $F(1,41.04) = 7.788$, $p < 0.01$.
2. Withdrawal-related motivation tendencies in the first 10 seconds of an advertisement (Hypothesis 2) were negatively associated with SRPI; 25.9% of the variance within the model was explained by this feature $R^2 = .259$, $F(1,28.205) = 12.404$, $p < 0.01$.
3. Approach-related tendencies at the end and withdrawal related tendencies at the start of the advertisement in combination (Hypothesis 3), were significantly associated with SRPI; a large proportion of the variance in SRPI was explained by this feature, $R^2 = .357$, $F(1,30.668) = 21.483$, $p < 0.001$.
4. When the reverse combination was tested (Hypothesis 4) the results were not significant.
5. The mean levels of approach-related tendencies throughout the advertisement (Hypothesis 5) were significantly correlated with SRPI. A fair amount of the variance in SRPI was explained by this feature, $R^2 = .119$, $F(1,39.879) = 5.319$, $p < 0.05$.

DISCUSSION

Our study provides evidence for the link between frontal lobe dynamics and changes in consumers' motivational states measured as self-rated purchase intent. Approach-related tendencies at the end of a TVC motivate consumers as evidenced by an increase in SRPI: this model alone explained 14% of the variability in SRPI. Withdrawal at the start of the advertisement, wherein a prospect of loss comes to the foreground, detracts from the formation of purchase intentions: 25% of the variability in SRPI was explained in this model alone. These results align with theory related to the negativity bias, in that loss or conflict and avoidance/withdrawal is more effectual, i.e. negative information at the onset of a TVC explains more of the variance in SRPI than positive heroics at the end. Consumer motivation is tied to the quality of information (negative vs. positive) and how this is appraised subjectively as either loss or reward.

Combining withdrawal from the onset and approach from the end of the TVC, in terms of having a plot that introduces prospect of loss and then alleviates this loss through brand heroics, was associated with an increase in SRPI. A large amount of variance in the SRPI was explained: 35.7%. Of all the models considered, this specific model accounted for the greatest amount of variability in SRPI. These data

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confirm that a temporally patterned sequence of emotions is a more powerful predictor of purchase intent. We also observed that the order of emotion was critical: when we reversed the order of valence—approach at the start and withdrawal at the end—the model yielded no significant prediction of SRPI. The sequence of motivational valence that viewers experience is key in motivating consumers towards a purchase. This was further verified by the fact that approach alone throughout the entire TVC contributed to consumer motivation; however, this model explained the least amount of variability in SRPI: 11.9%.

In our view, consumer motivation rests on how audio-visual content is structured, i.e. in terms of the sequence of emotions that the creative concepts seeks to elicit. Positive advertising or negative information alone are not strong motivational queues, but rather when taken together contribute to strong, significant shifts in consumer motivation.

The use of linear mixed effects models allowed us to take into account underlying dependencies in our data—in some instances, the same participant groups watched 2 or more of the 42 TVCs. It was important to take into account these dependencies when modelling the linear association between the frontal asymmetry data and SRPI measures from multiple participant groups, as dependencies violate assumptions of general linear models leading to Type 1 errors. An avenue for future research could be the use of multivariate approaches that would allow us to study concurrently modelled effects of the asymmetry variable on the prediction of SRPI.

CONCLUSION

Our study demonstrates that neuroscience measures of emotion/motivation are associated with traditional measures of purchase intent through the temporally patterned sequence of shifts from withdrawal (loss aversion) to approach (brand/product playing the hero). Emotion plays a significant role in the success of a TVC—if success is determined by changes in subjective appraisals of purchase intent. Combinations of approach/withdrawal at different regions of a TVC provide a reasonable linear predictor of consumer's subjective appraisals of purchase intent.

It is important to note that the neuroscience is not merely a replication of the self-report measure: the frontal asymmetry also provides a time-varying record of the motivational state of the consumer during viewing, allowing for a more in-depth quantitative analysis of a TVC's underlying structure. The results provide significant insight into the use of structure and narrative in building effective advertising materials.

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