Bringing Advertising Closer to Mind: Using Neurophysiological Tools to Understand Student Responses to Super Bowl Commercials

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Abstract

Similar to techniques used by systems designers, marketers have long used focus groups and survey-based tools to gain insight into the thoughts and intentions of their targeted consumers. Now, neurophysiological tools are helping provide an increased understanding of consumers by helping illuminate unconscious thoughts. Here we look to help undergraduate business students gain an appreciation for the nuances of using such neurophysiological tools and what they might offer. A preliminary study is presented where eighteen students in an advertising class participated in electroencephalographic recordings while watching the three nationally top-rated commercials and three nationally bottom-rated commercials of the 2014 Super Bowl. Class rankings of the commercials using the ADPLAN Framework were compared with topological maps of neural activations. Exemplar data is provided here to illustrate findings. Follow-on work is described and considerations for interpreting data in light of the age group sampled and individual differences.

1. Introduction

The Super Bowl in the United States draws a lot of national attention each year not necessarily for the athletic players of this American football tournament but rather for the advertisers. The 2014 Super Bowl was no different where a 30-second slot cost advertisers $4 million to reach the eyes of 110 million viewers [1]. From these carefully-crafted commercials, advertising agencies are keen to know if they hit the mark with their audience.

Marketers may use common techniques of focus-groups and surveys, such as what has been incorporated into the Northwestern University Kellogg School of Management’s ADPLAN Framework [2], to understand the impact of an ad. Business students often study these basic techniques through a marketing curriculum which increasingly overlays lessons from cognitive psychology to predict human behavior. Now, marketers and students may incorporate tools that are gaining attention that allow them to peer quite literally into the minds of their consumers: neurophysiological tools. Institutions such as Temple University are using neurophysiological tools to examine the impact of ads such as those run during the Super Bowl [3].

Neurophysiological tools are helping provide marketers with an increased understanding of their targeted consumers, where such methods are thought to uncover a person’s unfiltered thoughts and feelings [4]. The related field of Neuro-Information Systems (IS) has emerged by examining how neuroscience methods can inform IS and human-computer interaction (HCI) [5, 6]. Information systems researchers are using neurophysiological tools to better understand end-users of systems and their thought-processes when making complex decisions or evaluating designs [7, 8]. Such focus has resulted in recent special issues in two of the field’s leading journals both with publications in 2014: the Journal of Management Information Systems (JMIS), and the Journal of the Association for Information Systems (JAIS) (forthcoming).

Here, we present a preliminary study that demonstrates how future marketers may use neurophysiological tools by incorporating them into an undergraduate course on advertising at a large southeastern university in the United States. Students participated in a study that recorded their brainwaves while watching commercials from the 2014 Super Bowl and later contrasted this experience with using a more traditional rating technique. The hopes were to provide students with direct experience with how these tools can be utilized in practice and the associated challenges.

2. Neurophysiological Tools for Assessing Human Mental States

The goal for incorporating neurophysiological tools into current practice is to do so with minimal invasion to the person and his/her environment. Non-
invade techniques for recording neural activations involve sensors placed on the skin’s surface for signal acquisition instead of using surgically-implanted electrodes. The most common of these approaches is the use of encephalography (EEG), a bio-recording technique that measures electrical activity of the brain collected from scalp electrodes. This technique has been used safely and for many years in the medical community and is now moving from the clinical setting into the real world to allow people to control computers with their minds [9] and to better understand their mental processes in organizational settings [10, 11]. Another less-invasive approach includes the use of functional magnetic resonance imaging (fMRI) for measuring oxygenated blood volume using a powerful, magnetized probe that can reflect activity throughout the brain [12]. An additional technique is the use of functional near-infrared (fNIR) which also measures oxygenated blood volume in the brain but uses the emission and detection of near-infrared light to do so [13].

Electroencephalographic use has seen a growing presence in areas of business like marketing, economics, and more recently IS [5]. Such tools are being used to gauge people’s deeper reactions to various stimuli and understand their decision-making processes [4, 11, 14]. Activation patterns in the brain have also been shown to reflect a person’s unfiltered, emotional responses [15, 16]. Further, such brain imaging information coupled with more traditional measures from surveys and observational data can provide a richer context within which researchers may better understand human behavior [17].

There are a number of brain signals that may be recorded and interpreted using EEG with varying significance depending on the region of the brain from which they are recorded. Specifically, activations in the frontal lobe (i.e., the front-most part of the brain) indicate varying thoughts related to judgment, engagement, attention, and emotion [18]. Often these are the characteristics which marketers are most concerned. Further, positive and negative approach to a stimulus may be determined from EEG asymmetry where higher activations in the left hemisphere indicate positive approach and higher activations in the right hemisphere indicate negative approach [15].

3. The ADPLAN Framework in Brief

A particularly popular technique for rating the effectiveness of ads, the ADPLAN Framework, is in fact concerned with attention amongst other aspects of impact on consumers. The framework was developed by the Kellogg School of Management at Northwestern University and is used in conjunction with their annual Super Bowl Advertising Review started in 2005 [19]. It provides a guide for evaluating an advertisement’s ability to build the brand based on six criteria:

- **Attention** – Does the ad capture a consumer’s attention?
- **Distinction** – Is the ad sufficiently different from competitors to avoid confusion?
- **Positioning** – Does the ad distinguish why this brand should be selected over others through a frame-of-reference or clearly-communicated goal?
- **Linkage** – Does the ad keep the attention of consumers to draw ties between the ad and the brand conveyed?
- **Amplification** – Does the consumer think about the brand long after having seen the ad?
- **Net equity** – Does the ad reinforce pre-established brand equity?

Although several of these criteria may be evaluated using neurophysiological tools, perhaps the most distinct measure is that of attention as evidenced in the frontal lobe.

4. Pilot Study

This preliminary study explored what could be discovered from EEG recordings from the frontal lobe of students when they watched the nationally top-rated and nationally bottom-rated commercials which aired during the 2014 Super Bowl. These recordings were then contrasted with rankings by the class using the ADPLAN Framework.

4.1. Participants

An entire advertising class of 18 undergraduate students participated in the study but resulted in only 14 sets of usable EEG recordings due to errors with data capture and electrodes that exhausted their lifespan farther into the study. There were 10 male and 8 female students with an average age of 24 years (ranged 20-32 years). Participants were sampled from the campus of a large university in the southeastern part of the United States in an upper-division marketing class on advertising. All individuals voluntarily participated as part of an experiential class exercise but were provided an
alternative assignment in case they chose not to participate.

4.2. Experimental Procedure

After obtaining consent, answering any questions about the study, and collecting basic demographic data, each student was assigned a code and fitted with a standard electrode cap for recording his/her EEG. Eight channels of EEG were recorded using the BioSemi Active Two bioamplifier system connected to a PC (http://www.cortechsolutions.com/Products/Physiological-data-acquisition/Systems/ActiveTwo.aspx). The electrode cap was configured according to the widely used 10-20 system of electrode placement [20]. Active electrodes were placed on the cap to allow for the recording of brain activations over the frontal lobe sampled at 256 Hz using a Common Average Reference (CAR). The eight recorded channels were: Fp1, Fp2, F3, F4, Fz, C3, C4, and Cz, where electrodes starting with “F” cover the frontal and pre-frontal (Fp) lobe.

Once fitted with the electrode cap, students were asked to sit still with their eyes open approximately three feet in front of a 21-inch LCD computer monitor. The monitor displayed a randomized series of six commercials which aired during Super Bowl 2014. A commercial lasted on average one minute in duration. Table 1 lists the six commercials used in this study with national rankings provided according to the USA Today newspaper [1]. The table shows the sponsoring company for the commercial, the particular commercial theme or “spot” that was aired, the quarter of the football game during which the commercial aired (possible 1-4 quarters), and its overall score provided from 6,272 consumer judges.

<table>
<thead>
<tr>
<th>Company</th>
<th>Spot</th>
<th>Quarter</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budweiser</td>
<td>Puppy Love</td>
<td>4</td>
<td>8.29</td>
</tr>
<tr>
<td>Doritos</td>
<td>Cowboy Kid</td>
<td>4</td>
<td>7.58</td>
</tr>
<tr>
<td>Budweiser</td>
<td>Hero's Welcome</td>
<td>3</td>
<td>7.21</td>
</tr>
<tr>
<td>GoDaddy</td>
<td>Bodybuilder</td>
<td>4</td>
<td>4.04</td>
</tr>
<tr>
<td>Subway</td>
<td>Crunch Time</td>
<td>2</td>
<td>3.91</td>
</tr>
<tr>
<td>Bud Light</td>
<td>Cool Twist</td>
<td>2</td>
<td>3.89</td>
</tr>
</tbody>
</table>

After participating in the experiment, students engaged in a class exercise using the ADPLAN Framework to rate the six commercials. After receiving an orientation to the technique by the marketing instructor, students reflected on their own individual impressions from the commercials and rated each of the six criteria on a scale of 1-5, where 1 was poor and 5 was excellent. Using this scale, a commercial could achieve a maximum score of 30 points total. Students were also asked to qualify each rating with a brief, written comment. These evaluations were later included as part of an assigned paper for students to reflect on the entire experience and relate presented EEG results with their own ADPLAN-based rankings. This paper was worth 50 out of 1000 points for the course.

5. Results

Recordings from the eight channels of scalp electrodes were analyzed offline using a previously validated technique for brain localization and associated software: standardized low resolution brain electromagnetic tomography (sLORETA) [21]. This analysis was conducted for each participant. However, only the brain activations of two participants are featured here as exemplar cases of what was discovered using neurophysiological tools.

Table 1. Six Commercials Viewed.

Figure 1. Topological plots of EEG activations for Participant 001.
Figures 1 and 2 present topological plots of neural activations across Participant 001 and 006’s scalps analyzed for the nationally top-rated commercial and nationally bottom-rated commercial. These activations are presented on a fixed scale such that brighter areas with yellow indicate highest levels of activation. Higher activation in the left hemisphere may indicate stronger positive approach to the commercial whereas higher activation in the right hemisphere may indicate negative approach to the commercial.

For the class’s ADPLAN rankings summarized in Table 2, the Budweiser Hero’s Welcome commercial came in tops. Budweiser’s Puppy Love was still ranked in the top three commercials although not the highest. Bud Light’s Cool Twist was ranked third instead of being ranked the lowest. The difference in mean score for Puppy Love versus Cool Twist was not found to be significant per a one-tailed t-test with p = 0.358.

### Table 2. Class’ ADPLAN Rankings.

<table>
<thead>
<tr>
<th>USA Today Ranking</th>
<th>Commercial</th>
<th>Class Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Budweiser Hero’s Welcome</td>
<td>24.86</td>
</tr>
<tr>
<td>1</td>
<td>Budweiser’s Puppy Love</td>
<td>23.71</td>
</tr>
<tr>
<td>57</td>
<td>Bud Light’s Cool Twist</td>
<td>22.86</td>
</tr>
<tr>
<td>56</td>
<td>Subway’s Crunch Time</td>
<td>22.71</td>
</tr>
<tr>
<td>2</td>
<td>Doritos’ Cowboy Kid</td>
<td>21.86</td>
</tr>
<tr>
<td>54</td>
<td>Go Daddy’s Bodybuilder</td>
<td>17.71</td>
</tr>
</tbody>
</table>

6. Discussion

According to USA Today, its consumer judges’ overall top-rated commercial, Budweiser’s Puppy Love as featured in Figure 3, was rated highest by both men and women, adults making $75K-100K, and ages 35-54. Interestingly, the age group encompassing the students sampled here, ages 18-34, rated this commercial the second highest whereas it was Hyundai’s Sixth Sense that got this age group’s highest rankings (but was rated sixth overall nationally). So it seems that the student demographic does not always follow the overall trend. This is a consistent finding that individual differences such as age, gender, and socio-economic levels play a big role in interpretation of brands [22]. The commercial that our advertising students ranked highest, Budweiser’s Hero’s Welcome, was ranked fifth per USA Today’s judges and more specifically fourth by people within the same age group.
Bud Light’s Cool Twist was ranked third by our advertising students and seemed to be somewhat indistinguishable per their ADPLAN rankings from the Budweiser Puppy Love commercial. However, according to the EEG results, on an individual basis several students evidenced what could clearly be distinguished as higher activations for Puppy Love over Cool Twist such as with Participant 006. Participant 006 remarked through self-reflection in his course paper that, “Although the Puppy Love commercial did impact me emotionally, it didn’t faze me to a point where I was emotionally involved with the commercial.” Interestingly, this statement may be considered evidence that this student’s conscious thoughts about ranking a commercial are perhaps in disagreement with his unconscious thinking; his brainwaves seem to indicate that he did have a stronger emotional response than he may have realized.

For other students, such as Participant 001, the Puppy Love and Cool Twist commercials both seemed to cognitively grab their attention and their EEG indicated a positive approach towards both. These results were in line with this student’s self-reports through his course paper where he remarked that, “Although I like dogs I did not really enjoy the advertisement as much as I did advertisement six,” and he emphasized how much he “enjoy[ed] drinking the beverages that were being advertised.”

A larger sample size may tease apart the ADPLAN and EEG distinctions to significantly align with the USA Today rankings or may indicate that students follow a somewhat different mindset and in fact lump such commercials closer together. This potential aggregation may be due to the nature of the brand contained within these particular commercials (alcohol) coupled with the experience of the students sampled. During class discussions, a large number shared that they enjoyed drinking beer and all were over the legal age limit.

Although a preliminary study, the results illustrate interesting differences in neural activations between the top-rated and bottom-rated commercials from the class’ ADPLAN rankings. These differences may be explained by differences in their individual profiles as found in related work regarding Neuro-IS and marketing [22, 23].

7. Conclusions

We present a preliminary study for how neurophysiological tools may be used to understand consumers when analyzing their responses to commercials. Encephalographic recordings were made while students watched six commercials (three nationally top-rated commercials and three nationally lowest-rated commercials) from the 2014 Super Bowl in an effort to better understand their unconscious thoughts. Evidence of these thoughts was compared with their conscious thoughts captured through rankings using the ADPLAN Framework.

Without statistical analysis of a larger sample size coupled with a more formal collection of ADPLAN rankings, we cannot make conclusive claims. The results do seem to indicate interesting differences that may be tied to the student population and age group captured. Further, this work provides encouragement for more research to understand the differences between individuals, experiences, and the impacts on advertising campaigns. Ultimately, this work lays a foundation for future study in the related area of neuromarketing and highlights considerations for future study design. Through their participation in this study, students engaged in experiential learning about how they might one day apply neurophysiological tools and what might be revealed.

8. Acknowledgements

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9. References


