

The Effects of Emotions on Cognitive Effort While Processing Mediated Stadium-Embedded  
Advertising: A Dynamic Motivational Systems Approach

### **Abstract**

**Research question:** While emotional responses to sporting events could have a residual effect on the processing of in-stadium signage that appears to the television audience, limited research has focused on the possible moderating role of emotions in such advertising processing. Thus, this manuscript reports on two studies that employed the limited capacity model of motivated mediated message processing (LC4MP) to answer the question “How do emotional states derived from the dramatic nature of spectator sports impact the automatic cognitive resource allocation to process in-stadium signage advertising?”

**Research methods:** In order to investigate the effect of emotions derived from sport team performance on viewers’ information processing of peripheral advertising signage, Study 1 utilized heart rate as a physiological correlate while Study 2 employed a more nuanced memory measurement (i.e., signal detection measure). Both experiments were conducted using undergraduate samples ( $N_{\text{Study1}} = 76$ ,  $N_{\text{Study2}} = 146$ ) recruited from a large university located in the Midwestern region of the United States.

**Results and Findings:** The results from the two experiments supported the theoretical prediction of LC4MP, namely that the processing of cognitive resource allocation, and the subsequent memory for advertising information on peripheral in-stadium signage, depends upon how close the games are and whether the favored team wins.

**Implications:** The current research extends the field’s understanding of signage processing as the two studies utilized a different theoretical perspective via different measurements compared with previous investigations in the field.

Stadium signage is an enticing form of advertising in the sport industry because of the benefits it provides to both the sport organization (e.g., revenue stream) and the sponsor (e.g., exposure to targeted audiences). With the proliferation of marketing opportunities and affiliated revenue streams within the sport industry, advertisers frequently seek to exploit sport facility advertising opportunities (e.g., virtual signage, stadium billboards). Corporate signage, consumed by both media (e.g., televised broadcast, streamed content) audiences and attending spectators, often adorns sport facilities (e.g., Pyun & James, 2011). Beyond the distribution of live programming, signage content can be (re)distributed through video-sharing websites after the game ends.

The real and perceived advantages of such advertising have drawn the interest of scholars and their work has identified several key factors that influence the effectiveness of in-stadium signage. The following are examples of the many influencing factors: demographic variables such as age, gender, and income (e.g., Kinney, McDaniel, & DeGaris, 2008); physical and visual features of signage such as its location, size, animation, and color (e.g., Breuer & Rumpf, 2012, 2015); matched fits such as the types of brand and the categories of product (e.g., Pham & Johar, 2001); signage types such as virtual advertising (e.g., Sander & Altobelli, 2011); and psychological involvement (e.g., Hickman, 2015).

While such examinations provide beneficial implications for the effectiveness of in-stadium signage, there is skepticism by some scholars and practitioners about the effectiveness of in-stadium signage. Researchers (e.g., Cianfrone & Zhang, 2006) have postulated that the impact of in-stadium signage is limited in terms of memory. For instance, Cianfrone and Zhang found that venue signage advertising is less likely to be remembered compared to other advertising methods (e.g., video commercials, athlete endorsement). As such, in order to more fully

understand what influences effective advertising in this area of sport marketing there is a need for researchers to examine in more detail the moderators and factors involved.

The limited impact of the in-stadium signage may be due to how this type of advertising is different than the traditional television commercial spots that appear during sport broadcasts (Cianfrone & Zhang, 2006). Thirty-second commercials, for example, typically occur when television producers choose to leave – for a television commercial break – the sport event action or competition being televised. The persuasive messages are therefore the only message appearing on the screen at that time. In-stadium ads, on the other hand, share the screen with the very content – sport programming – in which the audience is most interested. Therefore, it is reasonable to assume that in-stadium advertising signage information is generally processed as a peripheral signal rather than centrally or as the focal objective of the viewers' attention (e.g., Breuer & Rumpf, 2015; Lee & Faber, 2007).

Given this assumption, the two studies were developed based on predictions regarding Lang's (2000, 2006a) limited capacity theory of media processing. Lang's model conceptualizes human beings as biological organisms with finite levels of cognitive resources available at any moment in time to pay attention to, comprehend, and later remember media content. Although designed as a generally applicable theory of media message processing, Lang's model is similar to others (e.g., Potter & Keene, 2012) that have been applied specifically to the processing of sport programming. In a similar vein, Breuer and Rumpf (2012) suggested that attentional capacity is a crucial concept in understanding how sport viewers cognitively process the signage advertising. Different amounts of attention to the signage or even action on the field may lead to different patterns of the in-stadium advertising processing. However, cognitive attention and effort — which have been known as critical components for memory processes in other

disciplines such as cognitive psychology (e.g., Lang, 2000) — have received only limited attention in sport (e.g., Breuer & Rumpf, 2012, 2015).

Another limitation is that situational factors that possibly moderate the effectiveness of the in-stadium signage advertising have not been identified. An emerging line of research based on the limited capacity model of motivated mediated message processing (LC4MP; Lang, 2006a, 2006b) has provided empirical evidence that both attention to and memory of information in stimuli are significantly impacted by emotional experiences created by the stimuli. The unique emotional richness of televised sport is well revealed in the sport emotion related literature (e.g., Knobloch-Westerwick, David, Eastin, Tamborini, & Greenwood, 2009; Madrigal, Bee, Chen, & LaBarge, 2011). Indeed, when watching sporting events, fans view advertisements while they are emotionally aroused, pleased, or annoyed during their consumption of televised sports. This emotional response could have a residual effect on the processing of the sponsors' in-stadium signage that appears to the television audience. However, the possible moderating role of emotions in the mediated in-stadium signage advertising processing has rarely been tested (e.g., Pham, 1992).

To address the absences in the literature noted above, two experiments were conducted and the findings of which are reported below. Both investigations presented the sport clip stimuli which were designed to vary along two aspects (i.e., valence and arousal) known to impact cognitive resource allocation (Lang, 2006a; Potter & Bolls, 2012). Study 1 involved predictions about how variations in the valence and arousal of the sport programming would impact the real-time allocation of cognitive resources and used heart-rate, collected during the sport clip stimuli, as an indication of that (Wise, 2017). Complimentary to the dynamic measure of cognitive resource allocation in Study 1, Study 2 used a more nuanced memory measurement than the

more traditional percent correct index. As such, Study 2 involved calculating signal detection measures which have been widely utilized as valid measurements of encoding rates (e.g., Fox, 2004) in order to test predictions about how memory for the peripheral content (e.g., the in-stadium signage) would be impacted by emotional responses to the primary programming.

With the use of dynamic measures of cognitive processing – namely, the psychophysiological measures of cardiac response as a correlate of resource allocation (Lang, 1994; Potter & Bolls, 2011) in the first study and the calculation of signal detection indices for the brand recognition data in the second study – this investigation introduces to the literature a better understanding of the complex nature of memory for peripheral information such as brands associated with in-stadium advertising signage.

## **Literature Review**

### **Theoretical Basis of Predictions**

The LC4MP makes specific predictions about how the intensity of positive and negative feelings in response to a mediated stimulus leads to different automatic mechanisms to encode and store details of an event (e.g., Lang, 2006a, 2006b). The model is based upon dimensional (Lang, Bradley, & Curthbert, 1993) and dual-motivational (e.g., Cacioppo & Gardner, 1999; Cacioppo, Gardner, & Berntson, 1999) theories of emotions and a limited capacity model for mediated message processing model (Lang, 2000) in order to predict how mediated content is processed via human cognitive and emotional systems.

The LC4MP assumes that human beings have limited cognitive resources available at any one time to encode, store, and retrieve information into and between short and long-term memory. Encoding – which is a non-vertical and idiosyncratic process – involves the selection of key information from stimuli (or a stimulus) that is then further processed. This encoding process

occurs through an automatic reflective response to certain features of the content or message and the new information is then stored and retrieved through a memory linkage network (Lang, 2000, 2006a, 2006b; Lang et al., 2013). Cognitive overload often occurs when insufficient cognitive resource is allocated for memory task (Lang, 2000). Furthermore, the model also assumes that the allocation of this limited resource pool is guided not only by individual interests and conscious intentions, but also by the approach and avoid motivational systems (Cacioppo & Gardner, 1999; Cacioppo et al., 1999).

The approach/appetitive motivational system is automatically activated when individuals experience positive feelings (e.g., happy, joyful, humorous) and the avoid/defensive system is automatically activated when people experience negative feelings (angry, sad, fearful, disgusted). Arousal – which is the level of emotional intensity ranging from a state of calm to an excited state – is thought to determine the level of system activation (Lang, 2006a, 2006b). Also, early work in this area conceptualized sport fans' emotional responses within the theoretical framework of a dual motivational system (e.g., Hillman, Cuthbert, Bradley, & Lang, 2004). For example, Hillman and colleagues found that the appetitive system was activated when fans were exposed to their individual team's glorious moments (victory) whereas the aversive system was elicited when they watched their team's failures (defeat).

The LC4MP provides specific predictions about how motivational systems at the different levels of intensity result in different patterns of resource allocation to process mediated content (Lang, 2006a, 2006b; Lang, Sanders-Jackson, Wang, & Rubenking, 2013). Cognitive resource allocation increases encoding and storage because the system has evolved over time in humans to recognize the importance of processing information about a potential threat or opportunity. A message with a positive emotional tone activates the appetitive system, which

leads to an automatic allocation of cognitive resources to encoding. As a pleasant message becomes more arousing (increasing approach/appetitive activation), greater cognitive resources are allocated to process the message. Because the appetitive system has the primary goal of supporting approach behaviors such as collecting survival-related information (e.g., location of food, securing a friend) in the environment, more appetitive information desires to be encoded and retrieved. However, when a message is negative, the defensive activation system produces a different pattern of cognitive resource allocation. In the aversive system, more cognitive efforts are elicited at a low-to-medium level of activation than at a medium-to-high level of activation. Because humans have evolved to be able to easily recall information that is potentially harmful, early stages of intensity increase among negative programming results in increased cognitive resource allocation. However, at the highest levels, when the potential threat is actually imminent (increasing aversive/defensive system), resource allocation actually decreases because the particular details of the surrounding environment are no longer necessary for later retrieval. Instead, the aversive system is activated for the protection, such as what happens when humans avoid a threat (Lang, 2006a; 2006b).

This unique set of theoretical predictions has been supported by empirical studies conducted in various mediated circumstances such as televised content (e.g., Lang et al., 2013), radio programming (e.g., Lang et al., 2015), social media platforms (e.g., Kim, Kim, & Wise, 2014), online websites (e.g., Wise, Alhabash, & Eckler., 2013), video games (e.g., Chung & Sparks, 2016), pictures (e.g., Yegiyan & Lang, 2010), and sports content (e.g., Potter & Keene, 2012). For example, Potter and Keene (2012) found that sports fans process sport-related interviews in different ways as the interacting functions of their emotional states (i.e., valence and arousal) are derived from the interviews.



### **Motivated Processing of Peripheral Information**

The underlying assumption concerning automatic attention and cognitive resource allocation triggered by activation of motivational systems has been mostly tested in central information processing contexts where a message is primary media content. Such limited testing, however, does not allow for predictions to be made regarding how televised in-stadium advertising as secondary or peripheral information will be processed (Chung & Sparks, 2016), because it is the sporting contests which provide the primary information. The sports signage usually appears in the periphery of the video scene (e.g., Breuer & Rumpf, 2012, 2015). However, two recent studies (Chung & Sparks, 2016; Yegiyan & Lang, 2010) offer a foundation for understanding information processing of peripheral information in a mediated context using the LC4MP. Yegiyan and Lang showed a positive linear relationship between intensity of positive stimuli (appetitive system activation) and the recognition of information from the periphery of visual scenes. As the intensity of the pleasant stimuli increased, the peripheral information was more likely to be recognized in subsequent memory tests. Moreover, a negative linear relationship between intensity of negative stimuli (i.e., aversive activation) and the recognition of peripheral information was found. As the intensity of the negative stimuli increased, the peripheral details were less likely to be encoded. In another study, Chung and Sparks applied this to the processing of ads affiliated with the peripheral content within video games and found that the brand recognition rate was better for appetitive activation compared with aversive activation at moderate-high levels of activation. On the other hand, the brand recognition rate was poorer for appetitive activation compared with aversive activation at low-moderate levels of activation.

The implication of such studies (Chung & Sparks, 2016; Yegiyan & Lang, 2010) is that viewers automatically and unconsciously give different degrees of attention to a mediated event depending on how much the event is pleasant and arousing, which in turn leads to different levels of memory performance toward peripheral information in the event. The more cognitive resources are allocated to the event, the more there is an ability to recognize and remember the details of the event. When it comes to in-stadium signage, it can possibly be assumed that sports fan may unconsciously notice advertised brands during a sporting event when they pay sufficient amount of attention to the action on the field, and they are simultaneously exposed to the advertisements even if they do not intend to process the marketing messages themselves.

### **Research Overview and Hypotheses**

The overall guiding research question for the two studies was: How do the emotional states derived from televised spectator sports impact the motivated cognitive processing of secondary advertising information? In both experiments, the motivational system of activation (valence) was manipulated by game situations (winning: appetitive; losing: aversive; e.g., Hillman et al., 2004) while the activation level (arousal) was manipulated by score variations (tight: high-medium level of activation; lopsided: medium to low-level activation; e.g., Gan et al., 1994). For example, in the moderate aversive condition, participants watched their team's losing (unpleasant) in one-sided (calm) situations. In the high appetitive condition, participants watched their team's winning (pleasant) in tight (arousing) situations.

According to the LC4MP (Lang, 2006a; 2006b), the cognitive source allocation to encoding and to retrieving details of a message should be impacted by the level of activation in the appetitive and aversive motivational system. As explained in the literature review above, the evolutionary biological mechanism for survival (e.g., information intake with approach

opportunities; protection instincts in avoiding threats) is a key assumption of this theoretical prediction. Numerous empirical studies have demonstrated that at the high level of activation, greater cognitive resources were allocated for appetitive information than for aversive information while at the medium level of activation, the allocation of the cognitive resources was greater for aversive activation than for appetitive activation (e.g., Chung & Sparks, 2016; Lang et al., 2013; Yegiyan & Lang, 2010). In addition to that, the LC4MP posits that cognitive resource allocation determines the retrieving and encoding of messages. As such, this limited capacity model holds that with more cognitive resources there is better retrieving and encoding. The same pattern of prediction anticipated for cognitive resource allocation is also expected for encoding and retrieval process (e.g., Lang et al., 2013; Wang & Lang, 2012). Thus, it was hypothesized in the two experiments in the current investigation that the levels of activation (close vs. lopsided games) in appetitive (winning) and aversive (losing) systems will result in different patterns of cognitive resource allocation (H1) to encode (H2) and retrieve (H3) the mediated information televised on the screen (e.g., the in-stadium advertising signage in the periphery). The three hypotheses tested in this dual-study experimental research are as follows:

*Hypotheses:* There will be an interaction between the motivational system (winning vs. losing) and the level of activation (close vs. lopsided) on cognitive resource allocation (H1) in relation to encoding (H2) and retrieval (H3). At the higher level of activation (close games), appetitive activation (winning) will lead to greater cognitive resource allocation (H1a) in relation to encoding (H2a) and retrieval (H3a) than found in aversive activation (losing). At the lower level of activation (lopsided games), aversive activation (losing) will result in a greater

resource allocation (H1b) in relation to encoding (H2b) and retrieval (H3b) compared to that found in appetitive activation (winning).

Study 1 tested the predictions suggested by the LC4MP concerning the impact of motivation system activation on cognitive resource allocation (H1) as a result of different situations in sporting events. An electrocardiogram [ECG], which was recorded during the subjects' consumption of the sport contests, was used as an indicator of cognitive resource allocation to test H1. Study 2 investigated the impact of the motivational system activation on the encoding (H2) and retrieval (H3) of brand memory. For this second study, brand recognition and recall questions were asked to test predictions of how much information from the in-stadium signage was actually encoded (H2) and retrieved (H3) depending upon the motivation system activation by the experimental stimuli.

For Study 1, a within-subject design was developed because the dependent variable (i.e., change in heart rate) is largely associated with individual differences. The experimental design and stimuli for Study 2 were different from the first study because the second study relied on the actual brand memory tests and thus the repeated measures design used in the first study was not an optimal option because of drawbacks related to learning effect, fatigue effect, etc. Thus, the random assignment technique was utilized in Study 2 to minimize possible memory bias effects (e.g., prior brand experiences, brand exposure levels, brand placement).

### **Study 1: The Effects of Motivational System activation on Resource Allocation**

The aim of this experiment (Study 1) focused on how motivational system activation by sport fans' emotional states in valence and arousal impact the automatic allocation of cognitive resources (H1). When examining the relationship between emotions and cognition, previous research in sport-related literature often disregarded the fact that emotional and cognitive

processing associated during media consumption occurs very quickly and dynamically in real time (Potter & Bolls, 2011), with only a few exceptions (e.g., Kim, Magnusen, & Lee, 2017; Potter & Keene, 2012). The commonly used research approach of using a retrospective way to measure emotions and cognition often contains cognitive and social biases. In order to address calls in the sport management literature for a more dynamic and accurate approach to – and measurement of – sport message processing (e.g., Breuer & Rumpf, 2012, 2015), the current experiment utilized a real-time psychophysiological measure (i.e., heart rate), which allows for the capturing of dynamic changes in autonomic and bodily reactions to sporting stimuli in a real time.

## **Method**

### ***Design and Stimuli***

The experiment involved a 2 (Sport program-activated motivational system: appetitive, aversive)  $\times$  2 (Sport program-determined level of activation: high-medium, medium-low)  $\times$  2 (Video instantiation) within-subject design. All factors were within-subject factors. Order effects were controlled by randomly presenting the stimuli. In order to prevent compounding effects of a certain stimulus, the video instantiation method was utilized such that two stimuli in each of four different game situations (i.e., winning/tight, winning/lopsided, losing/tight, and losing/lopsided) were selected from games from the previous three seasons of a university's men's basketball team that has several National Collegiate Athletic Association (NCAA) championships. The video instantiation method further involved the use of opposing teams in the experimental stimuli who both have strong reputations in men's basketball and who play in a popular college basketball conference. Thus, eight NCAA basketball games that best exemplified two in each of four categories of sporting programs (i.e., winning/tight,

winning/lopsided, losing/tight, and losing/lopsided) were selected as the target stimuli. All video clips were edited to begin with the last five minutes of the selected games. This was done in order to capture the participants' attention and reduce the fatigue effects that are often associated with within-subject experiments. The video clips ended as soon as the games were finished. Winning conditions represented when the university (where the experiment was conducted) was leading the game whereas losing situations represented when the team was trailing. The score differentials during the selected stimuli were 1-to-4 points for tight game conditions and 15-to-25 points for lopsided game conditions following work of Gan et al. (1997).

### ***Measurements***

*Motivational Activation System.* The scores of the basketball games were adjusted in order to manipulate the motivational system of activation. For instance, the basketball game scores were changed in order to allow for winning (i.e., appetitive) and losing (i.e., aversive) situations.

Emotional valance – as an indicator of the motivational system activation – was measured via the electrical firing of the corrugator muscle motor action units located just above the eyebrow. This electromyographic data were collected while the subjects watched the televised sports event.

Although motor action units are always active to some extent, Neta, Norris, and Whalen (2009) demonstrated in a reliable manner that higher activation of the corrugator (frowning) muscles imply emotional experiences that are unpleasant (i.e., an aversive activation) while lower corrugator activation indicates emotional states that are pleasant (i.e., appetitive activation).

Facial EMG data were sampled at a rate of 1000 times per second and then the data were amplified 5000 times and band pass filtered within a 10-to-1000Hz range.

*Levels of Activation.* The point differential margin between the scores of the two basketball teams was adjusted in order to manipulate the intensity of activation. For instance, the basketball

game scoring margins were changed to determine high-moderate levels of activation (final score differentials of 1-to-4 points) or medium-low levels of activation (15-to-25 points differentials). Sympathetic arousal was physiologically operationalized and measured as skin conductance level (SCL) by sending a small (.5 V) constant charge to the subject's palm and measuring the change in microvolts over time (Dawson, Schnell, & Fillion, 2000). Furthermore, the measurement of SCL also provided data indicating the motivational system's level of activation (e.g., Potter & Bolls, 2011; Wang & Lang, 2012). Recorded at a high (i.e., 1000Hz) rate of sampling, the SCL data were collected during the subjects' viewing of the televised sporting event stimuli.

*Cognitive Resource Allocation.* In order to operationalize cognitive resource allocation, the electrocardiogram (ECG) was recorded time locked to the presentation of the televised sporting event stimuli. The ECG recording results in a substantial spike of activity associated with each heart beat. The milliseconds between each of these spikes was then converted to a value representing the number of heartbeats-per-minute (referred to as BPM) for each second of the stimulus presentation, with a slower heart rate indicating that greater cognitive resources were being allocated to process information (e.g., Lang, 1994; Potter & Bolls, 2011).

*Covariate.* According to Potter and Keene (2012), cognitive resource allocation to sport-related stimuli can be impacted by psychological attachment to team. In accordance with Bee and Madrigal's work (2012), psychological attachments (i.e., team identification) were utilized as a covariate. In the current research, team identification scales based on the work of Robinson and Trail (2005) were adopted, which included questions such as, "Being a fan of the [team] is very important to me."

### ***Participants and Procedure***

Undergraduate students ( $N = 76$ ) from the university were recruited and rewarded compensation (\$20). Once a subject arrived at the psychophysiological research laboratory for her/his scheduled appointment (only available for one subject), the experimenter explained the procedure of the experiment, obtained informed consent from the subject, and sat them in a comfortable chair in front of 42-inch LCD monitor. The researcher then attached three sensors for physiological measures (i.e., ECG, SCL, and Facial EMG) on the subject's forearms, a non-dominant palm, and above eyebrow respectively. After collecting demographic and team affiliation information, the subject viewed the eight sport stimuli in random order. A 30-to-60 second neutral stimulus following a five-second break was inserted between each stimulus game clip to return the subject's emotions to baseline. After the subject watched all of the sport video clips, the sensors were removed and the subject was thanked and dismissed. The experiment procedure was administered by MediaLab software (Jarvis, 2012) and the experiment took approximately 90 minutes for each subject.

### ***Data Screening***

Of the subjects who completed the experimental procedure, there were 53 males and 23 females with an average age of 19.77 years. Out of the 76 subjects, a total of 69 participants represented themselves as avid fans of the university's men's basketball teams as indicated by relatively high mean scores for team identification ratings ( $M_{\text{Team Identification}} = 6.0$  out of 7.0). One subject had unusable data because of a computer malfunction. Therefore, the data from 68 subjects were included in the main data analysis.

Following the approach used by previous scholars (e.g., Potter & Keene, 2012), calculations were made for change scores from a one-second baseline over the course of the last



90 seconds of each stimulus. The change scores were then tested via a 2 (Sport program-activated motivational system: appetitive and aversive)  $\times$  2 (Sport program-determined level of activation: high-medium and medium-low)  $\times$  90 (time) repeated measures ANCOVA. Also, adjustments to the sphericity assumption related to the physiological data were facilitated through the use of Greenhouse-Geisser coefficient values.

## Results

### *Manipulation Check*

In order to check whether the experimental stimuli elicit participants' emotional states as intended, 2 (Sport program-activated motivational system: appetitive, aversive)  $\times$  2 (Sport program-determined level of activation: high-medium, medium-low) repeated measures of ANOVAs were conducted on the Facial EMG (Motivational system) and SCL (Level of activation) data. It was found that sport program-activated motivational system yield a significant main effect on corrugator muscle activity,  $F(1, 66) = 5.67, p < .05, \eta^2 = .08$ . Also, the main impact of sport program-determined level of activation on SCL was significant,  $F(1, 68) = 7.34, p < .01, \eta^2 = .10$ . None of the other significant main and interaction effects were observed in both data. To be specific, it was showed that there was greater corrugator activation for the losing situations ( $M = .010, SD = .04$ ) than the winning situations ( $M = .001, SD = .04$ ). This result indicates that the losing conditions produced greater unpleasant feelings than did the winning situations. Higher SCL was observed in the tight conditions ( $M = .67, SD = 2.2$ ) than the lopsided conditions ( $M = -.11, SD = 2.34$ ). Thus, the motivational systems were properly activated by video stimulations as manipulated.

### ***Hypothesis Testing***

The hypothesis (H1) for Study 1 was supported by a significant Motivational System  $\times$  Activation Level interaction on heart rate change score data after controlling for the effect of team identification,  $F(1, 65) = 6.76, p < .05, \eta^2 = .094$ . None of the other significant main and interaction effects were found. As predicted in H1 (see Figure 1), planned post-hoc comparisons showed that at the higher level of activation, appetitive system resulted in a steeper deceleration in heart rate ( $M = -.51, SD = .92$ ) compared to the aversive system ( $M = 2.06, SD = .42$ ),  $t(67) = -3.17, p < .01$  (H1a). At the lower level of activation, the aversive system resulted in slower heart rate ( $M = -.64, SD = .75$ ) compared to appetitive system ( $M = .98, SD = .58$ ),  $t(67) = 2.61, p < .01$  (H1b).

{Insert Figure 1 about}

### **Study 1 Discussion**

As hypothesized, the results revealed that motivational system activations induced by sport competitions have a significant impact on cognitive resource allocation. Consistent with previous studies on motivated cognition and the theoretical prediction of LC4MP (e.g., Lang, 2006a, 2006b; Lang et al., 2013), increasing the intensity of system activation increased the cognitive resources for the appetitive and decreased cognitive resources for aversive system as indexed by cardiac decelerations. In this specific experimental context, during the game when the scores are extremely close, cognitive resources are greater for winning situations than for losing situations. In the case of lopsided competition, a losing game allocates more cognitive resources than a winning game. Accordingly, it can be argued that emotional states induced by different game situations play a significant role in sport fans' cognitive information processing

**Study 2: The Effects of Motivational System Activation on Brand Recall and Recognition**

Findings from Study 1 indicate that the motivational system activations by the emotional nature of spectator sport lead to the automatic allocation of cognitive resources, and that this interacts according to the uncertainty of the outcome and whether the viewer's favorite team wins. However, what was not answered in the first experiment was whether increased cognitive resource allocation actually leads to improving the memory for in-stadium signage information. Even though the emotional experiences during consumption of sports lead to automatic cognitive resource allocation, the primary task (i.e., watching a sporting event) may require more cognitive efforts than allocated. The allocated cognitive resources may remain fewer for secondary information processing task (Chung & Sparks, 2016). Study 2 was conducted in order to assess encoding and retrieval efficiency for in-stadium signage information in the televised sport context as a function of motivational system activation (H2 and H3). Sport management scholars such as Breuer and Rumpf (2012) as well as Pham and Johar (2001) have noted that brand awareness measurement is challenging because it cannot truly capture viewers' actual attention or memory. However, the calculation of signal detection indices for the brand recognition data allows us to predict the ability regarding how subjects accurately distinguish target memory probes from foils.

**Method*****Participants, Design, and Procedure***

Undergraduate participants ( $N = 146$ ) were recruited from various classes within a sport management program housed within the same university as Study 1. Once the undergraduate classes were selected, the classes were randomly assigned to a 2 (Sport program-activated motivational system: appetitive, aversive)  $\times$  2 (Sport program-determined level of activation:

high-medium, medium-low) between-subject design. Before conducting the experiment, the investigator explained the procedure of the experiment except for the purpose of the study (i.e., memory test). The experiment started with the subjects' completing questionnaires regarding demographic information, multiple choices of team preferences (i.e., local team, against team, and neither team) in the specific match, and psychological attachments to the selected team. Then, each group was randomly exposed to one of four versions of the video that featured winning in a close game (93-92), winning in a lopsided game (93-73), losing in a close game (92-93), and losing in a lopsided game (73-93). After watching a five-minute basketball video clip in a classroom setting equipped on a 10-foot projection screen, the participants were asked to complete the questionnaire items involving their individual emotional states. Then, unexpected recall and recognition tests regarding brands that appeared in the stimulus were conducted.

### ***Stimuli***

NBA broadcasts were used for Study 2, taken from a 2013 NBA playoff contest between a local team and rival team because it was suspected that the subjects would be familiar with in-stadium signage at their school and that this would contaminate the memory data. This game was chosen for several reasons. The game was held in the rival team's arena so that there would be less of a chance that the study participants would be familiar with the corporate signage embedded in the away arena. Through the data screening process, it was found that the rival team's fans ( $M = 2.23$ ) were more likely to remember the advertised brands embedded in their team's stadium than the home team's fans ( $M = 1.7$ ) as indicated by the results of independent t-tests on brand memory,  $p < .05$ . Also, the experiment was conducted nearly two years after the competition, something which we felt would adequately account for possible memory bias effects. In addition, the nature of the relationship between the teams (i.e., rival) and the nature of

the game (i.e., semifinal game) allowed for the opportunity for participants to pay more attention to the stimuli.

The video clip included the highlights of the game (e.g., scoring) and was created to secure the participants' attention through the process. Using the edited video clip (5-minutes), four manipulated versions were developed as the study stimuli. Original scoreboard information in the edited video clip was replaced with newly created scoreboard information (i.e., winning/tight, winning/lopsided, losing/tight, and losing/lopsided). The treatments were designed to induce proper emotional feelings based on the  $2 \times 2$  design. The game outcomes (i.e., home team winning or losing) were manipulated to activate the motivational system, while score variations (i.e., close and lopsided) were manipulated to determine the level of activation in the motivational system. Further, the score differentials during the game were consistent with the final scores across the four conditions. In the case of the local team's winning in a close game, the local team had been leading the whole game by a few points (1-to-3 points). For the condition that necessitated the local team's loss via a lopsided game, the rival team had been followed by the local team within a large variation of scores (10-to-20 points) throughout the entire game.

Furthermore, the in-stadium signage advertisements were those actually presented in the competition. There were approximately seven actual brand logos that appeared during the game (e.g., logo on the playing surface, on the basketball goal stand, on the central venue signage). The seven product categories consisted of beer, automobile, movie, sports, airline, insurance, and beverage categories. Most of them (e.g., beer, automobile, sports) are usually marketed in the general sport broadcasting contexts (Fenton, 2009). Also, it should be noted that all the visual information regarding the exposure of advertisements (e.g., the location, frequency, and

duration) were exactly the same across the four conditions. The only difference within the conditions was the scoreboard information that was embedded at the bottom of screen.

### ***Measurements***

*Motivational System and Activation Level.* To measure indicators of the motivational system activations and the intensity of activations, the Self-Assessment Manikin (SAM) with 7-point pictorial scales (Bradley & Lang, 1994) was used. Through the implementation of five graphical features, the emotion dimensions of valence and arousal are used in the composition of the SAM. As such, within the SAM, valence ranges from unhappy to happy and arousal ranges from calm to highly aroused. This visual self-report instrument has been widely used to measure emotional states (i.e., valence and arousal) because of its advantages (e.g., simple, quick, friendly, less cognitive load). The valence dimension was considered as an indicator of the motivational system (i.e., appetitive or aversive). The arousal dimension was used to indicate the level of activation in the motivational system (i.e., low or high).

*Brand Recognition.* Recognition memory was used to measure encoding (e.g., Lee & Faber, 2007; Sparks & Lang, 2015). To assess brand recognition, subjects were asked to select brands that they had seen during the game. To avoid indiscriminately high scores (Rothschild, Qualheim, Deith, & Hyun, 1990), the seven brand logos actually seen in the game were replaced with different logo designs associated with the same brands. Additionally, another seven brand logos that correspond with matched product categories (e.g., beer [Budweiser vs. Miller], movie [After Earth vs. Pacific Rim]) were provided as foils. Thus, a total of 14 possible brand logos comprising seven targets and seven foils were presented to the study participants.

Furthermore, based on signal detection theory (e.g., Fox, 2004; Green & Swets, 1966), sensitivity ( $A'$ ) was calculated using the following formula:  $sensitivity (A') = 1 - 0.25 \times \{y (1 - y)\}$

$+ x(1 - x) / x(1 - y)$  (Pollack, Norman, & Galanter, 1964). In this formula,  $x$  is the probabilities of hits ( $N$  of correctly identified target brands/  $N$  of target brands) and  $y$  is probabilities of false alarms ( $N$  of foils incorrectly identified as target brands/  $N$  of foil brands). This is because simply counting the number of brands correctly might trigger a type I error (Green & Swets, 1966). The higher  $A'$  scores indicate that participants are able to accurately distinguish between actual brands and false brands.

*Brand Recall.* In order to assess retrieval, free recall brand recall tests were utilized by asking subjects to list all the brand names viewed in the sporting video (e.g., Lee & Faber, 2007; Wang & Lang, 2012). The free recall scores were calculated by adding the numbers of brands that were correctly recalled. The maximum scores for this test were seven points. Two graduate students assisted to code recall answers. Two separately coded answers were consistent with one another.

*Covariate.* Psychological attachment to team may affect brand recall and recognition (Pham, 1992). As suggested by previous literature (Lee & Faber, 2007), psychological attachments (i.e., team identification) were used as covariate. Team identification scales based on the work of Robinson and Trail (2005) were adopted.

### ***Data Screening***

Out of 146 subjects who completed the experiment, 96 subjects (70 males and 26 females) rooted for the local team with an average team identification ratings of 4.41 out of 7.0 and an average age of 21.44 years old. Those who followed the rival team or neither team ( $n = 50$ ) were excluded in the main analysis because they had different emotional experiences compared to the local team's fans. The screened data contained 96 subjects who were assigned to one of four conditions: moderate-high appetitive condition ( $n = 26$ ), low-moderate appetitive

condition ( $n = 24$ ), moderate-high aversive condition ( $n = 24$ ), low-moderate aversive condition ( $n = 22$ ).

## Results

### *Manipulation Check*

In order to check manipulations and random assignments, a series of ANOVAs were performed on self-administrated emotions (i.e., valence and arousal) and psychological attachments (i.e., team identification). The results of the analyses showed that game outcomes have a significant main impact on pleasant ratings  $F(1, 88) = 50.73, p < .001, \eta^2 = .36$ . A significant main effect of uncertainty about outcomes was also found for arousal ratings,  $F(1, 88) = 12.27, p < .001, \eta^2 = .12$ . None of the interaction effects were found in the self-reported emotions data. To be specific, the results indicated that the winning condition ( $M = 5.78, SD = 1.33$ ) elicited greater pleasant feelings than did the losing condition ( $M = 3.20, SD = 2.01$ ). Arousal ratings were higher for the tight condition ( $M = 4.41, SD = 1.97$ ) than for the lopsided condition ( $M = 3.06, SD = 1.71$ ). Thus, the motivational systems were properly activated by video stimulations as intended. Furthermore, it was revealed that scores for team identification ( $p = .27$ ) were not varied across the four manipulated conditions, ensuring that the treatment groups were randomly distributed.

### *Hypotheses Testing*

In order to test the hypotheses (i.e., H2 and H3), a MANCOVA was conducted with a (Sport program-activated motivational system: appetitive, aversive)  $\times$  2 (Sport program-determined level of activation: high-medium, medium-low) on brand recall and recognition sensitivity ( $A'$ ). As predicted, after controlling for team identification, a significant univariate interaction effect between the motivational system and the level of activation was found for



recognition sensitivity ( $H2$ ),  $F(1, 90) = 6.08, p < .05, \eta^2 = .063$  (See Figure 2). However, a univariate interaction effect on brand recall ( $H3$ ) was not significant,  $F(1, 90) = 2.34, p = .12, \eta^2 = .025$ . Except for the hypothesized effect ( $H2$ ), no other significant effects were detected.

{Insert Figures 2 about here}

As predicted in  $H2$ , planned post-hoc comparisons showed that at the higher level of activation, recognition sensitivity ( $A'$ ) scores were higher for the appetitive system ( $M = .14, SD = .15$ ) than for the aversive system ( $M = .04, SD = .14$ ),  $t(48) = 1.73, p < .05$ , one-tailed ( $H2a$ ). At the lower level of activation, recognition sensitivity ( $A'$ ) scores were better for the aversive ( $M = .11, SD = .18$ ) than for the appetitive ( $M = .04, SD = .16$ ),  $t(44) = -1.27, p = .105$ , one-tailed ( $H2b$ ). Regarding  $H3$ , the results were somewhat mixed. The interaction effect on brand recall did not reach statistical significance ( $p = .13$ ); but, planned comparisons showed that high appetitive activation ( $M = 1.30, SD = 1.46$ ) elicited greater brand recall scores than high aversive activation ( $M = .67, SD = .63$ ),  $t(49) = 1.72, p < .05$ , one-tailed ( $H3a$ ). Also, the direction of mean scores was still predicted such that low aversive activation ( $M = .96, SD = 1.30$ ) resulted in higher brand recall scores than low appetitive activation ( $M = .83, SD = .91$ ).

## Study 2 Discussion

Findings from the second experiment provide additional evidence for LC4MP (Lang, 2006a, 2006b) and extend the results of Study 1. As expected, brand recognition tasks were significantly impacted by viewers' motivational states and levels of activation ( $H2$ ). As shown in Figure 2, participants in the winning and tight condition performed better for brand memory tests than did those in the losing and tight condition. However, the motivational states and the levels of activations induced by sporting programming context had a limited univariate effect on brand recall ( $H3$ ). This result may be due to the different processing nature of encoding and retrieving.

The encoding does not necessarily lead to storage and retrieval (Lang, 2006a, 2006b). Also, the allocated cognitive resources may be sufficient for participants to encode the brand logo, but insufficient to store or retrieve the brand name. Taken together, the game-induced emotions effects were salient on the brand memory when brand-relevant cues (i.e., logos) are provided, but limited without the cues. For the purposes of comparing the various findings from Study 1 and Study 2, the observed values for the variables were adjusted and illustrated in Figure 3.

{Insert Figure 3 about here}

### **General Discussion**

The current study investigated the effects of sports program induced emotions on motivated processing of in-stadium signage advertisements in the sports broadcasting context. The results of the two experiments conducted within the study suggest that the biological motivational systems activated by team performance factors impact automatic allocations of cognitive resources as indicated by cardiac deceleration (Study 1) to encoding of peripheral signage advertisements as indicated by recognition sensitivity scores (Study 2). As described in Figure 3, the patterns of cognitive efforts, recognition, and recall found in these experiments are consistent with the theoretical hypotheses of LC4MP (Lang, 2006a, 2006b). Also, the results are in line with the findings of motivated cognition studies (e.g., Lang et al., 2013, Yegiyan & Lang, 2010). Overall, as noted below, the theory-driven experiments conducted in the current study extend the field's understanding of signage processing as they were approached from a different theoretical perspective (i.e., LC4MP) via different measurements (i.e., heart rate and signal detection analysis) compared with the existing literature in the field.

### **Cognitive Efforts & Peripheral Signage Processing**

The current study advances previous studies and our understanding of advertising in sport marketing communication by providing new insights into the underlying mechanism of signage advertising processing. In conjunction with sport emotion related literature (e.g., Hillman et al., 2004) and LC4MP (Lang, 2006a, 2006b), sport fans' emotional experiences (e.g., happiness, arousal, unhappiness), in response to sporting competitions, motivate to activate the evolutionary motivational system. Then, the activated motivational states automatically allocate different amounts of cognitive resources (H1) to encode peripheral signage advertisements (H2). For example, positive emotional experiences during the suspenseful sporting competition increase the viewers' focus (i.e., attention) on the game, and more information concerning signage advertising is encoded. The cognitive resources assigned by watching sports (primary task) have a residual impact on how sport fan cognitively process peripheral signage information (secondary task). To be specific, the cognitive resources allocated for the primary task should help to process the secondary task (Chung & Sparks, 2016). It should be noted that sport fans' emotional states and its biological function in cognitive system make a unique contribution to cognitive allocations to process of peripheral marketing stimuli. Further, as indicated by the consistent patterns shown in heart rate and recognition sensitivity ( $A'$ ) data from the current study's two experiments, sport fans are able to distinguish the advertised brand from others depending on how much cognitive effort they exert during their viewing of televised sports. Given the finding that more cognitive resources are allocated the more brand related information is encoded, how to increase cognitive effort should be considered (e.g., timing of advertising, design of advertising) in order to maximize the effectiveness of peripheral advertising.

### **The Role of Emotions in Spectator Sport**

From the general sport management and marketing viewpoints, it is interesting to note that emotions derived from the competitive nature of sport produce powerful abilities to guide the cognition of sport fans. One could highlight that the impact of the core products of spectator sports (i.e., team performance) are not limited to the global level (e.g., league promotions, ticket sales, team related product purchasing), but include sport fans' cognitive information processing, which make the sport industry a rather unique context when compared to other business settings. For example, as revealed in the second experiment (Study 2), participants' memory concerning the advertised brand was impacted by their emotional states even though the participants were exposed to exactly the same video clips except for the scoreboard information located at the bottom of screen. Again, this result provides a conceptual understanding of the relationship among team performance, sport fans' emotions, and cognitions, which support additional evidence from recent studies which stressed the significant role of emotions in the spectator sport settings (e.g., Bee & Madrigal, 2012; Kwak, Kim, & Hirt, 2011; Wang & Kaplanidou, 2013). Framed differently, this specific theoretical model (LC4MP) could serve as a useful framework in the field of sport marketing communication. Thus, exploring this model within other sport spectator settings (e.g., TV commercial embedded in sporting programming, sport sponsorship) would extend our knowledge related to the emotional nature of sport consumption and its impact on sport fans' cognition.

### **Practical Implications**

Understanding the emotional nature of sport competition also offers special opportunities for the corporate sponsor to build strong brand awareness and for the advertiser to maximize the effectiveness of the advertisements. Based on the findings, the sport organization (e.g.,

professional team, sports league) may negotiate the signage prices with the corporate company to generate reliable revenue sources. For example, with the advent of digital signage, sport marketers could place digital graphic logos on playgrounds or change advertisements placed in digital venue signage (e.g., Bennett et al., 2006; Sander & Altobelli, 2011) depending on situations; such that the corporate sponsor may want to put its logo when the team of the target market audience is aroused and pleased, followed by when an audience's team is calm and irritated.

Another possibility concerns the pricing strategies that teams use, or advertisers demand, concerning in-stadium signage rates. Although the unpredictability of game outcomes is one of the reasons sports is so compelling, there are certainly good-faith predictions that can be made about how certain teams can perform against others. The findings from the current study indicate that some games are worth more than others when it comes the value of in-game signage. Season prices for in-game signage could actually be calculated based on predictions of whether the home team is likely to win-close or lose in a blowout. Commentators and sports betting systems make similar predictions all the time.

With regards to the study's mixed finding (*H3*), it could be suggested that the signage advertising with other types of brand exposure (e.g., backdrop, TV commercials) would have a larger and more cumulative impact on brand recall and recognition (e.g., Pope & Voges, 1997) based on the current study's finding that signage exposure in conjunction with team performances did not significantly increase the retrieval of brand names (*H3*); but, they were able to distinguish the advertised brands from others when the brand-related cues were provided (*H2*). As noted by Pope and Voges, using the in-stadium signage to "promote the promotion" (p. 7) may be an optimal strategy for marketers.

**Limitations & Suggestions for Future Research**

While the current study extends the research in this area by addressing some of the limitations of previous studies, there are still some gaps that need filled in future studies. First, consistent with previous work in this area, the current investigation is limited in terms of the ecological validity challenges faced in a laboratory experimental setting. For example, the recorded video materials may have elicited different responses compared with live-broadcast settings. Future studies should replicate the current investigation by including a co-active condition, which could possibly stress the importance of the suspenseful game and improve the external validity of stimuli. Lastly, even though it could be postulated that the cardiac response is a valid measurement of cognitive effort, future studies would be enriched if other types of real time measurements (e.g., eye-tracking [actual attention], secondary task reaction times [available cognitive resources]) are measured as well.

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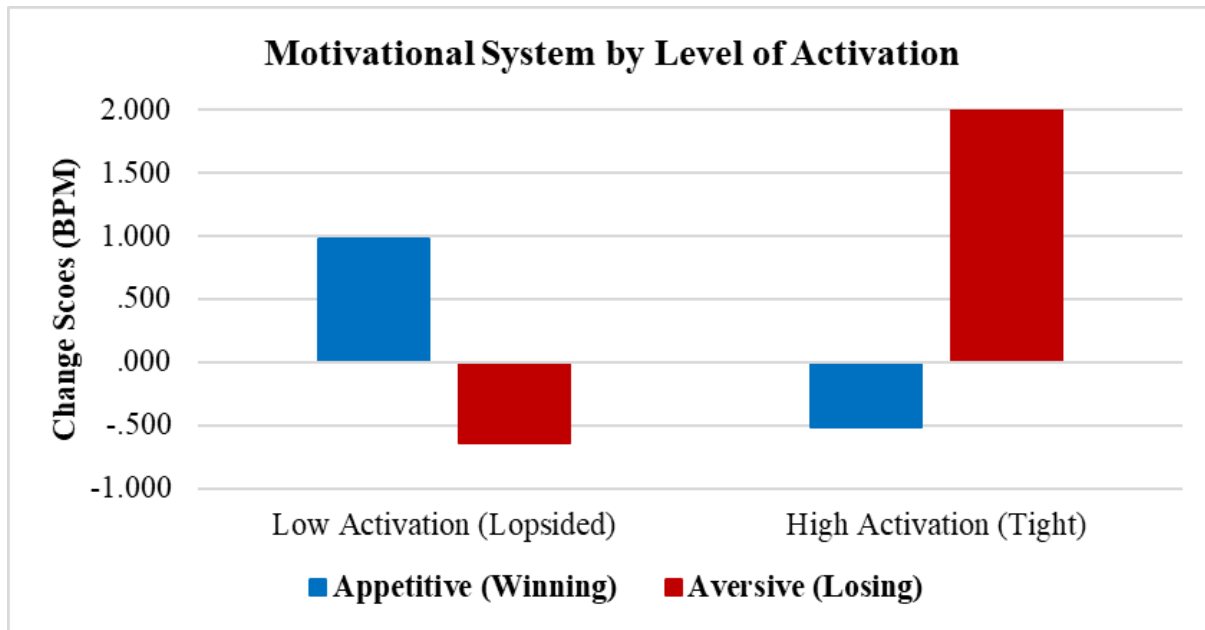


Figure 1. Interaction Effect between Motivational System and Level of Activation on Cardiac Change Scores

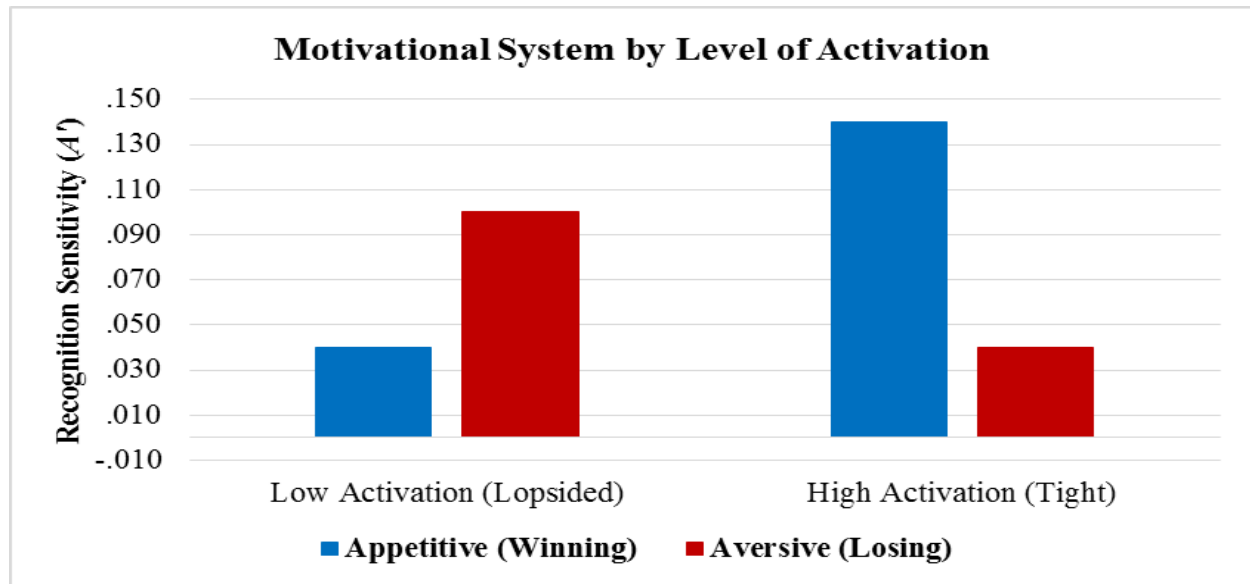


Figure 2. Interaction Effect between Motivational System and Level of Activation on Brand Recognition Sensitivity

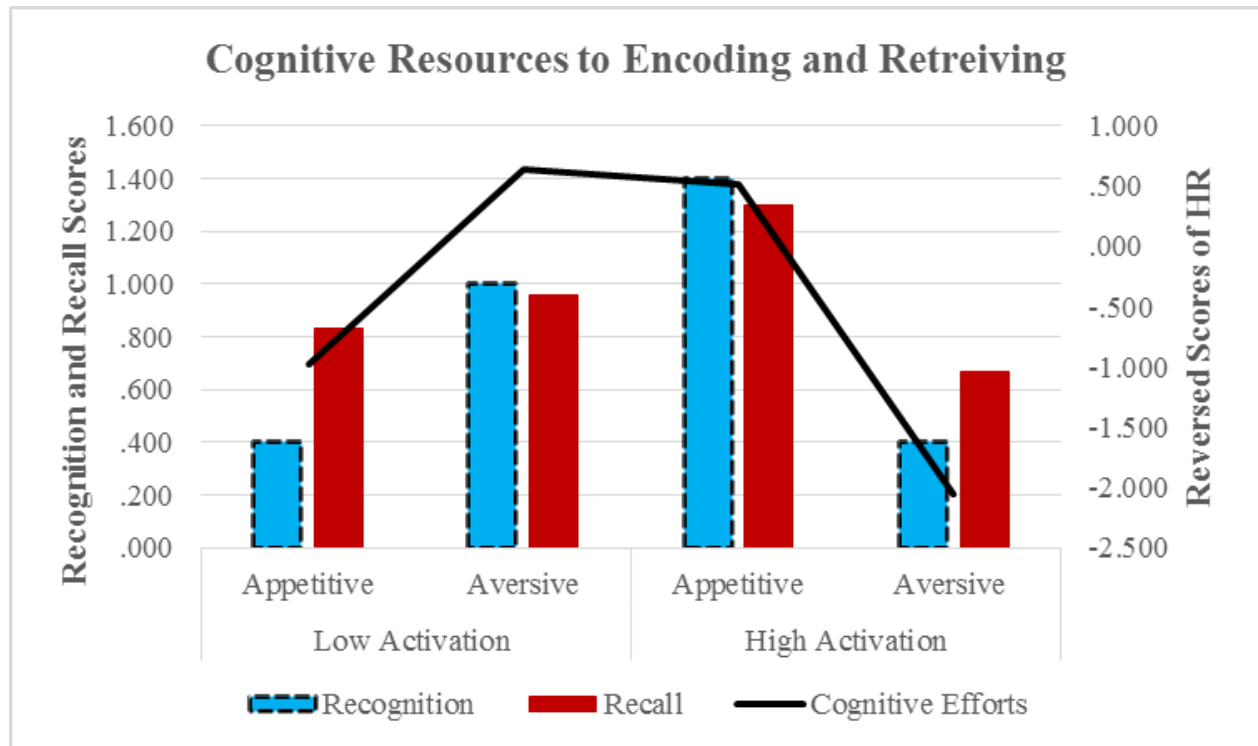


Figure 3. Interaction Effect between Motivational System and Level of Activation on Cognitive Resources to Encoding and Retrieving.

Note: For recognition scores, sensitivity scores ( $A'$ ) are multiplied by ten. Reversed change scores of heart rate are reported to represent cognitive efforts (Allocated cognitive resources).