BRAND AWARENESS OF VIRTUAL ADVERTISING IN SPORT

A Dissertation

by

YOSUKE TSUJI

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2007

Major Subject: Kinesiology

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Approved by:

Chair of Committee,	Gregg Bennett
Committee Members,	George B. Cunningham
	James Leigh
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ABSTRACT

Brand Awareness of Virtual Advertising in Sport. (May 2007)

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The purpose of this study was to assess the brand awareness levels of virtual advertising in sport. More specifically, this study explored factors affecting brand awareness communicated through virtual advertising in a sport broadcast. Particularly, this study focused on the following factors: baseball involvement, team identification, animation, and repetition.

To measure consumers' awareness levels of virtual advertising and to control for extraneous variables, two 3x3 Latin square designs were adopted. A group in one of the Latin square groups saw three different brands (Champion, Icehouse, and Mercury) appearing in different number of exposures (one, four, and six). The other two groups in the same Latin square groups each saw the same video with different combinations of number of exposures and brands. The three groups in the other Latin square group each saw exactly the same three videos, but with animation effects on the virtual advertisements. A sample of 208 undergraduate students from several physical activity classes was solicited to participate in the study. They were handed a random CD that contained one of the six 24-minute video clips of a Texas Rangers game with virtual advertising embedded. After watching the CD, they were asked to answer an online questionnaire. Unaided and aided recalls, as well as recognition rates were measured to

determine the brand awareness levels of virtual advertising. In addition, items measuring baseball involvement, team identification (Rangers & Red Sox), brand involvement, and demand artifacts questions were included in the survey. A series of sequential logistic regression analyses and analysis of covariance were performed on the awareness measures.

The results suggest an effect of repetition on unaided recall levels. At the recognition level, repetition had an interaction with baseball involvement, but no other effects were found. Additionally, animation was found to be ineffective in attracting viewers' attention; however, animation had an interactive effect with repetition on unaided recall. The effects of baseball involvement and team identification were found to affect awareness levels, but were inconsistent in prediction. Limitations and future research questions are discussed.

DEDICATION

To my parents

ACKNOWLEDGMENTS

First, I would like to sincerely thank my committee chair, Dr. Gregg Bennett, and my committee members, Dr. George B. Cunningham, Dr. James Leigh, and Dr. Michael Sagas, for their support and guidance throughout the course of this research. I would also like to thank my friends, colleagues, and department faculties and staff for making my time at Texas A&M University a great experience. I owe special gratitude to Dr. Ken Overton and his staff at Vistas Inc. They had assisted me greatly in creating the virtual advertising video. I would also like to extend my gratitude to all of my friends and mentors back in Japan who have given me numerous encouragements throughout this endeavor. Finally, I would like to thank my family, especially my parents, for their support and encouragement. Without their support, none of this would have been possible.

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CHAPTER I

INTRODUCTION

Measuring advertising effectiveness has been a widely debated topic for numerous years for both academicians and industry researchers. It has been extensively investigated for several reasons, one of which is that firms have invested substantial amounts of their budgets on advertising (Zeisser, 2002). Much of this research has focused on how advertising "works" or affects consumers. Vakratsas and Ambler (1999) argue that advertising must influence consumers in some way (e.g., awareness, memory, attitude) before it affects behavior.

Of the methods used to assess its effectiveness, the extant literature contains many investigations of the awareness levels of consumers to advertising (e.g., Danaher & Mullarkey, 2003; Gupta & Lord, 1998; Law & Braun, 2000; Leigh, 1984; Schneider & Cornwell, 2005; Till & Baack, 2005). This stream of research has focused on awareness levels of brands and advertisements in print advertising (Leigh, 1984), television advertising (Singh & Rothschild, 1983a; Till & Baack, 2005), online advertising (Danaher & Mullarkey, 2003), outdoor advertising (Donthu, Cherian, & Bhargava, 1993), radio advertising (Higie & Sewall, 1991), product placements in video games (Nelson, 2002; Schneider & Cornwell, 2005), television shows (Law & Braun, 2000), and movies (d'Astous & Chartier, 2000; Gupta & Lord, 1998).

This dissertation follows the style of *Journal of Sport Management*.

Although cognitive awareness of brands and advertisements is an established stream of research and researchers have conducted investigations with numerous media, the effectiveness of virtual advertising, a newer media vehicle, has gone relatively unexplored in the marketing and advertising literature. Virtual advertising is the seamless insertion of digitized images into a television broadcast (Turner & Cusumano, 2000; see Appendix A for a review on virtual advertising). It has been increasingly used within sport broadcasts (e.g., football's first down line, corporate signage behind home plate in baseball). Those watching the broadcast from their homes are exposed to the communication content; however, this message cannot be seen to those in attendance at the event because it is electronically generated within the broadcast. The objectives of virtual advertising are similar to those of conventional advertising media. For example, firms that use virtual advertising intend to reach their desired target market, leverage their brands or products, transfer images, communicate with consumers through the medium, and increase brand awareness (Cianfrone, Bennett, Siders, & Tsuji, 2006).

Virtual advertising technology was initially introduced in Europe as broadcast firms, sport properties, and event managers sought alternative methods to advertise during soccer games due to the lack of commercial breaks within these broadcasts (Boddy, 2004). With the advent of "TiVo" or digital video recorders (DVR) (Zeisser, 2002), use of virtual advertising as a means of communication has become more prevalent. DVR technology includes feature functions such as skipping commercials and instant replays of live broadcasts. Nielsen Media Research estimated that 18% of household had DVRs at the end of 2006 and expected that total to reach 39% by 2010

(Kiley, 2006). Such increases could threaten conventional television advertising, as firms may become hesitant to invest in television commercials if the number of people exposed to them decreases as consumers use the skip function via DVRs. Virtual advertising has been proposed to as an alternative to counter the increased use of DVRs.

Virtual advertising offers some advantages over conventional advertising media (Turner & Cusumano, 2000). One notable advantage of virtual advertising is that placing advertising within the game does not allow viewers to skip over it unless they discontinue watching the program. Another advantage is that virtual advertising firms can place logos on any surface of the broadcast, which then increases brand exposure. This should enable companies to repeatedly expose their products and/or brands to consumers. One last significant advantage is that virtual advertising technology allows for the animation of signage. This particular technology is relatively new to television broadcasts and probably gains viewer's attention. The increase in attention should lead to awareness of products similar to that experienced through other media (Mehta & Purvis, 2006; Mulligan 1998).

Statement of Problem

Because these unique advantages pose questions regarding the effects of virtual advertising on the cognition of consumers, analyzing the awareness levels of consumers exposed to virtual advertising seems warranted. Also, because virtual advertising was initially introduced within sports broadcasts and continues to be used there, it seems appropriate to analyze the effectiveness of this medium in a sport setting. Furthermore,

sport relies heavily upon and benefits from advertising revenue in several ways (Wolfe, Meenaghan, & O'Sullivan, 1997/1998). For example, sport has used television for exposure purposes, and sport properties collect significant amounts of revenue from media rights agreements. In response, firms use sport broadcasts to position their products and brands among target markets. In fact, spending on television sport advertising was expected to grow 20% from 2004 to 2006 (Sports Business Journal, 2006), accounting for an estimated spending of $30 billion dollars in 2006 (Plunkett Research Ltd., 2007).

Although there is a plethora of original research on the effects of advertising with several media, there remains a relative paucity of original research on virtual advertising: consumer awareness of it, attitudes toward it, and its overall effectiveness. This study is significant because of that relative paucity of research in this area. Because consumers must be aware of ads before other effects can take place, this research will focus on brand awareness fostered among consumers by virtual advertising. Few researchers have attempted to investigate the brand awareness levels created by virtual advertising. The experimental setting and design of this research add value to the study.

Purpose of Research

The purpose of this study was therefore to assess brand awareness levels, through animation and frequency of exposure, of virtual advertising on respondents exposed to the medium during a sport broadcast. More specifically, the study attempted

to investigate the effects of those factors on levels of brand awareness while controlling for baseball involvement and team identification variables. Research question one assessed the effects of these factors on unaided recall rates of respondents. In a similar fashion, research questions two and three investigated these effects on aided recall and on recognition rates respectively.

Assumptions

Assumptions for this study include the following:

1. Participants of the study were aware of the brands used in the study.
2. Participants watched the video in its entirety.
3. Participants answered questions honestly and sincerely.

Delimitations

Delimitations for this study include the following:

1. Participants of the study were pooled from students participating in a physical activity class in southwestern United States.

Limitations

Limitations for this study include the following:

1. Participation in the study was voluntary.
2. The study took place in a computer lab, which differs from a normal sport viewing experience.

3. Participants of the study were not pooled from a general population.
4. The stimulus was inserted only behind home plate in a baseball game.

Organization of the Dissertation

This dissertation will consist of five chapters. Chapter I introduces the scope of the study as well as its significance to the field of sport marketing and sport management. Chapter II identifies the relevant literature in regard to brand awareness and factors affecting these types of responses. Chapter III proposes the research methodology used in the study. In Chapter IV, the results of the study are presented. Chapter V concludes with discussion, suggestions, implications, and future research directions.

CHAPTER II

LITERATURE REVIEW

The purpose of this chapter is to provide relevant literature and a theoretical framework related to the research question on awareness of virtual advertising. Subsections are presented in the following order: advertising effectiveness, brand awareness, measurement of brand awareness, baseball involvement, team identification, repetition, animation, and relatedness and prominence.

Advertising Effectiveness

Although Vakratsas and Ambler (1999) explain several models to understand the effectiveness of advertising, this study uses the cognitive information model because its focus is to explore viewers' brand awareness levels from virtual advertising in sport (see Appendix A for a review of advertising effectiveness). The cognitive information model assumes that consumers' preferences are unaffected by other elements such as feelings and emotion (Vakratsas & Ambler, 1999). The model assumes that information conveyed in advertising is influential and that consumers' decisions are only rational (Vakratsas & Ambler, 1999). Thus, this "thinking" only model builds on the informative role of advertising. Using this model to guide the study, the importance of brand awareness and its potential outcomes, as well as factors affecting brand awareness are presented subsequently.

Brand Awareness

Keller (1993) points out that brand awareness, or consumers' ability to recall and recognize a brand from memory, is an important factor in the consumer decision-making process. First, it is important that consumers be able to retrieve the name of the brand when they think of a particular product category. Keller (1993) suggested that enhancing brand awareness would increase the likelihood that a particular brand will be considered when consumers make purchase decisions. There is little chance of purchase for those brands that go unnamed (Aaker, 1991).

Second, brand awareness alone can affect consumers' decisions about brands in a consideration set. For instance, studies have indicated that consumers tend to consider familiar, well-established brands when making purchase decisions (Jacoby, Syzabillo, & Busato-Schach, 1977; Roselius, 1971). Consumers are likely to minimize their efforts of decision-making, in terms of time spent and cognitive effort, by selecting a brand of which they have heard (Macdonald & Sharp, 2003) or with which they are familiar (Aaker, 1991). Also, for products in a low involvement situation, the elaboration likelihood model (Cacioppo & Petty, 1984) predicts that consumers may base their decision solely on factors such as brand name. Dickson and Sawyer (1986) showed that for products such as coffee, toothpaste, and margarine, consumers spent only an average of 12 seconds to place them in the basket from the time they first looked at the shelf. Brand familiarity and brand awareness can make a difference even for large and involved purchase decisions (Aaker, 1991).

Finally, brand awareness is a necessary component for creating an association with the image of a brand. Without awareness of a brand, no other form of communication effects (i.e., brand attitude, brand image) can occur (Aaker, 1991; Macdonald & Sharp, 2003; Rossiter & Percy, 1983). For instance, Aaker and Day (1974) found that awareness led to a change in an individual's attitude and subsequent purchase decisions. Another study found that recall is positively correlated with liking an along with other favorable advertising diagnostics (e.g., interesting) (Mehta & Purvis, 2006).

The importance of brand awareness is also true for sponsorship and investigations that are carried out to measure its effectiveness. Sponsorship is a type of advertising, which is very similar to virtual advertising. If it is not animated or placed in a unique location, viewers may perceive virtual advertising as sponsorship signage. In fact, Bennett, Ferreira, Tsuji, Siders, & Cianfrone (2006) argued that virtual advertising has a closer relationship to sponsorship than to advertising (see Appendix A for a review on sponsorship effectiveness). Scholars have suggested that achieving awareness from consumers is one of the main objectives of sponsorship association (Johar, Pham, & Wakefield, 2006; Madrigal, 2001; Sandler & Shani, 1993). Additionally, Quester (1997b) argues that none of the benefits of sponsoring an event can be achieved without correctly identifying and creating an association with the event.

In the sport sponsorship context, several scholars have used brand awareness as a measure of effectiveness (Bennett, Henson, & Zhang, 2002; Cuneen & Hannan, 1993; Johar, Pham, & Wakefield, 2006; Lardinoit & Derbaix, 2001; Pitts, 1998; Quester,

1997a; Sandler & Shani, 1993; Stotlar, 1993, Stotlar & Johnson, 1989). They have investigated awareness levels of sponsorship at sporting events and in sport broadcasts. In a sporting event context, Stotlar and Johnson's (1989) study revealed that nearly 70% of college football and basketball fans correctly identified the signage in a stadium or arena. More specifically, they concluded that the location of stadium signage is vital to the success of brand awareness. Cuneen and Hannan (1993) measured recognition levels of sponsorship at an LPGA golf tournament setting. They found that 98% of subjects noticed some sort of advertising located sporadically around the tournament grounds. In another study, Pitts (1998) found that compared to studies in the past (Sandler & Shani, 1993; Stotlar, 1993), higher correct recall rates of sponsors were reported (58% to 83%) at the Gay Games.

Several endeavors have been made regarding awareness of stadium signage and billboards in sport broadcasting (d'Ydewalle, Abeele, Van Rensbergen, & Coucke, 1988; Lardinoit & Derbaix, 2001; Levin, Joiner, Cameron, 2001; Nebenzahl & Hornik, 1985). Nebenzahl and Hornik (1985) studied brand awareness levels in a televised basketball game. They found that respondents were able to recall the product category within the broadcast, but were unsuccessful in recognizing the individual brand names. d'Ydewalle et al. (1988) studied the eye movement of people watching a soccer game on television. They found that people hardly ever watched the billboards surrounding the soccer field. They also found that more involved individuals spent less time looking at the billboards, and subjects in the study were able to recognize the billboards, but not recall them.

Numerous field studies, as well as sponsorship awareness studies seen through television, have been conducted, but only one study has assessed the awareness of virtual advertising. Cianfrone et al. (2006) compared the ability of consumers to recall and recognize television commercials and virtual advertisements. They found that television commercials were recalled and recognized more often than virtual advertisements. Virtual logos in the score display area were most frequently remembered, whereas logos on the playing field did not receive much attention from the respondents. However, this exploratory field study failed to account for animation or frequency/repetition effects on the sample, a limitation suggested by these scholars as a foundation for further research.

To understand the awareness levels of virtual advertising in sport, the following model is proposed (Figure 1).

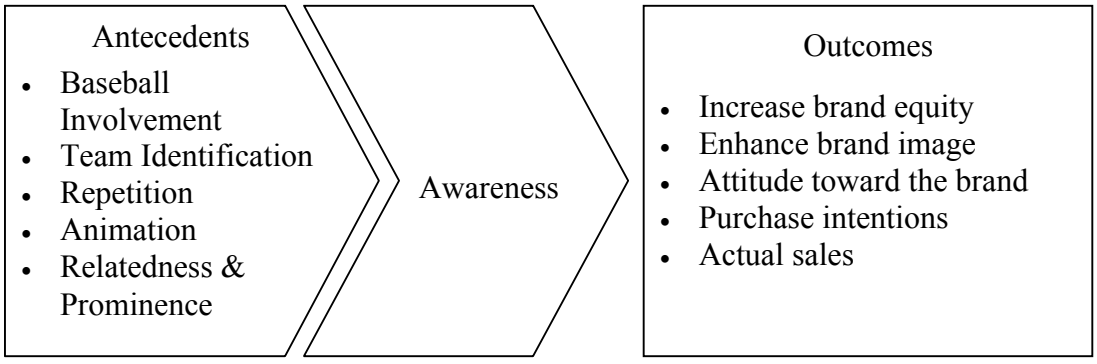

Figure 1 - Proposed model for the awareness of virtual advertising in sport

This model suggests that brand awareness is influenced by baseball involvement, team identification, repetition, animation, and relatedness and prominence. In this study, the first four factors are tested for their effects on awareness levels, while controlling for the last. To understand the identification process, or the storage and retrieval mechanisms of an individual, the associative network model is utilized. This model is grounded on Anderson's (1976, 1983a, 1983b) work on adaptive control of thought (ACT) theory. ACT theory explains knowledge and memory processing using the concept of networks in memory (Anderson, 1983a). According to the associative network model, semantic memory, or knowledge, can be characterized as a network of nodes and connecting links (Anderson, 1983a; 1983b; Keller, 1987, 1993; Raaijmakers & Shiffrin, 1992). Furthermore, nodes in the network represent stored information or concepts, and links represent the semantic or episodic relations (Anderson, 1983b; Raaijmakers & Shiffrin, 1992). When two or more pieces of information are learned together, a link between the nodes representing the items may be created (Raaijmakers & Shiffrin, 1992). For example, when an event and the title sponsor for the event are learned together, two nodes containing respective information and a link connecting the nodes are formed.

Retrieval of information from memory depends on what Anderson (1983a; 1983b) termed spreading of activation. In his continuous activation model, stored information or a node is thought to be continuously active. When an individual is presented with a retrieval cue (which is also a node in memory), the activation spreads through the linked node. When that activation in another node surpasses the limit, it is

considered that the contained information is recalled (Keller, 1993). This spreading of activation is considered to converge according to the strengths of the nodes in the network (Anderson, 1983a). In other words, the strength of a node is what determines the probability and speed of retrieval (Anderson, 1983a). The strengths of the node are contingent upon factors (e.g., relatedness, repetition) at the time of information encoding (Anderson, 1983a; 1983b; Burke & Srull, 1988; Pham & Johar, 1997). For example, when a consumer thinks of a sponsor during the FIFA World Cup 2006, he or she may think of Adidas because of its frequent exposure on television. Forgetting of information occurs on the other hand, not because stored information in the long-term memory is lost, but because an individual falls into one of more of the following situations: other items or other paired items interfere with the original memory trace, the strengths of nodes decays over time, or the nature of the cues change (Anderson, 1983a; Hutchinson & Moore, 1984; Raaijmakers & Shiffrin, 1992).

When an individual is exposed to advertising, he or she can produce the following types of nodes (Hutchinson & Moore, 1984, as cited in Keller, 1987): brand-specific information, ad-specific information, brand identification, product category, and evaluative reactions. Brand-specific information carries messages intended to persuade the consumer regarding the benefits of buying the brand. Ad-specific information includes those related to the execution of the advertising. Brand identification refers to the awareness of the advertised brand. Product category information is the knowledge of how the product works and when/where it should be used. Lastly, evaluative reactions are the cognitive and affective responses stored in

memory. Not all of the above information is stored in a single ad exposure; even if they were stored, they may or may not be linked together (Keller, 1987).

Typically, brand-related information is communicated through various media; of interest is the television. Generally, television is considered a low-involvement medium through which consumers do not actively search for information (Krugman, 1965). Advertising messages communicated through television are often retained without a process of perception and comprehension (Nebenzahl & Hornik, 1985). In a sport broadcast, virtual advertisements appearing in the background are considered secondary to the actual game. Therefore, in the minds of the viewers, information encoded for advertisements during the game may very likely be weak.

Aaker (1991) explained different levels of brand awareness by placing them on a continuum. At one end is the state in which a consumer is unaware of a brand. Because the consumer is unaware of the brand, no further associations can be made. At the next level of awareness is brand recognition, a rather weak connection to the brand. In an awareness test, it involves correctly selecting a brand from a set of multiple brands provided. This is the basic stage of communication, in which companies try to establish a connection to consumers. When this stage is established, the next task for a company is to associate product attributes with the brand in consumers' mind. The next higher level is brand recall, which involves a task, in which a consumer successfully retrieves a brand from memory. An individual may be asked to recall from scratch (unaided recall) or with a use of a cue to aid the recall task (aided recall). Unaided recall tasks are typically considered more difficult than aided recall tasks. The first brand mentioned in

an unaided recall task is said to have achieved a top-of-mind awareness. At the highest position in the awareness continuum is the dominant brand, when high percentage of respondents name one brand.

Accordingly, brand awareness is an important construct in predicting individual behaviors as well as the potential sales outcome for an organization. Thus, it is vital for organizations to understand where their brands are positioned along the awareness continuum in the minds of consumers. Of equal importance are the factors that might affect this construct. Therefore, it is imperative that various methods to measure awareness, as well as factors affecting awareness (baseball involvement, team identification, repetition, animation, relatedness and prominence) be discussed.

Measurement of Brand Awareness

Researchers have conducted numerous studies to measure human memory (Richardson-Klavehn & Bjork, 1988). These past tests have involved the manipulation and use of some or all of the three phases of memory (Lockhart, 2000). First is the encoding phase, in which subjects are presented with and study the target stimulus. Next is the retention interval phase, which is followed by the retrieval or test phase when respondents make an effort to answer to questions about the target stimulus.

According to Richardson-Klavehn and Bjork (1988), measurement of human memory has been studied from two main perspectives. The first method is called the explicit or direct form of measurement, in which researchers use direct references to a target stimulus during the test. It involves a conscious effort by the respondent to

recollect the target stimulus as requested in the instructions (Lockhart, 2000). This type of test is typically conducted using recall and recognition tests. The other type of memory measurement, which is conducted without reference to the stimulus, is called the implicit or indirect form of measurement. This task involves revealing a target stimulus from memory in the absence of any instructions of recollection (Lockhart, 2000). Thus, during an implicit memory test, subjects receive instructions only for the task. While direct recall and recognition tests of advertising and sponsorship have been widely conducted, several researchers have argued that these methods may not be exhaustive in assessing human memory (Cornwell, Weeks, & Roy, 2005; Nebenzahl & Hornik, 1985; Pham & Vanhuele, 1997; Richardson-Klavehn & Bjork, 1988). Although implicit memory may provide further understanding of viewers' memories of virtual advertising, establishing initial research on explicit memory seems more important. Thus, this study measures viewers' explicit memory of virtual advertising.

The extant literature regarding explicit memory has often assessed brand awareness through the use of recall and recognition scales, which test the ability of consumers to remember advertising or sponsorships from memory. More specifically, unaided recall, aided recall, and recognition scales have been used in advertising and marketing research as indicators of advertising effectiveness (Aaker, 1991; Singh & Rothschild, 1983b; Zinkhan, Locander, & Leigh, 1986). Such research has suggested that cognition of brands generated through advertising would translate into favorable attitudes, intentions, and outcomes (Zinkhan et al., 1986; Preston, 1982; Stipp, 1998;

Stipp & Schiavone, 1996). Thus, an ad that can enhance cognition among consumers has been deemed effective by previous research.

Unaided recall, sometimes called free recall, requires consumers/respondents to generate relevant cues for retrieval as well as perform necessary retrieval tasks cognitively (Zinkahn et al., 1986). Aided recall or cued recall is less demanding for the consumer because they are provided with some specific cues to access the appropriate memory trace or nodes in memory (Leigh, 1984; Leigh & Menon, 1986, 1987; Zinkahn et al., 1986).

Recognition is much easier than the previous two methods in that target items are presented along with one or more distractor items to the respondents (Brown, 1976; Leigh, 1984; Leigh & Menon, 1986, 1987; Zinkahn et al., 1986). Thus, recognition is solely dependent upon one's strengths of the nodes and link in memory or one's ability to discriminate the correct items from the distractors (Brown, 1976; Gupta & Lord, 1998; Lardinoit & Derbaix, 2001; Zinkahn et al., 1986). Due to its simplicity, most studies have reported that recognition rates are higher than recall measures (Brown, 1976; du Plessis, 1994; Lynch & Srull, 1982). Inclusion of distractor items is important as these items allow for adjustments to respondents' errors (e.g., guessing) (Singh & Churchill, 1987). Generally, recognition is more practical to measure incidental exposure, whereas recall is better suited to measure intentional exposure (Greenwald & Leavitt, 1984; Singh & Rothschild, 1983a).

Presentation of items in a recognition test may be done one at a time (in a test procedure called a "yes-no" task) or all at once. Within the latter procedure, the

researcher may require the respondents to choose "n" items from the list (i.e., forced test) or ask them to choose all that apply (i.e., unforced test) (Brown, 1976; Leigh & Menon, 1986). In addition, a confidence-rating test of the selected choices may accompany these tasks. With the use of an unforced procedure, the researcher can detect guessing by the respondents by focusing on the incorrect selections (Leigh & Menon, 1986).

The instructions during the test may vary according to a researcher's intentions, and they may have an effect on the outcome of memory research. Instructions that inform subjects about a subsequent memory test are called intentional instructions, whereas those that require subjects to remain uninformed about any ensuing memory tests are called incidental instructions (Lockhart, 2000). These two types of instructions have less effect on recognition tests, but recall is greatly influenced reduced by incidental learning (Brown, 1976).

The difficulty of recognition tests increases with the nature of the distractors, in particular, with relative semantic similarity or overlap of perceptual features (Lockhart, 2000; Singh & Churchill, 1986). For instance, tests that group the target brand with distractors in the same product category pose a more difficult task for the subjects. In addition, the number of distractors within a recognition task also affects the difficulty for the respondents (Singh & Rothchild, 1983a). The difficulty in a measurement task may in fact create a situation in which the subjects cannot answer any of the target items correctly. Although the accuracy-based measurement should not be too difficult for the subjects, it should also not be too undemanding. Tasks that are too easy will allow high

performance levels across conditions, thereby masking the effect of conditions (Lockhart, 2000).

In an advertising recognition test, there are two possible responses (i.e., "yes" or "no") to two types of advertising stimulus (i.e., real or distractor), which create four possible outcomes. First, a "hit" is recorded when an individual responds, "yes" to real advertising. If, however, one fails to recognize the real ad, the response is called a "miss." Another incorrect judgment by a respondent is "false alarm" in which the subject answers "yes" to a bogus advertising stimulus. Finally, a "correct rejection" occurs when the subject says "no" to a distractor. Figure 2 depicts these relationships.

		Stimulus Advertising	
		Real	Distractor
Response	Yes	Hit	False Alarm
	No	Miss	Correct Rejection

Figure 2 - Illustrative outcomes in a recognition task

Further analyses of recognition tests mainly use the hit rate (H) and the false-alarm rate (FA) for adjustments and corrections (Leigh & Menon, 1986). A hit rate is calculated by the ratio of targets correctly chosen to the total number of target stimuli available, whereas the false-alarm rate is the ratio of incorrectly chosen items to the

total number of distractor items included in the test (Brown, 1976; Green & Swets, 1966; Leigh & Menon, 1986).

$$H = Tc / T \quad (1)$$

$$FA = Dc / D \quad (2)$$

In these formulae, Tc is the number of correctly chosen targets, T is the total targets in the test set, Dc is the number of incorrectly chosen distractors, and D is the total distractors in the test set. For instance, a hit rate of 1.0 denotes that the respondent correctly selected all target stimuli in the test set. However, a hit rate of 1.0 would not be a brilliant score unless his or her false-alarm rate is also low. If the same respondent had a false-alarm rate of 1.0, it would indicate that he or she had answered, "Yes, I have seen the ad" to all target and distractor items. Thus, correct identification with no mistakes would be those individuals with high hit rates and low false-alarm rates. When one has a same score on both hit rate and false-alarm rate (i.e., H = 0.3, FA = 0.3), it implies that the responses occurred by chance. Therefore, marketers seek high hit rates and low false-alarm rates from respondents.

According to Singh and Churchill (1986, 1987), recognition tests are criticized for their failure to account for respondents' errors. The researchers argue that failing to account for errors may lead to erroneous conclusions, especially for between-subjects' comparisons (Brown, 1976; Leigh & Menon, 1986). Shapiro (1994) argues that recognition studies that use only the correct number of responses would be unable to

completely understand the human recognition process. He also notes that research that merely counts the number of correct responses may incorrectly conclude that recognition memory is substantial, when in reality, it was changes in judgment about memory.

Although there are a plethora of alternative measures to evaluate and correct respondents' sensitivity and biases, problems with them have arisen (see Appendix A for a review on alternative measures of recognition). Lockhart (2000) suggests a simple solution for correcting recognition research. He argues that a simple measure of hit rate (H) minus false-alarm rate (FA) would suffice. Furthermore, this simple measure has been empirically found to be consistent and to converge with recall measures (Leigh & Menon, 1986). In this study, this formula will be referred to as "corrected hit rate" or H_{C2}.

$$H_{C2} = H - FA \tag{3}$$

Baseball Involvement

The construct of involvement and its effect on memory retrieval have been well documented in advertising and sport sponsorship literature (Lardinoit & Derbaix, 2001; Leigh & Menon, 1987; Levin et al., 2001; Meenaghan, 2001a; Park & Hastak, 1994; Pham, 1992; Tavassoli, Shultz, & Fitzsimons, 1995). As previous literature in consumer behavior has indicated, involvement is the perceived personal relevance of a target to an individual (Celsi & Olson, 1988, Zaichkowsky, 1985). To be more specific,

involvement is tied into one's needs, goals, and values and his or her knowledge of a target (Celsi & Olson, 1988).

Generally, consumers' attention and processing of advertising information is influenced by their motivation, ability, and opportunity (MacInnis & Jaworski, 1989). MacInnis and Jaworski (1989) define motivation in advertising information processing as the "desire to process brand information in the ad" (p.4), ability as "skill or proficiency in interpreting brand information in an ad" (p.7), and opportunity as the condition in which the processing takes place. Celsi and Olson (1988) have argued that involvement activates one's knowledge (i.e., ability) in memory. This activation of knowledge, in turn, creates a motivational drive that would potentially stimulate an individual's cognitive behavior, such as attention and comprehension processes (Celsi & Olson, 1988).

Greenwald and Leavitt (1984) have proposed the effects of involvement on attention and comprehension processes. According to their view, there are four levels of audience involvement along a continuum, ranging from the preattention stage, to focal attention, to comprehension, and lastly to the elaboration stage. Audience involvement is defined as the "allocation of attentional capacity to a message source, as needed to analyze the message at one of a series of increasingly abstract representational levels" (Greenwald & Leavitt, 1984, p.591). According to these authors, the difference of these four stages is the amount of capacity allocated to the separate levels. The attentional capacity of an individual is considered to be finite and variable (Kahneman, 1973; Lynch & Srull, 1982). In other words, a person has a certain amount of attentional

capacity that he or she can use for selectively focused ad. Within that limit, consumers typically cannot process multiple items of information (from external sources and information from memory) at the same time (Lynch & Srull, 1982). Greenwald and Leavitt (1984) report that preattention uses minimal capacity; focal attention uses some capacity for a message; comprehension consists of a propositional analysis of the context of the message; and elaboration uses the most capacity and integrates the message with the individual's held knowledge to form opinions.

In Greenwald and Leavitt's (1984) view, greater involvement of a consumer should lead to greater motivation to attend and comprehend the information presented. Celsi and Olson (1988) studied the effect of involvement on attention and comprehension processes, based on the work by Greenwald and Leavitt (1984). They found that greater involvement led to subjects attending advertisements, cognitively processing the advertisements, and engaging in more elaborated thinking.

Using Greenwald and Leavitt's (1984) perspective, involvement with sports (baseball in this study), should greatly affect participants' information processing of advertising stimuli. Individuals at low levels of involvement are likely to have a low motivational state. These individuals would most likely not attend much to the game or cognitively process the sports game, much less the sponsorship stimuli. As the degree of involvement increases, individuals tend to devote increasing attention to the overall game and the peripherals within a sport broadcast (Pham, 1992).

According to Mitchell (1981), involvement has two properties, intensity and direction. In their definition, intensity refers to the level of involvement (e.g., high-low),

and direction involves the focus of their attention (e.g., directed at the brand or elements of the advertisement). As involvement reaches higher levels, more attention would be focused on the relevant target, and greater processing capacity would be allocated to elaborative thinking (Celsi & Olson, 1988; MacInnis & Jaworski, 1989). This implies, in a sports context, that highly involved fans may pay close attention to the game itself and elaborate on the information collected with their knowledge held in memory. This process may shut out any peripheral information that would distract from their viewing experience. d'Ydewalle et al.'s (1988) study found that more involved individuals spent less time looking at the billboards. Thus, awareness rates will level off as involvement increases, generating an inverted-U shape (Pham, 1992). Tavassoli et al. (1995) found a similar result as awareness (i.e., recall and recognition) peaked at moderate level involvement in their study of a FIFA World Cup soccer game.

Virtual advertising, if not animated, mimics existing stadium signage (Bennett et al., 2006). Because stadium signage is peripheral to the game itself, it is most likely that memory within an individual is superficial (Lardinoit & Derbaix, 2001). This type of memory trace could be evident in recognition measures, but not recall tasks. In this sense, Park and Hastak (1994) stated that involvement impacts recall, but not recognition. However, other researchers have reported mixed results of the effect of involvement on recognition rates. Levin et al. (2001) investigated viewer's recall and recognition of NASCAR sponsors. Their recall and recognition rates of on-car advertisements were higher for highly involved fans than for less involved fans. In their study of a televised basketball game, Lardinoit and Derbaix (2001) found effects of

involvement on both unaided recall and recognition; however, the practical significance was minimal. With the use of virtual advertising and its animation capability, the construct of involvement casts additional questions as far as its impact on awareness levels.

Team Identification

Another factor considered to affect the awareness of virtual advertising is a fan's identification with a team. Although identification may seem similar to involvement, this construct is different. Identification with an entity is grounded in social identity theory. Social identity theory is the classification of people into various social categories according to an individual's categorization schemas (Tajfel & Turner, 1986). This segmentation (a) allows an individual to cognitively classify and systematically define people, and (b) enables the individual to place him/herself into that categorized social environment (Ashforth & Mael, 1989). According to social identity theory, an individual has a personal identity, which includes his or her distinct characteristics (e.g., feelings, interests, bodily attributes) and a social identity, which is the group classification he/she identifies with (e.g., sport teams, alma mater, gender) (Ashforth & Mael, 1989). An individual's position within an identified group is relative and comparative (Tajfel & Turner, 1986). That is, a characteristic of oneself, such as age, is relative to whether the individual is in a group with mostly older or younger people. In addition, the level of identification with a group is a matter of the degree to which his/her personal identity resonates with the group's values (Ashworth & Mael, 1989).

Accordingly, individuals attempt to establish and enhance their positions by affiliating with a group that promotes positive self-images in the social environment (Fisher & Wakefield, 1998).

In general, there is a positive correlation between the relationship of an organization and its members and the support from the members. Brickson (2000) identified that the degree of identification with a group would motivate the individual to treat favorably and care for his/her own group relative to other groups. In a sport setting, Fisher and Wakefield (1998) found group identification to be predictive of group support behaviors. Highly identified respondents in their study indicated extra support for the team during the game, higher frequencies of game attendance, and greater amounts of licensed goods owned regardless of team performance. Similarly, other studies have reported different levels of sports perception (i.e., beliefs, attitudes, and intentions), support behaviors, and consumption behaviors according to spectators' degree of identification with a team (Madrigal, 2000; 2001; Sutton, McDonald, Milne, & Cimperman, 1997; Wann & Branscombe, 1993). Madrigal (2000; 2001) reported that highly identified members support and purchase goods from the team sponsors from the sheer notion of "what is good for the team." This behavior reinforces their identity as a member of the team (Madrigal, 2001). With so much support for team identification and their support behaviors, it seems logical that team identification has a positive effect on brand awareness levels in sport.

Repetition

The advantage of signage within a stadium is its repeat exposure within a television broadcast (Nebenzahl & Hornik, 1985). Virtual advertising allows brand logos to be placed uniquely and for this reason, receive substantial repeat exposure. Therefore, investigating the repetition effects of virtual advertising seems warranted. Research regarding the effects of repetition on advertising effectiveness has been well established (Burke & Srull, 1988; Cacioppo & Petty, 1979; Danaher & Mullarkey, 2003; Drèze and Hussherr, 2003; Pechmann & Stewart, 1988; Ray & Sawyer, 1971, Singh & Cole, 1993; Singh & Rothchild, 1983a).

One of the important aspects regarding to advertising repetition research is the concept of "wear in" and "wear out" (Pechmann & Stewart, 1988). An ad is said to have "worn in" when viewers perceive the ad to have a significant positive effect on them. On the other hand, "wear out" occurs when the viewers are no longer affected or when an ad creates a negative effect by being seen too frequently. The amount of repetition that causes "wear in" and "wear out" effects differs for each individual. Some may experience "wear in" at the first exposure to an advertising stimulus, whereas others may not have a "wear in" effect until the third exposure to an ad. Likewise, "wear out" effect may take place at the sixth exposure for some, and for others "wear out" may not occur at all regardless of the number of exposures.

In regard to recall, "wear in" occurs immediately after an exposure to advertising (Cacioppo & Petty, 1979; Pechmann & Stewart, 1988; Ray & Sawyer, 1971). Recall of advertising continues to increase in a linear relationship with the

number of exposures until "wear out" occurs, which is approximately six (Pechmann & Stewart, 1988). Ray and Sawyer (1971), using print advertising, found a linear relationship between the number of exposures and percentage of recall. However, this recall eventually flattened due to a ceiling effect after the fourth exposure (Ray & Sawyer, 1971). Singh and Cole (1993) reported a similar result from their investigation of television commercials. They found that repetition significantly influenced subjects' recall rates between one and four exposures, but no effects were detected between four and eight exposures. In addition, Johar et al., (2006) contend that identification accuracy can be improved with repeated exposures. However, Burke and Srull (1988) found a factor that may hinder one's recall rates. They found that ad repetition increased recall when advertisements were presented with no other competitive ads, but no increase in recall was found when consumers were exposed to multiple ads in the same product category.

Studies exploring repetition effects on recognition measures have reported similar results. Singh and Rothchild (1983a) noted that recognition scores rose with the number of repetitions (1, 2, and 4) and with the length of television commercials. In an online advertising setting, repeated exposure to banner ads increased viewers' awareness levels (Danaher & Mullarkey, 2003; Drèze and Hussherr, 2003).

However, contradictory findings have been reported. In the verbal learning literature, high repetition of words produces high recall rates, but the same high repetition hinders recognition rates (Gregg, 1976). Gregg (1976) contends that recognition rates are better for low frequency words. Lynch and Srull (1982) link this

particular behavior to the fact that subjects cannot discriminate whether they had seen in reality or in the experimental setting. In another study, Pham (1991) found that an increase in exposure time did not have a linear relationship in predicting recognition rates of billboards. Advertising repetition studies have focused mainly on conventional advertising; thus, it seems appropriate to investigate levels of brand awareness and explore any differences between virtual advertising and previous research.

Animation

du Plessis (1994) has found that recall of television commercials has decreased in the past couple of decades. The author argues that this results from consumers giving less attention to advertisements. With the high amount of clutter in television broadcasting and the fact that television programs, as well as sports, rely upon advertising and sponsorship revenue (Wolf et al., 1997/1998), marketers are forced to turn to more creative methods to reach to their target markets (Mullin, Hardy, & Sutton, 2000).

Marketers have implemented new strategies, and studies have shown support for them. Researchers have found that placement of signage is more effective in front of the scorer's table than at other places (Stotlar & Johnson, 1989). Levin et al.'s (2001) study of NASCAR fans found that brand recall and brand recognition measures were greater for integrated advertising/sponsorship within a television broadcast than advertising or sponsorship alone.

Virtual technology is among the new and creative methods used by marketers (Mullin et al., 2000). Virtual technology allows the insertion of animated brand logos into a live broadcast. Broadcast firms have used virtual advertising since the 1990s; however, animation effects are still rarely used. Viewers may have been used to seeing the 1st down line on National Football League (NFL) broadcasts; however, they may perceive corporate logos in a unique area as well as animated corporate logos to be somewhat new. When an individual encounters an unexpected stimulus in a familiar setting, the unexpected stimulus tends to capture attention making it relatively visible (Johnston, Hawley, Plewe, Elliott, & DeWitt, 1990). This has been called the "novel popout" by researchers (Johnson et al., 1990).

Researchers have illustrated that novelty and visual prominence increases attention in a variety of settings, including advertising (Till & Baack, 2005). Pieters, Warlop, and Wedel (2002) contend that one of the aspects of advertising that cuts through the clutter and garners attention among consumers is the originality of the ad. They reported that ad originality enhanced the brand information stored in consumers' memories by increasing the amount of attention paid to the ad. In addition, ad originality improved retrieval of brands from memory (Pieters et al., 2002). Lynch and Srull (1982) report that a novel stimulus would capture one's attention more, should be processed extensively, and eventually recalled more than information that is old. The von Restorff effect (von Restorff, 1933; as cited in Lynch & Srull, 1982) shows that any technique that would imply novelty or unexpected feelings to an object would enhance recall. In online advertising, Li and Bukovac (1999) found that animated banner ads, in

comparison to still banner ads, were quickly identified and better recalled. Other researchers have demonstrated that increased attention leads to greater levels of both unaided (Craik, Govoni, Naveh-Benjamin, & Anderson, 1996; Rosbergen, Pieters & Wedel, 1997) and aided recall (Craik et al., 1996; Rajaram, Srinivas, & Travers, 2001). However, Drèze and Hussherr (2003) found the contrary in their research of online banner advertising. Their eye-tracking study found that peripheral information was not attended to, and animating the banners did not increase awareness of them.

Although researchers have reported mixed effects of animation on consumers' attention, the effect seems to vary under different conditions (Hong, Thong, & Tam, 2004). Greenwald and Leavitt (1984) cite that if the novel stimulus is repeatedly presented, individuals probably reduce the attention they give elsewhere, and the effectiveness of the stimulus would likely decrease (i.e., habituation). On the other hand, Pechmann and Stewart (1990) reported that consumers required more exposures to comprehend novel and complex advertising content. Thus, with the increasing presence of virtual advertising in sport settings, it seems appropriate to investigate the effects of animation on awareness levels. Coupled with other factors, such as involvement or repetition effect, animation may create an additional effect on consumers' awareness levels.

Relatedness and Prominence

Correct identification of sponsors is not solely dependent on the strength of the nodes in memory (Johar & Pham, 1999; Johar et al. 2006; Pham & Johar, 2001). Johar

and Pham (1999) argue that the identification process includes constructive thinking. Pham and Johar (1997) studied consumers' mechanism of source identification within the marketing communication context. Through experiments, they concluded that spontaneous and effortless retrieval is probable when there is a strong association of a brand and a source in memory. If this cue does not revive the brand from memory, consumers rely on a process called trace refreshment. This process involves accessing the memory for original learning episodes with contextual and perceptual details (Pham & Johar, 1997). For instance, consumers trying to remember sponsors of FIFA World Cup 2006 might process the actual experience of watching the game and the commercial on television. According to Pham and Johar (1997), this process is not automatic and requires some effort. Additionally, this process seems to be preferred over schematic inferencing, which is a process by which an individual relies on the content and general knowledge about the message source (Pham & Johar, 1997). An example of schematic inferencing would be a consumer who thinks one of the sponsors of the FIFA World Cup 2006 was Nike (which was not), because both entities have global presence in their respective domain. They also revealed that trace refreshment was used after short delays, whereas schematic inferencing was used after long delays. Finally, the process to follow those is, pure guessing. Although pure guessing was not the preferred method of source identification when motivation for accuracy was high, use of this method was observed when other methods of identification failed. In addition, consumers relied on pure guessing more as delay increased.

Building on the works of Pham and Johar (1997), Johar and Pham (1999) investigated the source identification process in the sport sponsorship context. In their study, they identified two heuristics of constructive sponsor identification in consumers. The first heuristic is relatedness, which refers to the semantic association between the sponsored event and the sponsoring brand or company (Johar et al., 2006). While controlling for extraneous variables, sponsoring brands that appear to be related to the sponsored property have a greater chance of being identified as the actual sponsors of the event than those brands deemed unrelated (Johar & Pham, 1999; Pham & Johar, 2001). The other heuristic is prominence, which refers to consumers' perception of the reputation of the brand or the company based on its success in the market (Johar, et al., 2006; Pham & Johar, 2001). While controlling for extraneous variables, prominent brands in the marketplace are more likely to be identified as event sponsors than less prominent brands (Johar & Pham, 1999; Pham & Johar, 2001). Pham and Johar (2001) investigated whether the prominence heuristic holds when an individual's learning situations are manipulated. They found that the prominence heuristic was used more when the event-sponsor association was weak (i.e., learning was difficult). In other words, when the event-sponsor association was learned with ease, consumers relied on direct retrieval from memory.

Johar et al. (2006) investigated whether these heuristics manifest themselves in a field setting. They surveyed spectators at a minor league baseball team to test their laboratory findings. They found that the fans' sponsor identification process relied mostly on the same two heuristics presented above. However, these heuristics were

initiated only if the direct retrieval process failed (Johar et al., 2006). Because these heuristics were found to be robust in their study, they labeled the sponsorship identification task to be more of a judgment task than a memory task. In addition, because these heuristics are omnipresent, they warn future studies to consider them to prevent inflating systematic errors. Based on the literature, this study intends to control for these heuristics.

Research Questions

Based on the literature review, the following research questions were presented.

RQ1a: What are the reported unaided recall rates of virtual advertising?

RQ1b: What are the effects of levels of baseball involvement and team identification on unaided recall rates?

RQ1c: What are the effects of repetition of virtual advertising on unaided recall rates?

RQ1d: What are the effects of animating virtual advertising on unaided recall rates?

RQ1e: What are the interactive effects of repetition and animation of virtual advertising on unaided recall rates?

RQ2a: What are the reported aided recall rates of virtual advertising?

RQ2b: What are the effects of levels of baseball involvement and team identification on aided recall rates?

RQ2c: What are the effects of repetition of virtual advertising on aided recall rates?

RQ2d: What are the effects of animating of virtual advertising on aided recall rates?

RQ2e: What are the interactive effects of repetition and animation of virtual advertising on aided recall rates?

RQ3a: What are the reported recognition measures of virtual advertising?

RQ3b: What are the effects of levels of baseball involvement and team identification on recognition measures?

RQ3c: What are the effects of repetition of virtual advertising on recognition measures?

RQ3d: What are the effects of animating of virtual advertising on recognition measures?

RQ3e: What are the interactive effects of repetition and animation of virtual advertising on recognition measures?

CHAPTER III

METHODOLOGY

This chapter explains the methods used in the study. Sections in the chapter include the following: participants, research design, treatment stimuli, survey instrument, pilot test, data collection, and data analysis.

Participants

Participants (n=208) were undergraduate students at a large university located in the southwestern United States. More specifically, a convenience sample of students was solicited via instructors to participate in the study for partial course credit. Use of students in this investigation was justified for the following reasons. First, the student population is one of the core sports fan markets for most professional sports leagues, which consist of males between the ages of 18 and 49, (Stein-Wellner, 1997). The female audience is becoming very important to sports organizations because it has grown more than 40% over the past 25 years (Goldman-Edry, 2001). Additionally, college students are members of Generation-Y (Gen-Y). Sometimes called Millennials or Echo-Boomers, this cohort consists of 75 million individuals born between 1977 and 1995, which have an estimated annual spending power of $192 billion dollars (Brooks, 2005). Thus, this segment of the population should be of great interest to marketers and advertisers.

Research Design

To test for the effects of repetition and to control for the effect of brand category, a Latin square design was selected for this study (Figure 3). In addition, to test for animation effects, this study used two Latin square designs. Three groups were exposed to an animated version of the video, and three other groups were not exposed to animation. Latin square design offers numerous advantages over other experimental designs. It can compare *t* treatment means with two extraneous sources of variability (Hamlin, 2005; Ott & Longnecker, 2000). In this study, the focus was the repetition effect with two extraneous sources (three groups and three product categories). Other advantages of this particular design include increased reliability, needs fewer participants, reduced expense, and speedier results than available with other designs (Hamlin, 2005; Reese, 1997).

Product Category

Animation Effect		Alcohol	Automobile	Sports Apparel
	NO	1	4	6
		6	1	4
		4	6	1
	YES	1	4	6
		6	1	4
		4	6	1

Figure 3 – Latin square design

The Latin square design assumes that the sample is homogenous to detect the significant main effect (Hamlin, 2005). This is because a heterogeneous sample could increases variability in the extraneous variable, which could cause an interaction in this particular design (Hamlin, 2005). This poses a problem when significant main effects are not detected. When a study reports a significant main effect, it probably does not have an interaction (Hamlin, 2005). However, if there is no significant main effect, it is either because of no main effect in the study or a main effect masked by an interaction (Hamlin, 2005).

The number of exposures chosen was one, four, and six times within a 24-minute CD and the sequence of the eleven brand exposures was alternated (Figure 4). As Figure 4 shows, same brand did not appear in succession. The number of repetitions and the levels of frequency are consistent with prior studies measuring the repetition effect (Pechmann & Stewart, 1988).

6 Alcohol (beer = Icehouse) = B
4 Automobile (car = Mercury) = C
1 Sports Apparel (Champion) = SA

B C B C B SA B C B C B

Figure 4 – Example of order of virtual advertising exposure

Treatment Stimuli

The stimulus for this study was a 24-minute video clip of two innings of a professional baseball broadcast between the Texas Rangers and the Boston Red Sox. With the aid of a virtual advertising company, three brand logos were inserted behind home plate adjacent to existing signage. Each exposure was maintained for 43.3 seconds, and exposures differed by less than one hundredth of a second. This procedure was used because the length of visual stimuli exposure increases recall and recognition (Rossiter & Percy, 1983). Background color and the size of the brand logos were the same across product categories. The broadcast was clipped and edited to shorten the length and reduce tedium for the subjects. Similarly, television commercials were limited to one 30-second commercial between innings, which was irrelevant to the treatment.

Three brands were selected within product categories that typically sponsor professional baseball. The three product categories selected were automobiles, alcohol, and sports apparel. These three product categories were each in the top ten product categories that invested in sport sponsorship in 2004 (Brand Strategy, 2005). Brand logos were then digitally inserted uniquely onto a canvas behind home plate adjacent to existing stadium signage. Selecting a product category that has image congruence with the sport is important because researchers have found differences in recall for congruent and incongruent pairs (Misra & Beatty, 1990; Quester & Farrelly, 1998).

Within those respective categories, domestic brands were chosen to control for any potential country-of-origin effect. In addition, previous research has indicated that

bias exists in identification of more prominent brands; therefore, less prominent brands within each product category were selected (d'Ydewalle et al., 1988; Johar & Pham, 1999; Johar et al., 2006; Pham & Johar, 2001). Selection criteria for two of the brands, Icehouse (alcohol) and Champion (sports apparel), was based on the fact that these brands that did not rank in the "Top 2,000 Brands," which were scaled on media spending in the United States (Brandweek, 2005; Roy and Cornwell, 2004). The third brand selected, Mercury (automobile), was ranked in "Top 2,000 Brands" by Brandweek; however it was one of the lowest media spending brands within the domestic automobile category.

Survey Instrument

A questionnaire was constructed, based upon a review of the relevant literature and research questions, to measure the brand awareness fostered by virtual advertising in a sport broadcast (see Appendix C). First, to examine whether respondents had paid attention to the video, questions regarding the content of the game were asked. Then, questions assessing the proposed research questions were given. Unaided recall was operationalized as the individual's ability to recall the brand from memory without any assistance. Aided or cued recall was operationalized as one's ability to recall the brand in question with the use of an aid, in this case, a product category. Using a product category (e.g., beer, car, sports apparel) as a cue in aided recall is consistent with past research (Till & Baack, 2005). Recognition questions followed the recall questions, which were operationalized as the ability to select the target brand from a list with

distractors. More specifically, unforced recognition methodology was used for this study. One target item was included along with five other distractor items, which follows the study by Zinkhan et al. (1986). These tests were administered to the sample in the following order: unaided recall, aided recall, and recognition test. There may be concerns regarding the effects of recall tests on subsequent recognition tests; however, Singh and Rothschild (1983b) showed no effects them.

Next, involvement was operationalized as "a person's perceived relevance of the object based on inherent needs, values, and interests" (Zaichkowsky, 1985, p. 342). This construct was measured using Zaichkowsky's (1994) 10-item Personal Involvement Inventory scale. Team identification was operationalized as an individual's level of identification with the team. This construct was measured using Trail and James' (2001) Team Identification Index. Subjects were asked demand artifact questions adopted and modified from work of Leigh (1984). Demand characteristics occur when an individual suspects, interprets and behaves in a way that he or she believes is expected or desired by the researcher (Sawyer, 1975). Finally, relevant demographic questions were asked. The online questionnaire was configured to prevent respondents from attempting to go back to previous questions.

A panel of experts assessed the initial survey to judge its relevance, representativeness, and clarity. They were also asked to provide suggestions for improvement to the instrument. The panel consisted of one marketing professor and one sport management professor. In addition, twenty graduate students in a sport marketing class watched the video and evaluated the survey for its face validity. Students in this

class were asked to rate the quality of the stimulus as well as to comment on the items' clarity. After these procedures, the questionnaire was modified (e.g., wording) based on the feedback from the panel and the students.

Pilot Test

A pilot test was undertaken to determine whether the stimulus and the instrument were acceptable. The sample for the pilot study was 70 undergraduate students enrolled in a sport management class. These respondents participated in the study using a procedure similar to the main study. They were handed a randomly selected CD, which contained one of six virtual advertising stimuli. Then, they were asked to watch it on a computer in a computer lab. Following the completion of the video, they were directed to an online survey via Survey Monkey. Unaided and aided recall tests, as well as recognition tests were administered after students viewed the video. Subjects were able to identify the brands in the stimuli. Champion had a 17.1% unaided recall rate, 20% aided recall rate, and 35.7% recognition rate. Icehouse had a 24.3% unaided recall rate, 14.3% aided recall rate, and 38.6% recognition rate. Lastly, Mercury had a 12.9% unaided recall rate, 18.6% aided recall rate, and 25.7% recognition rate.

Involvement with baseball and team identification with the Texas Rangers and Boston Red Sox analyses were conducted. The respondents' overall mean score for baseball involvement was higher ($M = 5.48$; $SD = 1.22$) than the neutral point (score of

4 on a 7-point Likert-type scale), but team identification scores for the Rangers and Red Sox were low (Rangers $M = 2.30$; $SD = 0.80$; Red Sox $M = 1.61$; $SD = 0.80$).

Lastly, subjects in the pilot study were asked for their level of agreement (7 being strongly agree and 1 being strongly disagree) with the demand artifact questions. They reported that they did not intend to memorize the sponsors on video ($M = 2.35$; SD = 1.94); did believe the video looked like an actual broadcast ($M = 5.91$; SD = 1.56); and had not participated in a similar study using virtual advertising ($M = 1.71$; SD = 1.43).

These findings, however, presented problems for analyses using the Latin square design. Latin square design usually calls for the use of analysis of variance (ANOVA) (Ott & Longnecker, 2000). Leigh's (1984) work on recall and recognition of umbrella ads used a dichotomous dependent variable, in which he conducted an ANOVA and an analysis of covariance (ANCOVA) on the basis that both methods are robust analyses if the dependent variables are between .25 and .75 (Knoke, 1975). The pilot study could not meet the assumption set forth by Knoke (1975); thus additional questions regarding brand involvement (Champion, Icehouse, and Mercury) were incorporated in the actual study to control for their potential effects. Items for these questions were again adopted using Zaichkowsky's (1994) Personal Involvement Inventory scale. Other than these corrections, the study was carried out as planned after some minor modifications (e.g., wording).

Data Collection

Upon entering the computer classroom, students were handed a CD, which contained a 24-minute video clip of a professional baseball game with virtual advertising embedded. Six different CDs with animated and non-animated virtual advertising were randomly distributed among the students. The students were instructed to view the CD on their computers and then respond to an online questionnaire administered via Survey Monkey. The questionnaire assessed the research questions proposed earlier.

Data Analysis

To answer the research questions for this study, descriptive statistics, factor analysis, logistic regression analyses, and ANCOVA were conducted. Since unaided recall and aided recall rates were dichotomized, they were assessed using logistic regression. ANCOVA was used to assess the Latin square design for recognition measures (H_{C2}) while controlling for other factors, and dichotomized hit rate was assessed using logistic regression.

After data collection, baseball involvement and team identification variables were factor analyzed to explore their dimensionality (Table 1). Reversed-coded questions were recoded for this purpose. Exploratory factor analysis (EFA) was chosen over confirmatory factor analysis (CFA) as Zaichkowsky's (1994) scale has rarely been applied to sport. In addition, CFA should be used only to confirm theoretical structures (Stevens, 1996). Because this criterion could not be met, EFA was conducted. Principal

Table 1 Factor Analysis of Baseball Involvement and Team Identification Variables

Variable	Mean		SD	Factors 1	2	3
Baseball is Important	4.32		1.57	.88		
Baseball is Boring*	3.66	(4.34)	1.91	.88		
Baseball is Relevant	4.42		1.32	.86		
Baseball is Exciting	4.47		1.89	.85		
Baseball Means Nothing*	2.68	(5.32)	1.62	.84		
Baseball is Appealing	4.60		1.75	.80		
Baseball is Fascinating	4.07		1.79	.80		
Baseball is Worthless*	2.39	(5.61)	1.56	.77		
Baseball is Involving	4.46		1.60	.77		
Baseball is Not Needed*	2.61	(5.39)	1.62	.69		
I Consider myself a real fan of Rangers	2.41		1.78		.94	
I Feel a loss if I stop being a Rangers fan	2.27		1.75		.92	
Being a Rangers fan is important to me	2.45		1.84		.88	
I Consider myself a real fan of Red Sox	1.64		1.30			-.95
I Feel a loss if I stop being a Red Sox fan	1.63		1.26			-.93
Being a Red Sox fan is important to me	1.58		1.20			-.92
Eigenvalues				7.48	2.84	1.66
Cronbach alpha				.92	.94	.95
Factor means				4.71	2.39	1.61
Percentage of variance explained				46.77	17.77	10.40
Cumulative variance explained				46.77	64.53	74.93

Note: Asterisk (*) indicates reverse coded questions. Numbers in parentheses indicate mean score of reverse coded questions.

component analysis with direct oblimin rotation was performed on these variables, which extracted three factors with eigenvalues over 1.0. Scree plot was also used to determine the number of factors to retain. The scree plot agreed with retaining three factors, which explained 74.9% of the variance. These factors were baseball involvement, Rangers team identification, and Red Sox team identification. The minimum cut-off value for the item loadings was set at .40 (Ford, MacCallum, & Tait, 1986). Items did not cross load in different factors and met at least the .40 criterion. The

alpha reliabilities for baseball involvement, Rangers team identification, and Red Sox team identification were .92, .94, and .95, respectively. Mean scores for these three variables were calculated and team identification questions were adjusted for skewness (logarithm transformation).

Then, personal involvement with the respective brands was factor analyzed to reveal dimensionality. Reversed-coded questions were recoded and factor analyzed. According to Zaichkowsky (1994), involvement supposedly has two underlying dimensions (cognitive and affective). However, her study could not confirm them. Therefore, an EFA was used instead of a CFA. Principal component analysis with direct oblimin rotation was performed on these involvement variables extracting five factors with eigenvalues over 1.0. The scree plot was also examined for retention of factors. The fifth largest factor with eigenvalue over 1.0 was dropped as it started to level off. Then, the pattern matrix was consulted for item loading and interpretation of the factors. In the matrix, reverse coded items seemed to load together. This may be due to the overreaction of the subjects to the reverse coded questions. Because these items may contaminate further analyses, all reverse coded items were dropped. The remaining six items were again factor analyzed (Table 2). Using principal component analysis with direct oblimin rotation, three factors were extracted with eigenvalues over 1.0. The scree plot confirmed these three factors, which explained 68.73% of variance. Retained factors were named Icehouse (34.32%), Mercury (18.09%), and Champion (16.32%). Alpha coefficients for the factors were .93, .91, and .88, respectively. Accordingly, the mean scores of the retained factors were calculated for subsequent analyses.

Table 2 Factor Analysis of Brand Involvement Variables

Variable	Mean	SD	Factors 1	2	3
Icehouse is					
Fascinating	3.02	1.38	.90		
Appealing	3.14	1.55	.89		
Exciting	3.20	1.47	.88		
Important	3.02	1.41	.88		
Involving	3.21	1.32	.82		
Relevant	3.56	1.54	.72		
Mercury is					
Fascinating	3.04	1.27		-.84	
Exciting	3.09	1.29		-.84	
Involving	3.16	1.20		-.83	
Appealing	3.41	1.34		-.81	
Important	3.28	1.24		-.81	
Relevant	3.48	1.22		-.80	
Champion is					
Appealing	4.47	1.20			.87
Exciting	3.84	1.09			.84
Involving	3.91	1.09			.80
Relevant	4.40	1.17			.75
Important	4.11	1.08			.74
Fascinating	3.72	1.09			.71
Eigenvalues			6.18	3.26	2.94
Cronbach alpha			.93	.91	.88
Factor means			3.19	3.25	4.08
Percentage of variance explained			34.32	18.09	16.32
Cumulative variance explained			34.32	52.41	68.73

CHAPTER IV

RESULTS

The findings of this investigation are presented as follows: (a) descriptive statistics, and (b) analysis of the research questions.

Descriptive Statistics

The sample (N = 208) included undergraduate students from a large southwestern university in the United States. Respondents of this study consisted of 48.6% males and 51.4% females with most of them being Caucasians (79.1%). The average age of the sample was 19.79 years (SD = 1.89). The sample included students from all years (i.e., freshman, sophomore, junior, senior) and from different disciplines on campus. Detailed descriptive statistics are presented in Table 3.

In this study, students were randomly assigned to one of six groups. Groups one through three watched a video with virtual advertising that was not animated, and groups four through six watched an animated version. In the videos seen by groups one and four, the brands appeared the same number of times (Champion appeared six times, Icehouse four times, Mercury one time), groups two and five had corollary videos (Champion once, Icehouse six times, Mercury four times), and groups three and six had the corollary videos (Champion four times; Icehouse once; Mercury six times).

Table 3 Demographics of the Sample

Variable	N	%	Cumulative %
Gender			
Male	101	48.6%	48.6%
Female	107	51.4%	100.0%
Age (mean = 19.79, SD = 1.89)			
17 yrs	1	0.5%	0.5%
18 yrs	49	23.7%	24.2%
19 yrs	59	28.5%	52.7%
20 yrs	39	18.8%	71.5%
21 yrs	37	17.9%	89.4%
22 yrs	13	6.3%	95.7%
23 yrs & older	9	4.3%	100.0%
Ethnicity			
African American	3	1.5%	1.5%
Asian	6	2.9%	4.4%
Hispanic	28	13.6%	18.0%
Native American	3	1.5%	19.4%
Caucasian	163	79.1%	98.5%
Others	3	1.5%	100.0%
Classification			
Freshman	62	30.1%	30.1%
Sophomore	58	28.2%	58.3%
Junior	40	19.4%	77.7%
Senior	46	22.3%	100.0%

Each cell was tested for its random assignment of subjects (Table 4). A series of chi-square tests were conducted for subjects' gender, ethnicity, and classification, and an ANOVA test was conducted for subjects' age. For ethnicity, Asian Americans, African Americans, Native Americans, and Others were all grouped together as "Others." This procedure was used because there were few subjects in these groups. The findings reveal that demographic variables were not associated with the cells in the study (gender $\chi^2(5) = 3.84$, $p = .572$; ethnicity $\chi^2 (10) = 12.02$, $p = .284$; classification χ^2

Table 4 Frequencies and Results of Chi-Square Analyses & ANOVA of Demographic Variables among Groups

Groups	Variables & Frequencies				Statistics
Gender	**Male**	**Female**			
Group 1	17	17			χ^2 (5) = 3.84
Group 2	20	14			p = .572
Group 3	14	22			
Group 4	18	16			
Group 5	14	20			
Group 6	18	18			
Ethnicity	**Caucasian**	**Hispanic**	**Others**		
Group 1	29	5	0		χ^2 (10) = 12.020
Group 2	27	5	2		p = .284
Group 3	26	7	1		
Group 4	25	5	4		
Group 5	29	3	2		
Group 6	27	3	6		
Classification	**Freshman**	**Sophomore**	**Junior**	**Senior**	
Group 1	8	11	8	7	χ^2 (15) = 19.199
Group 2	10	10	3	11	p = .205
Group 3	13	13	5	3	
Group 4	11	7	6	10	
Group 5	14	7	6	7	
Group 6	6	10	12	8	
Age	**M**	**SD**			
Group 1	19.74	1.42			F (5, 201) = 1.900
Group 2	19.91	2.44			p = .096
Group 3	19.06	0.92			
Group 4	20.38	2.53			
Group 5	19.73	2.03			
Group 6	19.97	1.38			

(15) = 19.199, p = .205; F (5, 201) = 1.90, p = .096). Therefore, the subjects in the study were randomly assigned to the cells.

Then, the three questions determining whether the subjects had paid attention to the game were analyzed (Table 5). Nearly 90% of the subjects answered the questions

Table 5 Frequencies of Game Contents Variables

Variable	N	%	Cumulative %
Which team was winning after 5th inning (the conclusion of the video)?			
Texas Rangers	6	2.9%	2.9%
Boston Red Sox	5	2.4%	5.3%
Tie ball game	191	92.3%	97.6%
Don't remember	5	2.4%	100.0%
During the video, Casey Fossum, the pitcher for Boston Red Sox, injured what part of his body?			
Hamstring	16	7.7%	7.7%
Arm	4	1.9%	9.7%
Fingers	183	88.4%	98.1%
Don't remember	4	1.9%	100.0%
Who was the home team in the video?			
Texas Rangers	181	87.0%	87.0%
Boston Red Sox	13	6.3%	93.3%
Don't remember	14	6.7%	100.0%

correctly, showing that they had indeed watched the game.

The means and standard deviations for demand artifact variables were calculated (Table 6). Demand artifact questions were included to assess subjects' tendencies to guess the intention of the study. Nearly 90% (i.e., 185 subjects) of the subjects reported that they did not pay close attention to sponsors on the video; close to 95% of the subjects (i.e., 197 subjects) reported that they had never participated in a similar study; and more than 80% (i.e., 169 subjects) reported that they believed the stimuli looked like they were part of an actual broadcast. The means scores for these responses were 2.04, 1.61, and 5.60 respectively.

Table 6 Mean and Standard Deviations of Demand Artifact Variables

Variable	Mean	SD
Demand Artifact		
I tried to memorize sponsors on video	2.04	1.47
I have participated in a similar study	1.61	1.25
The video looked like an actual broadcast	5.60	1.49

Analyses of Research Questions

This section provides the analyses of the proposed research questions.

Research Question 1a

RQ1a: What are the reported unaided recall rates of virtual advertising?

The frequencies of unaided recall rates were calculated for the sample. The numbers of correct responses and percentages by groups are listed in Table 7. At the descriptive level, the unaided recall rates among the six groups ranged from one recall in Group 4 (one exposure of Mercury with no animation effect) to eleven recalls in Group 5 (four exposures of Mercury with animation effects). The unaided recall rates for one exposure ranged from one subject (2.9% in Group 4) to four subjects (11.8% in Group 1). The unaided recall rates for four exposures across the six groups ranged from five subjects (14.7% in Group 2) to eleven subjects (30.6% in Group 5). The unaided recall rates for six exposures were somewhat similar to those for four exposures. They ranged from four subjects recalling in Group 3 (11.1%) to ten subjects in Group 6 (29.4%). In addition, total unaided recall rates were calculated across brands and number of exposure to see whether there were any differences at the descriptive level (Table 8). Total unaided recall rates across brands seemed to have no differences,

Table 7 Frequencies of Unaided Recall

Variable	Number of Exposures	Yes	%	No	Total
Non-Animation					
Group 1					
Champion	6 exposures	6	17.6%	28	34
Icehouse	4 exposures	6	17.6%	28	34
Mercury	1 exposure	4	11.8%	30	34
Group 2					
Icehouse	6 exposures	8	23.5%	26	34
Mercury	4 exposures	5	14.7%	29	34
Champion	1 exposure	2	5.9%	32	34
Group 3					
Mercury	6 exposures	4	11.1%	32	36
Champion	4 exposures	6	16.7%	30	36
Icehouse	1 exposure	2	5.6%	34	36
Animation					
Group 4					
Champion	6 exposures	5	14.7%	29	34
Icehouse	4 exposures	9	26.5%	25	34
Mercury	1 exposure	1	2.9%	33	34
Group 5					
Icehouse	6 exposures	9	25.0%	25	36
Mercury	4 exposures	11	30.6%	25	36
Champion	1 exposure	2	5.6%	34	36
Group 6					
Mercury	6 exposures	10	29.4%	24	34
Champion	4 exposures	9	26.5%	25	34
Icehouse	1 exposure	3	8.8%	31	34

whereas looking them from a number of exposures, differences were observed. Unaided recall rates for brands that appeared once were lower than those for brands that occurred four or six times. Table 9 lists the number of unaided recalls by subject. In the study, 20% of the subjects recalled one of the target stimuli. Ten percent of the sample noticed two target stimuli, and three percent recalled all three target stimuli. To statistically test for factors that influence unaided recall, subsequent analyses were conducted.

Table 8 Frequencies of Unaided Recall by Number of Exposures

Variable	Champion	Icehouse	Mercury	Total
Non-Animation				
Six exposures	6	8	4	18
Four exposures	6	6	5	17
One exposure	2	2	4	8
Total Non-Animation	14	16	13	43
Animation				
Six exposures	5	9	10	24
Four exposures	9	9	11	29
One exposure	2	3	1	6
Total Animation	16	21	22	59
Total				
Six exposures	11	17	14	42
Four exposures	15	15	16	46
One exposure	4	5	5	14
Total by brands	30	37	35	

Research Questions 1b, c, d, & e

RQ1b: What are the effects of levels of baseball involvement and team identification on unaided recall rates?

RQ1c: What are the effects of repetition of virtual advertising on unaided recall rates?

RQ1d: What are the effects of animating virtual advertising on unaided recall rates?

RQ1e: What are the interactive effects of repetition and animation of virtual advertising on unaided recall rates?

Research questions 1b through 1e assessed the effects of baseball involvement, team identification, repetition, and animation as well as their interactive effects of animation and repetition on unaided recall rates. To analyze the data, three separate sequential logistic regression analyses were conducted. Dependent variables for the

Table 9 Frequencies of Unaided Recall by Subjects

Number of recalls	Frequencies	%	Cumulative%
All 3	6	2.9%	2.9%
2 out of 3	21	10.1%	13.0%
1 out of 3	42	20.2%	33.2%
None	139	66.8%	100.0%

three analyses were the unaided recall rates for the brands used in the study.

To understand the effects of demand artifact questions on awareness measures (i.e., unaided recall, aided recall, and recognition), bivariate correlations were conducted. Results are presented in Table 10. The results showed significant effects between subjects' tendencies to memorize sponsors and awareness levels. However, other questions regarding demand artifact questions were not significant. Therefore, to control for subjects' tendency to memorize sponsors, this item was incorporated in further analyses.

Independent variables in this analysis were baseball involvement, team identification, repetition, animation, and the interaction of repetition and animation. Furthermore, to understand the significant increase of other relevant factors, sequential logistic regression analyses were adopted. Items intended to control for the effects of memorization and brand involvement were inserted as the first set of variables. In the next set, baseball involvement item and team identification items (Rangers and Red Sox) were added to assess their effects on awareness levels. Then, to test for the inverted-U relationship of involvement and awareness measures, squared baseball involvement scores were calculated and added subsequently. The next block contained

Table 10 Correlation of Demand Artifact Variables and Awareness Measures

Variable	M	SD	1	2	3	4	5	6
1. Memorized sponsors	2.04	1.47	---					
2. Participated in similar study	1.61	1.25	.11	---				
3. Video looked real	5.60	1.49	-.03	-.15*	---			
4. Unaided recall	.49	.79	.30***	.06	.02	---		
5. Aided recall	.49	.73	.28***	.07	-.08	.76***	---	
6. Recognition	1.03	1.06	.33***	-.01	-.05	.68***	.74***	---

*Significant at $p < .05$ level
*** Significant at $p < .001$ level

two dummy-coded variables for repetition and a dummy-coded variable for animation. In one of the dummy-coded variables for repetition, a numeric value of one was assigned to those subjects who were exposed to four repetitions of the brand and a zero for others and for another variable, a numeric value of one was assigned to those subjects who saw six repetitions and zero was assigned to the others. For the dummy-coded variable for the animation effect, a numeric value of one was assigned to those subjects who were exposed to the animated version of virtual advertising, and a zero was assigned to subjects exposed to the still form. Finally, two interactive dummy-coded variables (repetition x animation) were inserted as the last set.

In assessing the significance of the overall model fit, the chi-square (χ^2) test for goodness of fit scores, along with Hosmer and Lemeshow's goodness of fit test scores, are reported. For a good fit, chi-square scores should be significant ($p < .05$) and Hosmer and Lemeshow's test scores should fail to reject the null hypothesis ($p > .05$).

In addition, both Cox and Snell's R^2 and Nagelkerke's R^2 measures are displayed. Cox and Snell's R^2 is similar to that of regression; however its maximum value is limited (Allison, 1999). Nagelkerke's score is a modification of Cox and Snell's R^2 so that its maximum value is one.

In addition, to test for multicollinearity in logistic regression, Allison (1999) suggests the use of ordinary least-squares regression (OLS) to estimate the variance inflation factors (VIF) and tolerance levels. He contends that the use of OLS is justified because multicollinearity is a property of the independent variables and not the dependent variable. According to Allison (1999), when using logistic regression, the VIF and tolerance values should be at a more conservative level than that of OLS (VIF <10; tolerance < 1.0). One should be careful interpreting the results from logistic regression analyses when the VIF are below 2.5 and the tolerance value is below .40 (Allison, 1999). In this study, additions of squared score for baseball involvement and interaction items will likely generate multicollinearity, since part of them have been entered into the equation previously. Thus, multicollinearity for these items is inevitable.

Results for the sequential logistic regression analyses on unaided recall rates for the three brands are presented in Table 11.

Unaided Recall – Champion

Results suggest that the first set of items had a significant effect on unaided recall rates of Champion as the chi-square score (χ^2 (2) = 8.969, p =.011) and Hosmer and Lemeshow's chi-square index (χ^2 (8) = 6.570, p = .584) showed good fit to the data. The results indicate a significant impact of subjects' bias of memorizing sponsors on

Table 11 Results of Sequential Logistic Regression on Unaided Recall of Champion, Icehouse, and Mercury

Variable	Exp(b)				
DV- Champion					
1st Step					
Memorize Sponsor	1.317*	1.356*	1.346*	1.410*	1.419*
Brand Involvement	1.551	1.576	1.638	1.686	1.687
2nd Step					
Baseball Involvement		.859	1.938	2.381	2.453
Rangers Team ID		1.808	1.869	2.193	2.307
Red Sox Team ID		.624	.589	.514	.589
3rd Step					
Baseball Involvement^2			.907	.888	.884
4th Step					
Animation				1.144	.818
Four exposures				5.498**	3.578
Six exposures				3.571*	3.828
5th Step					
Animation x Four exposures					2.320
Animation x Six exposures					.839
Model Fit					
Chi-square	8.969	10.270	11.147	20.510	21.809
df	2	5	6	9	11
p	.011	.068	.084	.015	.026
Chi-square change		1.301	.877	9.363	1.299
df		3	1	3	2
p		.729	.349	.025	.522
-2 Log likelihood	162.660	161.359	160.482	151.119	149.820
Cox & Snell R^2	.042	.048	.052	.094	.100
Nagelkerke R^2	.075	.086	.093	.167	.177
Hosmer & Lemeshow χ^2	6.570	9.848	6.390	4.019	2.496
df	8	8	8	8	8
p	.584	.276	.604	.855	.962

Table 11 Continued

Variable	Exp(b)				
DV- Icehouse					
1st Step					
Memorize Sponsor	1.363**	1.326*	1.364**	1.381**	1.381**
Brand Involvement	1.119	1.137	1.190	1.093	1.095
2nd Step					
Baseball Involvement		.780	.191*	.162*	.167*
Rangers Team ID		3.058	2.841	2.430	2.372
Red Sox Team ID		.741	.737	.671	.675
3rd Step					
Baseball Involvement^2			1.178	1.194*	1.190
4th Step					
Animation				1.090	1.276
Four exposures				4.615*	4.876
Six exposures				4.685**	5.377
5th Step					
Animation x Four exposures					.904
Animation x Six exposures					.773
Model Fit					
Chi-square	8.131	11.952	15.568	25.548	25.608
df	2	5	6	9	11
p	.017	.035	.016	.002	.007
Chi-square change		3.821	3.616	9.979	.060
df		3	1	3	2
p		.281	.057	.019	.970
-2 Log likelihood	186.628	182.807	179.191	169.211	169.151
Cox & Snell R^2	.038	.056	.072	.116	.116
Nagelkerke R^2	.063	.092	.119	.190	.191
Hosmer & Lemeshow χ^2	7.449	6.090	13.215	6.320	4.880
df	8	8	8	8	8
p	.489	.637	.105	.611	.770

Table 11 Continued

Variable	Exp(b)				
DV- Mercury					
1st Step					
Memorize Sponsor	1.475**	1.544***	1.577***	1.577***	1.599***
Brand Involvement	.864	.957	.987	.968	.913
2nd Step					
Baseball Involvement		.703*	.183*	.203	.136*
Rangers Team ID		.762	.679	.605	.737
Red Sox Team ID		.290	.323	.461	.563
3rd Step					
Baseball Involvement^2			1.174	1.163	1.218
4th Step					
Animation				1.688	.153
Four exposures				3.446*	1.069
Six exposures				2.691	.683
5th Step					
Animation x Four exposures					15.274*
Animation x Six exposures					21.379*
Model Fit					
Chi-square	12.258	21.577	24.472	31.419	37.543
df	2	5	6	9	11
p	.002	.001	.000	.000	.000
Chi-square change		9.319	2.896	6.947	6.124
df		3	1	3	2
p		.025	.089	.074	.047
-2 Log likelihood	176.245	166.926	164.030	157.084	150.959
Cox & Snell R^2	.057	.099	.111	.140	.165
Nagelkerke R^2	.096	.165	.186	.235	.277
Hosmer & Lemeshow χ^2	6.360	4.643	10.508	15.007	14.402
df	8	8	8	8	8
p	.607	.795	.231	.059	.072

* denotes significance at $p < .05$ level

** denotes significance at $p < .01$ level

*** denotes significance at $p < .001$ level

unaided recall rates for Champion (Exp(b) =1.317, $p < .05$) while controlling for the other variable. Brand involvement with Champion was not significant (Exp(b) =1.551, $p > .05$).

Next block contained items that measured respondents' involvement with baseball, team identification with the Rangers and the Red Sox. Addition of this block was not significant ($\Delta\chi^2(3) = 1.301$, $p = .729$) when predicting unaided recall rates of Champion. Because the addition of the last block was not significant, interpretation of the parameters was not made. Subsequently, the squared score of baseball involvement was entered to see whether curvilinear relationship existed in unaided recall of Champion. The result also indicate a non-significant effect ($\Delta\chi^2(1) = .877$, $p = .349$) of this block with unaided recall of Champion.

The next set of variables was inserted to determine the main effects of repetition and animation. They had a significant chi-square change by these factors ($\Delta\chi^2(3) = 9.363$, $p = .025$). This indicates a significant main effect of animation, repetition, or both. Specifically, the block shows a significant effect for four repetitions (Exp(b) =5.498, $p < .01$) and a significant effect for six repetitions (Exp(b) = 3.571, $p < .05$) on unaided recall rates for Champion with all other variables held equal. However, no effect for animation was found in the analysis (Exp(b) = 1.144, $p > .05$).

The last block, which assessed the effect of the interaction between animation and repetition, did not have a significant chi-square change from the overall model ($\Delta\chi^2(2) = 1.299$, $p > .05$). Because the block was not significant, interpretations of the parameters were not made. This model explained 16.7% of variance of unaided recall of

Champion. Based on the suggestion by Allison (1999), multicollinearity for the above equation was calculated using OLS. Results revealed that multicollinearity was evident when the squared score of baseball involvement was entered. Results also reveal that the interaction items of repetition and animation were also multicollinear.

Unaided Recall – Icehouse

The same sequential logistic regression procedure was conducted for unaided recall rates of the brand Icehouse. Results indicate significant effects in the first block ($\chi^2(2) = 8.131$, $p = .017$; Hosmer & Lemeshow $\chi^2(8) = 7.449$, $p = .489$). Similar to the results for Champion, subjects' tendencies to memorize sponsors during the video exposure had significant effects (Exp(b) = 1.363, $p < .01$), while controlling for the other variable.

In the second block, effects of baseball involvement and team identification items were added into the equation. No significant effects of these variables were found ($\Delta\chi^2(3) = 3.821$, $p > .05$). In addition, the third block consisting of the squared score of baseball involvement was not significant ($\Delta\chi^2(1) = 3.616$, $p > .05$). Thus, parameters in these two blocks were not interpreted.

Furthermore, the results suggest significant effects ($\Delta\ \chi^2(3) = 9.979$, $p = .019$) for the main effects of repetition and animation on unaided recall of Icehouse. Subjects in the group that saw Icehouse appear four times were more likely to recall it (Exp(b) = 4.615, $p < .05$) than others in the sample. Likewise, subjects in the group with six Icehouse exposures were more likely to recall it (Exp(b) =4.685, $p < .01$) than others in

the sample. Similarly to the results for Champion, effects of animation were not detected (Exp(b) = 1.090, $p > .05$) in this model.

The last block, which assessed the effects of the interaction of repetition and animation, did not have a significant impact ($\Delta\chi^2(2) = .060$, $p = .970$) on the unaided recall rates of Icehouse. Therefore, this block was not interpreted. The model explained 19% of variance of the dependent variable. Similar to Champion, multicollinearity for the above equation was a concern when adding the squared score of baseball involvement and interaction items of repetition and animation.

Unaided Recall – Mercury

Lastly, a sequential logistic regression analysis was conducted to test for the effects of baseball involvement, team identification, repetition, animation, and their interactive role on unaided recall rates for Mercury. The first block contained items that measured subjects' memorization of sponsors and their personal involvement with Mercury. These results suggest that this block was influential ($\chi^2(2) = 12.258$, $p = .002$; Hosmer & Lemeshow $\chi^2(8) = 6.360$, $p = .607$) an indication of an effect for either or both items. Further analysis revealed that a unit increase in subjects' tendency to memorize sponsors during the video exposure had a significant effect (Exp(b) = 1.475, $p < .01$) on unaided recall rates of Mercury.

The second block, which assessed the effects of baseball involvement and team identification also had significant chi-square change in the equation ($\Delta\chi^2(3) = 9.319$, $p < .05$). Further analysis revealed that baseball involvement had a significant effect (Exp(b) = .703, $p < .05$) on unaided recalls of Mercury. The third block containing the

squared score of baseball involvement did not have a significant effect ($\Delta\chi^2(1) = 2.896$, $p > .05$) on unaided recall of Mercury. Results suggest that no curvilinear relation was present with baseball involvement and unaided recall rates of Mercury.

The next block, which consisted of items measuring the main effects of repetition and animation, was added in the equation. The results reveal that this block was not significant ($\Delta\chi^2(3) = 6.947$, $p > .05$) when adding this set of variables. Lastly, the interaction block had a significant chi-square change ($\Delta\chi^2(2) = 6.124$, $p = .047$), an indication of an interaction between repetition and animation. With all other variables held constant, results indicate that an animated stimulus with four exposures had over 15 times (Exp(b) = 15.274, $p < .05$) the odds of recall than others in the sample, while animated stimulus with six exposures were over 21 times (Exp(b) = 21.379, $p < .05$) more likely to be recalled than others in the sample. This model explained 27.7% of variance in the model.

However, evidence of multicollinearity was detected when adding the interaction block. Some of the variables in the third block (squared score of baseball involvement) and the interaction block generated VIFs above 2.5 (highest 3.48) and tolerance values below .40 (lowest .287) an indication of unstable coefficients.

Research Question 2a

RQ2a: What are the reported aided recall rates of virtual advertising?

The frequencies of aided recall rates were calculated for the subjects. The numbers of correct responses and the percentages are listed in Table 12. The aided recall rates in this study ranged from one in Group 2 (one exposure of Champion with no animation effect) to twelve in Group 5 (four exposures of Mercury with animation effects). Overall aided recall rates for one exposure ranged from one subject (2.9% in Group 2) to four subjects (11.8% in Group 1). The aided recall rates for brands with four exposures ranged from six subjects (17.6% in Group 1) to twelve subjects (33.3% in Group 5). Lastly, aided recall rates for six exposures ranged from three subjects in Group 1 (8.8%) to nine subjects in Group 6 (26.5%).

The total aided recall rates were then calculated across brands and number of exposures to examine differences at the descriptive level. The results are presented in Table 13. For total aided recall rates across brands, Mercury seemed to slightly perform better than Champion and Icehouse, whereas from a number of exposure perspective, ads that appeared four times were recalled better than those with one or six exposures. In addition, Table 14 presents the number of aided recalls by subjects. At least 35% of the subjects recalled one or more of the target stimuli with a prompt. More than 11% recalled more than two, but only one percent of the subjects recalled all three. Aided recall rates matched the performance of unaided recall rates in some areas, but not all. Additionally, the number of subjects recalling all three target stimuli decreased from six to two.

Table 12 Frequencies of Aided Recall

Groups	Number of Exposures	Yes	%	No	Total
Non-Animation					
Group 1					
Champion	6 exposures	3	8.8%	31	34
Icehouse	4 exposures	6	17.6%	28	34
Mercury	1 exposure	4	11.8%	30	34
Group 2					
Icehouse	6 exposures	4	11.8%	30	34
Mercury	4 exposures	7	20.6%	27	34
Champion	1 exposure	1	2.9%	33	34
Group 3					
Mercury	6 exposures	6	16.7%	30	36
Champion	4 exposures	11	30.6%	25	36
Icehouse	1 exposure	2	5.6%	34	36
Animation					
Group 4					
Champion	6 exposures	6	17.6%	28	34
Icehouse	4 exposures	7	20.6%	27	34
Mercury	1 exposure	2	5.9%	32	34
Group 5					
Icehouse	6 exposures	7	19.4%	29	36
Mercury	4 exposures	12	33.3%	24	36
Champion	1 exposure	3	8.3%	33	36
Group 6					
Mercury	6 exposures	9	26.5%	25	34
Champion	4 exposures	9	26.5%	28	34
Icehouse	1 exposure	3	8.8%	31	34

Table 13 Frequencies of Aided Recall by Number of Exposures

Variable	Champion	Icehouse	Mercury	Total
Non-Animation				
Six exposures	3	4	6	13
Four exposures	11	6	7	24
One exposure	1	2	4	7
Total Non-Animation	15	12	17	44
Animation				
Six exposures	6	7	9	22
Four exposures	9	7	12	28
One exposure	3	3	2	8
Total Animation	18	17	23	58
Total				
Six exposures	9	11	15	35
Four exposures	20	13	19	52
One exposure	4	5	6	15
Total by brands	33	29	40	

Research Questions 2b, c, d, & e

RQ2b: What are the effects of repetition of virtual advertising on aided recall rates?

RQ2c: What are the effects of animating virtual advertising on aided recall rates?

RQ2d: What are the interactive effects of repetition and animation of virtual advertising on aided recall rates?

RQ2e: What are the interactive effects of repetition and animation of virtual advertising on aided recall rates?

Research Questions 2b through 2e were proposed to measure the effects of baseball involvement, team identification, repetition, animation, and the interaction effect of repetition and animation on aided recall rates by the respondents. Three separate sequential logistic regression analyses analogous to those of unaided recall

Table 14 Frequencies of Aided Recall by Subjects

Number of recalls	Frequencies	%	Cumulative%
All 3	2	1.0%	1.0%
2 out of 3	23	11.1%	12.1%
1 out of 3	50	24.0%	36.1%
None	133	63.9%	100.0%

rates were conducted to address the research questions. Results for these analyses are presented in Table 15.

Aided Recall – Champion

For the first block, the results suggest that it had a significant effect ($\chi^2(2) = 7.406$, $p = .025$; Hosmer & Lemeshow $\chi^2(8) = 10.754$, $p = .150$) on aided recall of Champion. The results indicate a significant effect for personal involvement with Champion (Exp(b) = 1.445, $p < .05$). Subjects who reported more involvement with Champion had 1.445 times the odds of recalling the brand, while holding the other variable constant.

The next set of variables was items measuring the effects of baseball involvement and team identification. The results suggest a non-significant effect of this block ($\Delta\chi^2(3) = 7.037$, $p = .071$). In addition, subsequent block measuring the curvilinear relation of baseball involvement and aided recall of Champion was not significant ($\Delta\chi^2(1) = .648$, $p = .421$). Thus, no interpretations were made for these two blocks.

The next block contained those items measuring the main effects of repetition and animation. Addition of this block indicated a significant effect ($\Delta\chi^2(3) = 17.681$, p

Table 15 Results of Sequential Logistic Regression on Aided Recall of Champion, Icehouse, and Mercury

Variable	Exp(b)				
DV- Champion					
1st Step					
Memorize Sponsor	1.257	1.182	1.167	1.253	1.248
Brand Involvement	1.654*	1.548	1.593	1.717	1.728
2nd Step					
Baseball Involvement		.832	1.661	2.072	1.950
Rangers Team ID		7.406*	7.832**	11.965**	11.907**
Red Sox Team ID		.539	.520	.507	.450
3rd Step					
Baseball Involvement^2			.924	.898	.905
4th Step					
Animation				1.129	2.888
Four exposures				9.291***	20.729**
Six exposures				2.638	3.941
5th Step					
Animation x Four exposures					.255
Animation x Six exposures					.552
Model Fit					
Chi-square	7.406	14.443	15.091	32.772	34.179
df	2	5	6	9	11
p	.025	.013	.020	.000	.000
Chi-square change		7.037	.648	17.681	1.407
df		3	1	3	2
p		.071	.421	.001	.495
-2 Log likelihood	174.565	167.528	166.880	149.199	147.792
Cox & Snell R^2	.035	.067	.070	.146	.152
Nagelkerke R^2	.060	.115	.120	.250	.260
Hosmer & Lemeshow χ^2	10.754	14.226	15.878	8.338	4.937
df	7	8	8	8	8
p	.150	.076	.044	.401	.764

Table 15 Continued

Variable	Exp(b)				
DV- Icehouse					
1st Step					
Memorize Sponsor	1.445**	1.410**	1.442**	1.455**	1.450**
Brand Involvement	1.289	1.283	1.332	1.265	1.268
2nd Step					
Baseball Involvement		.771	.233	.223	.200
Rangers Team ID		2.285	2.183	1.871	2.057
Red Sox Team ID		.873	1.177	.956	1.002
3rd Step					
Baseball Involvement^2			1.150	1.152	1.167
4th Step					
Animation				1.191	1.425
Four exposures				3.400*	4.599
Six exposures				2.320	2.140
5th Step					
Animation x Four exposures					.566
Animation x Six exposures					1.134
Model Fit					
Chi-square	11.304	14.145	16.300	21.069	21.592
df	2	5	6	9	11
p	.004	.015	.012	.012	.028
Chi-square change		2.842	2.155	4.769	.523
df		3	1	3	2
p		.417	.142	.190	.770
-2 Log likelihood	156.725	153.883	151.728	146.960	146.437
Cox & Snell R^2	.053	.066	.075	.096	.099
Nagelkerke R^2	.095	.119	.136	.174	.178
Hosmer & Lemeshow χ^2	13.245	2.678	4.890	5.072	9.893
df	8	8	8	8	8
p	.104	.953	.769	.750	.273

Table 15 Continued

Variable	Exp(b)				
DV- Mercury					
1st Step					
Memorize Sponsor	1.383**	1.423**	1.452**	1.437**	1.428**
Brand Involvement	1.062	1.164	1.196	1.172	1.145
2nd Step					
Baseball Involvement		.607**	.194*	.205	.161*
Rangers Team ID		.909	.816	.824	1.001
Red Sox Team ID		.741	.779	1.142	1.350
3rd Step					
Baseball Involvement^2			1.146	1.139	1.170
4th Step					
Animation				1.288	.347
Four exposures				3.690*	1.753
Six exposures				2.465	1.246
5th Step					
Animation x Four exposures					5.118
Animation x Six exposures					4.646
Model Fit					
Chi-square	8.547	22.099	24.254	31.376	33.679
df	2	5	6	9	11
p	.014	.001	.000	.000	.000
Chi-square change		13.552	2.155	7.123	2.303
df		3	1	3	2
p		.004	.142	.068	.316
-2 Log likelihood	195.107	181.555	179.400	172.277	169.974
Cox & Snell R^2	.040	.101	.110	.140	.149
Nagelkerke R^2	.064	.161	.176	.224	.239
Hosmer & Lemeshow χ^2	12.081	2.642	9.475	5.186	12.372
df	8	8	8	8	8
p	.148	.955	.304	.737	.135

* denotes significance at p < .05 level
** denotes significance at p < .01 level
*** denotes significance at p < .001 level

= .001) on aided recall rates of Champion. Further examination of this block revealed that respondents who saw four exposures of the brand recalled the brand better than others in the sample (Exp(b) = 9.291, $p < .001$). Effects of animation (Exp(b) = 1.129, $p > .05$) and six exposures (Exp(b) = 2.638, $p > .05$) did not have a significant effect on aided recall rates of Champion.

Lastly, adding the final block containing the interaction items were also not significant ($\Delta\chi^2(2) = 4.001$, $p = .135$) in predicting aided recall rates of Champion. Thus, the block was not interpreted. The model explained 25% of variance of the dependent variable. With regard to multicollinearity in the equation, VIF and tolerance values were beyond the limit suggested by Allison (1999) when entering the squared score of baseball involvement and the interaction items for repetition and animation.

Aided Recall – Icehouse

The same sequential logistic regression analysis was applied to the equation leading to Icehouse. Results from the first block indicate a significant effect of the model ($\chi^2(2) = 11.304$, $p = .004$; Hosmer & Lemeshow $\chi^2(8) = 13.245$, $p = .104$) and of subjects' tendencies to memorize sponsors (Exp(b) = 1.445, $p < .01$) on aided recall of Icehouse, while controlling for the other variable. The second block, examining the effects of baseball involvement and team identification ($\Delta\chi^2(3) = 2.842$, $p = .417$) and the third block investigating the curvilinear relationship of baseball involvement ($\Delta\chi^2(1) = 2.155$, $p = .142$) did not produce significant results.

The next block containing the main effects of repetition and animation, and the last block, examining the interaction was not significant as well (main effects, $\Delta\chi^2(3) =$

4.769, $p = .190$; interaction effect $\Delta\chi^2(2) = .523$, $p = .770$). For the equation leading to aided recall rates of Icehouse, neither repetition nor animation had effects on aided recall rates reported by the respondents. This model explained 9.5% of variance of the dependent variable. Multicollinearity was again found when adding the squared score of baseball involvement and interaction items of repetition and animation.

Aided Recall – Mercury

Lastly, sequential logistic regression analysis was again conducted to test for the effects of repetition and animation on aided recall rates of Mercury. Results suggest that the first block, testing for subjects' demand artifact and personal involvement with Mercury, had a significant effect on the dependent variable ($\chi^2(2) = 8.547$, $p = .014$; Hosmer & Lemeshow $\chi^2(8)=12.081$, $p = .148$). From the parameter estimates, they showed that respondents' tendencies to memorize sponsors had a significant effect (Exp(b) = 1.383, $p < .01$) on aided recall of Mercury while controlling for the other variable.

The second block, which contained items measuring effects of baseball involvement and team identification, was then entered into the equation. The results suggest a significant addition of this block ($\Delta\chi^2(3) = 13.552$, $p = .004$). Within this

block, baseball involvement had a significant influence (Exp(b) = .613, p = .002) on aided recall rates with all others equal. Other variables were found unrelated to respective recall rates. Subsequently, the next block was entered to see the curvilinear effects of baseball involvement and aided recall rates of Mercury. The results indicate a non-significant effect of the block ($\Delta\chi^2(1) = 2.155$, p = .142).

The next block, which assessed the main effects of repetition and animation, did not have a significant impact on the dependent variable ($\Delta\chi^2(3) = 7.123$, p = .068). Lastly, the interaction items of animation and repetition were entered into the equation. The results showed a non-significant effect on the dependent variable ($\Delta\chi^2(2) = 2.303$, p = .316). Therefore, no interpretation was made for this block. This model explained 16.1% of variance of aided recall of Mercury. Multicollinearity was present when squared score of baseball involvement and interaction of animation and repetition items were entered.

Research Question 3a

RQ3a: What are the reported recognition rates of virtual advertising?

The frequencies of recognition rates were calculated for the subjects. The numbers of correct responses and percentages are listed in Table 16. The reported recognition rates ranged from six in Group 1 (one exposure of Mercury with no animation effect) to 18 in Group 6 (four exposures of Champion with animation effects). Overall, recognition rates for one exposure ranged from six subjects (17.6% in Group 1) to twelve subjects (33.3% in Group 5). Recognition rates for brands with four exposures ranged from eleven subjects (32.4% in Group 2) to 18 subjects (52.9% in Group 6). For brands with six exposures, they ranged from eleven subjects (30.6% in Group 3) to 16 subjects (44.4% in Group 5). For a better interpretation of Table 16 and to see whether any differences existed at the descriptive level, frequencies of recognition rates were tallied by number of exposures (Table 17). For total recognition rates across brands, Champion seemed to perform slightly better than the other two, whereas from a repetition standpoint, ads that appeared four and six times were recognized better than those that appeared only once.

In addition, Table 18 illustrates the numbers for recognition by subject. The majority (57.2%) of subjects recognized at least one of the target stimuli, and 22.6% of the subjects recognized two of the target stimuli. Eleven percent of the subjects were able to recognize all three target stimuli. Overall, recognition rates were higher than unaided and aided recall rates at the descriptive level.

Table 16 Frequencies of Recognition

Variable	Number of Exposures	Yes	%	No	Total
Non-Animation					
Group 1					
Champion	6 exposures	15	44.1%	19	34
Icehouse	4 exposures	12	35.3%	22	34
Mercury	1 exposure	6	17.6%	28	34
Group 2					
Icehouse	6 exposures	15	44.1%	19	34
Mercury	4 exposures	11	32.4%	23	34
Champion	1 exposure	9	26.5%	25	34
Group 3					
Mercury	6 exposures	11	30.6%	25	36
Champion	4 exposures	15	41.7%	21	36
Icehouse	1 exposure	8	22.2%	28	36
Animation					
Group 4					
Champion	6 exposures	12	35.3%	22	34
Icehouse	4 exposures	13	38.2%	21	34
Mercury	1 exposure	6	17.6%	28	34
Group 5					
Icehouse	6 exposures	16	44.4%	20	36
Mercury	4 exposures	15	41.7%	21	36
Champion	1 exposure	12	33.3%	24	36
Group 6					
Mercury	6 exposures	13	38.2%	21	34
Champion	4 exposures	18	52.9%	16	34
Icehouse	1 exposure	8	23.5%	26	34

Table 17 Frequencies of Recognition by Number of Exposures

Variable	Champion	Icehouse	Mercury	Total
Non-Animation				
Six exposures	15	15	11	41
Four exposures	15	12	11	38
One exposure	9	8	6	23
Total Non-Animation	39	35	28	102
Animation				
Six exposures	12	16	13	41
Four exposures	18	13	15	46
One exposure	12	8	6	26
Total Animation	42	37	34	113
Total				
Six exposures	27	31	24	82
Four exposures	33	25	26	84
One exposure	21	16	12	49
Total by brands	81	72	62	

Next, alternative measures of recognition (false-alarm rate [FA] and corrected hit rate [H_{C2}]) were calculated. The results of these calculations are presented in Tables 19 and 20. From a group-wise perspective, the results suggest consistent false-alarm rates across groups and brands. Similarly, observing from the repetition viewpoint, false- alarm rates seem consistent across number of exposures. Because corrected hit rates are a function of hit rates and false alarm rates, the outcomes did not show any trends at the descriptive level (hit rates are not reported as they are redundant).

Then, cross-tabulation tables were created for hit rates and false-alarm rates to understand subjects' tendency to guess sponsors. Table 21 presents a cross-tabulation table by individuals in each group, and Table 22 displays a cross-tabulation table by brands in each group (essentially a task level analysis). At the individual level (Table

Table 18 Frequencies of Recognition by Subjects

Number of recognition	Frequencies	%	Cumulative%
All 3	24	11.5%	11.5%
2 out of 3	48	22.6%	34.1%
1 out of 3	47	23.1%	57.2%
None	89	42.8%	100.0%

21), subjects who correctly selected at least one of the target stimuli ranged from 16 subjects in Group 4 (47%) to 25 subjects in Group 5 (69%). The total subjects recognizing the target items were 119 (57.2%). The cross-tabulation table also reveals that the subjects' selection of bogus advertising was consistent across groups. Subjects selecting one or more distractors ranged from 13 subjects in Group 5 (33%) to17 subjects in Group 4 (50%). The total for those subjects who selected one or more distractors was 92 (44.2%). Subjects who reported not recognizing any advertisements listed in the recognition task ranged from seven subjects in Group 6 (20.6%) to twelve subjects in Group 3 (33.3%). The total for these subjects in the sample was 58 (27.9%).

On the other hand, those subjects who selected only one or more distractor items and missed all target items ranged from 3 subjects in Group 5 (8.3%) to 7 subjects in Group 4 (20.6%). The total subjects who failed to recognize any target stimuli, but selected one or more distractor items were 30 (14.4%). There was an extreme case in which a subject selected a total of nine distractor items and no target stimuli. On the other extreme were respondents who successfully selected all three target stimuli and did not choose any distractor items (8 total subjects, 3.8%). Analyzing each task at the descriptive level, the tendencies of subjects to select target and distractor items seem to

Table 19 Mean Scores of Measures of Recognition

Variable	Champion	Icehouse	Mercury	Total
Non-Animation				
Group 1 (Champion-6, Icehouse-4, Mercury-1)				
H	.44	.35	.18	.32
FA	.08	.09	.12	.10
H_{C2}	.36	.26	.06	.23
Group 2 (Champion-1, Icehouse-6, Mercury-4)				
H	.26	.44	.32	.34
FA	.08	.07	.08	.08
H_{C2}	.18	.37	.24	.26
Group 3 (Champion-4, Icehouse-1, Mercury-6)				
H	.42	.22	.31	.31
FA	.08	.05	.07	.07
H_{C2}	.33	.17	.23	.25
Total Non-Animation				
H	.38	.34	.27	
FA	.08	.07	.09	
H_{C2}	.29	.27	.18	
Animation				
Group 4 (Champion-6, Icehouse-4, Mercury-1)				
H	.35	.38	.18	.30
FA	.11	.06	.14	.10
H_{C2}	.24	.32	.04	.20
Group 5 (Champion-1, Icehouse-6, Mercury-4)				
H	.33	.44	.42	.40
FA	.07	.07	.06	.06
H_{C2}	.26	.38	.36	.33
Group 6 (Champion-4, Icehouse-1, Mercury-6)				
H	.53	.23	.38	.38
FA	.05	.04	.08	.06
H_{C2}	.48	.19	.31	.33
Total Animation				
H	.40	.36	.33	
FA	.08	.06	.09	
H_{C2}	.33	.30	.24	

Table 20 Mean Scores of Measures of Recognition by Number of Exposures

Variable	Champion	Icehouse	Mercury	Total
Non-Animation				
Six exposures				
H	.44	.44	.31	.40
FA	.08	.07	.07	.07
H_{C2}	.36	.37	.23	.32
Four exposures				
H	.42	.35	.32	.36
FA	.08	.09	.08	.08
H_{C2}	.33	.26	.24	.28
One exposure				
H	.26	.22	.18	.22
FA	.08	.05	.12	.08
H_{C2}	.18	.17	.06	.14
Animation				
Six exposures				
H	.35	.44	.38	.39
FA	.11	.07	.08	.09
H_{C2}	.24	.38	.31	.31
Four exposures				
H	.53	.38	.42	.44
FA	.05	.06	.06	.06
H_{C2}	.48	.32	.36	.39
One exposure				
H	.33	.24	.18	.25
FA	.07	.04	.14	.08
H_{C2}	.26	.19	.04	.16

be similar across groups and repetition.

Additionally, six to thirteen subjects selected one or more distractor items at each task. To provide an easier understanding of the distribution of subjects by repetition, Table 23 is presented.

Table 21 Total Hit & Total Distractor Cross-Tabulation

Number of Hits – Hit rate		Number of Distractors Selected and False-Alarm rates										
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
			.07	**.13**	**.20**	**.27**	**.33**	**.40**	**.47**	**.54**	**.60**	
Group 1 Non-Animation (Champion 6 Icehouse 4 Mercury 1)												
All 3	1.00	0	2	1	0	0	0		0	0		3
2 of 3	.67	4	1	0	1	1	0		1	0		8
1 of 3	.33	3	2	0	0	0	2		0	1		8
Miss All	.00	11	1	1	0	2	0		0	0		15
Total		18	6	2	1	3	2		1	1		34
Group 2 Non-Animation (Champion 1 Icehouse 6 Mercury 4)												
All 3	1.00	1	1	0	0		0	0				2
2 of 3	.67	7	1	1	1		1	0				11
1 of 3	.33	2	2	0	1		2	0				7
Miss All	.00	9	2	1	1		0	1				14
Total		19	6	2	3		3	1				34
Group 3 Non-Animation (Champion 4 Icehouse 1 Mercury 6)												
All 3	1.00	1	2	0	1	0	0				0	4
2 of 3	.67	6	1	1	1	0	0				0	9
1 of 3	.33	1	2	0	0	1	0				0	4
Miss All	.00	12	4	1	0	0	1				1	19
Total		20	9	2	2	1	1				1	36
Group 4 Animation (Champion 6 Icehouse 4 Mercury 1)												
All 3	1.00	0	3	1	1	0	0		0			5
2 of 3	.67	3	0	0	1	0	1		0			5
1 of 3	.33	3	0	1	1	0	1		0			6
Miss All	.00	11	2	0	2	1	0		2			18
Total		17	5	2	5	1	2		2			34
Group 5 Animation (Champion 1 Icehouse 6 Mercury 4)												
All 3	1.00	2	3	0	0		0	0	0			5
2 of 3	.67	7	0	1	0		0	0	0			8
1 of 3	.33	6	3	0	2		0	1	0			12
Miss All	.00	8	0	0	1		1	0	1			11
Total		23	6	1	3		1	1	1			36
Group 6 Animation (Champion 4 Icehouse 1 Mercury 6)												
All 3	1.00	4	1	0	0	0	0					5
2 of 3	.67	4	2	0	0	1	0					7
1 of 3	.33	4	1	3	1	0	1					10
Miss All	.00	7	3	2	0	0	0					12
Total		19	7	5	1	1	1					34

Table 22 Hit Rate and False-Alarm Rate Cross-Tabulations by Groups

Variable	FA = .00	FA = .20	FA = .40	FA = .60	FA = .80	Total
Non-Animation – Group 1						
Champion 6 exposures						
Hit	9	4	1	1		15
Miss	16	1	2	0		19
Total	25	5	3	1		34
Icehouse 4 exposures						
Hit	9	1	2	0		12
Miss	17	1	2	2		22
Total	26	2	4	2		34
Mercury 1 exposure						
Hit	4	1	1	0		6
Miss	18	5	3	2		28
Total	22	6	4	2		34
Non-Animation – Group 2						
Champion 1 exposure						
Hit	5	3	1			9
Miss	18	5	2			25
Total	23	8	3			34
Icehouse 6 exposures						
Hit	11	2	2			15
Miss	15	2	2			19
Total	26	4	4			34
Mercury 4 exposures						
Hit	10	1	0	0		11
Miss	15	4	3	1		23
Total	25	5	3	1		34
Non-Animation – Group 3						
Champion 4 exposures						
Hit	10	4	1		0	15
Miss	16	3	1		1	21
Total	26	7	2		1	36
Icehouse 1 exposure						
Hit	7	1	0			8
Miss	22	4	2			28
Total	29	5	2			36
Mercury 6 exposures						
Hit	7	3	1	0		11
Miss	20	3	1	1		25
Total	27	6	2	1		36

Table 22 Continued

Variable	FA = .00	FA = .20	FA = .40	FA = .60	FA = .80	Total
Animation – Group 4						
Champion 6 exposures						
Hit	5	5	2	0		12
Miss	17	2	1	2		22
Total	22	7	3	2		34
Icehouse 4 exposures						
Hit	11	2	0			13
Miss	15	4	2			21
Total	26	6	2			34
Mercury 1 exposure						
Hit	3	2	1	0		6
Miss	18	3	5	2		28
Total	21	5	6	2		34
Animation – Group 5						
Champion 1 exposure						
Hit	11	1	0	0		12
Miss	18	2	2	2		24
Total	29	3	2	2		36
Icehouse 6 exposures						
Hit	14	2	0	0		16
Miss	14	3	2	1		20
Total	28	5	2	1		36
Mercury 4 exposures						
Hit	11	3	1			15
Miss	18	1	2			21
Total	29	4	3			36
Animation – Group 6						
Champion 4 exposures						
Hit	14	3	1			18
Miss	12	4	0			16
Total	26	7	1			34
Icehouse 1 exposure						
Hit	7	1	0			8
Miss	21	4	1			26
Total	28	5	1			34
Mercury 6 exposures						
Hit	12	0	1	0		13
Miss	14	4	2	1		21
Total	26	4	3	1		34

Table 23 Hit Rate, False Alarm Rate, and Animation Cross-Tabulation by Number of Exposures and Animation

Variable	FA = .00	FA = .20	FA = .40	FA = .60	FA = .80	Total
Non-Animation						
Six exposures						
Hit	27	9	4	1		41
Miss	51	6	5	1		63
Total	78	15	9	2		104
Four exposures						
Hit	29	6	3	0	0	38
Miss	48	8	6	3	1	66
Total	77	14	9	3	1	104
One exposure						
Hit	16	5	2	0		23
Miss	58	14	7	2		81
Total	74	19	9	2		104
Animation						
Six exposures						
Hit	31	7	3	0		41
Miss	45	9	5	4		63
Total	154	16	8	4		104
Four exposures						
Hit	36	8	2			46
Miss	45	9	4			58
Total	81	17	6			104
One exposure						
Hit	21	4	1	0		26
Miss	57	9	8	4		78
Total	78	13	9	4		104

To test for the performance levels of hit rates, false-alarm rates, and corrected hit rates, they were tested for their correlation with unaided and aided recall rates. Bivariate correlation analyses for these variables were conducted by brands and the number of exposures and are presented in Tables 24 and 25. The results indicate a significant and positive relationship among the two measures of recall, the hit

Table 24 Means and Correlations of Measures of Recognition by Brands

Variable	Mean	UR	AR	H	H_{C2}	FA
Recognition						
Champion						
Unaided Recall	.14	---				
Aided Recall	.16	.68**	---			
H	.39	.51**	.54**	---		
H_{C2}	.31	.53**	.55**	.95**	---	
FA	.08	-.11	-.08	.03	-.27**	---
Icehouse						
Unaided Recall	.18	---				
Aided Recall	.14	.68**	---			
H	.35	.64**	.55**	---		
H_{C2}	.28	.63**	.56**	.97**	---	
FA	.06	-.09	-.13	-.09	-.35**	---
Mercury						
Unaided Recall	.17	---				
Aided Recall	.19	.73**	---			
H	.30	.66**	.75**	---		
H_{C2}	.21	.66**	.72**	.95**	---	
FA	.09	-.15*	-.12	-.10	-.42**	---

*Correlation is significant at 0.05 level.
** Correlation is significant at 0.01 level.

rate and the corrected hit rate. In both tables, the hit rate and corrected hit rate showed an extremely strong relationship. Unaided recall and aided recall also showed a substantial strong relationship with measures of recognition. False-alarm rates were significantly and negatively correlated with H_{C2} measures and two of the unaided recall rates. These two measures of unaided recall were for Mercury ($r = -.154$, $p < .05$) and for four exposures ($r = -.151$, $p < .05$). Other false-alarm rates did not have any significant relationships.

Table 25 Means and Correlations of Measures of Recognition by Number of Exposures

Variable	Mean	UR	AR	H	H_{C2}	FA
Recognition						
Six exposures						
Unaided Recall	.20	---				
Aided Recall	.17	.64**	---			
H	.39	.60**	.56**	---		
H_{C2}	.31	.60**	.56**	.96**	---	
FA	.08	-.11	-.101	.00	-.29**	---
Four exposures						
Unaided Recall	.22	---				
Aided Recall	.25	.74**	---			
H	.40	.65**	.70**	---		
H_{C2}	.33	.65**	.69**	.96**	---	
FA	.07	-.15*	-.12	-.08	-.35**	---
One exposure						
Unaided Recall	.07	---				
Aided Recall	.07	.67**	---			
H	.24	.48**	.50**	---		
H_{C2}	.15	.48**	.49**	.94**	---	
FA	.08	-.10	-.08	-.08	-.40**	---

*Correlation is significant at 0.05 level.
** Correlation is significant at 0.01 level.

Research Questions 3b, c, d, & e

RQ3b: What are the effects of repetition of virtual advertising on recognition rates?

RQ3c: What are the effects of animating virtual advertising on recognition rates?

RQ3d: What are the interactive effects of repetition and animation of virtual advertising on recognition rates?

RQ3e: What are the effects of levels of baseball involvement and team identification on recognition rates?

Sequential logistic regression analysis was conducted to test for the effects of repetition, animation, and their interactive effects on hit rates. Similar to the procedure for unaided and aided recall, demand artifact questions, brand involvement, baseball involvement, team identification, squared score of baseball involvement, dummy-coded variables for animation and repetition, and dummy-coded variables for their interaction were sequentially inserted into three separate equations. The results from Champion are presented first, followed by those for Icehouse and Mercury in Table 26.

Hit Rate – Champion

The first set of questions entered was for demand artifacts and brand involvement. The results suggest that the initial model had a good fit to the data ($\chi^2(2) = 12.131$, $p = .002$; Hosmer & Lemeshow $\chi^2(8) = 12.347$, $p = .136$). The parameter estimates indicate a significant effect for memorizing of sponsors (Exp(b) = 1.340, $p < .01$) and personal involvement with Champion (Exp(b) = 1.445, $p < .05$). Subjects who reported their tendencies to memorize sponsors had 1.34 times the odds of recognizing the brand, with all other variables treated equal. Similarly, respondents who were more involved with Champion had 1.445 times the odds of recognizing the brand, while holding the other variable constant.

The next block contained items measuring the effects of baseball involvement and team identification. The results showed a non-significant effect of this block ($\Delta\chi^2(3) = 5.049$, $p = .168$) on the dependent variable. Additionally, subsequent block measuring the curvilinear relation of baseball involvement and hit rates of Champion

was not found to be significant ($\Delta\chi^2(1) = 1.481$, $p = .224$). Thus, no interpretations were made for these two blocks.

The next set of variables was those items measuring the main effects of repetition and animation. The addition of this block indicated a non-significant effect ($\Delta\chi^2(3) = 4.711$, $p = .194$) on hit rates of Champion. Animation and multiple exposures on respondents did not have an effect on hit rates of Champion. Lastly, adding the final block containing the interaction items were also not significant ($\Delta\chi^2(2) = 4.001$, $p = .135$) in predicting hit rates of Champion. Thus, the block was not interpreted. The model explained 7.7% of variance of the dependent variable. For this equation, multicollinearity was detected when entering the squared score of baseball involvement and the interaction items for repetition and animation.

Hit Rate – Icehouse

The first block in the equation had a significant effect on the dependent variable ($\chi^2(2) = 8.721$, $p = .013$; Hosmer & Lemeshow $\chi^2(8) = 9.410$, $p = .309$). The item that measured subjects' memorizing of sponsors had a significant effect (Exp(b) = 1.313, $p < .01$) on the outcome. The next block, which contained items with baseball involvement and team identification, was found to be significant ($\Delta\chi^2(3) = 9.725$, $p = .021$) when predicting hit rate of Icehouse. Further analysis revealed that only identification with the Rangers had a significant effect on recognizing Icehouse (Exp(b) = 3.889, $p < .05$). The subsequent block testing for curvilinear relationship of baseball involvement and hit rate of Icehouse was not significant ($\Delta\chi^2(1) = 1.576$, $p = .209$).

The next two blocks, measuring main effects of animation and repetition ($\Delta\chi^2(3) = 7.349$, $p = .062$) and interaction of these items ($\Delta\chi^2(2) = .424$, $p = .809$) were not significant in predicting hit rates of Icehouse. Thus, no further interpretations were made. The model explained 11.7% of variance of hit rate of Icehouse. Multicollinearity was again detected when entering the squared score of baseball involvement and the interaction items for repetition and animation.

Hit Rate – Mercury

A procedure analogous to the previous two sections was used for equation leading to the brand Mercury. The results suggest significance for the first block ($\chi^2(2)= 24.227$, $p = .000$; Hosmer & Lemeshow $\chi^2(8) =12.300$, $p = .138$). The parameter estimates in the first block suggest significant effects for memorizing sponsors (Exp(b) = 1.656, $p = .000$) on hit rates of Mercury.

The next block, containing items assessing the effects of baseball involvement and team identification, was not significant ($\Delta\chi^2(3) = 4.670$, $p = .198$). Similarly, the third block, which examined the curvilinear relationship of baseball involvement and hit rates of Mercury, was not significant ($\Delta\chi^2(1) = 2.145$, $p = .143$). The subsequent blocks measuring the main effects of animation and repetition ($\Delta\chi^2(3) = 7.469$, $p = .058$) and the interaction of these factors ($\Delta\chi^2(1) = 660$, $p = .719$) were not found to be significant. Therefore, no interpretations were made for these blocks. The model explained 15.6% of variance of the dependent variable. In this equation, multicollinearity was found when entering the squared score of baseball involvement and the interaction items for repetition and animation.

Table 26 Results of Sequential Logistic Regression on Hit Rates of Champion, Icehouse, and Mercury

Variable	Exp(b)				
DV- Champion					
1st Step					
Memorize Sponsor	1.340**	1.287*	1.305*	1.325**	1.337**
Brand Involvement	1.445*	1.405	1.384	1.372	1.372
2nd Step					
Baseball Involvement		.830	.382	.373	.319
Rangers Team ID		2.755	2.658	2.729	3.153
Red Sox Team ID		1.416	1.436	1.473	1.770
3rd Step					
Baseball Involvement^2			1.092	1.096	1.116
4th Step					
Animation				.947	1.374
Four exposures				2.213*	2.190
Six exposures				1.493	2.804
5th Step					
Animation x Four exposures					1.081
Animation x Six exposures					.275
Model Fit					
Chi-square	12.131	17.180	18.661	23.373	27.374
df	2	5	6	9	11
p	.002	.004	.005	.005	.004
Chi-square change		5.049	1.481	4.711	4.001
df		3	1	3	2
p		.168	.224	.194	.135
-2 Log likelihood	265.961	260.912	259.430	254.719	250.718
Cox & Snell R^2	.057	.079	.086	.106	.123
Nagelkerke R^2	.077	.108	.116	.144	.167
Hosmer & Lemeshow χ^2	12.347	3.838	9.600	9.804	16.919
df	8	8	8	8	8
p	.136	.871	.294	.279	.031

Table 26 Continued

Variable	Exp(b)				
DV- Icehouse					
1st Step					
Memorize Sponsor	1.313**	1.250*	1.268*	1.277*	1.277*
Brand Involvement	1.105	1.079	1.101	1.043	1.047
2nd Step					
Baseball Involvement		.812	.361	.331	.311
Rangers Team ID		3.889*	3.733*	3.840*	4.071*
Red Sox Team ID		2.314	2.284	2.344	2.467
3rd Step					
Baseball Involvement^2			1.097	1.105	1.112
4th Step					
Animation				.874	1.007
Four exposures				1.935	2.399
Six exposures				2.815**	2.806
5th Step					
Animation x Four exposures					.640
Animation x Six exposures					1.002
Model Fit					
Chi-square	8.721	18.446	20.022	27.371	27.795
df	2	5	6	9	11
p	.013	.002	.003	.001	.003
Chi-square change		9.725	1.576	7.349	.424
df		3	1	3	2
p		.021	.209	.062	.809
-2 Log likelihood	259.613	249.888	248.312	240.962	240.539
Cox & Snell R^2	.041	.085	.092	.123	.125
Nagelkerke R^2	.057	.117	.127	.170	.173
Hosmer & Lemeshow χ^2	9.410	2.463	8.374	5.306	9.164
df	8	8	8	8	8
p	.309	.963	.398	.724	.329

Table 26 Continued

Variable	Exp(b)				
DV- Mercury					
1st Step					
Memorize Sponsor	1.656***	1.650***	1.690***	1.710***	1.714***
Brand Involvement	.929	.953	.974	.948	.933
2nd Step					
Baseball Involvement		.759*	.273	.285	.262
Rangers Team ID		1.095	1.018	1.022	1.092
Red Sox Team ID		1.052	1.059	1.598	1.731
3rd Step					
Baseball Involvement^2			1.125	1.121	1.131
4th Step					
Animation				1.179	.709
Four exposures				3.006*	2.192
Six exposures				2.652*	1.880
5th Step					
Animation x Four exposures					1.863
Animation x Six exposures					2.003
Model Fit					
Chi-square	24.227	28.897	31.042	38.510	39.170
df	2	5	6	9	11
p	.000	.000	.000	.000	.000
Chi-square change		4.670	2.145	7.469	.660
df		3	1	3	2
p		.198	.143	.058	.719
-2 Log likelihood	229.211	224.541	222.396	214.928	214.268
Cox & Snell R^2	.110	.130	.139	.169	.172
Nagelkerke R^2	.156	.184	.197	.240	.244
Hosmer & Lemeshow χ^2	12.300	11.648	4.925	2.894	6.312
df	8	8	8	8	8
p	.138	.168	.766	.941	.612

* denotes significance at p < .05 level
** denotes significance at p < .01 level
*** denotes significance at p < .001 level

Corrected Hit Rate

To test for the effects of repetition, animation, baseball involvement, and team identification variables, a two-way mixed ANCOVA was conducted. The results of this analysis are presented in Table 27. First, assumptions for the ANCOVA were checked for the acceptability of its use (i.e., linearity, homogeneity of regression slopes, correlations among covariates). The findings suggested that all assumptions were met; thus, the analyses were conducted. Dependent variables for the analyses were corrected hit rate for the number of exposures. The data were reorganized for this purpose. These three variables were inserted as the within-subjects factors, and animation was entered as the between-subjects factors. Additionally, demand artifact items, brand involvement items, baseball involvement item, and team identification items were inserted in the equation as covariates. Levene's test of equality of error variances, Box's test of equality of covariance matrices, and Mauchly's test of sphericity did not pose any problems for proceeding with the analysis ($p > .05$).

The results suggest an interaction between baseball involvement and repetition ($F(2, 198) = 3.299$, $p = .039$). Furthermore, test of within-subjects contrast indicated that this relationship was not a curvilinear relationship. Therefore, the results showed that a decrease in recognition rates occurs as involvement in baseball and number of exposures increase. Specifically, for brands that appeared six times, greater involvement with baseball significantly decreased the corrected hit rates of them. The effect size of the interaction of these factors was small (repetition x baseball involvement $\eta^2 = .032$). The results also show that memorizing sponsors ($F(1, 199) = 14.360$, $p = .000$, $\eta^2 = .067$)

Table 27 Two-Way Mixed ANCOVA for H_{C2}

Source	Wilks' λ	F	df	*p*	η^2
Multivariate Tests					
Repetition	.999	.100	2, 198	.905	.001
x Memorize Sponsors	.986	1.452	2, 198	.237	.014
x Involvement Champion	.997	.282	2, 198	.755	.003
x Involvement Icehouse	.996	.439	2, 198	.645	.004
x Involvement Mercury	.975	2.562	2, 198	.080	.025
x Baseball Involvement	.968	3.299	2, 198	.039	.032
x Rangers Team ID	.994	.625	2, 198	.536	.006
x Red Sox Team ID	.998	.222	2, 198	.801	.002
x Animation	.988	1.220	2, 198	.298	.012
Between Subjects					
Memorize Sponsors		14.360		.000	.067
Involvement Champion		.071		.790	.000
Involvement Icehouse		1.356		.246	.007
Involvement Mercury		1.723		.191	.009
Baseball Involvement		4.381		.038	.022
Rangers Team ID		1.884		.171	.009
Red Sox Team ID		.763		.383	.004
Animation		.129		.719	.001
Within Subjects	b	F			
Repetition x Baseball Involvement		3.777		.024	.019
One exposure	.006	.215 (t-value)		.830	.000
Four exposures	-.052	-1.842 (t-value)		.067	.017
Six exposures	-.080	-2.915 (t-value)		.004	.041

had a significant effect on the dependent variable while controlling for other variables. No other factors emerged as significant. Tables 28 and 29 summarize the results of the analyses.

Table 28 Summary of Results for Unaided Recall, Aided Recall, and Recognition

Variables	Champion	Icehouse	Mercury
Unaided Recall			
Memorize Sponsors	1.317*	1.363*	1.475**
Brand Involvement	ns	ns	ns
Baseball Involvement	ns	ns	.703*
Rangers Team ID	ns	ns	ns
Red Sox Team ID	ns	ns	ns
Baseball Involvement^2	ns	ns	ns
Animation	ns	ns	ns
Repetition			ns
4	5.498**	4.615*	
6	3.571**	4.685**	
Repetition x Animation	ns	ns	
Four			15.274*
Six			21.379*
Aided Recall			
Memorize Sponsors	ns	1.445**	1.383**
Brand Involvement	1.654*	ns	ns
Baseball Involvement	ns	ns	.607**
Rangers Team ID	ns	ns	ns
Red Sox Team ID	ns	ns	ns
Baseball Involvement^2	ns	ns	ns
Repetition		ns	ns
4	9.291***		
6	ns		
Animation	ns	ns	ns
Repetition x Animation	ns	ns	ns
Recognition (Hit Rates)			
Memorize Sponsors	1.340**	1.313**	1.656***
Brand Involvement	1.445*	ns	ns
Baseball Involvement	ns	ns	ns
Rangers Team ID	ns	3.889*	ns
Red Sox Team ID	ns	ns	ns
Baseball Involvement^2	ns	ns	ns
Repetition	ns	ns	ns
Animation	ns	ns	ns
Repetition x Animation	ns	ns	ns

* denotes significance at $p < .05$ level
** denotes significance at $p < .01$ level
*** denotes significance at $p < .001$ level
ns denotes not significant $p > .05$
Numbers are Exp(b)

Table 29 Summary of Results for Corrected Hit Rates (H_{C2})

Variables	Statistics
Recognition	
Corrected Hit Rate (H_{C2})	
Memorize Sponsors	significant F (1, 199) = 14.360, p = .000
Brand Involvement	ns
Repetition	ns
Animation	ns
Repetition x Animation	ns
Baseball Involvement	
Repetition x Involvement	significant F (2, 198) = 3.299, p = .039
Baseball Involvement^2	ns
Rangers Team ID	ns
Red Sox Team ID	ns

Note: ns denotes not significant $p > .05$

CHAPTER V

CONCLUSION

The purpose of the current study was to explore the brand awareness levels of virtual advertising in sports. More specifically, several factors were manipulated and presented to different groups to explore the antecedents of brand awareness in virtual advertising. The manipulated factors were repetition and animation. In addition, baseball involvement and team identification were also included to investigate their effects and to control for these items while assessing brand awareness levels. The following contains a review of the research questions and discussion of the findings from the analyses.

Summary of Findings

Research Questions 1a, 2a, and 3a

Research questions 1a, 2a, and 3a assessed the brand awareness levels of the respondents' unaided and aided recall, and recognition. Unaided and aided recall rates were relatively low, and they were somewhat similar at the descriptive statistic level. When directly comparing unaided recall rates to aided recall rates, some groups improved their scores and other groups had reduced scores. Looking at the total numbers of unaided and aided recall by brand, Icehouse had eight fewer aided recall rates than unaided recall rates. In addition, looking at unaided and aided recall rates by

subjects, the number of subjects correctly identifying all three target stimuli decreased from six in unaided recall tests to two in aided recall tests.

The consensus among researchers is that aided recall rates are typically higher than those of unaided recall due to the fact that with a prompt of a cue, memory nodes containing relevant information assists the process of recalling the target stimulus easier for most people (Leigh, 1984; Leigh & Menon, 1986, 1987; Zinkahn et al., 1986). Decrease of Icehouse's aided recall rates may be due to an individual's memory or lack thereof regarding the brand in question. The subjects may not have known the brand in a particular product category prior to watching the video. Because the sample of the study was undergraduate students under the drinking age, subjects may not have been familiar with a less prominent brand (Icehouse) in the beer category. Thus, interpretations of aided recall of Icehouse in this study warrant caution.

With regard to the recognition rates of respondents, all brands in each group saw an increase in the number from both unaided and aided recall. As previous literature had suggested (Brown, 1976; du Plessis, 1994; Lynch & Srull, 1982), this is somewhat an expected outcome with recognition procedure, because respondents are presented with a target stimulus within a list with distractors. A majority (57%) of the subjects recognized at least one or more of the target stimuli compared to the 33% and 36% unaided and aided recall rates respectively. This finding matches or is higher than previous studies in the past (d'Ydewalle et al., 1988; Lardinoit & Derbaix, 2001; Nebenzahl & Hornik, 1985; Pham, 1992).

The overall performance of the three measures of awareness, as well as their relationship to the corrected hit rates (H_{C2}), were excellent. This lends support to the extant literature (Leigh & Menon, 1986; Lockhart, 2000) that H_{C2} is an alternative measure of recognition that corrects for guessing. In addition, false-alarm rates were not significantly related to hit rates. This indicates that subjects were not randomly guessing in the recognition task. If they were guessing, a positive correlation between the hit rates and false-alarm rates would have emerged. False-alarm rates were significantly and negatively related to two unaided recall cases (Mercury & four exposures). These significant and negative relationships illustrate that when a brand has left a strong trace in one's memory, false identifications of bogus brands decreased in a recognition task. In other words, those respondents with better unaided recall rates were more likely to accurately identify the target stimuli.

Research Questions 1b, 2b, and 3b

Research questions 1b, 2b, and 3b assessed the effects of baseball involvement and team identification with the Texas Rangers and the Boston Red Sox. The effects of these factors were found inconsistently. Baseball involvement was found to influence unaided recall rates and aided recall rates for Mercury. With regard to both unaided and aided recall of Mercury, the results show that an increase in baseball involvement led to a lesser likelihood of recall. This is consistent with d'Ydewalle et al.'s (1988) study in which more involved viewers paid less attention to the stadium signage. Viewers with higher levels of baseball involvement tend to focus more on the game itself rather than on peripheral information. However, these findings contradict with prior research that

had reported an increase in awareness levels (Laridnoit & Derbaix, 2001) or found an inverted U-shape relationship in both unaided recall (Tavassoli et al., 1995) and recognition (Pham, 1992; Tavassolli et al., 1995) among involved consumers. The effect sizes regarding baseball involvement were low, ranging from 3% change to 7% change. These numbers indicate baseball involvement is a relatively minor factor with regard to brand awareness of virtual advertising.

Additionally, an interaction effect of repetition and baseball involvement in corrected hit rates (H_{C2}) was detected. This result suggests that as viewers' involvement with baseball increased, recognition rates decreased for those brands with more exposures. The effects of four exposures on corrected recognition rates had a marginal effect, while effect for those with six exposures was significant. Although effect size for this interaction was small (4.1%), this result implies that frequent exposure of virtual advertising to a more involved baseball fan would in fact decrease his or her recognition rates. Simply stated, more exposure of virtual signage (i.e., sponsorship signage) to highly involved baseball fans do not increase recognition rates, but has an adverse effect on them. This is a unique and interesting finding of this study. This may be due to the fact that more involved subjects are focused on the game or they are used to seeing signage behind home plate that they no longer pay attention to peripheral information with multiple exposures. Other analyses did not find baseball involvement to be related to brand awareness levels.

Effects for team identification were reported in one occasion. Team identification with the Rangers was found to increase the hit rates for Icehouse. No

effects were found for team identification with the Red Sox. Results indicate a support from Rangers fans of the team's sponsors. However, most of the subjects in this study indicated low identification with both teams. Different results may be present with different sample of fan who highly identify with a particular team. Because the effects of baseball involvement and team identification were not consistent, caution is suggested when interpreting and generalizing to other settings. In addition, researchers should investigate the effects of these factors in future studies.

Research Questions 1c, 2c, and 3c

Research questions 1c, 2c, and 3c assessed the effects of repetition in virtual advertising on individuals' awareness levels. In all groups, virtual advertising seemed to wore-in immediately for all unaided recall, aided recall, and recognition rates. These findings are consistent with previous studies in the past that found subjects were able to recall with one exposure to the stimuli (Cacioppo & Petty, 1979; Pechmann & Stewart, 1988; Ray & Sawyer, 1971). For unaided recall, with the exception of Mercury, exposing brands either four times or six times generated unaided recall rates, which were at least three times more than showing brands only once. These findings are similar to those of Ray and Sawyer (1971) and Singh and Cole's (1993) study that identified a linear relationship between recall and number of exposures. Unaided recall rates for Mercury had an interaction effect with animation, which is discussed in the next section. Although total unaided recall rates were low, multiple exposures of virtual advertisements left substantial traces in respondents' memories.

For aided recall, subjects who were exposed to four Champion brand logos had significantly greater likelihood of recalling the brand. With regard to Icehouse and Mercury, no effect of repetition was detected. It may not be wise to interpret Icehouse results because some of the subjects were younger than the legal drinking age. The effects of repetition did not influence respondents' recognition tasks. The non-significant findings of the main effect of repetition are similar to those of Pham (1991) who found that the exposure time of billboards does not always equate to recognition by viewers.

These results indicate that repetition of exposure tend to affect viewers' recall rates, but does not improve recognition levels. The results may be due to the different threshold of recall and recognition. In general, recognition tests are easier than recall tasks. This is because the thresholds for recognition are lower since they only require discriminating target items from distractor items (Brown, 1976). It seems that for many subjects, the traces left in memory for brands with one exposure were enough for recognizing, but not enough to recall them. On the other hand, brands with four or six exposures had enough traces for some subjects to recall them, but their recognition rates probably reached the wear-out point. Accordingly, this could have been the reason for recognition rates of one exposure to be not statistically different from those of four and six exposures in a laboratory setting.

Research Questions 1d&e, 2d&e, and 3d&e

Research questions 1d&e, 2d&e, and 3d&e assessed the effectiveness of animation and its potential interaction with repetition in virtual advertising. With one

exception, the findings suggest that there were no effects of animation on viewers' levels of awareness of virtual advertising. An interaction was detected for unaided recall of Mercury. Results indicate that the combination of four exposures and animation increased the likelihood of viewers' recall by 15.27 times and the combination of six exposures and animation increased the odds of recall of Mercury by 21.38 times. This is an interesting finding because, had animation not been incorporated, repetition of virtual advertising would not be significant for unaided recall of Mercury. Animation, coupled with repetition, can attract viewers' attention to the peripheral information.

Other analyses that generated non-significant results are consistent with Drèze and Hussherr's (2003) finding that animation of a banner in an online environment did not increase awareness. The reason for the failure to detect significance may be result of the nature of animation effect. With consultation of the virtual advertising company, constant animation effect was not used in this study. This is because television networks are still hesitant to use animation effects for fear of evoking negative reactions from viewers. Therefore, this study used subtle features of animation (appearing only eleven times after changes in brand logos were made). The subtlety and number of animations may have influenced the awareness levels.

Another explanation for this may be that the novelty of animation had worn out for most of the respondents. According to Tellis (2004), technology in advertising lasts only for a short period of time because of rapid imitation by competitors. Tellis (2004) reports that response rates for banner advertising were 10% when it first appeared on the Internet. However, reports show that due to heavy usage, the response rate declined

to 1% by 2002. This may be the reason for significant findings in Li and Bucovac's (1999) study and non-significant findings in Drèze and Hussherr's (2003) study and this study. This sample of college students, who are most likely technologically savvy, might have become used to watching animation effects either on television or the Internet and no longer consider them something that "pops-out" in their viewing experience.

The single most effective factor predicting viewers' awareness levels was the individual's tendencies to memorize the sponsors during the video exposure. This factor was significant in most of the analyses (with one exception being aided recall of Champion), consistently increasing the likelihood of recall and recognition. This factor was included in this study because demand characteristics need to be controlled when conducting experiments (Sawyer, 1975). In addition, brand involvement was not significant in predicting awareness levels except in two cases. Personal involvement with Champion was found to be significantly related to its hit rate and its aided recall. This may be due to the closer semantic relatedness of sports apparel to the game of baseball than other product categories used in the study. This relatedness may have influenced respondents' awareness levels. Similar to demand artifact questions, it is imperative that this construct be controlled in future awareness studies.

Managerial Implications

A majority of respondents (57%) recognized at least one of the target stimuli in the study. Recall rates for the target stimuli were lower than recognition, but at least a third of the respondents noticed them (unaided 33%, aided 36%). Since the game of

baseball allows ample space behind home plate for communicating messages, this space could continuously be used for this purpose.

In this study, hit rates, false-alarm rates, and corrected hit rates were calculated to further understand subjects' memory. Hit rates are essentially the percentage of correct selections of a target stimulus, whereas false-alarm rates provide measures of subjects' errors. The results provide consistent low false-alarm rates across respondents, groups, and exposures. These results may appear intriguing for parties involved in sponsorship. However, these figures may be, to an extent, deceitful because there are about a third of subjects that reported not seeing any advertisements in the recognition task (H = 0.0, FA = 0.0). Marketers should exercise care when interpreting the results because of the differences in individuals' decision criteria for hits and false-alarms. The cross-tabulation tables (Tables 21, 22, and 23) show that the relationship between hit rates and false-alarm rates are noteworthy. In each group, at least eleven subjects (out of 34 to 36 subjects) did not recognize any of the target advertisements. Within those subjects, three to seven of them associated the sporting event with other brands. In one case, two subjects in Group 1 claimed they had seen at least seven advertisements during the broadcast, which were all distractor items. Similarly, one subject in Group 3 answered, "Yes, I have seen the ad" nine times out of potential 15 distractor items. Even among those subjects who had correctly selected the target stimuli, some also reported recognizing bogus advertising during the broadcast.

With cross-tabulation of the data, additional insights were revealed. Non-sponsors of the game who were credited with sponsoring an event may enjoy benefits

from it, while the actual sponsors do not (Sandler & Shani, 1989). In other words, this false identification of other brands could cause actual sponsors to lose their competitive advantage because some other company in the same product category takes their place in the minds of consumers. While false identification in this study was not a result of an "ambush marketing" campaign; however, it still remains detrimental to sponsoring companies. Similar to the suggestions by Crimmins and Horn (1996) in ways to increase sponsorship effectiveness, managers may want to consider using television commercials in support of virtual advertising to increase its effectiveness.

Effects of baseball involvement and team identification on awareness levels were inconsistent in the study. Baseball involvement was found to decrease the levels of awareness in this study. Although the effects of baseball involvement on awareness levels in this study were small, managers might want to consider investing their money in conjunction with other promotional activities to counter the decrease of awareness. Examples might include media mentions during the game, trivia questions for sports fans, and product giveaways. On the other hand, team identification was found to increase recognition on one occasion. Literature indicates support of highly identified fans toward team sponsors, this is a positive finding. Managers may want to consider investing their money on teams with a large fan base, especially those with highly identified fans (e.g., Boston Red Sox, New York Yankees).

Repetition effects were found to affect recall, but not recognition. This indicates that managers who only want recognition of their brands do not need frequent exposures of their brand logo to the consumers. However, managers need to be

reminded that this study was conducted in a forced exposure setting. Therefore, managers should consider purchasing signage (virtual or real) for multiple exposures.

Animation effects slightly influenced awareness levels through interaction with repetition on unaided recall rates. The other non-significant findings, in most cases, indicate that it may be safe to not use the animation so that it will not evoke negative attitudes from viewers. Thus, virtual advertising should be placed so that it looks like an actual sponsorship signage at the event venue.

Although some respondents did not recall or recognize virtual advertising in this study, they may still have had been affected by it. For instance, Janiszewski (1988) found that incidental exposure to newspaper ads could increase reader attitude toward advertising and the brand, despite readers' ability to recognize the ad. Similarly, Shapiro, MacInnis, and Heckler (1997) found that incidentally exposed brands were included in an individual's purchase consideration set despite his or her explicit memory.

Overall, these non-significant (or inconsistent findings) effects of baseball involvement, team identification, animation, and repetition raise additional questions for managers. While researchers and practitioners have advocated the potential antecedents and effects of sponsorship signage in sport event venues, in this study, they were not as influential in predicting the brand awareness levels as suggested. Managers may want to consider the results of this study along with other studies to re-strategize their investment in sports.

Limitations of the Study

Limitations for this study include a lack of ecological validity because it was conducted in a laboratory setting and the quality of the videos may not have been professional grade. Some viewers may have noticed the degraded quality of virtual advertising in the stimuli, potentially making them aware of the content of the study.

The animation effect took place only when the brands were introduced on screen. Within 24 minutes of video time, there were eleven opportunities to watch the animation effect for those in the animation group. In addition, the animation effect did not include a game enhancement feature. First down lines in NFL or college football are sometimes drawn by a brand sponsoring the event. Since the brand helps enhance the viewing experience of consumers, it may leave stronger traces in one's memory. Thus, generalization for this study should be limited only to brand logos appearing for commercial purposes.

In addition, the placement of virtual advertising was limited to the canvas behind home plate. Other unique placement of virtual advertising may create different awareness levels for other subjects. Furthermore, physically existing signage took up the majority of the canvas behind home plate. Most virtual advertising displays are currently shown in an isolated area behind home plate. The existing signage may have affected viewers' learning experience.

The content of the video was from 2002. With the current fluidity of players in the Major League Baseball, several players belong to different teams in 2006 (e.g., Nomar Garciaparra moved from the Boston Red Sox to the Chicago Cubs to the L.A.

Dodgers; Rafael Palmerio moved from the Texas Rangers to the Baltimore Orioles; Kenny Rogers moved from the Texas Rangers to the Detroit Tigers; Alex Rodriguez moved from the Texas Rangers to the New York Yankees). In addition, some players had off-the-field problems prior to the study, and one of the players was an alumnus of the subjects' university. The stadium has been renovated, and the section behind home plate has changed since 2002. Therefore, viewers may have watched the video with greater interest and intensity than they usually watch baseball games. These factors may have swayed the subjects' attention more to the game than usual resulting in less awareness levels of virtual advertising.

Future Research Directions

In relation to virtual advertising, future research should consider other sports that may use it as an alternative means of communication. One such sport may be basketball. For example, regional coverage of Texas Tech University's men's basketball broadcasts is inundated with virtual advertisements. Placing virtual advertisements in different sport settings may raise additional research questions regarding their effectiveness.

The animation effect in this study appeared only when ads first appeared in the broadcast. Constant animation of brand logos may generate different responses from viewers. Furthermore, virtual advertising with animation effect allows managers to deliver corporate messages to consumers in sentences. Normal virtual advertising or sponsorship signage, the messages are usually the brand logo or at the longest no more than one or two words. However, longer messages can be delivered with the use of

animation effect of virtual advertising. They can be scrolled on the canvas or they can dissolve in and out of the canvas, creating sentences. Future studies should consider its effect on consumers.

In addition, exploring viewers' perceptions of combinations of virtual advertising should be considered. That is, broadcast companies have combined virtual game enhancement technology (e.g., virtual first down line in football) and commercial virtual advertising to increase effectiveness. Brand logos that help draw the virtual first down yard line or help indicate the speed of a pitch might evoke different awareness levels as well as different emotions than strictly commercial purpose virtual advertisements.

From a methodological standpoint, the survey was administered immediately after the subjects were exposed to the stimuli. The differences between immediate awareness and delayed awareness (e.g., day-after-recall) remain unknown. Singh, Rothschild, and Churchill (1988) reported that recognition decays over time, but very slowly. On the other hand, recall rates of advertising need consistent reinforcements (Krugman, 1972). Therefore, as time differences may affect recall and recognition differently in the virtual advertising context, future research should consider this factor.

Attitudes should be measured along with awareness levels to determine the acceptability of virtual advertising for brands (or companies) that use the medium to reach consumers. Some people may notice the virtual ads on television; however, they may perceive them to be annoying and deceiving rather than conveying brand related information. Bennett et al.'s (2006) study suggests viewers do not perceive them as

intrusive or deceptive. However, their study was conducted in a football broadcast without animation or repetition effects. These different factors may pose different effects and outcomes.

Future studies should also measure implicit memory to fully understand the effectiveness of virtual advertising. Shapiro and Krishnan (2001) argue that even when explicit memory is diluted in divided attention cases, implicit memories may still be preserved. In addition, Damasio (1999) found that feelings and emotions, which can greatly affect viewers' subsequent purchase decisions, are processed automatically and implicitly.

In conclusion, this study assessed the effects of baseball involvement, team identification, repetition, and animation on awareness levels of virtual advertising in sports. The results showed somewhat inconsistent effects of baseball involvement, team identification, and repetition on awareness levels. However, animation did not influence respondents' awareness levels. With the non-significant animation results, they suggest using virtual advertising similarly to sponsorship signage. This study was an initial attempt to determine the antecedents to brand awareness of virtual advertising in a controlled experimental setting. Further research of this communication method should provide additional contributions to the field of sport marketing.

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APPENDIX A

RELEVANT LITERATURE REVIEW

Virtual Advertising

Television viewing of sport has increased drastically in the United States. On the four major television networks, families could watch more than 2,000 hours of sport programming on annually, and those with cable television have access to 86,000 hours of sports television (Shank, 2005). Stotlar and Johnson (1989) found that nearly to three quarters of people in United States watch sports at least once a week on television. Nearly 93.2 million viewers tuned into Super Bowl XLI in Miami, making it the second most watched Super Bowl in history (Bauder, 2007). On a worldwide level, the world's most watched sport event, the FIFA World Cup 2006, was watched by more than 5.9 billion people (Reuters, 2006). This number exceeds the number of viewers in 2002 and surpasses those of the Athens Olympics in 2004. To meet the needs of consumers, television broadcasters have introduced sport-specific television channels such as ESPN U and College Sports Television. The increase in broadcasting hours and the influx of sport-specific channels indicate that sports coverage on television increases viewership.

To capitalize on this increase in viewership, corporations have started to use sport as a vehicle to communicate their messages to consumers via television commercials or sponsorship of an event or team in the form of stadium signage (Turner & Cusumano, 2000). These two methods of communication are commonplace in most televised sporting events.

Sport properties have benefited from this relationship with sponsoring companies and advertisers. Because sports draw a large audience, sponsors can reach their target market (Wolfe et al., 1997/1998). At the same time, sports have generated

revenue from this relationship, as well as increased exposure of their sport (Wolfe et al., 1997/1998). This interdependent relationship would not have been possible without the presence of the media. Sports and the media have evolved hand-in-hand. Researchers have noted "it is often difficult to discuss sport in modern society without acknowledging its relationship with the media" (Bernstein & Blain, 2002, p3). Sport, with the help of media, can build an audience and achieve a status (Wolfe et al., 1997/1998). In exchange, the media use sport to penetrate markets and attract audiences that advertisers want to reach (Goff & Ashwell, 2005; Wolfe et al., 1997/1998). In this way, sports have created symbiotic relationships with both the media and the sponsors (Wolfe et al., 1997/1998).

However, the relationships of sports, media, and sponsors may be changing with the introduction of new technology. With the advent of "TiVo" and other digital video recorders (DVRs), consumers are now skipping commercials to enhance their television viewing experience (Zeisser, 2002). This technology allows viewers to pause and perform instant replays of live broadcasts as well as skip commercials at their own will. Forrester Research reports that owners of DVRs watch 60% of the programs they recorded and skip 92% of the ads (Kridler, 2005). Nielsen Media Research expected that 18% of US households would own a DVR by December 2006, and they expect that figure to increase to 39% by 2010 (Kiley, 2006). Household penetration is more prevalent in high income and educated households (Kiley, 2006). This type of viewing behavior is a huge concern to advertising-supported television because advertisers may withdraw their money (Boddy, 2004). Procter & Gamble Co., which spent $2.5 billion

dollars on advertising in 2004, has already reduced its advertising budget by as much as 25% (Kridler, 2005). In addition, some sporting events have experienced decreased viewing rates due to the abundant channels available through cable television and satellite dishes (de Moraes, 2006; Levin, 2006).

To provide solutions to viewers' ability to skip commercials and to battle broadcast rating erosion, marketers and companies have started to use a new technology called virtual advertising (Friedman & Kerwin, 2005). Virtual advertising is a digitized superimposition of an image onto a television screen (Turner & Cusumano, 2000). This technological advance has allowed marketers to communicate corporate messages that viewers cannot escape using DVRs. Virtual advertising, sometimes called electronic billboard or virtual signage, allows marketers to place a logo anywhere in the stadium or on the playing surface in a television broadcast (Burgi, 1997; Méndez, 1999; Turner & Cusumano, 2000). The spectators at the game do not see the signage, but the television audience will be exposed to them. Virtual advertising can also make the logos appear as if they were real logos in the stadium (Méndez, 1999). Virtual advertising has been used in college football games where a corporate logo appeared in the stands and on the actual playing field. Additionally, virtual signage has appeared on selected collegiate basketball broadcasts (K. Overton, personal communication, October 18, 2005).

Virtual technology has been used in three broad ways in television broadcasts. First, it is used for commercial purposes. Corporate logos on the actual playing field of a college football game or signage behind home plate of a baseball game are good

examples of this usage. Second, this technology is used for game enhancement purposes to provide viewers with increased insight about the game. An example for this usage can be seen in televised football games that show the virtual first down line. Finally, this technology is used to integrate corporate products within a sitcom, movie, or DVD (Lubell & Carr, 2006). Virtual product placements have appeared on syndicated shows such as "Friends" and are being welcomed by television producers to balance production costs (Friedman & Kerwin, 2005). Spending on product placement reached $3.45 billion in 2004, according to PQ Media (Lubell & Carr, 2006).

The goals of firms that choose virtual advertising are similar to those of companies that purchase other sponsorship signage around the stadium. For example, virtual advertising can be used to reach a specific target market, increase brand awareness, leverage products, transfer images of the event to the product or brand, and send messages to consumers (Cianfrone et al, 2006). Although the objectives may be the same as those of conventional advertising, virtual advertising offers advantages over physically existing signage. Turner and Cusumano (2000) suggest the advantages of virtual advertising. For example, the technology can keep the logos onscreen all the time, if the broadcaster so desires, where as existing stadium signs are only seen when the game action occurs in the part of the field where the sign is placed (Turner & Cusumano, 2000).

Virtual advertising can also be used to change signage according to geographic locations (Turner & Cusumano, 2000). For example, marketers who have a product with only regional appeal can display a sign for their specific areas. In 1998, viewers of

a San Diego Padres and San Francisco Giants game saw different local versions of a virtual advertisement (Fahri, 1998). Viewers in San Diego saw an advertisement for the San Diego Zoo while viewers in San Francisco saw a virtual sign for Hitachi in the same place (Fahri, 1998). This strategy can also be applied to fit a company with a global strategy. A specific sign can be displayed in different languages according to the countries in which it is being broadcast.

Additionally, virtually inserted signage can be rotated or changed easily with the click of a button, which permits display of numerous companies in a single sport broadcast. Lastly, this technology allows signage to be animated to attract viewers' eyes. A company's blimp may be in the air during the broadcast, or a sign may be introduced with an animation effect for more appeal. Fox TV has used the animation aspect of this technology when they had a Ford F-250 truck virtually come on and off the field for ten seconds during an NFL game (Elliott, 2002). In another case, BMW of North America had launched an advertising campaign in which their logos have been inserted during a soccer match (Greenberg, 2003). BMW decided to send virtual vehicles across the field; "brand" the center field with their logos; blink the logos when a team has scored a goal; and insert in-game virtual billboards when flow of the game allows (Greenberg, 2003). In a baseball setting, viewers of the inaugural World Baseball Classic held in 2006 saw logos behind home plate appear with an animation effect.

This technology has been welcomed by several parties. Providers of virtual advertising claim that stadiums can be maintained without advertising billboards (Méndez, 1999). Fans will no longer have to withstand the blatant display of signage at

the stadium (Méndez, 1999). Players, especially pitchers, have welcomed the introduction of this new technology because rotational signage behind home plate distracted their view (Méndez, 1999). Virtual signage can solve those problems.

As noted above, virtual advertising can display different signage in accordance with the local market (Fahri, 1998; Méndez, 1999; Turner & Cusumano, 2000). This indicates a significant increase in potential advertising dollars for the sports organization as well as broadcasters. However, this may create legal problems. In Australia, a facility owner threatened to ban live coverage of a cricket game due to an intended use of virtual advertising by the television network (Méndez, 1999; Turner & Cusumano, 2000). Facility owners claimed that the television network did not own the space for virtual advertising (Méndez, 1999). This problem, along with other potential problems, suggests that all parties involved should understand their legal obligations in the use of virtual advertising.

Virtual advertising offers numerous advantages and disadvantages. Although legal disadvantages were observed in the past, solutions to these problems seem plausible (Turner and Cusumano, 2000). With increased interest in its ability to deliver corporate messages, this technology seems likely to be more prevalent in the future. Specifically, animation effects have started to become more common to cut through the clutter and draw attention of viewers. Thus, this study was undertaken to further understand viewers' perceptions of virtual advertising in sports.

Advertising Effectiveness

Marketers usually try to communicate product information to consumers through advertising (Pride & Ferrell, 2003). Through advertising, they intend to inform and persuade consumers to stimulate demand for a product (Pride & Ferrell, 2003). Studying advertising effectiveness has been a difficult task that both practitioners and scholars shared for years (Mullin et al., 2000).

The first attempt at deciphering how advertising works in the mind of a consumer is based on the AIDA model (Attention → Interest → Desire → Action) and was conducted by E. St. Elmo Lewis in 1898 (Vakratsas & Ambler, 1999). This hierarchical model explains that an individual will go through this process when exposed to an advertisement. Vakratsas and Ambler (1999) discuss the taxonomy of seven different models of advertising effectiveness in their thorough review of related journal articles and proceedings papers. They categorize people's intermediate responses to advertising. According to Vakratsas and Ambler (1999), advertising must have some mental effect (e.g., awareness, attitude) in order to affect people's behavior. These dimensions or intermediate responses consist of cognition, the "thinking" part of an individual's response, affect, the "feeling" dimension, and lastly experience, how people look back to prior experience for usage.

The first model they discuss is the market response model, which uses none of the aforementioned dimensions. This model is an econometric model that tries to understand behavioral outcomes (e.g., sales) by using of advertising, price, and promotional measures (Vakratsas & Ambler, 1999). The model excels at using

objective data and removing the uncertainties that arise from intermediate responses (Vakratsas & Ambler, 1999). The second and third models are the "cognitive information" and "pure affect" models. The cognitive information model assumes that consumers' preferences are not influenced by advertising and that their decisions are completely rational (Vakratsas & Ambler, 1999). Thus, this "thinking" model builds only on the informative role of advertising. The third model assumes that consumers form their preferences based on feelings and not on product information (e.g., Batra & Ray, 1986; Mitchell & Olson, 1981). These affective responses can lead to forming an attitude toward the brand and an attitude toward the ad (Mitchell & Olson, 1981), which is important in predicting purchase intentions (Mackenzie, Lutz, & Belch, 1986). Attitude toward the ad is defined as a "predisposition to respond in a favorable or unfavorable manner to a particular advertising stimulus during a particular exposure occasion" (Lutz, 1985, p.46). Attitude toward the ad seems to influence attitude toward brand, which eventually affects brand purchase intentions (Mackenzie et al., 1986).

The next model, the persuasive hierarchy model, assumes that advertising must inform consumers first and then persuade them of its appeal (Vakratsas & Ambler, 1999). In other words, the model follows a sequence of cognition → affect to evaluate advertising information (Vakratsas & Ambler, 1999). Studies using this model have frequently used a moderator or mediator (e.g., involvement) to understand advertising effectiveness; the most notable is the Elaboration Likelihood Model (ELM) (Petty, Cacioppo, & Schumann, 1983). In contrast to this approach, products that are considered low in involvement work using different mechanism (Vakratsas & Ambler,

1999). When a consumer deems a certain product category to be low in involvement, product experience seems to dominate product preference, although advertising reinforces existing habits and shapes experiences (Ehrenberg, 1994; Pechmann & Stewart, 1989). This model proposes that advertising effectiveness works in the order cognition → experience → affect.

The next model is the integrative model, which incorporates cognition, affect, and experience to work in different hierarchical orders depending on the context of advertising and settings (Vakratsas & Ambler, 1999). For instance, level of involvement or familiarity may be a factor influencing the order of the intermediate responses. Hierarchy-free models conclude Vakratsas and Ambler's (1999) taxonomy of advertising effectiveness models. This model includes all others that do not fit into the aforementioned models and encompasses those that have more person-centered views of advertising (Vakratsas & Ambler, 1999).

Sponsorship Effectiveness

Virtual advertising, if not animated or placed in a unique area, may be perceived by viewers as a sponsorship billboard in the stadium. Bennett et al. (2006) argued that virtual advertising may in fact be closely related to sponsorship than it is to other forms of advertising. Accordingly, it is imperative that the effectiveness of sponsorship be discussed. Corporate sponsorship is a rapidly growing marketing communication options for companies. Sponsorship of events has become more prevalent in the 21st century because it is believed to reach audiences that are considered difficult to reach

using traditional advertising (Quester & Thompson, 2001). In 2005, sponsorship dollars surpassed $30 billion worldwide (Marketing News, 2006). Within North America, sponsorship spending is expected to surpass $13 billion, of which close to 70% (i.e., $8.9 billion) will be spent on sports (Marketing News, 2006). Sponsorship has been defined as "an investment, in cash or in kind, in an activity, in return for access to the exploitable commercial potential associated with that activity" (Meenaghan, 1991b, p.36). This definition implies that corporate objectives in sponsorship are not altruistic, but instead they try to accomplish the following: (a) expose their corporate involvement with the sport, and (b) associate the image of the sport with the company (Meenaghan, 1991b).

A major objective of sponsorship is to increase brand awareness and enhance and/or alter brand image through association with the sponsored activity (Meenaghan, 1991b; Parker, 1991). The use of sponsorship is preferred over other forms of marketing communication because it is believed to cut through the clutter (Madrigal, 2001). In addition, it is difficult to differentiate a product based on technological advancements and improvements because competitors immediately create an imitation of the original product (Parker, 1991). Thus, it is crucial to use the attitudinal (i.e., image) aspects of the brand to differentiate itself from the competitors through a communication medium such as sponsorship (Parker, 1991).

In the past, sponsorship research has not been well conducted due to a perception that it was not worthwhile (McDonald, 1991). Additionally, the fact that sponsorship effects were difficult to see and the sheer fact that marketers were afraid to

know the real effect made researchers reluctant to conduct the study (McDonald, 1991). In the studies actually conducted, an initial attempt was made to measure information such as media mentions and exposure time of billboards and signage during a broadcast (Jones & Dearsley, 1989; Meenaghan, 1991b; Parker, 1991). These types of measurement (i.e., measuring media coverage) have been criticized because they do not necessarily correlate with recall and other attitude changes (Pham, 1991; Quester & Farrelly, 1998). Other studies have explored recall and recognition measures for sponsors at events (Cuneen & Hannan, 1993; Sandler & Shani, 1993; Stotlar & Johnson, 1989). Although brand awareness measures (i.e., recall and recognition) are considered as one of the main objectives of the sponsors (Madrigal, 2001; Sandler & Shani, 1993), these tests tend to have small and ambiguous effects (Cornwell & Maignan, 1998). They are considered first-line measures of sponsorship impact; thus, they do not illustrate the main picture of consumer relationships with the sponsors (Meenaghan, 2001a).

In a more recent effort, Meenaghan (2001a) used a focus group to understand sponsorship effectiveness. He attempted to understand individuals' perception toward sponsorship, which is expected to eventually influence consumers' attitudes and behavioral intentions toward the brand. Investigation of attitudes and behavioral intentions is important because these two factors are considered central in explaining actual purchase behaviors (Ajzen, 1991; Eagly & Chaiken, 1993; Lutz, 1991).

Through sponsoring an activity, a company hopes to benefit from the rub-off effect of the image of the event onto their corporate brand image (Crimmins & Horn,

1996; Gwinner & Eaton, 1999; Meenaghan & Shipley, 1999; Meenaghan, 2001a; Quester & Farrelly, 1998). According to the media vehicle effect, media vehicles hold unique characteristics perceived by the receiver that will affect responses (Meenaghan & Shipley, 1999). In the case of sport sponsorship, each sport has distinctive features (e.g., action sports: alternative, individualistic, risky) in the minds of consumers. When a brand is linked to an event through sponsorship, the images of the event are considered to transfer to the sponsor and vice versa (Crimmins & Horn, 1996; Gwinner & Eaton, 1999; Jones & Dearsley, 1989; Meenaghan & Shipley, 1999). Gwinner and Eaton (1999) showed that the brand image of an event transfers from event to the sponsors. Jones and Dearsley (1989), through both their qualitative and quantitative inquiry, found that sponsors could in fact influence the image of the sport. This transfer process is enhanced if there is functional or image congruence between the brand and the event. Similar results have been observed with sponsorship of the Olympics and its effect on both corporate and brand images (Crimmins & Horn, 1996; Stipp & Schiavone, 1996). Crimmins and Horn (1996) report that showing the link between a sponsor and an event clearly will further process the image transfer effect. They also emphasize the importance of using other communication channels to strengthen the link between the activity (e.g., sports) and the brand. Companies that sponsor an event may also benefit from consumers' cognitive elaboration, which suggest that sponsors must be "big" or have "good quality" to be able to sponsor the event (Pracejus, 2004).

According to Meenaghan (2001a), the formations of brand attitude or brand image among consumers in sponsorship settings are contingent on the level of goodwill

in sponsorship and the intensity of fan involvement. Sponsorship works differently from other advertising and promotion activities in a way it bestows benefits (e.g., financially) on an activity to which consumers' have an emotional attachment (Bloxham, 1998; Meenaghan, 2001a; 2001b). Thus the relationship between the company and the event generates a goodwill effect among fans (Meenaghan, 1991a). Additionally, this construct is considered to be what "ultimately differentiates sponsorship from advertising" and probably the reason why consumers respond differently to the two of them (Meenaghan, 2001a; p.100). Other researchers have termed goodwill as "gratitude" (Crimmins & Horn, 1996) or "reciprocity" (Pracejus, 2004). This felt sentiment is believed to derive not only from the benefit given, but also from the subtle, indirect, and disguised form of persuasion (Meenaghan, 2001a). However, the level of perceived goodwill differs with sponsorship category and the degree of exploitation (Meenaghan, 2001a; Meenaghan & Shipley, 1999). It is commonly said that the perceived goodwill is higher for sponsoring a philanthropic event (e.g., social cause, environmental programs) than for sponsoring popular arts or sporting events (Meenaghan, 2001a, 2001b; Meenaghan & Shipley, 1999). Furthermore, sponsoring mass sports or mass arts event is perceived as similar to advertising (Meenaghan & Shipley, 1999). The degree of exploitation is also negatively correlated with perceived goodwill (Meenaghan & Shipley, 1999).

The other factor that thought to moderate the formation of brand attitude or brand image is fan involvement (Meenaghan, 2001a, 2001b). Fan involvement refers "specifically to the extent to which consumers identify with, and are motivated by, their

engagement and affiliation with particular leisure activities" (Meenaghan, 2001a, p.106). In the case of sponsorship, companies build and share a relationship with fans who usually have emotional attachment to a certain activity (Meenaghan, 2001a). For instance, Meenaghan (2001b) found more positive responses (e.g., goodwill) from those fans who were more emotionally involved with the activity. Pitts (1998) found that respondents at the Gay Games showed more support for and expressed their intentions to purchase from sponsors. She argues that the lesbian and gay population seems to be more appreciative of sponsors' support and tend to reciprocate them with loyalty. As Bloxham (1998) suggested, sponsors can reap the strongest effects from their contract by sponsoring contents that have stronger viewing loyalty and involvement. In their article about Olympic sponsorship effectiveness, Crimmins and Horn (1996) explained, "Fans are grateful for sponsorship. Others are not" (p. 17).

Although numerous positive effects can be generated by sponsorships, they can also create negative images for a brand. Obviously, sponsoring intrusive or inappropriate programs might create negative attitudes towards a brand (Bloxham, 1998). Meenaghan (2001b) explored the negative aspects of sponsorship and identified that fans may consider overt exploitation of sponsorship to be excessive and also resent corporate involvement that actually interferes with the sport itself. For instance, fans of the Olympics around the world might feel negatively about NBC and the International Olympic Committee's recent decision to move the swimming and gymnastics competition to early in the day (2008 Beijing Olympic Games) to serve the US audience (Atkinson, 2006). In addition, fans might dislike preferential allocation of tickets to

sponsors because it may deny access to real fans who wish to attend the game (Meenaghan, 2001b). Other criticism toward sponsorship was that companies sponsor only high-profile events (Meenaghan, 2001b). Although respondents raised concerns about this matter, they were well aware of the business objectives of sponsors, the benefits created, and the reasons for entering the sponsorship contract (Meenaghan, 2001b; Stipp, 1998).

Sponsorship, aside from effects of goodwill and fan involvement, is considered different from advertising (Hastings, 1984; Meenaghan, 2001b). Advertising can convey information forcefully to change consumers' perceived brand image, whereas sponsorship tries to enhance perceived brand image through association with sports (Crimmins & Horn, 1996). Advertising has control over the contents it portrays to the viewers; sponsorship has space limitations and can display only one or two words (Hastings, 1984; Nebenzahl & Hornik, 1985). The quantity and quality of signage exposures during a broadcast are beyond the control of the sponsor because the camera is in constant motion (Meenaghan, 1991a; Nebenzahl & Hornik, 1985; Pham, 1991). In addition, consumers' perceptions of the messages or the images sent through sponsorship depend on their own interpretations (Crimmins & Horn, 1996). In traditional advertising, such messages can be explicitly stated and the connection easily drawn between the message and the brand (Hastings, 1984).

Compared to sponsorship, advertising is deemed selfish and negative by the respondents in Meenaghan's (2001b) study. Sponsorship, on the other hand, had more positive response due to its indirect and subtle method of persuasion and its background

role within the activity. In addition, companies involved with sponsorship are regarded as benefiting the society, whereas companies using advertising are concerned solely about themselves (Meenaghan, 2001b).

To reap the most benefit out of a sponsorship contract, companies should tie-in other advertising and promotional activities (Crimmins & Horn, 1996; Pitts, 1998). In a broadcast setting, Pokrywczynski (1994) argued that arena billboards need 8 – 20 times more exposure than a television commercial to enjoy the same benefit. Cianfrone et al. (2006) found greater recall for television advertisements than for virtual advertisements in a college football broadcast.

Cornwell et al. (2005) provided an overview of theoretically grounded sponsorship effectiveness studies. According to Cornwell (1999) and Cornwell and Maignan (1998), past studies lacked theoretical frameworks to explain how sponsorship works. They present a model of "Consumer-Focused Sponsorship-Linked Marketing Communications" in which they consider that individual and group factors (past experience, knowledge, involvement, arousal, social alliance), market factors (brand equity, clutter, competitor activities), and management factors (sponsorship policy, activation, leverage) go through a "processing mechanics" to produce an outcome (awareness, attitude, purchase intentions). Their article focused on these theoretical mechanics used in the literature to provide a better understanding of theory development in sponsorship effectiveness and to enhance theoretically grounded studies. Theories mentioned in their article were mere exposure (e.g., Bennett, 1999), low-level processing (e.g., Olson & Thjømøe, 2003), reactivation (e.g., Pham & Vanhuele, 1997),

matching/congruence (e.g., Gwinner & Eaton, 1999; Johar & Pham, 1999; Johar et al., 2006; McDaniel, 1999), articulation (e.g., Cornwell, Humphreys, Maguire, Weeks, & Tellegen, 2006), balance/meaning transfer (e.g., Dean, 2002), identification (e.g., Madrigal, 2001), classical conditioning (e.g., Speed & Thompson, 2001), prominence heuristic (Johar & Pham, 1999; Johar et al., 2006; Pham & Johar, 2001), and attribution theory (Dean, 2002; Rifon, Choi, Trimble, & Li, 2004). As Cornwell et al. (2005) mention, it is imperative that a theoretical framework be formed and used to further understand consumers' perceptions of sponsorship.

Another suggestion by Cornwell et al. (2005) is the use of experiments to fully understand sponsorship effectiveness. Past studies have mostly been conducted in the field. However, Pham (1991) argues that the effect of sponsorship cannot be measured in a field setting; rather, he contends that it should be tested experimentally to single out the effects of other marketing communications. Johar et al.'s (2006) approach of initially utilizing experiment (Johar & Pham, 1999; Pham & Johar, 1997, 2001) and moving onto field study (Johar et al., 2006) seems to be appropriate for future sponsorship effectiveness research.

Alternative Measures of Recognition

According to Singh and Churchill (1986, 1987), recognition tests are criticized for their failure to account for respondents' errors. Researchers argue that failing to account for errors may lead to erroneous conclusions (Brown, 1976; Leigh & Menon, 1986). One source of this error is "acquiescence response set" bias (Singh & Churchill,

1986; 1987). This bias is an individual's general tendency to respond in a favorable way (i.e., "yes") rather than in a negative way (i.e., "no") to a set of questions. Singh and Churchill (1986) refer to these people as "yea-sayers" and "nay-sayers," respectively. Others allusions to response biases included guessing while uncertain about the decision, an eagerness to help the researcher, and etc. (Singh & Churchill, 1987).

To correct for biases and guessing by the respondents, researchers have derived alternative measures using threshold theory and signal detection theory (Green & Swets, 1966; Leigh & Menon, 1986; Link, 1982; Luce, 1963). Leigh and Menon (1986) and Snodgrass and Corwin (1988) explain a thorough comparison of these methods. First, measures from signal detection theory are discussed followed by threshold theory, and nonparametric models.

The most widely used method of detecting and correcting recognition measures is signal detection theory (Cradit, Tashchian, & Hofacker, 1994; Green & Swets, 1966; Leigh &Menon, 1986; Macmillan & Creelman, 2005; Shapiro, 1994; Singh & Churchill, 1986; 1987; Tashchian, White, & Pak, 1988). It assumes the following (Cradit et al., 1994; Shapiro, 1994; Singh & Churchill, 1986; 1987): any information encoded or stored has strength in one's memory (some researchers suggest the degree of familiarity); measurements of both target and distractor items are normally distributed; exposure to information increases the strength in memory; and an individual sets a decisional criterion (threshold) on the strength (familiarity) continuum. In signal detection theory, target items are often termed as "old," and distractor items are called "new." In this study, for the ease of explanation, the terms "target" and "distractor" are

used instead of "old" and "new." In addition, for the same reason, the familiarity continuum is used instead of memory strength to explain signal detection analysis.

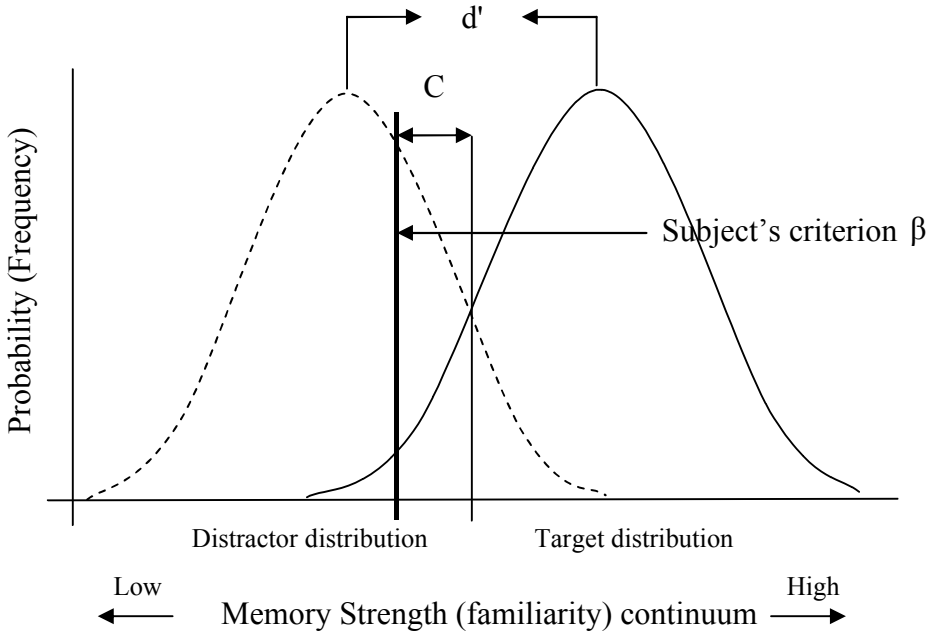

Figure A-1 – Illustration of signal detection analysis

Both target and distractor items should have a certain degree of familiarity. Some target items may have high familiarity, whereas others are medium or low. Distractor items will also have different levels of familiarity, but with a lower mean than the target items. Therefore, during a recognition test, an individual should form an overlapping distribution for both target and distractor stimuli. At this point, the respondent decides if his or her familiarity with the item exceeds his or her set criterion. Any item that is to the right of the criterion (Figure A-1) in the target distribution is marked as a "hit," whereas those that fail to exceed the criterion in the target

distribution are recorded as a "miss." On the other hand, items that pass the criterion in the distractor distribution are considered "false-alarms," and those that fell short are called "correct rejections." The two distributions may overlap very closely, meaning that the respondent cannot decide between target items and distractor items. On the other hand, the two distributions may not overlap at all, which suggests that the respondent easily distinguished target items from distractor items without making errors.

The focus, then, shifts to how far apart the two distributions are (i.e., sensitivity) and where the individual sets his or her decision criterion (i.e., response bias). Sensitivity refers to an individual's ability to accurately discriminate a target stimulus from the non-target stimuli (Shapiro, 1994). In marketing and psychology, researchers have utilized d' (d prime) to measure sensitivity (Cradit et al., 1994; Shapiro, 1994; Singh & Churchill, 1986; Snodgrass & Corwin, 1988). d' is the distance between the means of both distributions in standard deviation units given that these distributions are normally distributed and have equal variance (Shapiro, 1994; Singh & Churchill, 1986; 1987). It can be measured by the following formula (Singh & Churchill, 1986):

$$d' = z(H) - z(FA) \qquad (A - 1)$$

where z(H) is the z score in the target distribution, and z(FA) is the z score for the distractor distribution. A d' = 0 indicates that the two distributions overlap and the respondent cannot make distinguish between the stimuli. d' > 0 shows a respondent's ability to discriminate between the stimuli, and d' < 0 implies that the respondent is

either guessing, or giving contrary responses, or that there is a measurement error (Singh & Churchill, 1986).

From the signal detection analysis, a couple of bias measures can be calculated (Snodgrass & Corwin, 1988). The intention is to determine where the criterion is located along the familiarity continuum. People may differ in their respective degrees of familiarity for decision-making in a signal detection task. In other words, some people may be very careful when making decisions and a certain degree of familiarity will not suffice to report recognition, whereas the same degree of familiarity might be enough for others. In the literature, people in the former group are labeled conservative and the latter liberal respondents (Shapiro, 1994; Singh & Churchill, 1986; Snodgrass & Corwin, 1988). The contribution of signal detection analysis is that the decision style of the respondents (liberal or conservative) is independent from the level of sensitivity (Tashchian et al., 1988). The measures used here are the likelihood ratio measure, β, which locates the criterion by the ratio of the heights of the two distributions and the intersection measure, C, which estimates the location of the criterion by its distance from the intersection of the two distributions (Shapiro, 1994; Singh & Churchill, 1986; Snodgrass & Corwin, 1988). The β measure can be calculated by (Snodgrass & Corwin, 1988):

$$\beta = f_t\, z(H) / f_d\, z(FA) \qquad (A - 2)$$

where f_t is the height of the target distributions and f_d is the height of the distractor distribution. $\beta = 1$ indicates that the subject did not have any bias and set his or her criterion on the intersection (Snodgrass & Corwin, 1988). $\beta > 1$ implies an individual's tendency to respond in a more conservative way, in which he or she locates the criterion to the right of the intersection. On the other hand, $\beta < 1$ indicates a liberal criterion, meaning that he or she may have a high hit rate as well as a high false-alarm rate. Snodgrass and Corwin (1988) suggest the natural logarithm value to be used in further analysis to prevent complications. This transformation uses $\beta = 0$ as the neutral criterion, $\beta < 0$ for liberal responses, and $\beta > 0$ for conservative responses. The natural logarithm of β can be calculated by (Snodgrass & Corwin, 1988):

$$\ln(\beta) = \ln [f_t z(H) / f_d z(FA)] \qquad (A - 3)$$

The C measure is similar in that it attempts to determine the distance between the criterion and the intersection. The C measure at the intersection is zero and the distance from that point is measured in z score units (Snodgrass & Corwin, 1988). A neutral response bias will yield a $C = 0$. Conservative response biases will have positive C values, and liberal response biases will produce negative C values (Snodgrass & Corwin, 1988). The C value can be calculated by (Snodgrass & Corwin, 1988):

$$C = 0.5 [z(FA) + z(H)] \qquad (A - 4)$$

Signal detection theory assumes that the distributions of both target and distractor items are normal (Brown, 1976; Leigh & Menon, 1986; Shapiro, 1994; Singh & Churchill, 1986; 1987; Snodgrass & Corwin, 1988). However, responses to recognition tests are not always distributed normally. In fact, Leigh and Menon (1986) report that some studies failed to show the normality of their distribution. To check for normal distribution, scholars can resort to the Receiver Operating Characteristic (ROC) graph (Leigh & Menon, 1986). An ROC graph plots the hit rate on the y-axis and the false-alarm rate on x-axis. When normality is assumed in the data, the ROC graph should present a linear relationship (Brown, 1976).

If the normality of the data cannot be assumed, alternative methods of measurement should be pursued. Snodgrass and Corwin (1988) discussed signal detection analysis when the data at hand are in a logistic distribution. They contend that indices based on signal detection theory with logistic distributions are easier to calculate than those of normal distribution and reduce the chance of error. The indices and calculations are as follows (Snodgrass & Corwin, 1988):

$$d_L = \ln\{[H(1 - FA)] / [(1 - H)FA]\} \quad (A - 5)$$

$$\ln(\beta_L) = \ln\{[H(1 - H)] / [FA(1-FA]\} \quad (A - 6)$$

$$C_L = 0.5 [\ln\{[(1 - FA)(1 - H)] / [(H)(FA)]\}] \quad (A - 7)$$

On the other hand, other researchers have advocated the use of threshold theory (Leigh & Menon, 1986; Luce, 1963; Snodgrass & Corwin, 1988). Luce's threshold

theory (1963) predicts that decision space is composed of few distinct states (Leigh & Menon, 1986; Macmillan & Creelman, 2005). A threshold exists between these states, and any stimulus that falls below a threshold cannot be discriminated as different by respondents (Leigh & Menon, 1986). One of the methods that have been proposed to correct for guessing is the H_{C1} measure (Brown, 1976; Leigh & Menon, 1986). H_{C1} can be calculated by the following formula (Leigh & Menon, 1986):

$$H_{C1} = [H - (1 - H)] [(T/N) / (1 - T/N)] \quad (A - 8)$$

In this formula, T is the number of targets in the set, and N is the total number of items (i.e., target plus distractors). Another measure of sensitivity that originates from threshold theory is the H_{C2} measure, which is simple and often used. It can be calculated by estimating the difference between the hit rate (H) and the false-alarm rate (FA) (Leigh & Menon, 1986):

$$H_{C2} = H - FA \quad (A - 9)$$

Calculation for the above analyses of recognition is rather simple and do not have to account for other assumptions (Leigh & Menon, 1986). Lockhart (2000) argued that this simple method of adjusting for guessing is sufficient in recognition research. Furthermore, these simple measures have been empirically found to be consistent and converge with recall measures (Leigh & Menon, 1986).

Snodgrass and Corwin (1988) propose measures using the two-high threshold model. This model consists of three different mental states: one in which target items are recognized as target items; one in which distractor items are recognized as distractor items; and one that is uncertain. According to this view, a false alarm is generated by an individual's guessing of a distractor item in the uncertain state. To correct for guessing and locate the sensitivity measure, H_{C2} is also suggested. For the response bias measure (i.e., equivalent to the β measure in signal detection analysis), B_r is suggested. This index measures the tendencies of subjects to say "yes" to an item when in an uncertain state. It can be calculated by the following (Snodgrass & Corwin, 1988):

$$B_r = FA / [1 - (H - FA)] \qquad (A - 10)$$

According to Snodgrass and Corwin (1988), neutral bias is presented with a value of 0.5. A value higher than 0.5 will indicate a liberal bias, and a value less than 0.5 represents a conservative bias.

Another method that has caught the attention of researchers is the nonparametric model (Green & Swets, 1966; Grier, 1971; Leigh & Menon, 1986; Pollack & Norman, 1964; Shapiro, 1994; Singh & Churchill, 1986; 1987; Snodgrass & Corwin, 1988; Tashchian et al., 1988). Some of the advantages of this model are (a) it makes no assumption about the distribution of items; (b) measures can still be calculated even if a respondent answers all target items correctly; and (c) parametric analysis such as analysis of variance can be used for nonparametric measures (Shapiro, 1994). The

model uses the ROC graph to estimate the sensitivity and bias measures. Green (1964) and Green and Moses (1966) has suggested that one's memory performance in a forced choice test can be estimated from the area below the ROC curve.

In this model, an equivalent measure to the d' (sensitivity measure) is the A' measure and the measure for the bias indices are the B" and B'_H (Singh & Churchill, 1987; Snodgrass & Corwin, 1988). The latter of the bias indices is a measure proposed by Hodos (1970) that computes the area beneath the ROC curve differently. Brown (1976) and Leigh and Menon (1986) refer to A' as an R-measure and introduce another measure of sensitivity, which is the A-index. According to Brown (1976), the A-index is most suited for comparing directly with recall measures. It also corrects for bias of the R-measure (Leigh & Menon, 1986). These nonparametric measures can be calculated by the following formulae (Grier, 1971; Leigh & Menon, 1986; Snodgrass & Corwin, 1988):

R (A')

$$\text{If } H \geq FA = 0.5 + [(H - FA)(1 + H - FA)] / [4H(1 - FA)] \qquad (A - 11)$$

$$\text{If } H < FA = 0.5 - [(FA - H)(1 + FA - H)] / [4FA(1 - H)] \qquad (A - 12)$$

$$\text{A-index} = 2R - 1 \qquad (A - 13)$$

B"

$$\text{If } H \geq FA = [H (1 - H) - FA(1 - FA)] / [H(1 - H) + FA(1 - FA)] \qquad (A - 14)$$

$$\text{If } H < FA = [FA (1 - FA) - H(1 - H)] / [FA(1 - FA) + H(1 - H)] \qquad (A - 15)$$

B'_H

$$\text{If } H \leq (1 - FA) = \{[H(1 - H)] / [FA(1 - FA)]\} - 1 \quad (A - 16)$$

$$\text{If } H > (1 - FA) = 1 - \{[FA(1 - FA)] / [H(1 - H)]\} \quad (A - 17)$$

When the hit rate equals the false-alarm rate, the R-measure (A') value would equal to 0.5 (Snodgrass & Corwin, 1988). In addition, a larger R-measure (A') indicates more sensitivity by the subject (Shapiro, 1994). For B"and B_H measures, they lie between -1 and +1 and a value of zero implies that the subject has a neutral criterion; positive values indicate a liberal criterion, and negative values indicate a conservative criterion (Snodgrass & Corwin, 1988).

Thus have researchers accounted for subjects' guessing and decision criteria in recognition testing. Several researchers agree that failure to adjust for guessing could lead to erroneous conclusions, especially in between-subjects' comparisons (Brown, 1976; Leigh & Menon, 1986). In addition, Shapiro (1994) argues that recognition studies that use only the number of correct responses would be unable to completely understand the human recognition process. He also notes that research that merely counts the number of correct responses may incorrectly conclude that recognition memory is substantial, when in reality it was changes in judgment about memory.

Although a plethora of adjustment measures is available for recognition tests, there are some problems associated with them. Snodgrass and Corwin (1988) compared these methods for their performance in memory research. They report that bias indicators, particularly likelihood measure β and both indices (B" & B_H) in the

nonparametric model have difficulty detecting bias differences as respondents' performance decreases. Additionally, the sensitivity measures, d_L and R (A'), and the bias measures, β_L and B", were found to be in a non-independent relation. That is, they found that as the sensitivity measures (i.e., B" and d_L) decreased, the attainable values of bias measures (i.e., R-measure or A' and β_L) were gradually limited. Therefore, they suggest the use of C measure from normal and log-linear distributed signal detection analysis and measures derived from threshold theory. In addition to the study by Snodgrass and Corwin (1988), Leigh & Menon (1986) argue that measures with normal distribution assumption are not suited for advertising recognition tests. Furthermore, Singh & Churchill (1987) point out that the assumptions for signal detection theory are often violated in advertising recognition studies. Therefore, scholars should evaluate their data before applying alternate measures of recognition.

APPENDIX B

INFORMATION SHEET

TEXAS A&M UNIVERSITY
Department of Health and Kinesiology

Dear Student:

Your participation in a survey of fan behavior is needed. As a sport management researcher at Texas A&M University, I am conducting research to understand the influence of viewer's perception and attitude of sport on subsequent behaviors. In total, some 120 students enrolled in activity classes will be asked to participate in this study.

Participation will require about 35 minutes to watch and to answer the questionnaire. There are no risks or benefits involved in the completion of the survey. You may refuse to answer any question on the survey if it makes you feel uncomfortable. All data will be dealt with in a confidential manner and no institution or individual taking part in the study will be identified.

This research study has been reviewed and approved by the Institutional Review Board - Human Subjects in Research, Texas A&M University. For research related problems or questions regarding subjects' rights, the Institutional Review Board may be contacted through Ms. Angelia Raines, Director of Research Compliance, Office of the Vice President for Research (979-458-4067; araines@vprmail.tamu.edu).

Hopefully you will find time in your busy schedule to participate in this study. If you have any comments or concerns with the study, please contact me at the correspondence given below. Thank you for your time and participation; we look forward to your response.

Sincerely,

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Dept. of Health and Kinesiology
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APPENDIX C

QUESTIONNAIRE

Please check appropriate box				
Which team was winning after 5th inning (the conclusion of the video)?				
Texas Rangers	Boston Red Sox	Tie ball game	Don't remember	
During the video, Casey Fossum, the pitcher for Boston Red Sox, injured what part of his body?				
Hamstring	Arm	Ankle	Fingers	Don't remember
Who was the home team in the video?				
Texas Rangers	Boston Red Sox	Don't remember		

As you watched the baseball game, you may have noticed some brand logos and advertisements. In the numbered boxes in the first column below, please write down the names of the brands or companies for which you remember seeing ads or logos.

	Brand / Company
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

During the portion of the baseball game you watched, logos and advertisements of different product categories appeared. For each product category, please write in as many brands as you can remember seeing. **PLEASE DO NOT PUSH THE BACK BUTTON TO GO TO THE PREVIOUS PAGE!**

Car	Name of brand
Brand 1	
Brand 2	
Brands 3	

Beer	Name of brand
Brand 1	
Brand 2	
Brands 3	

Sports Apparel	Name of brand
Brand 1	
Brand 2	
Brands 3	

Please select (put a check mark) the brands that you saw during the video clip from the following choices. If you did not see them, please choose "No." **AGAIN, PLEASE DO NOT PUSH THE BACK BUTTON TO GO TO THE PREVIOUS PAGE!**

Did you see the following brands in the video?

		Yes	No
1.	LINCOLN		
2.	CHEVROLET		
3.	MERCURY		
4.	Ford		
5.	PONTIAC		
6.	TOYOTA		

Please select (put a check mark) the brands that you saw during the video clip from the following choices. If you did not see them, please choose "No." **AGAIN, PLEASE DO NOT PUSH THE BACK BUTTON TO GO TO THE PREVIOUS PAGE!**

Did you see the following brands in the video?

		Yes	No
1.	Champion		
2.	PUMA		
3.	UNDER ARMOUR		
4.	adidas		
5.	Reebok		
6.	FRUIT OF THE LOOM		

Please select (put a check mark) the brands that you saw during the video clip from the following choices. If you did not see them, please choose "No." **AGAIN, PLEASE DO NOT PUSH THE BACK BUTTON TO GO TO THE PREVIOUS PAGE!**

Did you see the following brands in the video?

		Yes	No
1.	Heineken		
2.	Busch Beer		
3.	Michelob Light		
4.	Corona		
5.	Icehouse		
6.	Miller Lite		

Please indicate your opinion for the following questions.

To me BASEBALL is…

		Strongly Disagree						Strongly Agree
1	Important	1	2	3	4	5	6	7
2	Boring	1	2	3	4	5	6	7
3	Relevant	1	2	3	4	5	6	7
4	Exciting	1	2	3	4	5	6	7
5	Means Nothing	1	2	3	4	5	6	7
6	Appealing	1	2	3	4	5	6	7
7	Fascinating	1	2	3	4	5	6	7
8	Worthless	1	2	3	4	5	6	7
9	Involving	1	2	3	4	5	6	7
10	Not Needed	1	2	3	4	5	6	7

Please indicate your opinion for the following questions.		Strongly Disagree						Strongly Agree
1	I consider myself to be a “real” fan of the Texas Rangers.	1	2	3	4	5	6	7
2	I would experience a loss if I had to stop being a fan of the Texas Rangers.	1	2	3	4	5	6	7
3	Being a fan of the Texas Rangers is very important to me.	1	2	3	4	5	6	7
4	I consider myself to be a “real” fan of the Boston Red Sox.	1	2	3	4	5	6	7
5	I would experience a loss if I had to stop being a fan of the Boston Red Sox.	1	2	3	4	5	6	7
6	Being a fan of the Boston Red Sox is very important to me.	1	2	3	4	5	6	7

Please indicate your opinion for the following questions.

To me the brand CHAMPION is…

		Strongly Disagree						Strongly Agree
1	Important	1	2	3	4	5	6	7
2	Boring	1	2	3	4	5	6	7
3	Relevant	1	2	3	4	5	6	7
4	Exciting	1	2	3	4	5	6	7
5	Means Nothing	1	2	3	4	5	6	7
6	Appealing	1	2	3	4	5	6	7
7	Fascinating	1	2	3	4	5	6	7
8	Worthless	1	2	3	4	5	6	7
9	Involving	1	2	3	4	5	6	7
10	Not Needed	1	2	3	4	5	6	7

Please indicate your opinion for the following questions.

To me the brand ICEHOUSE is…

		Strongly Disagree						Strongly Agree
1	Important	1	2	3	4	5	6	7
2	Boring	1	2	3	4	5	6	7
3	Relevant	1	2	3	4	5	6	7
4	Exciting	1	2	3	4	5	6	7
5	Means Nothing	1	2	3	4	5	6	7
6	Appealing	1	2	3	4	5	6	7
7	Fascinating	1	2	3	4	5	6	7
8	Worthless	1	2	3	4	5	6	7
9	Involving	1	2	3	4	5	6	7
10	Not Needed	1	2	3	4	5	6	7

Please indicate your opinion for the following questions.

To me the brand MERCURY is…

		Strongly Disagree						Strongly Agree
1	Important	1	2	3	4	5	6	7
2	Boring	1	2	3	4	5	6	7
3	Relevant	1	2	3	4	5	6	7
4	Exciting	1	2	3	4	5	6	7
5	Means Nothing	1	2	3	4	5	6	7
6	Appealing	1	2	3	4	5	6	7
7	Fascinating	1	2	3	4	5	6	7
8	Worthless	1	2	3	4	5	6	7
9	Involving	1	2	3	4	5	6	7
10	Not Needed	1	2	3	4	5	6	7

Please indicate your opinion for the following questions.		Strongly Disagree						Strongly Agree
1	I tried to memorize sponsors that were on the video.	1	2	3	4	5	6	7
2	I have participated in a similar study using virtual ads before.	1	2	3	4	5	6	7
3	The video clip I saw looked like the actual broadcast.	1	2	3	4	5	6	7

Demographics (Write in or circle appropriate selection)

Age: _____

Sex: Male Female

Ethnicity: African American Asian American Hispanic American Native American Caucasian Others

Classification: Freshman Sophomore Junior Senior Others

Major: _____

Thank you very much for your cooperation

VITA

Yosuke Tsuji received his Bachelor of Law degree from Keio University in 2001. He earned his Master of Science degree in Exercise and Sport Sciences with an emphasis in sport management from the University of Florida in 2002. He received his Doctor of Philosophy degree in 2007. His research interests are in the area of sport consumer behavior.

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