The Bad Thing about Good Games: The Relationship between Close Sporting Events and Game-Day Traffic Fatalities

STACY WOOD
MELAYNE MORGAN MCINNES
DAVID A. NORTON

For sports fans, great games are the close ones—those between evenly matched opponents, where the game remains undecided until the very end. However, the dark side to sporting events is the incidence of traffic fatalities due to game-related drinking. Here, we ask whether the closeness of the game affects the number of fatalities that occur. Two opposing predictions can be made. Games that are not close ("blowouts") may be less engaging, thus increasing drinking. Alternatively, close games may be more dangerous, increasing competition-associated testosterone that spills over into aggressive driving. An analysis of major sporting events (2001–8) shows that closer games are significantly correlated with more fatalities. Importantly, increased fatalities are observed only in locations with winning fans (game site and/or winners' hometown), congruent with a testosterone-based account. Ultimately, this finding has material consequences for public welfare on game days and suggests that one silver lining for losing fans may be a safer drive home.

Drive home *safe*-ly!
[*Clap, clap, clap-clap-clap*]
Drive home *safe*-ly!
[*Clap, clap, clap-clap-clap*]

(Traditional end-of-game taunt by Duke University's Cameron Crazies to vanquished opponents)

An appreciation of sports and the dedication of sports spectators are prominent aspects of American culture. Fan devotion is deeply, even religiously, held and is often characterized by ardent participation (Belk, Wallendorf, and Sherry 1989; Kozinets 2001). Case in point, attendance at NCAA football and basketball games topped 89 million spectators between 2005 and 2006, and the "big four" professional sports leagues drew almost 140 million in-person spectators between 2006 and 2007 (Quinn 2009). Television further swells the number of spectators; for example, national broadcasts of college football games average 4 million viewers each (Quinn 2009).

While sports fans clearly want their own teams to win, "good" games are typically thought to be close games—those that are exciting to watch and that feature an uncertain outcome between competitively matched opponents. Predicted close games garner higher spectator attendance (Schmidt and Berri 2001) and higher Nielsen television ratings (Paul and Weinbach 2007).

And, yet, the darker aspect of sports spectatorship involves the propensity for increased alcohol consumption. While there are some ways in which social community can reduce problematic alcohol consumption (Moorman 2002), sports spectatorship provides one important counterexample. Heavy social drinking is a common and deeply ingrained tradition for both professional (Toomey et al. 2008) and college games (Neal and Fromme 2007) that often occurs before the game ("tailgating"), during the game (although only in stadiums that sell alcoholic beverages), and after the game. Unfortunately, heavy drinking is associated with many types of risky

Stacy Wood (stacy_wood@ncsu.edu) is the Langdon Distinguished Professor of Marketing, College of Management, North Carolina State University, Raleigh, NC, 27695. Melayne Morgan McInnes (mcinnes@moore.sc.edu) is associate professor of economics, and David A. Norton (david.norton@grad.moore.sc.edu) is a doctoral candidate in marketing, Moore School of Business, University of South Carolina, Columbia, SC, 29208. The authors are grateful to Kin Blackburn and Terry Shimp for helpful comments on analysis and the 2009 NCAA Men's Basketball championship game for prompting the research question.

John Deighton served as editor and Brian Ratchford served as associate editor for this article.

Electronically published May 13, 2011

 0093-5301/2011/3804-0002$10.00. DOI: 10.1086/660164

behavior, perhaps most notably, impaired driving. Game-day drinking, especially, has been shown to lead to increased driving danger. In a widely cited article published in the *New England Journal of Medicine*, Redelmeier and Stewart (2003) demonstrated that across 27 Super Bowl Sundays, there was a 41% relative increase in the average number of traffic fatalities after the telecast.

Thus, driving home from the stadium or sports bar is clearly not a risk-free endeavor, but does it matter whether it was a good game? Here, we address whether the closeness of the game influences the risk of game-day traffic fatalities. And, if so, are more fatalities associated with blowouts or with games that go down to the wire? To examine this question, we compiled a database of high-profile sporting events in two college and professional sports, football and basketball (regular season "rival" games and tournament games), and regional traffic fatalities during the years 2001–8. Our use of these historical data permits an exacting analysis of the real relationship between close games and traffic fatalities, although it is not designed to offer unequivocal process insights. However, here we use existing biological research to help understand psychological consumption phenomena and guide our analysis of fatality patterns. Ultimately, the results speak both to important public policy ramifications for consumer safety and to an expanded conceptualization of physiological influence (e.g., neurochemistry, embodied cognition, emotional trends) in consumer behavior.

HYPOTHESIS DEVELOPMENT

It is interesting to note that two opposing predictions about close games can be made. On one hand, because close games are more engaging, this may decrease the extent to which spectators turn their attention to social drinking to enhance the entertainment of the event. Sporting blowouts are considered less appealing to watch (Paul and Weinbach 2007) and may encourage fans to focus on the other social aspects of the event, one of which is alcohol consumption (Neal and Fromme 2007; Toomey et al. 2008). A national study of 14,000 students at 119 colleges conducted by the Harvard School of Public Health found that collegiate sports fans heavily participate in social drinking traditions on game days (such as seeking out local bars' game-day beer specials or tailgating), and many of those include binge-style drinking. This drinking, termed Extreme Ritualistic Alcohol Consumption (ERAC; Glassman et al. 2010), is strongly rooted in the game-day experience as a form of ritual-oriented entertainment.

This premise—that a blowout game may cause spectators to turn to drinking as an alternative source of excitement or arousal—is a straightforward hypothesis that finds support in literatures on flow states and alcohol abuse. Flow states are highly engaging experiences characterized by an absorption in which participants lose self-consciousness or a sense of time (e.g., time seems to have passed faster than normal) and where the activity is seen as intrinsically rewarding. More research has examined the flow states of athletes, but sports spectators watching an exciting athletic performance also experience flow states during play between closely matched opponents (Csikszentmihalyi and Bennett 1971; Mitchell 1988; Smith and Westerbeek 2004).

If an exciting close game can engender flow, then a blowout may increase the likelihood of the antithesis of flow, boredom (Csikszentmihalyi and Bennett 1971). Research in alcohol and addiction studies has found that the desire to alleviate boredom is a common and ongoing motivation for alcohol and drug consumption (Nicholi 1983). Social drinking to alleviate boredom and enhance having a good time is often a primary reason reported by individuals for heavy drinking, especially by young adults (Patrick and Schulenberg 2011). Situational characteristics (such as stress, boredom, and conviviality) affect individuals' desire to drink; situational boredom tends to increase the desire to drink, especially in sensation-seeking individuals (Forsyth and Hundleby 1987) and individuals with high susceptibility to boredom (Carlson, Johnson, and Jacobs 2010). Thus, one reasonable hypothesis is that, by decreasing situational boredom, close games will be associated with decreased alcohol-based traffic fatalities after the game.

However, the opposite prediction can also be made: close games may lead to increased traffic fatalities. This may occur because highly competitive games affect spectators' emotional and physiological states (Carroll et al. 2002; Gonzales-Bono et al. 1999) that may, in turn, negatively interact with the high level of drinking common on big game days (Neal et al. 2005). Thus, one can argue that the combination of game-related alcohol consumption combined with the emotional influence of competitive spectatorship may prove a dangerous combination. Here, support for this hypothesis relies on research from the social/consumer psychology of fan behavior and research on the neuroendocrinology of competition.

It is well established that consumers strongly affiliate with loved possessions (Ahuvia 2005; Belk et al. 1989) and that this affiliation is particularly strong in fan communities (Kozinets 2001; Muniz and O'Guinn 2001). Recent research shows that affiliated brand traits can rub off on consumers after fairly innocuous product interaction (Park and Roedder John 2010); how much stronger, then, is the response likely to be for the more passionately endorsed "brand" of one's sports team? So strong, in fact, that biological research shows the response is physical in nature—highly competitive encounters increase hormonal response, specifically testosterone, during the contest for both participants and spectators (Mazur, Booth, and Dabbs 1992).

However, hormonal responses change for winners and losers on the resolution of the game. While winning fans love to "bask in the reflected glory" of their team's victory (the BIRG effect; Cialdini et al. 1976), losing fans still feel a commitment to their vanquished team and mourn losses (Fisher and Wakefield 1998). Neuroendocrinology research shows that testosterone levels increase in the face of highly competitive situations as an anticipatory response, and then, after the competition's outcome, testosterone sharply rises in winners and declines in losers (Mazur and Booth 1998)—a pattern that occurs in both competitors (Gonzales-Bono et al. 1999) and spectators (Bernhardt et al. 1998; Oliveira et al. 2001).

How might increases in testosterone affect driving safety? The danger arises, not because of testosterone in itself, but because of its influence on aggressive behavior. Raising testosterone increases aggressive behavior in rats (Monaghan and Glickman 1992), monkeys (Winslow, Ellingboe, and Miczek 1988), and humans (Kouri et al. 1995; Mazur and Booth 1998). In one study, the administration of increasing doses of testosterone in male volunteers increased aggressive, but not nonaggressive, behaviors (Kouri et al. 1995). Thus, winning a more competitive close game (vs. a less competitive blowout) could lead to an increase in testosterone, which, in turn, could stimulate dominating or aggressive behaviors, while losing can decrease testosterone, which then increases submissive behavior and reduces the likelihood of the individual to engage in new potentially damaging encounters (Mazur and Booth 1998; Suay et al. 1999). It is interesting to note that a study of rugby spectators (Moore et al. 2007) found that winning fans reported higher scores than losing fans on the assault subscale of the Buss-Durkee Hostility Inventory. Aggressive or dominating behaviors in driving (cutting into traffic, driving too close to cars in front, speeding) are key factors in fatality-producing automobile accidents, especially when alcohol is involved (James and Nahl 2000). Losers may engage in drinking during the game but might be less likely to engage in postgame aggressive driving. Winners, conversely, may be more likely to both drink aggressively (postgame celebration) and drive aggressively.

Finally, it should be noted that a third possibility is that of no correlation; game-day traffic fatalities may be unrelated to whether the game was close or who won. While the Super Bowl (Redelmeier and Stewart 2003) has been shown to increase traffic fatalities, this study did not consider the victory margin or allow for a differential effect on winners and losers. It is possible that pregame partying, which begins hours before kickoff or tip-off, is a more important determinant of game-day traffic fatalities than whether the game ends up going down to the wire.

EMPIRICAL ANALYSIS

Procedure

To examine the relationship between game closeness and traffic fatalities, we compiled a database of high-profile sporting events in two college and professional sports, football and basketball, during the years 2001–8. This included regular season "rivals" games (Fiutak 2009; e.g., Texas vs. Oklahoma, Duke vs. North Carolina) that are particularly important to the participating teams and tournament games (e.g., NCAA Final Four, NFL Playoffs). The total list of 271 games can be seen in appendix table A1. Each game was coded for sport (basketball or football), level (collegiate or professional game), the day of the week on which the game occurred, and whether it occurred at a neutral or nonneutral (one team's home field) site. To measure game closeness, we recorded both the final point spread, or victory margin (the number of points separating the winning and losing teams' scores; e.g., a 24-17 final score would indicate a victory margin of 7), and obtained expert ratings of each game's closeness on a generalized scale. While victory margins offer a simple metric of the closeness of a game, they can be problematic for two reasons, one analytical and the other conceptual. First, analytically, differences in scoring obscure comparisons across sports (football and basketball have markedly different scoring norms). Second, conceptually, because of end-of-game tactics (e.g., using fouls to gain control of the ball in basketball), there is much truth in the athletic aphorism that "the game can be closer than it looked from the score." Thus, each game was rated on closeness using a generalized 5-point scale (end points: (1) not very close at all; (5) very close) by four independent expert judges recruited through an online sports enthusiast message board. As evidence of the consistency of the judges, the average of these ratings is significantly correlated with the end-of-game victory margin (correlation coefficient = 0.783, $p < .001$). Our preference is to use the expert ratings of closeness for the analyses reported here; however, we do find the same results when we conduct the analyses using victory margin, as reported in the robustness checks.

For each game day, we assessed fatalities as the total number of traffic accidents involving fatalities on that day (thus, we use the number of fatal crashes, not absolute deaths), using the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS) database, for three locations: the counties containing the game location, the winner's hometown, and the loser's hometown. For many games (e.g., rivalry games), the game location was either the winner's or loser's hometown. For neutral-site games (e.g., championship or tournament games), the game location would differ from both the winner's and loser's hometowns. For each accident, we noted whether it was documented as alcohol related. Again using information from the FARS database, we also collected total annual traffic accidents involving fatalities for each location.

We first looked at the relationship between game closeness and traffic fatalities for the game location. Because the traffic fatality counts observed in our data are non-negative integers, we use count data models. We begin with a simple Poisson model:

$$\text{Prob}(y \text{ fatalities}|X) = \frac{e^{-X'B}(X'\beta)^y}{y!},$$

where y is the count of traffic fatalities for game i, X is the vector of characteristics for game i, and β is the coefficient vector to be estimated. We cluster by event in order to allow for lack of independence across years for games associated with a given event and report cluster-robust standard errors. We test for evidence of overdispersion (Cameron and Trevedi 2005) and fail to reject equidispersion in all reported regressions. Even in the presence of overdispersion, the Poisson model retains consistency given that our conditional mean is correctly specified (Cameron and Trevedi 2009). To control for variation in the propensity for accidents in a given location, the log of annual traffic fatalities for a given location is included. We also include indicator variables to control for variation by sport (football vs. basketball), level (professional vs. college), and weekend (vs. weekday) traffic patterns. The results are presented below, and robustness to alternative specifications is shown in the section that follows.

Results

Our descriptive statistics are shown in table 1, and our estimates are shown in table 2. We find that game-day fatalities for a given event are positively associated with the closeness of the game at the game location. Specifically, we find that, for the game location, increasing a game's closeness rating by one scalar point is associated with a 21.2% increase in traffic fatalities. We can also interpret this finding by calculating the average marginal effects using the *margeff* command (Bartus 2005). Here, we find that every 1 point increase in a game's closeness (on the 5-point rating scale) would increase the expected number of excess fatalities at the game site by .123 on average (table 3). To calculate how fatalities change from a blowout game (rating = 1) to a nail-biter (rating = 5), we use

$$e^{(4 \times .212)} - 1 = 1.33,$$

demonstrating that going from a blowout to a nail-biter increases observed fatalities by 133%.

This is a sizable effect. While one must exercise caution in comparing this finding to other driving statistics, because we analyze fatalities per day rather than annually, we can gain some sense of the magnitude of this close-games effect by comparing it to a recent study of the estimated effects of mandatory state seat belt laws on traffic fatalities. Seat belt laws have been shown to reduce statewide teenage traffic fatalities by between 0.09% and 11.6% per day (Carpenter and Stehr 2008). It may be fair to say that, on any given day, the danger of a close game is as detrimental as the absence of seat belt laws.

Thus, we observe strong evidence that close games are more dangerous, in terms of traffic fatalities, than blowout games. We posited that this effect might occur due to the patterns of testosterone and subsequent aggressive behavior observed in the fans of winning and losing teams. Recall that past biological research has shown that (1) winners exhibit sharp increases in testosterone at the conclusion of a game while losers exhibit a sharp decrease, and (2) increases in testosterone are associated with increased aggressive behaviors in men and women. We posit that the combination of drinking and potentially aggressive postgame driving may contribute to the observed relationship between game closeness and traffic fatalities. While we cannot directly test spectator testosterone levels in this research, the extant research on competitively induced testosterone does suggest several directions for deeper analysis of our database. Given our fatality data set, we might expect to see some indication of this pattern of behavior by looking at differences between the relationship between close games and fatalities for winners' locations versus losers' locations. We would expect to see that the relationship was present or stronger in locations with greater percentages of winners and that the relationship was null or weaker with greater percentages of losers. In line with these expectations, we find a strong positive relationship between game closeness and traffic fatalities at winners' locations (coefficient estimate = 0.291) and no significant relationship at losers' locations (coefficient estimate = 0.048; see table 2). Thus, we observe that, for the winner's location, increasing a game's closeness rating by 1 scalar point is associated with a 29.1% increase in traffic fatalities.

We can also speak to this account by determining whether this pattern holds for accidents where alcohol was reported, since aggressive driving behaviors are especially dangerous in combination with alcohol-impaired drivers. Here, the

TABLE 1

DESCRIPTIVE STATISTICS

Variables	Mean	SD	Min	Max
Game-day traffic fatalities (No. of traffic accidents reporting at least one fatality):				
Game location	.583	.939	0	5
Winner's location	.502	.847	0	5
Loser's location	.336	.766	0	5
Game location with report of alcohol involved	.096	.373	0	3
Winner's location with report of alcohol involved	.085	.317	0	2
Loser's location with report of alcohol involved	.059	.279	0	2
Average rating of "close game"	2.929	1.023	1	5
Annual traffic fatalities (natural log):				
Game location	4.289	1.305	2.079	6.617
Winner's location	3.774	1.365	1.386	6.617
Loser's location	3.551	1.220	.693	6.617
College (1 = yes, 0 = no)	.838	.369	0	1
Football (1 = yes, 0 = no)	.458	.499	0	1
Weekend (1 = yes, 0 = no)	.498	.501	0	1

TABLE 2

POISSON ANALYSIS OF GAME-DAY TRAFFIC FATALITIES

	All fatalities			Alcohol-related fatalities		
	Total fatalities at game site	Total fatalities at winner's home	Total fatalities at loser's home	Total fatalities at game site	Total fatalities at winner's home	Total fatalities at loser's home
Average rating of "close game"	.212	.291	.048	1.779	1.786	.337
	(.087)*	(.100)**	(.187)	(.313)**	(.428)**	(.404)
Annual traffic fatalities	.636	.459	.554	.345	.313	.093
	(.057)**	(.063)**	(.116)**	(.133)**	(.122)**	(.259)
Football (vs. basketball)	.327	.026	.151	.196	.68	−.742
	(.148)*	(.206)	(.287)	(.442)	(.387)	(.599)
College (vs. professional)	.528	.583	−.444	−.071	−.678	−.849
	(.094)**	(.205)**	−.313	(.729)	(.271)*	(.543)
Weekend game (vs. weekday)	−.246	.248	.062	−.175	−.333	.4
	(.165)	(.181)	(.335)	(.461)	(.495)	(.526)
Constant	−4.767	−4.156	−3.261	−10.664	−10.23	−3.532
	(.456)**	(.510)**	(1.041)**	(1.096)**	(1.706)**	(2.159)
Observations	271	271	271	271	271	271

NOTE.—Robust standard errors in parentheses.
*Significant at the 5% level.
**Significant at the 1% level.

Poisson analysis again shows that closer games are associated with greater incidences of fatalities at the game location and winner's hometown, but not in the loser's hometown (see table 2).

Robustness Checks and Alternative Explanations

Clearly, it is important to test the robustness of an empirical result such as this. We consider the following: (i) replacing the expert rater average measure of game closeness with the victory margin, (ii) restricting the sample to neutral game sites or away games, (iii) replacing the Poisson error structure with the less restrictive negative binomial model that allows the mean and variance to differ, and (iv) controlling for possible unobserved event-specific heterogeneity with fixed effects rather than clustering.

In choosing these robustness checks, we are testing to see whether the results are sensitive to model choice or whether there could be an omitted factor that is correlated with the rating of game closeness and game-day traffic fatalities at winners' locations. First, to ensure that our closeness variable is robust, we check to see whether our results replicate using a different measure of game closeness (victory margin) rather than our expert ratings, especially with alcohol-related incidents. We observe that these results still hold when the objective victory margin is used in place of the more subjective rating of game closeness. Second, we consider whether an omitted factor may explain the pattern of results that we observe. As an example, a possible candidate for such an omitted factor might be weather. Poor weather conditions at a game locale could adversely affect traffic

TABLE 3

ANALYSIS OF AVERAGE MARGINAL EFFECTS

	Average rating of close game	SE	Observations
Total fatalities at game site	.123	(.052)*	271
Total fatalities at neutral game site	.159	(.060)**	158
Total fatalities at winner's home	.146	(.051)**	271
Total fatalities at winner's home (away games)	.106	(.052)*	172
Total fatalities at loser's home	.016	(.060)	271
Total fatalities at loser's home (away games)	−.002	(.060)	212
Alcohol-related fatalities at game site	.171	(.047)**	271
Alcohol-related fatalities at winner's home	.152	(.042)**	271
Alcohol-related fatalities at loser's home	.02	(.020)	271

NOTE.—Standard errors in parentheses.
*Significant at the 5% level.
**Significant at the 1% level.

TABLE 4

ANALYSIS INCLUDING TOTAL SCORE

	Total fatalities at game site	Total fatalities at winner's home	Total fatalities at loser's home
Average rating of "close game"	.216	.290	.044
	(.084)*	(.104)**	(.199)
Annual traffic fatalities	.621	.449	.535
	(.062)**	(.061)**	(.104)**
Football	2.087	2.200	2.072
	(.969)*	(.824)**	(.964)*
College	.792	.997	−.213
	(.168)**	(.438)*	−.378
Weekend game	−.260	.267	.017
	(.180)	(.201)	(.332)
Total score (sum of both players' scores)	.010	.012	.010
	(.006)	(.006)*	(.005)
Total score × football	−.014	−.019	−.018
	(.007)	(.008)*	(.013)
Constant	−6.521	−6.353	−4.860
	(1.087)**	(1.322)**	(1.569)**
Observations	271	271	271

NOTE.—Robust standard errors in parentheses.
*Significant at the 5% level.
**Significant at the 1% level.

conditions and therefore increase traffic fatalities, irrespective of our proposed "close game" effect. However, can poor weather at the game location explain the pattern we observe of increased fatalities in the winner's but not the loser's hometowns? To test this, we restrict the sample to away games only (where game weather should not matter). Here, we find the same pattern of effects: closer games lead to higher traffic fatalities at the winners' home but not at the loser's home. (These two analyses can be seen in appendix table B1.)

To test for sensitivity to our model choice, we consider negative binomial models with either cluster robust standard errors or fixed effects (see appendix table B2). While clustering by event controls or allows for unobserved event-specific factors that may affect traffic fatalities, we can instead treat the data as a short panel of repeated events. Panel data models allow us to include a fixed effect to control for unobserved time-invariant event-specific factors that may affect the traffic fatalities and be correlated with the right-hand-side variables. The advantage of the fixed effect is that it captures the effects of the two game characteristics that we include in the earlier regressions (college vs. professional, and football vs. basketball) as well as any other event-specific controls we could potentially add. Thus, the results are robust to both alternative specifications.

In addition, we note that one alternative explanation for these results could be that this phenomenon is solely a function of rampaging local fans after big "at home" wins. Thus, we provide two other robustness tests to see whether the result holds when controlling for these situations. First, we reestimate the model of game location fatalities for neutral sites only. Second, we reestimate the models for winners' and losers' locations excluding home games. For example, if Michigan plays Ohio State at Ohio State, then we include the game in the regression for Michigan but not for Ohio State. In both cases, closer games are still significantly associated with greater incidences of traffic fatalities at the game location and winner's hometown, but not in the loser's hometown (see appendix table B1).

Next, we consider whether the total score of the game (the sum of winner and loser scores) influences this effect by reanalyzing the model with two additional regressors: the total score and an interaction term. High-scoring games (often referred to as shoot-outs) are considered to be more exciting and thus might also lead to more fatalities. This analysis (see table 4) shows that our effect is robust to including total score and that, other things equal, higher scoring games are associated with more fatalities.

Finally, there is one factor in close games that one might expect to be highly influential to traffic fatalities that has little to do with alcohol or aggressive driving. One outcome of close games is that, because the game "goes down to the wire," most spectators will stay until the end, thus causing a greater density of drivers on the road. Our data don't support the influence of this factor because we don't observe a relationship between the closeness of the game and fatalities for losers' locations. For a close game, losers are just as likely to stay until the end of the game (since it is not clear until the end who the loser will be), so we would expect the same density of traffic in those locations. It is hard to believe, though, that traffic density does not play some role, so perhaps this issue remains a question for future research.

GENERAL DISCUSSION

In this research, we examine whether the closeness of sporting events can influence the occurrence of driving fatalities. We offer competing hypotheses for whether closer games lead to increases or decreases in deaths. The findings from an 8-year database covering both basketball and football games at both the collegiate and professional level show that good games have a bad side—closer games lead to significantly more game-day traffic fatalities.

The empirical nature of this study and the implications of the results reside solidly in the domain of transformative consumer research and its primary focus on individual health and societal welfare (Mick 2008). Because the data here are real fatalities, the surprisingly large impact of close games is both noteworthy and consequential. At the most basic level, these results prompt the simple but counterintuitive recommendation that winners need to break into their post-game elation to take special care on the drive home. One might expect that losing fans might be more aggressive on the road postgame if they are unhappy or frustrated that they lost a nail-biter, but the results here show the opposite. Other stakeholders or institutions that may be affected (e.g., law enforcement, hospitals) may be wise to monitor game progress and to increase staff when games are nail-biters and the home team wins.

In addition, the evidence suggests that this close-games effect is driven by a combination of testosterone and alcohol. This suggests specific measures that may be taken to ameliorate the effect. For example, cooling-down periods may allow testosterone and similar hormonal responses to abate after the game. Winning fans may be encouraged to participate in postgame celebratory rituals that diffuse aggression (e.g., inviting fans to stay after the game to sing the alma mater, to listen to the coach analyze the game, or to get autographs from players) versus those that inflame aggression (e.g., tearing down the goalposts or burning the loser's mascot in effigy).

It is interesting to note that this finding suggests why a practice common in international soccer (football) matches is effective. In Chile, for example, the fans of competing teams sit in separate sections of the stadium. After the game, the fans of the losing team leave the stadium first, while fans of the winning team are held back for 45 minutes by traditions of singing team songs and cheers and, occasionally, by armed guards. This delay is designed to let losing fans leave unmolested, but this research suggests that it would also have the additional beneficial outcome of letting the safer drivers leave and clear the road, while winning fans have a chance for testosterone to abate before they get on the road.

It is also interesting to consider how advertising is affected by the closeness of sporting events. If close games create physiological arousal, then this may affect the types of advertisements that are attended or that are remembered. Classic findings in marketing suggest that physiological arousal can have a deleterious effect on how consumers process ad information and that, with high arousal, they tend to rely more on heuristics (Sanbonmatsu and Kardes 1988). It may also be that close games prompt an affinity for different types of ad messages, such as those that show risky or thrill-seeking behaviors (e.g., skydiving) or sexually oriented stimuli. One recent and provocative study demonstrates that states that supported the winner in national elections in 2004, 2006, and 2008 showed increases in online pornography searches after results were announced (Markey and Markey 2010).

From a theoretical perspective, the results extend our knowledge about the consumption of competition, especially as it relates to the interdependence of both the physiological and the symbolic. The extant consumer behavior literature has looked at the passionate consumption of fans (Ahuvia 2005; Belk et al. 1989; Kozinets 2001; Muniz and O'Guinn 2001) or highly arousing consumption experiences (Arnould and Price 1993; Celsi, Rose, and Leigh 1993) from a primarily sociological perspective. The findings here should prompt increased attention to the concomitant physiological factors and their influence on both behavior and perception. We often consider aggression to be an outcome of consumer dissatisfaction (e.g., negative sales encounters) and, yet, here we see how aggression may result from the consumer/fan getting exactly what was desired—a win. Here, in a sporting environment (and potentially in other highly competitive fan communities), aggression may result from a positive consumption outcome and "feel good" to the consumer and yet have negative consequences. Given one recent finding on the socially effacing effect of testosterone on women (Eisenegger et al. 2010), a particularly promising avenue for future investigation is to examine how fan behavior at competition-based events differs by gender. Overall, the domain of sport spectatorship offers a context for choice and consumption that combines high involvement, extended affective experiences, symbolic meaning, and physiological influence and, as such, is a fertile ground for consumer research.

Further, at a much broader level, these findings illustrate the importance of considering hormonal or neurochemical responses in any consumption experience. Consumer psychology is beginning to explore more the neurophysiological drivers of perception and choice. For example, new research in consumer behavior observes ovulation-based influences on choice in female participants (Durante et al., forthcoming). A consideration of such physiological influence may lend insight to very diverse streams in judgment and decision making, including, for example, patterns of emotional experience and evaluation over time (e.g., moments vs. episodes; Varey and Kahneman 1992), neuroeconomic investigations of choice under affective anticipation and competition (Grether et al. 2007; Knutson and Greer 2008), and recent explorations of embodied cognition (e.g., muscular influence on choice; Hung and Labroo, forthcoming).

Ultimately, this research shows that the kind of sports games that spectators love to watch are the ones that might be the most dangerous to drivers in areas heavily populated by fans of the winning team. Ironically, it may be that the Cameron Crazies' taunt to losing teams is an accurate and unwitting homage—losers *are* more likely to drive home safely.

APPENDIX A

TABLE A1

LIST OF GAMES ANALYZED

Event	College/ professional	Sport	Years	Observations
BCS National Championship	College	Football	2001–7	7
Fiesta Bowl	College	Football	2001–2; 2004–8*	7
Orange Bowl	College	Football	2002–4; 2006–8*	6
Rose Bowl	College	Football	2001, 2003–5, 2007–8*	6
Sugar Bowl	College	Football	2001–3; 2005–8*	7
ACC Championship	College	Football	2005–8	4
Big XII Championship	College	Football	2001–8	8
SEC Championship	College	Football	2001–8	8
Alabama vs. Auburn	College	Football	2001–7	7
Army vs. Navy	College	Football	2001–7	7
California vs. Stanford	College	Football	2001–7	7
Florida vs. Florida State	College	Football	2001–8	8
Florida vs. Georgia	College	Football	2001–7	7
Miami (FL) vs. Florida State	College	Football	2001–7	7
Notre Dame vs. Southern California	College	Football	2001–7	7
Ohio State vs. Michigan	College	Football	2001–7	7
Texas vs. Oklahoma	College	Football	2001–7	7
NCAA Final Four	College	Basketball	2001–7	21
Arizona vs. UCLA	College	Basketball	2001–7	16
Duke vs. North Carolina	College	Basketball	2001–7	16
Illinois vs. Missouri	College	Basketball	2001–7	7
Indiana vs. Purdue	College	Basketball	2001–7	13
Kansas vs. Missouri	College	Basketball	2001–7	16
Kentucky vs. Louisville	College	Basketball	2001–7	7
Oklahoma vs. Oklahoma State	College	Basketball	2001–7	14
Super Bowl	Professional	Football	2001–7	7
NBA Finals	Professional	Basketball	2001–7	37

NOTE.—The time span of data was subjectively chosen to offer a significant period of time for analysis (>5 years) and for which the National Highway Traffic Safety Administration's FARS data were available.

*Years skipped represent years in which this game was considered the BCS National Championship.

APPENDIX B

ROBUSTNESS CHECKS

TABLE B1

VICTORY MARGIN AND NEUTRAL/NONGAME (AWAY GAME) SITES

	Analysis with game closeness measured by victory margin (Alcohol related)		
	Total fatalities at game site	Total fatalities at winner's home	Total fatalities at loser's home
Victory margin (smaller = closer game)	−.233	−.19	−.027
	(.085)**	(.079)*	−.052
Annual traffic fatalities	.476	.436	.093
	(.171)**	(.113)**	−.253
Football	.556	1.217	−.67
	−.335	(.467)**	−.641
College	.195	−.355	−.865
	−.495	−.498	−.579
Weekend game	−.191	−.405	.373
	−.438	−.482	−.481
Constant	−3.273	−3.005	−2.168
	(1.249)**	(.923)**	−1.282
Observations	271	271	271

TABLE B1 (*Continued*)

	Analysis of neutral and nongame sites		
	Total fatalities at neutral game sites	Total fatalities at winner's home (away game)	Total fatalities at loser's home (away game)
Average rating of close game	.319	.228	−.008
	(.116)**	(.107)*	(.208)
Annual traffic fatalities	.616	.393	.494
	(.041)**	(.105)**	(.136)**
Football	.285	−.067	.079
	(.147)	(.327)	(.321)
College	.607	.382	−.643
	(.104)**	(.383)	(.370)
Weekend game	.054	.283	.026
	(.202)	(.258)	(.392)
Constant	−5.058	−3.474	−2.662
	(.465)**	(.695)**	(1.140)*
Observations	158	172	212

NOTE.—Standard errors in parentheses.
*Significant at the 5% level.
**significant at the 1% level.

TABLE B2

NEGATIVE BINOMIAL ANALYSIS AND FIXED EFFECTS

	Negative binomial analysis		
	Total fatalities at game site	Total fatalities at winner's home	Total fatalities at loser's home
Average rating of close game	.212	.301	.106
	(.087)*	(.093)**	(.188)
Annual traffic fatalities	.636	.459	.564
	(.057)**	(.063)**	(.129)**
Football	.327	.035	.177
	(.148)*	(.209)	(.307)
College	.528	.577	−.486
	(.094)**	(.212)**	(.280)
Weekend game	−.246	.269	−.025
	(.165)	(.195)	(.345)
Constant	−4.767	−4.199	−3.416
	(.456)**	(.506)**	(1.103)**
Observations	271	271	271
	Panel negative binomial models with fixed effects		
	Total fatalities at game site	Total fatalities at winner's home	Total fatalities at loser's home
Average rating of close game	.197	.341	.109
	(.080)*	(.099)**	(.137)
Annual traffic fatalities	.558	.502	.472
	(.129)**	(.107)**	(.130)**
Weekend game	−.187	.419	.224
	(.273)	(.306)	(.389)
Constant	−.941	−2.729	−2.53
	(2.096)	(.814)**	(.988)*
Observations	271	271	213
Number of events	28	28	20

NOTE.—Standard errors in parentheses.
*Significant at the 5% level.
**Significant at the 1% level.

REFERENCES

Ahuvia, Aaron C. (2005), "Beyond the Extended Self: Loved Objects and Consumers' Identity Narratives," *Journal of Consumer Research*, 32 (June), 171–84.

Arnould, Eric J. and Linda L. Price (1993), "River Magic: Extraordinary Experience and the Extended Service Encounter," *Journal of Consumer Research*, 20 (June), 24–45.

Bartus, Tamás (2005), "Estimation of Marginal Effects Using Margeff," *Stata*, 5 (November), 309–29.

Belk, Russell W., Melanie Wallendorf, and John F. Sherry Jr. (1989), "The Sacred and the Profane in Consumer Behavior: Theodicy on the Odyssey," *Journal of Consumer Research*, 16 (June), 1–38.

Bernhardt, Paul C., James M. Dabbs, Julie A. Fielden, and Candace D. Lutter (1998), "Testosterone Changes during Vicarious Experiences of Winning and Losing among Fans at Sporting Events," *Physiology and Behavior*, 65 (August), 59–62.

Cameron, A. Colin and Pravin K. Trevedi (2005), *Microeconometrics: Methods and Applications*, New York: Cambridge University Press.

——— (2009), *Microeconometrics Using Stata*, College Station, TX: Stata.

Carlson, Scott R., Season C. Johnson, and Pauline C. Jacobs (2010), "Disinhibited Characteristics and Binge Drinking among University Student Drinkers," *Addictive Behaviors*, 35 (March), 242–51.

Carpenter, Christopher S. and Mark Stehr (2008), "The Effects of Mandatory Seatbelt Laws on Seatbelt Use, Motor Vehicle Fatalities, and Crash-Related Injuries among Youths," *Journal of Health Economics*, 27 (May), 642–62.

Carroll, Douglas, Shah Ebrahim, Kate Tilling, John Macleod, and George Davey Smith (2002), "Admissions for Myocardial Infarction and World Cup Football: Database Survey," *British Medical Journal*, 325 (December), 1439–42.

Celsi, Richard L., Randall L. Rose, and Thomas W. Leigh (1993), "An Exploration of High-Risk Leisure Consumption through Skydiving," *Journal of Consumer Research*, 20 (June), 1–23.

Cialdini, Robert B., Richard J. Borden, Avril Thorne, Marcus R. Walker, Stephen Freeman, and Lloyd R. Sloan (1976), "Basking in Reflected Glory: 3 (Football) Field Studies," *Journal of Personality and Social Psychology*, 34 (3), 366–75.

Csikszentmihalyi, Mihaly and Stith Bennett (1971), "An Exploratory Model of Play," *American Anthropologist*, 73 (February), 45–58.

Durante, Kristina M., Vladas Griskevicius, Sarah E. Hill, Carin Perilloux, and Norman P. Li (forthcoming), "Ovulation, Female Competition, and Product Choice: Hormonal Influences on Consumer Behavior," *Journal of Consumer Research*.

Eisenegger, Christoph, Michael Naef, Romana Snozzi, Markus Heinrichs, and Ernst Fehr (2010), "Prejudice and Truth about the Effect of Testosterone on Human Bargaining Behaviour," *Nature*, 463 (January), 356–59.

Fisher, Robert J. and Kirk Wakefield (1998), "Factors Leading to Group Identification: A Field Study of Winners and Losers," *Psychology and Marketing*, 15 (January), 23–40.

Fiutak, Peter (2009), "The 10 Best Current Rivalries," *College Football News,* http://cfn.scout.com/2/591649.html.

Forsyth, Gordon and John D. Hundleby (1987), "Personality and Situation as Determinants of Desire to Drink in Young Adults," *International Journal of the Addictions*, 22 (July), 653–69.

Glassman, Tavis J., Virginia J. Dodd, Jiunn-Jye Sheu, Barbara A. Rienzo, and Alex C. Wagenaar (2010), "Extreme Ritualistic Alcohol Consumption among College Students on Game Day," *Journal of American College Health*, 58 (March–April), 413–23.

Gonzales-Bono, Esperanza, Alicia Salvador, Marian Angeles Serrano, and Jorge Ricarte (1999), "Testosterone, Cortisol, and Mood in a Sports Team Competition," *Hormones and Behavior*, 35 (February), 55–62.

Grether, David M., Charles R. Plott, Daniel B. Rowe, Martin I. Sereno, and John M. Allman (2007), "Mental Processes and Strategic Equilibration: An fMRI Study of Selling Strategies in Second Price Auctions," *Experimental Economics*, 10 (February), 105–22.

Hung, Iris W. and Aparna A. Labroo (forthcoming), "From Firm Muscles to Firm Willpower: Understanding the Role of Embodied Cognition in Self-Regulation," *Journal of Consumer Research*.

James, Leon and Diane Nahl (2000), *Road Rage and Aggressive Driving: Steering Clear of Highway Warfare*, Amherst, NY: Prometheus.

Knutson, Brian and Stephanie M. Greer (2008), "Anticipatory Affect: Neural Correlates and Consequences for Choice," *Philosophical Transactions of the Royal Society B*, 363 (1511), 3771–86.

Kouri, Elena M., Scott E. Lukas, Harrison G. Pope Jr., and Paul S. Oliva (1995), "Increased Aggressive Responding in Male Volunteers following the Administration of Gradually Increasing Doses of Testosterone Cypionate," *Drug and Alcohol Dependence*, 40 (November), 73–79.

Kozinets, Robert V. (2001), "Utopian Enterprise: Articulating the Meaning of Star Trek's Culture of Consumption," *Journal of Consumer Research*, 28 (June), 67–89.

Markey, Patrick M. and Charlotte N. Markey (2010), "Changes in Pornography Seeking Behaviors following Political Elections: An Examination of the Challenge Hypothesis," *Evolution and Human Behavior*, 31 (November), 442–46.

Mazur, Allan and Alan Booth (1998), "Testosterone and Dominance in Men," *Behavioral and Brain Sciences*, 21 (June), 353–97.

Mazur, Allan, Alan Booth, and James M. Dabbs (1992), "Testosterone and Chess Competition," *Social Psychology Quarterly*, 55 (March), 70–77.

Mick, David Glen (2008), "The Moment and Place for a Special Issue," *Journal of Consumer Research*, 35 (October), 377–79.

Mitchell, Richard G., Jr. (1988), "Sociological Implications of the Flow Experience," in *Optimal Experience: Psychological Studies of Flow in Consciousness*, ed. Mihalyi Csikszentmihalyi and Selega Csikszentmihalyi, Cambridge: Cambridge University Press.

Monaghan, Edward P. and Stephen E. Glickman (1992), "Hormones and Aggressive Behavior," in *Behavioral Endocrinology*, ed. Jill B. Becker, S. Marc Breedlove, and David Crews, Cambridge, MA: MIT Press, 261–85.

Moore, Simon C., Jonathan P. Shepherd, Sam Eden, and Vaseekaran Sivarajasingam (2007), "The Effect of Rugby Match Outcome on Spectator Aggression and Intention to Drink Alcohol," *Criminal Behaviour and Mental Health*, 17 (March), 118–27.

Moorman, Christine (2002), "Consumer Health under the Scope," *Journal of Consumer Research*, 29 (June), 152–58.

Muniz, Albert M. and Thomas C. O'Guinn (2001), "Brand Community," *Journal of Consumer Research*, 27 (March), 412–32.

Neal, Dan J. and Kim Fromme (2007), "Hook 'em Horns and

Heavy Drinking: Alcohol Use and Collegiate Sports," *Addictive Behaviors*, 32 (November), 2681–93.

Neal, Dan J., Dawn E. Sugarman, John T. Hustad, Catherine M. Caska, and Kate B. Carey (2005), "It's All Fun and Games . . . or Is It? Collegiate Sporting Events and Celebratory Drinking," *Journal of Studies on Alcohol*, 66 (March), 291–94.

Nicholi, Armand M. (1983), "The Nontherapeutic Use of Psychoactive Drugs—a Modern Epidemic," *New England Journal of Medicine*, 308 (April), 925–33.

Oliveira, Rui F., Marco Lopes, Luis A. Carneiro, and Adelino Canario (2001), "Watching Fights Raises Fish Hormone Levels," *Nature*, 409 (January), 475.

Park, Ji Kyung and Deborah Roedder John (2010), "Got to Get You into My Life: Do Brand Personalities Rub Off on Consumers?" *Journal of Consumer Research*, 37 (December), 655–69.

Patrick, Megan E. and John E. Schulenberg (2011), "How Trajectories of Reasons for Alcohol Use Relate to Trajectories of Binge Drinking: National Panel Data Spanning Late Adolescence to Early Adulthood," *Developmental Psychology*, 47 (March), 311–17.

Paul, Rodney J. and Andrew P. Weinbach (2007), "The Uncertainty of Outcome and Scoring Effects on Nielsen Ratings for Monday Night Football," *Journal of Economics and Business*, 59 (May–June), 199–211.

Quinn, Kevin G. (2009), *Sports and Their Fans: The History, Economics, and Culture of the Relationship between Spectator and Sport*, Jefferson, NC: McFarland.

Redelmeier, Donald A. and Craig L. Stewart (2003), "Driving Fatalities on Super Bowl Sunday," *New England Journal of Medicine*, 348 (January), 368–69.

Sanbonmatsu, David M. and Frank R. Kardes (1988), "The Effects of Physiological Arousal on Information Processing and Persuasion," *Journal of Consumer Research*, 15 (December), 379–85.

Schmidt, Martin B. and David J. Berri (2001), "Competitive Balance and Attendance: The Case of Major League Baseball," *Journal of Sports Economics*, 2 (May), 145–67.

Smith, Aaron and Hans Westerbeek (2004), *The Sport Business Future*, New York: Palgrave Macmillan.

Suay, Ferran, Alicia Salvador, Esperanza González-Bono, C. Sanchís, M. Martínez, Sonia Martínez-Sanchis, V. M. Simón, and Jose-Bruno Montoro (1999), "Effects of Competition and Its Outcome on Serum Testosterone, Cortisol and Prolactin," *Psychoneuroendocrinology*, 24 (July), 551–66.

Toomey, Traci L., Darin J. Erickson, Kathleen M. Lenk, and Gunna R. Kilian (2008), "Likelihood of Illegal Alcohol Sales at Professional Sport Stadiums," *Alcoholism Clinical and Experimental Research*, 32 (November), 1859–64.

Varey, Carol, and Daniel Kahneman (1992), "Experiences Extended across Time: Evaluation of Moments and Episodes," *Journal of Behavioral Decision Making*, 5 (3), 169–86.

Winslow, James T., James Ellingboe, and Klaus A. Miczek (1988), "Effects of Alcohol on Aggressive Behavior in Squirrel Monkeys: Influence of Testosterone and Social Context," *Psychopharmacology*, 95 (July), 356–63.