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## The 'home advantage' in athletic competitions

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### **Abstract**

Game location has a powerful influence on performance outcomes in sport. In this article, we review recent research on three conceptual models that outline: 1) the various game location factors that can alter athlete psychological states, 2) the natural protective response to territorial incursion in humans, and 3) the increased probability of involuntary attentional shifts in the presence of a supportive audience. Investigators have recently accumulated support for each of these models with variations in game location being linked to psychological, hormonal, and behavioural states of athletes, coaches and officials. We consider how an integrative approach might benefit the study of the home advantage phenomenon and describe an assortment of research questions to support the development of an integrative framework. By researching how audience support contributes to physiological reactivity, attention, stress responses and decision making (in athletes and officials) we can achieve a greater understanding of the processes through which a home environment can benefit (and occasionally harm) athletes and teams.

**Keywords:** cortisol, testosterone, territoriality, stress, aggression

### **The ‘home advantage’ in athletic competitions**

A large body of research confirms that athletes and teams perform considerably better when competing at home compared to away. For example, logistic regression models that factor in the home advantage can accurately predict the number of medals achieved by host nations in the Olympic Games (Nevill, Balmer, & Winter, 2012) and meta-analytic reviews (Jamieson, 2010) have demonstrated that home teams will win approximately 60 percent of all athletic contests. Although a home advantage is more prevalent in some sports than in others (see Jones, 2013) there are no sports in which athletes or teams are more successful away from their home venue. Comprehensive models have been developed to guide our understanding of the home advantage phenomenon and our goal in this review is to outline recent research on three such models and to offer practical suggestions for the progression of this field and the possibility for development of an integrative framework. We begin our review with the most well researched conceptual model of the home advantage.

#### **The standard model**

The standard model of the home advantage (Carron, Loughead, & Bray, 2005; Courneya & Carron, 1992; Schwartz & Barsky, 1977) describes the causal processes connecting game location factors to performance outcomes. The model considers four important game location factors – the support of the home audience, travel fatigue of the away team, familiarity with the home venue, and (in some sports) competition rules that might favour the home team. These four factors contribute to the psychological states of competitors and coaches, and even though officials do not have a designated ‘home venue’ their psychological states are also considered responsive to the support of a home audience. The psychological states of competitors, coaches and officials contribute to the behaviour of these individuals (e.g., decision making) and these behaviour responses tend to favour home athletes and generate greater home success.

Supporting the proposals of the standard model, archival studies have demonstrated that components of crowd structure (size, density, and propinquity) and crowd behaviour (booing, fighting, and cheering) are related to the magnitude of the home advantage (e.g., Armatas & Pollard, 2013). Specifically, home teams are more successful in the presence of a large audience displaying positive (encouraging) behaviour. Less is known about the processes through which this occurs. There is evidence that audience support can influence the decision making of sports officials (Downward & Jones, 2007) but the contribution of audience support to the behaviour of athletes and coaches remains unclear. Experimental studies have demonstrated that officials are more likely to award discretionary decisions that favour the home team (e.g., adding extra time) and harsher punishments for the away team (e.g., warnings) in the presence of crowd noise compared to a no-noise control (Nevill, Balmer, & Williams, 2002; Unkelbach & Memmert, 2010). This officiating bias might be explained by motivational factors (officials prefer not to displease the crowd) or crowd noise might simply act as a decision-making heuristic, whereby the likelihood that an incident is considered an infringement is increased by the presence of crowd noise (Nevill et al., 2002; Unkelbach & Memmert, 2010).

Alongside audience effects, the standard model also considers an important role for travel fatigue, familiarity with the home venue, and competition rules that favour the home team. The contribution of competition rules appears to be minimal (Allen & Jones, 2013), but home advantage effects are known to remain high in the absence of an audience (van de Ven, 2011). Many studies have explored the relationship between travel and the home advantage and demonstrate that travel effects become important over relatively long distances. In particular, the home advantage is reported to increase by as much as twenty percent per time zone crossed (Goumas, 2013) and travel effects are potentially more important when athletes are travelling in an eastward direction (Recht, Lew, & Schwartz,

1995). To explore the role of location familiarity, researchers have assessed the home advantage before and after teams move to a new stadium (Loughead, Carron, Bray, & Kim, 2003; Pollard, 2002). These studies demonstrate that teams experience a decline in the home advantage after they have relocated. This 'new stadium' effect could be related to unfamiliarity effects (e.g., pitch dynamics) but might also relate to another important factor in the home advantage – that of territoriality.

### **The territoriality model**

The territoriality model (Neave & Wolfson, 2003) considers the home advantage a manifestation of the natural protective response to territorial incursion. In many animal species, an invasion of one's perceived territory invokes a protective response that is associated with heightened testosterone concentrations and a greater occurrence of overt aggression. For example, observational studies of wild chimpanzees (*Pan Troglodytes*) show that testosterone concentrations are greatest before and after territorial boundary patrols (Sobolewski, Brown, & Mitani, 2012) and research into the behaviour of laboratory mice show that offensive aggression is greatest in home environments (own territory) compared to neutral or rival territory (Jansen et al., 2011). Neave and Wolfson (2003) proposed that a similar territorial response operates in humans and should be observable in the competitive context of organised sport. In a sample of association football (soccer) players, they found that testosterone concentrations were considerably higher before home games compared to away games and neutral training sessions.

In another study of territoriality, testosterone concentrations of elite junior ice-hockey athletes were found to be greater prior to home games than away games (Carré, Muir, Belanger, & Putnam, 2006), but rather than home game testosterone increases from baseline, as found in Neave and Wolfson (2003), the data from Carré et al. (2006) pointed towards a decreasing testosterone response in away games. More recently, Carré (2009) explored

testosterone responses to competition outcomes and found a considerably greater testosterone increase following victory in a home venue than victory in an away venue. Rises in testosterone are thought to benefit athletic performance because they coincide with greater physical aggression and motivation to compete (Wood & Stanton, 2012). There is evidence that testosterone responses can predict subsequent aggression in humans (Carré, Campbell, Lozoya, Goetz, & Welker, 2013) but the tendency for home teams to display greater physical aggression than away teams has not been fully supported (Jones, Bray & Olivier, 2005). Higher levels of testosterone, associated with competing at home, might contribute to the home advantage in other ways, for example, by increasing risk taking behaviour, the metabolic rate of muscles and improved spatial ability (Jones et al., 2005; Neave & Wolfson, 2003). However, these possibilities have yet to be tested in competitive sport.

In addition to testosterone, another hormone that changes in response to game location is cortisol. In the study of elite junior ice-hockey athletes, cortisol levels were found to be lower before away games compared to home games and baseline measures (Carré et al., 2006). Rather than an increased level of stress incurred from an opponent's territory, as might be expected, this finding is indicative of greater levels of stress when performing at home. That cortisol levels are greatest in home venues supports qualitative evidence that athletes can feel under pressure to perform in front of their own fans (Terry, Walrond, & Carron, 1998). It also suggests that performing at home is not always conducive to better performance as cortisol is associated with a 'threat' response to psychological stress (Jones, Meijen, McCarthy, & Sheffield, 2009; Jamieson, Mendes, & Nock, 2013) and this, in turn, has been linked to poor athletic performance (e.g., Turner, Jones, Sheffield, & Cross, 2012). When athletes underperform, under the stress of a supportive home audience, this is termed 'the home disadvantage'.

### **A home disadvantage?**



The added pressure of a supportive audience is proposed to increase the probability of ‘choking’ (poor performance) in competitions of great importance (Baumeister & Steinhilber, 1984). This is because a supportive audience can induce performance pressure and overcautious performance in critical situations – a pressure response that is purportedly moderated by past experience and personality characteristics (Wallace, Baumeister, & Vohs, 2005). Moreover, athletes’ motivation to achieve success may be overridden by a desire to avoid failure (Wallace et al., 2005) and a common finding in competitive sport is that avoidance motivation predicts a greater occurrence of choking under pressure (Jordet & Hartman, 2008). There is experimental evidence that supportive audiences contribute to a decline in athletic performance (Butler & Baumeister, 1998) or at best do not enhance it (Law, Masters, Bray, Eves, & Bardswell, 2003) even though participants in these experiments felt the supportive audience helped them perform better.

The mechanism considered most responsible for choking in critical situations is pressure effects on attentional focus (Wallace et al., 2005). In most situations, athletes complete their movements automatically without having to consciously think about what they are doing. In win-imminent situations of high importance (e.g., championship point in a tennis grand slam) athletes will naturally try to do everything in their control to ensure they execute their task as well as possible. This often results in attention shifting from an external, to an internal focus, as athletes pay greater attention to their movement responses (Wallace et al., 2005). Unfortunately this attempt to consciously control previously automatic movements often results in poor performance (Masters & Maxwell, 2008). Experimental studies demonstrate a ‘choking response’ when too much attention is allocated to processes that usually run automatically (Beilock, Jellison, Rydell, McConnell, & Carr, 2006) and studies of professional sports leagues demonstrate a disadvantage for home teams during win-imminent (high stress) situations (McEwan, Martin Ginis, & Bray, 2012). Nevertheless, the

contribution of audience support to shifts in attentional focus remains an area for future research.

### **Moving forward**

Research into the home advantage has progressed steadily in recent years and archival material (from professional sports leagues) has provided a great deal of information about the factors involved in between-location variations in athlete and team performance.

Unfortunately, research into the psychological and behavioural processes underlying these relationships is rather sparse and unfocused. There is some evidence that athlete psychological states differ between home and away locations (see Carron et al., 2005) and that audience behaviour contributes to the decision making of sports officials (see Nevill et al., 2002). But little is known about athlete and coach responses to audience support or how attention and stress responses might shift in home and away conditions. Research into the home advantage phenomenon would benefit from a more targeted focus on the psychological states of athletes. This might include assessments of decision making, attention, and stress responses. Such an approach would elucidate under what circumstances, and how, competing at home can enhance (and occasionally harm) athlete and team performance.

A critical question is whether the different models of the home advantage complement each other and can be amalgamated into a more general framework. For example, the occurrence of a home disadvantage in win-imminent situations might relate to fluctuating concentrations of testosterone and cortisol. Research has demonstrated that reproductively relevant behaviours (e.g., aggression) are related to a complex interaction between testosterone and cortisol such that testosterone relates to dominant behaviour only when cortisol concentrations are relatively low (Denson, Mehta, & Ho Tan, 2013). If high levels of stress (cortisol) can block the effect of testosterone on dominant responses this could help explain why athletes 'choke' in win-imminent situations where cortisol concentrations can

increase rapidly. Further, both audience pressure and territorial threat have a strong connection to motivational orientation (approach and avoidance) and this, in turn, is related to distinct physiological and cognitive consequences (see Blascovich & Mendes, 2010) that are similar to those observed in studies of game location (e.g., Carré et al., 2006). The balance of audience pressure (avoidance motivation) relative to the protective response to territorial incursion (approach motivation) might explain changes in neuroendocrine markers and why a home advantage can shift to a disadvantage in critical in-game situations.

To explore these effects will require a variety of experimental designs and investigators might look to manipulate home and away locations (e.g., students in a 'home' university laboratory and a rival university laboratory) where attention (e.g., eye movement) and autonomic markers (e.g., total peripheral vascular resistance) can be measured with greater ease (see, for example, Rees et al., 2013). Video based studies (where crowd noise can be manipulated) can also provide useful information on how officials and coaches might react in real world settings (see Nevill et al., 2002). Such experimental designs will no doubt incur a loss in ecological validity but are likely to compliment the descriptive data collected from naturally occurring high pressure competitions. A targeted recommendation might be to isolate/identify the different information being transferred from audiences to athletes/officials (e.g., displeasure, encouragement) and how this information contributes to subsequent decisions and behaviour (e.g., aggressive actions, attention allocation). 'Working the officials' is a common strategy among athletes and coaches, and spectators might also raise their noise levels (in response to unfavourable decisions) to increase the probability of more favourable decisions later in the contest. It is well documented that officials use prior knowledge and previous decisions to influence their current decisions (Bar-Eli, Plessner, & Raab, 2011) and an interaction between prior decisions and audience noise (venue) might better predict the decision making of sports officials.

## **Conclusions**

Game location has a powerful influence on performance outcomes in sport. The conceptual models discussed here each provide a unique take on the home advantage phenomenon and there is ample experimental and archival data to provide reasonable (but not robust) support for their main propositions. Indeed, the decisions of sports officials appear to be influenced by the behaviour of the crowd (e.g., Downward & Jones, 2007), athletes show a territorial response that is consistent with other animals (e.g., Carré et al., 2006) and home support seems to disrupt athletic performance in win-imminent situations of high importance (e.g., McEwan et al., 2012). Interestingly, more is known about the responses of sports officials than those of athletes and coaches. Officials tend to respond to crowd noise in a manner that favours the home team, but athletes are more complex – sometimes they respond well and other times they do not. This is why a general model of home ‘advantage’ for athletes is flawed because they will not always conform to it. For athletes, we need an integrative model that explains why a home environment can sometimes benefit, and at other times harm, athletic performance.

In this article we have reviewed new studies that contribute to our understanding of the home advantage phenomenon. We consider this an important avenue of inquiry, not only because this data can support consultants targeting athlete stress responses to varying environmental conditions, but also because it provides a context to explore more generally how humans respond to territorial incursion and social pressure. Investigating territorial responses in humans can be challenging, but organised team sport presents an ideal setting to capture the natural biological and behavioural changes that occur in a competitive environment. We recommend that researchers target their efforts towards developing a new conceptual model that can explain the psychological processes that govern success and failure in home and away locations.

**Recommended reading**

- Carron, A. V., Loughead, T. M., & Bray, S. R. (2005). (See References). A comprehensive overview of research on the standard model of the home advantage. This review separates research that has explored game location effects on psychological states and those that have explored game location effects on behavioural states.
- Jamieson, J. P. (2010). (See References). A comprehensive meta-analysis of the home advantage. This systematic review targets the magnitude of the home advantage and explores potential moderator variables including type of sport, length of season, and era of competition.
- Jones, M. B. (2013). (See References). A detailed narrative review of the home advantage in individual (rather than team) competitions. This review considers differences in the home advantage between sports that are subjectively judged (e.g. gymnastics) and those that are objectively scored (e.g. tennis).
- McEwan, D., Martin Ginis, K. A., & Bray, S. R. (2012). (See References). An exploratory study into the home (dis)advantage in loss-imminent and win-imminent situations. The study shows how different competitive situations might influence how athletes respond to a supportive home audience.
- Neave, N., & Wolfson, S. (2003). (See References). The original proposal and experiments into the territoriality model of the home field advantage. This multi-study paper explores differing concentrations of testosterone in athletes competing at home and away.

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