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Heuristic Reasoning and the Observer's View: The Influence of Example-Availability on *ad-hoc* Frequency Judgments in Sport

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Abstract

Drawing upon evidence from broader social psychology, and an illustrative empirical study of frequency-estimation during a simple sporting 'observe and recall' task, this paper makes the case for the more thorough investigation of the 'availability heuristic' (Tversky & Kahneman, 1973) on practical state-of-play reasoning in largely observational sporting activities. It is argued that this evidence particularly substantiates a need for a more robust body of research in two primary domains: (a) the 'gatekeeping' tasks pertinent (and usually preliminary) to an individual's sporting performance such as talent scouting, team selection and substitution decisions and, (b) the business of officiating in high-tempo environments.

Keywords: decision-making, judgement, heuristics, coaching, officiating, scouting

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Heuristic Reasoning and the Observer's View:

The Influence of Example-Availability on *ad-hoc* Frequency Judgments in Sport

Although not entirely ignored, cognitive heuristics have to date been relatively underexplored in sport psychology¹. Moreover, and as is also true of the broader literature on sporting decision-making, it is certainly the case that the bulk of heuristics research that has hitherto been completed is concerned almost exclusively with sporting *performance*, and particularly performance in professional and elite sports (see, for example, Souchon, Cabagno, Tractlet, Trouilloud, & Maio, 2009). This is, in many respects, a logical line of focus. Successful skill execution in many forms of high-level, sport-related task is demonstrably premised to a great degree upon an individual's ability to evaluate an inherently uncertain context and make 'pressurised decisions' therein. In a moment-by-moment manner, players make high-stakes judgements on the likely outcomes of various prospective courses of action. These judgements are themselves premised on practical assessments of what is happening at that time, and what has happened previously. It is the contention herein, however, that such decision-making processes are important at all levels of sport: 'stakes' are, after all, relative to the level of importance with which an individual or group imbues a situation. Equally, it could well be suggested that an understanding of the cognitive dynamics of situated decision-making can provide valuable insights not only into sport performance, but also in judgements made *about* sport performance 'from the sidelines'. The staggeringly diverse impressions that fans, scouts, coaches and so forth appear able to form regarding 'what actually happened' during a single sporting event have, after all, been a major focus for the social psychology of sport since the famous Dartmouth-Princeton football study by Hastorf and Cantril (1954). Consequently, the focus of this paper falls upon judgements made during the *observation* of sport. Supporting key assertions with evidence from an empirical study of frequency-estimation during a simple sporting 'observe and recall' task, the paper advances the following central thesis: the influence of cognitive heuristics on reasoning at the most primordial and

¹ Certainly when compared to the rich body of work in the field emanating from mainstream social psychology.

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ostensibly 'non-participatory' sites of sporting involvement makes a clear case for their more thorough psychological investigation with respect to two main realms of activity:

1. The 'gatekeeping' tasks pertinent (and usually preliminary) to an individual's sporting performance (e.g. talent scouting, team selection and substitution decisions), and;
2. The business of officiating in high-tempo environments;

In both of these, the salient mode of situated decision-making is of central importance.

Sport and Decision-Making

To date, human decision-making has been a topic of significant interest in a range of academic domains², with much of the early work in the field being derived largely from the economically-oriented game theory of Von Neumann and Morgenstern (1944)³. In general psychology, these 'rationalistic' models are ontologically allied to the econometrics from which they arose; this is to say that they are grounded in a tacit assumption that everyday human decisions are made through systematic, mathematical and probabilistic reasoning - Bayesian⁴ process - in an endeavour to strategically secure the best possible outcome in any given situation. Progressively, however, these models have come to be criticised for promoting an unrealistic image of decision making in the real world. Firstly, they treat decision-making as a purely academic exercise, a logic game, which is performed almost in a 'social vacuum'. This fails to take account of the manner in which individuals make operational decisions as parts of complex practical tasks and, critically, within complex *cultural, social and institutional contexts* (see Key & Schwartz, 2007; Sharps, Hess, & Ranes, 2007; Sharps & Martin, 2002; Thompson, 2003). Secondly, a range of subsequent studies have demonstrated that decision makers in everyday circumstances are often motivated to make a

² These domains include economics, mathematics, psychology, and many others. Bell, Raiffa and Tversky (1995) provide an extensive review of various such perspectives.

³ See also Bicchieri (2004)

⁴ A statistical probability interpretation using the Thomas Bayes formula (see Joyce, 2004).

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decision which would likely provide a 'good enough' outcome, rather than to seek a sole, optimal solution (Luce, Payne, & Bettman, 1999; Mellers, Schwartz, & Cooke, 1999). Consequently, the rationalistic paradigm in the study of decision-making has now been largely supplanted by a new range of approaches, more descriptive than predictive in character, which emphasise the personal-contextual, cognitive and experiential aspects of the 'deciding process'. These include the more normatively-oriented 'Bounded Rationality' approach (Simon, 1957), Prospect Theory (Kahneman & Tversky, 1979), the Recognition-Primed Decision model (Klein, 1993) and, central to the argument outlined in this paper, the *heuristic reasoning* approach (Tversky & Kahneman, 1973).

Sport, Decisions and Memory

In modern sport psychology, the processes involved in decision-making have to date proven a rich area for exploration⁵. Macquet (2009), for example, draws upon the Recognition-Primed Decision (RPD) model in articulating how the decisions made by participants in high-level volleyball, rather than employing a systematic and rational use of probability estimation, are influenced by three key situational factors: the manner in which the situation itself - and its 'typicality' - is identified, the comparisons that are made with previous experiences, and the use of pre-planning. These findings are congruent with those of traditional skill acquisition approaches⁶ such as Whiting's information processing model (Whiting, 1970) and Schmidt's schema theory (Schmidt, 1975) which emphasise the key role of *memory* in both decision-making, and the corollary processes of skill execution. More recently, meanwhile, the multi-domain work of Ericsson and Kintsch (1995) on the role of *long-term* working memory in the decisions and problem solving activities of experts and 'skilled performers' has proven highly influential in the psychology of sport. Their focus on the effective accessing of memory as a core part of the decision-making process has important ramifications not only for investigation of the activities of skilled athletes, but also other sporting experts such as coaches and

⁵ This review, due to considerations of space, is thus illustrative of major themes, rather than exhaustive.

⁶ In sporting contexts, these models are primarily associated with the acquisition of motor and perceptual skills by sport performers.

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officials. Indeed, contemporary research demonstrates that coaching, for example, is abound with complex and situated decisions (Côté, Salmela, Trudel, Baria, & Russel, 1995; Cushion, 2007; Cushion, Armour, & Jones, 2006; Jones & Wallace, 2005), the making of which can be heavily influenced by the schemata stored in memories of coaches themselves (Jones & Bowes, 2006). In a similar vein, refereeing and umpiring are social practices that, self-evidently, mandate the making of 'snap decisions'. Drawing on the Expert Performance approach advocated by Ericsson and Smith (1991), MacMahon, Starkes and Deakin (2007) demonstrate that recollections of *past experience* – particularly past experiences as a player – exert a significant influence over the ability of a referee (or, indeed, coach) to successfully identify infractions in real-time.

Although these approaches display a diversity of focus, there is little doubt that investigation of the role of memory in the making of sporting decisions has become a key priority for sport psychologists. Over the last forty years, however, a steadily expanding corpus of social cognitive research has documented at length how, when performing everyday reasoning tasks on-the-fly, individuals rarely, if ever, attempt (or indeed have the option of attempting) a comprehensive retrieval and examination of all potentially domain-relevant resources *from* social memory (Rothman & Schwarz, 1998; Winkielman & Schwarz, 2001; Winkielman, Schwarz, & Belli, 1998). More commonly, metacognitive 'short-cutting' strategies – judgemental heuristics – are employed to expedite these tasks (Kahneman, Slovic, & Tversky, 1982). Among the most commonly cited of these are the *representativeness* heuristic, which describes individuals' tendency to judge the probability of a hypothesis by evaluating the degree to which that hypothesis resembles the data directly available (see Tversky & Kahneman, 1974), and the *attitude* heuristic, in which truth and falsity judgements tend to be directed by pre-existing positive and negative attitudes towards given personalities or issues (Pratkanis, 1989). In terms of reasoning under conditions of contextual uncertainty, however, the most robustly demonstrated is the *availability* heuristic, first identified in a series of experimental studies in the early 1970s by Amos Tversky and Daniel Kahneman (1973; 1974).

Heuristic Reasoning and Example-Availability

The availability heuristic, in its most basic terms, describes the manner in which situated estimations of frequency or probability tend to be inducted from the germane information most cognitively salient to an individual, i.e. this order of judgement task is primarily informed by the task-relevant examples that can be *easily recalled*. For example, in one of their earliest experiments Tversky and Kahneman (1973) themselves noted that, in the English language, the letters 'K', 'L', 'N', 'R' and 'V' all appear in more words as the third letter than as the first. When asked to estimate rates of such occurrence, however, the significant majority of research participants (by a ratio of 2:1) asserted the reverse to be true, on the grounds that examples of words that begin with these letters, on the whole, the first letter of a word provides '...a better cue for recalling instances than does the third letter.' (Fox, 2006:86). A pertinent, and highly illustrative, field of research with respect to the operation of the availability heuristic relates to practical 'risk assessment'. In a famous study by Lichtenstein *et al.* (1978), over 75% of American participants estimated that more people die from accidents than from strokes, although strokes are almost twice as likely a cause of death as accidents in the US. This, the authors surmise, may be an output of greater media reporting⁷ of accidents than strokes, or simply because accidents provide more 'vivid' memories; whatever the causal factor(s) that make accidents more available to memory, however, the level of skew in the estimates themselves clearly demonstrates the availability heuristic at work. We might, with such examples in mind, consider the availability heuristic something of a 'rule of thumb' mode of reasoning – 'popular induction' (Nisbett, Borgida, Crandall, & Reed, 1976). Indeed, a number of authors point to the manner in which use of the availability heuristic can lead people to classic 'logical fallacies', in which robust and well-researched evidence is undermined in both the individual and popular consciousness by deviant, but familiar, anecdotal examples. However, a cautionary note to sound at this point, and as Gerd Gigerenzer (2006) has persuasively argued, is that one should always be guarded when

⁷ The link between media reporting and example availability was subsequently interrogated in more robust detail by Combs and Slovic (1979).

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conceptualising heuristics as little more than agents through which human reasoning becomes beset by biases and errors. Indeed, it is only possible to do so if we are to directly compare the outputs of ad-hoc reasoning tasks with those of formal statistical analysis, an inevitably uneven comparison from which the former is unlikely to emerge creditably under the vast majority of circumstances⁸. Very few sports, for example, structurally permit an individual to spend an extended period of time deliberating the full range of potential outcomes across a range of possible scenarios before choosing their course of action. In cricket or baseball, for example, where the player batting often has to contend with a ball moving at over ninety miles per hour, a very limited period indeed is available in which to select a shot that is likely to be profitable to play. Similarly, when making an in-the-field 'snap' judgement regarding the state of play at any given moment, a sporting official rarely has the luxury of an extended deliberation period. The use of some form of evidence-based systematic probability calculus within restricted timeframes is simply not an option. What is perhaps, then, most striking about heuristic reasoning in general is that it is an 'adaptive tool' (Gigerenzer, 2006) capable of producing surprisingly and consistently effective on-the-spot judgements. Heuristics – to this extent – are not 'parasites' on human reason, but prime features of it. With this in mind, it is this paper's explicit aim henceforth to (a) explore the relevance of the availability heuristic itself in sporting contexts - as a means of illuminating the potent connections between the availability of information in memory and situated reasoning tasks - but also (b) to do so in a manner that does not assume that the reasoning process itself is inherently 'flawed'.

Availability and the 'Schwarz Paradigm'

A major advance in the understanding of the availability heuristic arose initially in the work of Schwarz *et al.* (1991), which proposes that much work in the field had failed to '...disentangle the impact of content of recall and of the subjective experience of ease or difficulty that may accompany recall.' (p. 195). In short, it is necessary to understand whether reasoning is more, respectively,

⁸ Moreover, if a judgement being made is important, and the option of deliberation time is available, there is a very good chance that an individual would not rely upon ad-hoc heuristic reasoning to make that judgement anyway.

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contingent upon the overall *number* of examples that can be recalled, or the understood ease with which examples come to mind. Across three experimental studies, the authors found clear evidence to suggest that categories of event are assessed to be more common, and thus more likely to occur, when '...instances more *easily* come to mind, even when a smaller absolute *number* of instances are generated.' (Fox, 2006, p. 86). For example, in the first of these studies, Schwarz *et al.* (1991) devised a test to explore the supposition that if an individual finds a examples actively difficult to recall, they are likely to assume that the examples 'cannot be typical' and downgrade their assessment of its frequency or probability of occurrence in line with this. Students were asked to think of examples of occasions on which they had been assertive, and then list either six such occasions from memory (a relatively easy task) or twelve (a relatively difficult one). The students who listed six examples tended to subsequently rank themselves as more assertive than those asked to list twelve, despite the latter group recurrently recalling *more* actual examples overall than the former. This pattern of findings was repeated when asking students to find examples of unassertive behaviour; those that easily recalled six examples were more liable to judge themselves unassertive than those that struggled to recall twelve. Thus:

'...the content of recall affected self-judgments in the direction of the valence of the recalled behaviors only if the recall process itself was experienced as easy. If the recall process elicited experiences of difficulty, on the other hand, the content of recall affected self-judgments in a direction opposite to the implications of the recalled behaviors.' (Schwarz, et al., 1991, p. 197)

This proposition has (subsequent to the original work of Schwarz and colleagues) been corroborated by research on a number of phenomena involving probability and frequency judgements, such as self-evaluation of memory capacity (Winkielman, et al., 1998), and susceptibility to health problems (Rothman & Schwarz, 1998). As previously outlined, however, exploration of general heuristic

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reasoning in sport psychology – and the availability heuristic in particular – has to date been rather limited in terms of total research conducted, and also in terms scope, with the bulk of papers attending almost exclusively to the issue of athletic performance (such as Bennis & Pachur, 2006). One of the best contemporary examples of work outside of the direct athlete-performance realm, however, is the work of Souchon *et al.* (2009), in which the 'sporting' and 'disciplinary' decisions of referees in handball matches, at both League and National levels, are evaluated in terms of a range of judgemental heuristics. In terms of sporting decisions, the authors describe how:

'...referees avoided giving the relatively minor...sporting intervention at the higher standard of competition. This finding is consistent with the notion that a high standard of competition involves greater flow, thus effective refereeing is characterized by fewer interventions.' (p. 699)

With respect to disciplinary judgements, meanwhile:

'...the standard of competition interacted with the ambiguity of the offence to predict the disciplinary decision. Surprisingly, the more ambiguous fouls were punished as severely at a high standard of competition as at the low standard, while the more obvious fouls were penalized differently according to the standard of competition. After the obvious fouls, referees opted for fewer suspensions at a high standard of competition than at a lower standard.' (p. 700)

The study demonstrates with clarity that, when making both types of decision, referees use 'standard of competition' itself as a heuristic; their pre-held stereotypes regarding what could and should occur at different levels of sport effectively short-cut the need to fully recall and evaluate any given set of circumstances in reaching a quick conclusion.

In order to illustrate the core themes discussed above in a thematically relevant manner, a frequency estimation study was conducted, with a view to assessing the influence of the availability

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heuristic on participant reasoning during a simple sporting 'observe and recall' task. Drawing upon existing research, the study design embedded measurement of participant frequency-estimation with respect to two factors that might inform 'vividness'. Firstly, as documented by McKelvie (1995; 1997; 2000), account was taken of the fact that famous or well-known examples of a phenomenon can provide significant cues to memory, with resultant over-estimation of the quantity or frequency of its overall occurrence. Secondly, and as Tversky & Kahnemann (1973) demonstrate, personal familiarity or involvement with a phenomenon can also influence estimates in much the same way.

Method

Participants

With institutional ethical approval, undergraduate students reading for sport-related degrees (N=141) were invited to participate in the study. All those invited (42 women, 99 men, *M*age = 20.1 years, age range: 18-36 years) consented to be involved.

Materials

A show of 50 slides was prepared, lasting a total of 3 minutes. Each slide was shown for the same duration as all others, and contained a photographic image of one of five sports being played: association football, tennis, running, golf or netball. These slides were balanced in terms of overall quantities (N=10 for each sport), and the sports themselves were distributed evenly across the show to compensate for the effects of primacy/recency on participant recall (see Sousa, 2006). For the slides containing images of association football and tennis, action shots of well-known athletes in the pertinent sports were shown (henceforth 'celebrity sports'). For the remaining slides, 'generic' action shots were used; images showed non-famous athletes taking part in running, golf and netball (henceforth 'non-celebrity sports').

Procedure

Participants were initially asked to make a note of the sport in which they themselves were most heavily involved, and then to view the slideshow detailed above (with no indication made regarding the nature of subsequent tasks). Immediately upon the slideshow's conclusion, participants were asked to complete, within a window of 45 seconds, a survey indicating *which* sports they had seen, and how *many* slides pertinent to each of these there had been in the show. As such, it was postulated that, within the pressurised timeframe:

- a. In line with the work of McKelvie (2000), participants would produce statistically greater mean frequency estimations for occurrences of the celebrity sports than the non-celebrity sports, even though, in reality, there were equal numbers of all five sports displayed during the slideshow, and/or:
- b. In line with the work of Tversky & Kahnemann (1973), a positive relationship would emerge between the sports in which the participants themselves were primarily involved and higher frequency estimations of the occurrence of that sport in the slideshow.

Data Analysis

Data were initially examined for normality using the Kolmogorov-Smirnov test. The assumption of normality was not met; therefore a non-parametric approach was employed. A Friedman test was utilised to explore whether differences existed in participant frequency-estimation between the five different sports (football, FB; tennis TNS, netball NB, running, RNG; and golf, GLF), followed by a Wilcoxon signed-ranks test with Bonferroni adjustment to compare the overall means of celebrity and non-celebrity sports. Spearman's correlation (ρ) was carried out to examine for relationships between the sports in which the participants were primarily involved and their estimated frequency of occurrence in the slideshow. All data are presented as mean \pm SD unless otherwise stated. Significance level was set at $p < 0.05$. All statistical analyses were conducted using SPSS v15.0.

Results.

The Friedman test revealed a significant overall difference ($p < 0.001$) between celebrity and non-celebrity sports. Bonferroni adjustment produced a significance value of 0.005 to be used for all the comparisons. FB was not significantly different ($p = 0.166$) to TNS. However, they were both significantly different to all other (non-celebrity) sports ($P < 0.005$). There were no significant differences between the other sports (see Figure 1).

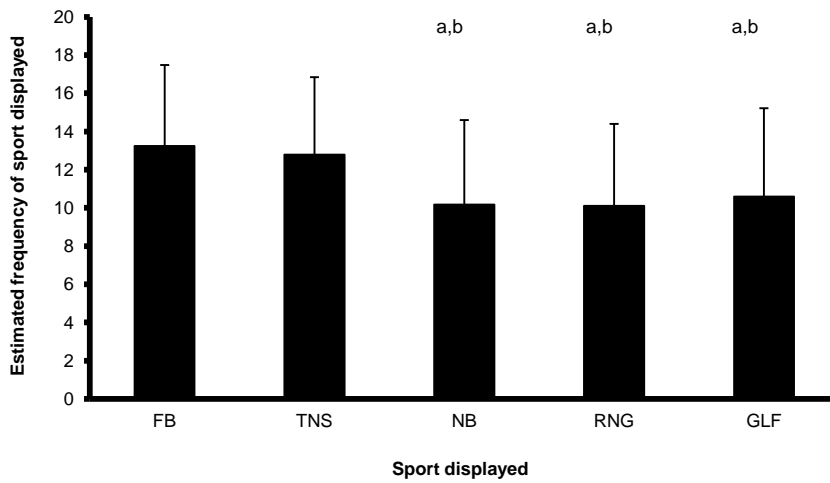


Figure 1: Estimated frequency of sport presented. Data presented as means. Vertical bars denote SD. FB, football; TNS, tennis; NB, netball; RNG running; GLF, golf. 'a' indicates significant difference with FB, while 'b' with TNS.

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Finally, there were no significant correlations between the sports in which participants were 'primarily involved' and their estimates of the frequency of occurrence of these sports within the slideshow, nor were there demonstrably divergent trends along lines of gender or age.

Discussion.

The findings described confirm the first of the two postulated outcomes above. Although the sports displayed in the slides occurred in equal numbers ($N=10$ for all), mean frequency estimations were substantially greater for the celebrity sports, football (13.24) and tennis (12.79), than for the non-celebrity sports, netball (10.17), running (10.10) and golf (10.60). In short, while participants' mean estimations of the frequencies of occurrence of non-celebrity sports in the slideshow were very accurate indeed (a combined mean of 10.29), mean estimations of the occurrence for the celebrity sports (a combined mean of 13.01) were inflated by over 30%. There was, however, no statistically significant relationship between participants' frequency estimations and their own involvement in particular sports. This indicates that, within the sample:

- a. Participants utilised the availability heuristic in making time-pressurised frequency-estimations, sizeably over-estimating the frequency of occurrence of those sports linked to more vivid examples.
- b. The involvement of well-known athletes in some of the viewed sports provided a much stronger cue to memory (i.e. were more 'vivid') than either the sports themselves, or the participants' own personal involvement in particular sports.
- c. The presence of 'more vivid' examples did not, however, lead to any substantial counterbalancing underestimation of the frequency of occurrence of those sports linked to less vivid examples.

Of course, the nature of the sample itself (a set of individuals that could reasonably be expected to recognise the 'sporting celebrities' as exactly that) is a key factor herein. As has been observed in a

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variety of studies to date, however, there is always an interpretative/experiential quality to how an individual constitutes 'vividness' in *any* case of a 'thing' (McKelvie, 2000). The research reported above, if repeated using a sample of participants with rather less interest and/or experience in (and therefore knowledge of) sport, would likely have produced very different results. The proposed 'fame' of the athletes would simply not be a good cue to memory if the participants themselves did not actually recognise those athletes, though one should always be mindful that the parameters of a concept such as 'fame' are not themselves always easy to delineate. An athlete such as David Beckham, for example, may have initially gained fame in association football but his subsequent career trajectory now renders him internationally recognisable to many people with no knowledge of sport whatsoever, but who may preserve strong interests in fashion or 'celebrity culture' at large. Consequently, circumspection should always be exercised when prejudging what might, or might not, provide strong cues to memory among given populations. It may well, for example, have been reasonable to expect the regular golfers in the sample to provide higher estimations of the number of golf-related slides in the show; this was, however, not the case. The *recognisability* of the footballers and tennis players in the slideshow clearly provided a stronger cue to memory among these participants than their own identification with golf itself.

Many judgements in 'non-participatory' sporting activities involve, or are premised upon, individuals making quantity or frequency estimations regarding what has recently happened, or is happening. As outlined in the introduction to this paper, there are two general domains for which these observations have particular import, which are now discussed in turn.

'Gatekeeping' Tasks

There is little doubt that individuals involved in 'gatekeeping' activities in sport, i.e. those responsible for the access of others to particular arenas such as talent scouts, coaches and team selectors, are often called upon to make snap judgements grounded in 'state of play' assessments. Although these are not always subject to the same degrees of time-pressurisation as those made by in-game officials (see below), the circumstances of such judgements still largely preclude extensive

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deliberation using full and detailed reams of objective evidence. Woodman (1993) in an early noteworthy piece described -different perspectives on coaching and suggested that as coaching emerges as a profession the decision making process and practice of coaches could be viewed as both an art and a science . Since then however, the increased professionalization of coaching and focus on performance enhancement has seen the development of scientific approaches to inform the decision making in coaching illustrated in potrayl of the coaching process . Recent practice has seen the development of performance analysis systems to ensure evidence based coaching. Despite this, a body of recent literature also suggest that coaches operate in socialy fluid and complex environments that do not allow for simplistic decision making and are a social process influenced by complex social factors that influence decision making of coaches. Results from this study suggest that observation, a key aspect of the coaching process, is influenced by social factors such as celebrity. This raises considerable issues for coaches who as gatekeepers use intuitive decisions based on observation to inform decisions such as substitutions, tactical changes, feedback and indeed future practice planning. Ultimately, observation under time pressure, shown to contain bias and inaccuracy in this study, and a key aspect of the coaching process can influence the development and participation of athletes and thus Coach educators may want to consider the influence of heuristics on coaches when exploring decision making.

Current research by the authors⁹, for example, explores substitution decisions made by coaches in a variety of sports. Many such decisions are predicated on an assessment of which players are consistently effective and which are consistently making mistakes. As participating coaches maintain, however, it is simply not practical for a coach to try to make a note of every action by every player on the team; to try to do so would, indeed, draw attention away from the broader context of

⁹ Colum Cronin, Louise Rowe, Paul K. Miller and Theodoros M. Bampouras: 'How well do coaches count? Decision-making from the sidelines.' Research in progress, supported by the University of Cumbria Research Innovation Funding scheme.

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'the game' itself'. Therefore, each success or failure by any given player makes relevant estimation pertinent to that which has gone before. Early findings indicate a tendency, among the participating coaches, to overestimate the *number* of mistakes made by players who have been cautioned, who have missed penalty kicks and so forth. In short, mistakes that involve or induce a significant break in the game appear to provide more vivid examples of 'poor performance' than mistakes that occur in open play. Consequently, preliminary evidence suggests that players who make a sizeable number of small errors are less likely to be substituted by their coach for 'consistent error-making' than players who make a smaller number of more memorable errors.

Officiating

Despite a widely-held desire for error-free decision-making from officials in association football (Lane, Nevill, Ahmad, & Balmer, 2006), ~~for example~~, officials have been shown to make decisions influenced by, for example, such apparently arbitrary variables as the height of player (Quaquebeke & Giessner, 2010), the colour of a player's shirt (Frank & Gilovich, 1988; Tiryaki, 2005) and the level and type of crowd noise (Nevill, Balmer, & Williams, 2002). If we consider, however, the particular pressures of time limitation on an official's decision-making, it is possible to hypothesise that all such vivid stimuli may simply render particular cases-of-event *easier* to recall at the moment that the decision is made. Cautions issued on the grounds of 'persistent infringement', for example, require an official to make a situated judgement regarding the overall quantity of infractions committed by a single player within a broad melee of activity. To keep a full count of all such infractions committed within a single game by all players would, without the benefit of perfect recall, be extremely difficult, and progressively *more* difficult as the clock advances. As such, it is reasonable to expect that some kind of shortcutting strategy would need to be employed and, moreover, that some infractions, classes of infraction and characteristics of infracting player are more vivid in memory than others. In cases where ~~the~~ the distribution of this mode of caution can be found to be inconsistent with the actual numbers of infractions committed (i.e. where some players receive 'persistent infraction' cautions despite other players having transgressed more often), a systematic

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analysis should reveal the classes of cue responsible for the overestimation in given officials. The findings of Findlay & Ste-Marie (2004), for example, demonstrate a clear 'reputation bias' among sporting officials; decisions are often made in line with prior knowledge regarding the 'type' of athlete involved. If, therefore, infractions committed by an athlete 'known' to be aggressive provide an official with more vivid examples of transgressive behaviour than infractions committed by athletes without such a reputation, there is a very real danger of emergent 'self-fulfilling prophecies'. Essentially, overestimation of infraction-frequency borne of an athlete's reputation may well lead to public disciplinary action which serves, in turn, to further *contribute* to that reputation. This mode of spiral can only be effectively halted through intervention designed to rebalance the manner in which officials themselves manage and understand the roles of particular cues.

Conclusions and Future Research

The full impact of the pioneering work of Tversky and Kahneman (1973), and Schwarz *et al.* (1991), has yet to be felt in the academic study of sport. Evidence from the broader realm of social psychology, and the illustrative study presented herein, indicate that there is much scope in sport psychology for a more thorough investigation of cognitive heuristics in general, and the availability heuristic in particular. Moreover, this scope need not be confined to (expert) performance studies, but should embrace a wide range of sport-related activities, not least coaching, scouting and officiating. Domain-specific and rigorous research is required to facilitate a better understanding not only of where the availability heuristic is in use in sporting activity, and its order of influence on judgements made, but also which factor(s) most strongly inform(s) the very vividness of a recalled example. A richer and more robust body of evidence relating to these matters has direct implications for not only the better academic understanding of the formulation of sporting 'state of play' judgements, but also bears the potential to inform a range of practical intervention strategies.

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