Citation Network Analysis of Research on Sport Officials: A Lack of Interconnectivity

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Abstract

In sport research, the majority of attention is directed toward athletes. While investigations on sport officials have proliferated in recent years, many queries remain unanswered. Through citation analysis, we investigated how information is shared amongst sport official researchers. We focused on a particular group of sport officials that interact with athletes during competition, or what MacMahon and Plessner (2008) termed “interactors”. We searched 3 databases for articles published before 2012 that centred on psycho-social and perceptual-cognitive aspects of officiating. Three groups of research included personality, stress, and decision-making. The resultant 115-article network revealed that little connectivity within and between groups; that is, articles did not frequently cite other articles in the citation network (an average of 4.25 citations per article, with the median value being 2.0). The 12 most cited articles (appearing in 9 journals) were mainly original papers and focused on male soccer referees’ decision-making; however, the publication dates varied from 1990 to 2004. We discuss the results and implications this paper has on sport officials research, particularly related to sport officials being used as a context to study general expertise, the lack of a true sport official journal, and the similarities and differences of the most cited articles.

Keywords: referees, arbiters, personality, stress, decision-making
Introduction

The athletic environment is an intricate and complex domain of expertise that includes athletes, coaches, fans, and sport officials. Sport scientists have dedicated their attention to understanding this environment by focusing mainly on the expert performance of the athletes. For instance, we now have a better comprehension of the role that deliberate practice (Ericsson, Krampe, & Tesch-Römer, 1993), deliberate play (Côté, 1999), and early engagement (Ford, Ward, Hodges, & Williams, 2009) have on attaining sport expertise. There is also a wealth of information on the characteristics of experts including anticipation skills (Abernethy & Russell, 1987), quiet eye (Vickers, 2007), and recall/recognition (Williams, Davids, Burwitz, & Williams, 1993). A great deal of literature explains how relative age effects (e.g., Musch & Grondin, 2001), birthplace effects (e.g., Côté, MacDonald, Baker, & Abernethy, 2006) and group dynamics (e.g., Kleinert et al., 2012) can shape performance in sport. Though plenty of fruitful future endeavours exist, the work by sport scientists over the past 50 years has been essential for outlining main principles and concepts on athlete development, while also establishing a substantial amount of literature for sharing and gleaning knowledge.

Much of the research in the sport environment centres on athletes, but other participants play a vital role as well including sport officials. The function of the sport official is complicated, yet necessary. Sport officials must protect the safety of the athletes, understand the laws of their sports, position themselves appropriately to view the action, make quick (and often successive) decisions, use proper judgment, communicate with athletes and coaches, and uphold the integrity of their sports (Helsen & Bultynck, 2004; Mascarenhas, Button, O’Hare, & Dicks, 2009; Mascarenhas, Collins, & Mortimer, 2005). Sport officials have a complex role, and it is a challenge to perform all these tasks (Rix-Lièvre, Boyer, Coutarel, Lièvre, 2014). As such,
research on sport officials is important to maintain the integrity of sport performance and athletes’ development.

Empirical, peer-reviewed research on sport officials began to appear in the 1970s. Early studies focused on sport officials’ consistency (Alker, Straub, & Leary, 1973), personalities (Fratzke, 1975), and psychology (Kroll, 1977). Through the 1980s and 1990s, research dedicated tremendous efforts to understanding stress levels in sport officials. Key papers by Anshel and Weinberg (1995, 1996, 1999), along with Rainey and Hardy (1997, 1999) helped to demonstrate that while sport officiating seems highly stressful, officials’ ratings of the magnitude of stress were not overly high. In fact, sport officials often reported the most stressful situation being fear of failure, rather than fear of verbal or physical abuse. During the late 1990s and into the 2000s, researchers continued their efforts at examining sport officials, with renewed interest in the process of decision-making. Here, it was discovered that crowd noise (Balmer et al., 2007; Nevill, Balmer, & Williams, 2002; Unkelbach & Memmert, 2010), crowd size (Downward & Jones, 2007; Johnston, 2008), and the home team (Balmer, Nevill, & Lane, 2005; Boyko, Boyko, & Boyko, 2007; Nevill & Holder, 1999; Sutter & Kochera, 2004) can bias the accuracy of sport officials’ decisions. Other contextual factors also influence sport officials’ performances including, but not limited to, foul differential (Anderson & Pierce, 2009), sequential decisions (Brand, Schmidt, & Schneeloch, 2006), deliberate practice (Catteeuw, Helsen, Gilis, & Wagemans, 2009; MacMahon, Helsen, Starkes, & Weston, 2007), distance from the play (De Oliveria, Orbetelli, & De Barros Neto, 2011), and uniform colour (Hagemann, Strauss, & Leißing, 2008; Tiryaki, 2005). Many of these research papers offered newfound knowledge to an understudied population. Subsequently, a recent movement in the discipline emerged that focuses on the complexity of decision-making by analysing behaviours in a naturalistic setting in
which multiple variables impact performance (e.g., Mascarenhas, et al., 2009; Rix, 2005).
Currently, however, only a few of these exemplary papers exist.

Through the proliferation of research papers, the sport officiating field has gained viability. Despite this, the common elements that constitute this field of research have not been identified, resulting in a knowledge structure that lacks visibility. For any research discipline to be viable, it must have a visible structure; that is, researchers must know what has been studied, understand implemented theoretical backgrounds, and identify major gaps (Gustafsson, Hancock, & Côté, 2014; Mina, Ramlogan, Tampubolon, & Metcalfe, 2007). Armed with this knowledge, researchers can then decide which avenues of future research might best benefit and advance the field. This increased visibility not only improves the efficiency and effectiveness of ongoing research, it also provides clear direction to practitioners – in this case, those working with sport officials to improve performance. Systematic reviews help to establish the visibility of a field of research by identifying important studies, finding research gaps, and ultimately providing directions for future research (Thomas, Nelson, & Silverman, 2005). While qualitative reviews are more common, quantitative reviews (e.g., meta-analyses and citation analyses) also contribute significantly to the understanding and advancement of a field of research. Although few review papers exist that qualitatively synthesize our knowledge of sport officials (see Guillen & Feltz, 2011; Mascarenhas et al., 2005; Plessner & Haar, 2006) no quantitative reviews have been performed on sport officials research.

One suitable method to quantitatively assess and describe the status of a body of literature that has existed for a number of years (i.e., since the 1970s for research on sport officials) is a citation network analysis. Through a citation-based analysis, researchers can identify the amount of interconnectivity (i.e., the citation structure) of a particular field. In doing so, key researchers,
prominent articles, common themes, and literature gaps are identified and the common elements that constitute a domain of research emerge (Gustafsson et al., 2014; Moore et al., 2005). This approach contrasts with methodologies such as meta-analysis, which aims to collate the results of a specific domain. Therefore, the purpose of the present study was to implement a citation network analysis of research on sport officials. The rationale for selecting citation network analysis was that we intended to explore the structure of sport officials literature (e.g., main themes being studied), as well as how well researchers integrated extant literature with new studies (Moore, Shiell, Hawe, & Haines, 2005).

**Method**

**Article Retrieval**

Possibly the most critical step in a citation analysis is seeking articles that will eventually constitute the citation network. To begin, we implemented a broad, exploratory approach to the article search in order to avoid arbitrarily narrowing the analysis. Thus, we identified six potential sport science databases from which to conduct our search: SportDiscus, PsycINFO, Medline, PubMed, Physical Education Index, and CINAHL. In each database, we searched the term “sport” in conjunction with either “judge”, “official”, “referee”, or “umpire” (including derivatives). We also limited our search to peer-reviewed, English articles. Following this procedure, it was determined that our search process was too broad, yielding more than 1000 total returned articles across the combined six databases. As citation network analysis aims to discover the citation structure of a connected field (e.g., one with the same theoretical underpinnings), it was determined that the best course of action was to limit our search to one particular aspect of officiating. Narrowing our search to articles involving psychological components of sport officiating, we focused on the three search databases most relevant to
psychology: PsycINFO (psychology), SportDiscus (sport psychology), and Physical Education Index (psychology of physical activity). Importantly, we then delineated between different types of sport officials. According to MacMahon and Plessner (2008), sport officials can be divided into three groups: (1) interactors, (2) monitors, and (3) reactors. Interactors, such as ice hockey referees, attend to a high number of cues and have a high level of interaction with athletes. Monitors can include gymnastic judges, and refer to official who attend to a high number of cues, but have little interaction with athletes. Finally, reactors attend to fewer cues and have little interaction with athletes; an example would be a tennis line judge. Not surprisingly, the function and role of each type of sport official varies. Thus, to present a more focused paper on psychological components of sport officiating, we solely examined interactors who consistently monitored a high number of cues and had high level of interaction with athletes (e.g., ice hockey, basketball, and soccer), thereby dropping “judge” and “umpire” for our search terms. This was chosen as the number of cues and interactions experienced by interactors might lend itself to more studies focused on psychological performance. A further measure was that we only included articles published before 2012. Finally, as we were focused on psychological components, any returned studies related to officials’ physiology were excluded from the citation analysis.

This led to a large, though manageable, citation network. Each returned article was inspected to ensure that it met all search criteria, and following, the reference list was then reviewed to seek out any additional manuscripts that ought to be included in the citation analysis, but were missed by the search process. This procedure yielded 115 unique articles related to sport interactors and meant that studies solely examining assistant referees and linesmen were excluded from the network. As a final verification procedure, the second author (a recognized
expert of research on sports officials) reviewed the list of articles and compared it to an
exhaustive database she began more than a decade ago. The second author had been
intentionally excluded from this search procedure until this point, which allowed her to provide
this objective verification of the article list. Indeed, the second author confirmed that the
generated list was comprehensive and no articles were missing. The complete list of articles is
available upon request to the corresponding author.

**Analysis**

To analyse the search results, articles were arranged alphabetically and then allocated a
number ranging from one to 115 based on this order. This reference number was then entered
into the first row and first column of a spreadsheet, resulting in the framework for a citation
matrix. Beginning with article 1, each reference list was then examined to ascertain other
articles in the matrix it cited. Article 1, for instance, might have cited articles 5, 25, and 45, in
which case, an “x” would be entered in row one below the column headings “5”, “25”, and “45”.
In doing so, we created a comprehensive matrix of the manuscripts that cited, or were cited by,
other articles in the network.

UCINET® 6 is a software program that evaluates citation structures. As such, the article
matrix was imported into UCINET® 6 for analysis. The first step of the citation analysis is to
identify the centrality scores, operationalized as the number of times a manuscript is cited by, or
cites, another article in the matrix. For instance, if article A cited article X while also being cited
by article Y and Z, the total centrality score for article A would be 3. Our particular focus,
however, was on in-degree centrality scores, which is the number of times an article is cited by
others in the network (Moore et al., 2005). In the above example, articles Y and Z cited article
A; therefore, the in-degree score for article A would be 2. By concentrating on in-degree scores,
we were able to identify the most central and pertinent manuscripts within the network population (Moore et al., 2005). The second step in UCINET® 6 is to produce a visual representation of the citation network. This allows for further inspection of the network, particular the identification of any sub-groups within the network (i.e., searching for clustering of articles related to a particular theme such as referee bias). The final step, which is related to centrality measures, is identifying the most cited articles, which can then be examined for possible similarities and differences (e.g., publication date, journal, expertise level of participants, male or female participants, and original or review papers). These chosen categories correspond with analyses conducted by previous researchers (e.g., Buckham, Hancock, Erickson, & Côté, 2012; Gustafsson et al., 2014) to provide an objective analysis of potential patterns amongst the most cited articles. In this study, we sought to isolate and describe the 10 most cited articles, approximating 10% of the citation network.

**Results & Discussion**

For the first result, which centres on the centrality measures, there were total of 490 citations across the 115 articles (an average of 4.25 citations per article, with the median value being 2.0) with in-degree scores ranged from 0 to 30. Previous citation analyses in sport have shown greater in-degree average scores. For instance, Bruner, Erickson, McFadden, and Côté, (2009) studied athlete development models noting 9 citations per article. In a recent study on athlete burnout, Gustafsson and colleagues (2014) noted 10 citations per article. Our study averaged 4 citations (median = 2.0) per article, despite focusing on a very specific participant group (sport interactors). This discrepancy in the amount of interconnectivity compared to previous studies warrants further attention, but first we present the visual representation of our analysis.
Examining the picture (see Figure 1), several boxes and lines are embedded within. In citation analysis, each box is referred to a node and represents a unique article in the network. Each box also has a corresponding number between 1 and 115, which is traced back to the original article list – again, available upon request from the first author. Larger nodes indicate a higher in-degree centrality score (i.e., they were cited most often by other articles in the networks), whereas smaller node denote little connectivity. The lines that connect the nodes are called ties, which refer to an instance where one article cites another. Thus, visual representations with many ties indicate high interconnectivity in a network. The top left portion of Figure 1 has 6 numbers (18, 19, 28, 44, 93, and 107) with no connecting lines, meaning they did not cite, nor where cited by, any articles in the network. As mentioned in the above paragraph, our network had low interconnectivity between the articles, which is now witnessed in the network picture. Many questions can be asked of this lack of interconnectivity, though definite conclusions are premature at this time.

***** INSERT FIGURE 1 NEAR HERE *****

An important discussion is of the role of research on sport interactors. It is possible that researchers are using sport interactors as a medium to investigate general theories of expertise such as decision-making, perception, or stress, which can then be applied to other populations such as athletes, medical professionals, or the military; therefore, researchers would cite literature specific to their purposes (e.g., decision-making researchers would cite studies on decision-making). This perspective, though helpful to understanding expert performance, would not aim to accrue knowledge on sport interactors, possibly explaining the lack of interconnectivity. To better understand this, it would be interesting to examine the references of each article in the citation network in order to establish the ratio of specific articles (i.e., citing
referee papers) compared to general articles (i.e., citing decision-making papers). A second possibility is that researchers who are interested in progressing the field might reference literature from other types of sport officials such as monitors or reactors in order to inform their research. Certainly it should be encouraged to incorporate the global body of literature on sport officials, which may be occurring; however, this practice should not preclude the use of interactor research to inform studies. Rather, it should supplement extant research on their studied populations. These would be interesting queries to explore in the future.

Further visual inspection of the network picture led to the identification of three clusters of nodes – the top left group, the bottom centre group, and the right side group. UCINET® clusters nodes that share similar connections; therefore, we investigated the articles that constituted each cluster. Interestingly, three distinct fields of sport interactors research emerged in these clusters. For the top left group, the articles concentrated on personality (the most cited (10 citations) was Purdy & Snyder, 1985), whereas the bottom centre group focused on stress (the most cited (21 times) was Taylor, Daniel, Leith, & Burke 1990). The right side group, on the other hand, targeted decision-making (the most cited (30 times) was Nevill et al., 2002). While there are some connections in the network between the stress and decision-making as well as stress and personality, there are very few connections between personality and decision-making. This possibly demonstrates a narrow, compartmentalized approach to sport interactor research, rather than a broad, inclusive approach. This compartmentalized approach to sport official research probably contributes to its lack of connectivity and visibility. An additional observation is that personality was the oldest topic included herein and had the least connectivity, while decision-making was the most recent and had the most connectivity. Perhaps
with more electronic access to journals, sport officials researchers are better able to stay informed, thus explaining this result.

Table 1 provides a list of the most cited articles in the network. As three articles shared the 10th most citations, our list includes the 12 most cited articles (see Table 1). The publication dates of the most cited articles were quite varied, spanning from 1990 to 2004, though half of the most cited articles were published during the past 15 years (i.e., 1999 onwards). Despite the first article in our network being published in 1971 (Schurr, 1971), the most cited articles were not published for 19 more years. In an effort to understand this result, we further analysed the publication dates of all articles. The percentage of published articles in the citation network is as follows: 14% before 1990; 17% between 1990 and 1999; 54% between 2000 and 2009; and 19% in 2010 and 2011. Thus, it is peculiar that not one article from pre-1990 is in the most cited, especially considering that an issue with citation analyses is a bias towards older articles that could have been cited for many more years compared to more recent articles, known as the seniority effect (Barabási, 2003; Bruner et al., 2009; Bruner, Erickson, Wilson, & Côté, 2010). As suggested by Barabási (2003), the seniority effect might be negated when newer articles are more searchable (e.g., online journals); however, as the twelfth most cited article had only 13 citations, it seems as though older articles were simply not cited often in our network. As such, we draw the conclusion from this analysis that older articles on sport officials did not provide a foundation for future research. This field of study is being structured around more recent articles. The recency of the studies that are used to build the foundation of sport officials research may explain, in part, its lack of visibility at this point in time.

***** INSERT TABLE 1 NEAR HERE *****
After examining publication dates, we also inspected publication venues. Variation in publication venue was noted, as a total of 9 journals were represented by the 12 most cited articles, with *Journal of Sports Sciences* (3 articles) and *Journal of Applied Sport Psychology* (2 articles) being the only journals represented multiple times. Over 40 journals are cited in our network, making it apparent that there is no true “sport officials” journal. This finding might assist to explain earlier results, as without such a journal, it becomes more difficult, though not impossible, for researchers to stay current on all sport interactor publications. At the very least, this might explain the lack of interconnectivity in the early years of the field, before electronic databases were prevalent. In the absence of journals specifically dedicated to research on sport officials, special issue journals might play a vital role in sharing research on sport interactors.

Regarding the demographic of the sample studied, only 8 of the articles adequately described their participants' expertise, which again, varied tremendously from intramural officials to professional and international referees. In the establishment of a valid and visible field of research, it is important for future researchers to explicitly consider and state the expertise level of the participants they studied. For instance, knowing the types of factors that influence decision-making in intramural sport might be valuable, but could also be considerably different from the environment of youth sport or professional sport. Hancock, Rymal, and Ste-Marie (2011) offered a classification of sport officials that may be useful to describe the participants of future studies: 1) recreational, 2) club, 3) varsity, 4) provincial (or state), 5) national (or professional), and 6) international. Starting with these classifications, researchers ought to be able to categorize their sample participants, thereby providing more clarity to research on sport officials.
There was plenty of homogeneity in regards to the sex of participants used in the most
cited articles. No studies reported using only female participants, while half the studies reported
using only male participants. This result is not surprising, as male officials are more common.
A strong suggestion, however, would be for future researchers to consider more study designs
that incorporate or specifically target female sport interactors. More specifically, studies that
could help increase the representation and retention of this underrepresented group would be
important to conduct.

Finally, there was also congruence in terms of the most cited articles being original or
review papers. In fact, 11 of the articles were original papers, and the lone review paper was
cited 13 times since its publication in 1999 (Nevill & Holder, 1999). Though this might be
surprising, it is imperative to note that Nevill and Holder (1999) reviewed the literature on the
home advantage, which is very specific, and likely precludes it from being cited in the majority
of subsequent work on sport interactors. What is more perplexing is that Mascarenhas and
colleagues (2005) produced a review paper that resulted in the development of the Cornerstone
Model of Refereeing Performance – a very inclusive model for expert officials – yet this has only
been cited in our network 3 times. Models and reviews papers ought to be among the most cited,
and sport interactor researchers should consider this in their future work.

Conclusions

The purpose of this study was to conduct a citation network analysis of research on sport
interactors, noting two key findings. The first main result was that despite more than 40 years of
study, the discipline suffers from a lack of connectivity between research papers, which we posit
has hurt the visibility of the field. This lack of connectivity extended to within our three groups
of research (personality, stress, and decision-making). This compartmentalized approach might
be a result of researchers: (1) using sport interactors to study general theories of expertise, (2)
frequently citing other types of sport officials, or (3) not having dedicated sport officials journals.
The second main result is for the top 12 papers. The most cited articles in the network typically
had the following features: (1) original papers, (2) published in a variety of journals, (3)
published during the past 15 years, (4) focused on male participants, (5) studied decision-
making, and (6) included sport interactors of varying expertise. This mix of characteristics
points to a lack of structure in the field, which might be improved through systematic studies
such as this one. We hope that this paper serves as a useful tool for researchers looking to
conduct future studies on sport officials – who can consider these key findings when creating and
publishing their studies – ultimately improving the structure and visibility of the discipline.
References


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Kaissidis, A. N., & Anshel, M. H. (1993). Sources and intensity of acute stress in adolescent and
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MacMahon, C., Helsen, W. F., Starkes, J. L., & Weston, M. (2007). Decision-making skills and
65-78.

Farrow, J. Baker, & C. MacMahon (Eds.), *Developing sport expertise: Lessons from

Mascarenhas, D. R. D., Button, C., O’Hare, D., & Dicks, M. (2009). Physical performance and
decision making in association football referees: A naturalistic study. *The Open Sports


Table 1

Top-12 most cited articles in the citation network analysis

<table>
<thead>
<tr>
<th>#</th>
<th>ID</th>
<th>Cited</th>
<th>Authors</th>
<th>Year</th>
<th>Journal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>72</td>
<td>30</td>
<td>Nevill, Balmer, &amp; Williams</td>
<td>2002</td>
<td>Psychology of Sport and Exercise</td>
</tr>
<tr>
<td>2</td>
<td>105</td>
<td>21</td>
<td>Taylor, Daniel, Leith, &amp; Burke</td>
<td>1990</td>
<td>J of Applied Sport Psychology</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>20</td>
<td>Anshel &amp; Weinberg</td>
<td>1995</td>
<td>J of Applied Sport Psychology</td>
</tr>
<tr>
<td>4</td>
<td>37</td>
<td>18</td>
<td>Goldsmith &amp; Williams</td>
<td>1992</td>
<td>J of Sport Behavior</td>
</tr>
<tr>
<td>5</td>
<td>46</td>
<td>17</td>
<td>Jones, Paull, &amp; Erskine</td>
<td>2002</td>
<td>J of Sports Sciences</td>
</tr>
<tr>
<td>6</td>
<td>79</td>
<td>16</td>
<td>Plessner &amp; Betsch</td>
<td>2001</td>
<td>J of Sport &amp; Exercise Psychology</td>
</tr>
<tr>
<td>7</td>
<td>102</td>
<td>15</td>
<td>Sutter &amp; Kochera</td>
<td>2004</td>
<td>J of Economic Psychology</td>
</tr>
<tr>
<td>8</td>
<td>47</td>
<td>14</td>
<td>Kaisididis &amp; Anshel</td>
<td>1993</td>
<td>Australian J of Science and Medicine in Sport</td>
</tr>
<tr>
<td>9</td>
<td>74</td>
<td>14</td>
<td>Nevill, Newell, &amp; Gale</td>
<td>1996</td>
<td>J of Sports Sciences</td>
</tr>
<tr>
<td>10</td>
<td>42</td>
<td>13</td>
<td>Helsen &amp; Bultynck</td>
<td>2004</td>
<td>J of Sports Sciences</td>
</tr>
<tr>
<td>11</td>
<td>73</td>
<td>13</td>
<td>Nevill &amp; Holder</td>
<td>1999</td>
<td>Sports Medicine</td>
</tr>
<tr>
<td>12</td>
<td>91</td>
<td>13</td>
<td>Rainey &amp; Winterich</td>
<td>1995</td>
<td>Perceptual and Motor Skills</td>
</tr>
</tbody>
</table>

Note: ID refers to the numbered beside the node from Figure 1; * = sole review article