

1 RUNNING HEAD: SPORT OFFICIALS CITATION ANALYSIS

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

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1 **Abstract**

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

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

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1 research on sport officials is important to maintain the integrity of sport performance and
2 athletes' development.

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

1 which multiple variables impact performance (e.g., Mascarenhas, et al., 2009; Rix, 2005).
2 Currently, however, only a few of these exemplary papers exist.

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

20 One suitable method to quantitatively assess and describe the status of a body of literature
21 that has existed for a number of years (i.e., since the 1970s for research on sport officials) is a
22 citation network analysis. Through a citation-based analysis, researchers can identify the amount
23 of interconnectivity (i.e., the citation structure) of a particular field. In doing so, key researchers,

1 prominent articles, common themes, and literature gaps are identified and the common elements
2 that constitute a domain of research emerge (Gustafsson et al., 2014; Moore et al., 2005). This
3 approach contrasts with methodologies such as meta-analysis, which aims to collate the results of
4 a specific domain. Therefore, the purpose of the present study was to implement a citation
5 network analysis of research on sport officials. The rationale for selecting citation network
6 analysis was that we intended to explore the structure of sport officials literature (e.g., main
7 themes being studied), as well as how well researchers integrated extant literature with new
8 studies (Moore, Shiell, Hawe, & Haines, 2005).

9 **Method**

10 **Article Retrieval**

11 Possibly the most critical step in a citation analysis is seeking articles that will eventually
12 constitute the citation network. To begin, we implemented a broad, exploratory approach to the
13 article search in order to avoid arbitrarily narrowing the analysis. Thus, we identified six
14 potential sport science databases from which to conduct our search: SportDiscus, PsycINFO,
15 Medline, PubMed, Physical Education Index, and CINAHL. In each database, we searched the
16 term “sport” in conjunction with either “judge”, “official”, “referee”, or “umpire” (including
17 derivatives). We also limited our search to peer-reviewed, English articles. Following this
18 procedure, it was determined that our search process was too broad, yielding more than 1000
19 total returned articles across the combined six databases. As citation network analysis aims to
20 discover the citation structure of a connected field (e.g., one with the same theoretical
21 underpinnings), it was determined that the best course of action was to limit our search to one
22 particular aspect of officiating. Narrowing our search to articles involving psychological
23 components of sport officiating, we focused on the three search databases most relevant to

1 psychology: PsycINFO (psychology), SportDiscus (sport psychology), and Physical Education
2 Index (psychology of physical activity). Importantly, we then delineated between different types
3 of sport officials. According to MacMahon and Plessner (2008), sport officials can be divided
4 into three groups: (1) interactors, (2) monitors, and (3) reactors. Interactors, such as ice hockey
5 referees, attend to a high number of cues and have a high level of interaction with athletes.
6 Monitors can include gymnastic judges, and refer to official who attend to a high number of
7 cues, but have little interaction with athletes. Finally, reactors attend to fewer cues and have
8 little interaction with athletes; an example would be a tennis line judge. Not surprisingly, the
9 function and role of each type of sport official varies. Thus, to present a more focused paper on
10 psychological components of sport officiating, we solely examined interactors who consistently
11 monitored a high number of cues and had high level of interaction with athletes (e.g., ice hockey,
12 basketball, and soccer), thereby dropping “judge” and “umpire” for our search terms. This was
13 chosen as the number of cues and interactions experienced by interactors might lend itself to
14 more studies focused on psychological performance. A further measure was that we only
15 included articles published before 2012. Finally, as we were focused on psychological
16 components, any returned studies related to officials’ physiology were excluded from the citation
17 analysis.

18 This led to a large, though manageable, citation network. Each returned article was
19 inspected to ensure that it met all search criteria, and following, the reference list was then
20 reviewed to seek out any additional manuscripts that ought to be included in the citation analysis,
21 but were missed by the search process. This procedure yielded 115 unique articles related to
22 sport interactors and meant that studies solely examining assistant referees and linesmen were
23 excluded from the network. As a final verification procedure, the second author (a recognized

1 expert of research on sports officials) reviewed the list of articles and compared it to an
2 exhaustive database she began more than a decade ago. The second author had been
3 intentionally excluded from this search procedure until this point, which allowed her to provide
4 this objective verification of the article list. Indeed, the second author confirmed that the
5 generated list was comprehensive and no articles were missing. The complete list of articles is
6 available upon request to the corresponding author.

7 **Analysis**

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

16 UCINET[®] 6 is a software program that evaluates citation structures. As such, the article
17 matrix was imported into UCINET[®] 6 for analysis. The first step of the citation analysis is to
18 identify the centrality scores, operationalized as the number of times a manuscript is cited by, or
19 cites, another article in the matrix. For instance, if article A cited article X while also being cited
20 by article Y and Z, the total centrality score for article A would be 3. Our particular focus,
21 however, was on in-degree centrality scores, which is the number of times an article is cited by
22 others in the network (Moore et al., 2005). In the above example, articles Y and Z cited article
23 A; therefore, the in-degree score for article A would be 2. By concentrating on in-degree scores,

1 we were able to identify the most central and pertinent manuscripts within the network
2 population (Moore et al., 2005). The second step in UCINET[®] 6 is to produce a visual
3 representation of the citation network. This allows for further inspection of the network,
4 particular the identification of any sub-groups within the network (i.e., searching for clustering of
5 articles related to a particular theme such as referee bias). The final step, which is related to
6 centrality measures, is identifying the most cited articles, which can then be examined for
7 possible similarities and differences (e.g., publication date, journal, expertise level of
8 participants, male or female participants, and original or review papers). These chosen
9 categories correspond with analyses conducted by previous researchers (e.g., Buckham,
10 Hancock, Erickson, & Côté, 2012; Gustafsson et al., 2014) to provide an objective analysis of
11 potential patterns amongst the most cited articles. In this study, we sought to isolate and describe
12 the 10 most cited articles, approximating 10% of the citation network.

13 **Results & Discussion**

14 For the first result, which centres on the centrality measures, there were total of 490
15 citations across the 115 articles (an average of 4.25 citations per article, with the median value
16 being 2.0) with in-degree scores ranged from 0 to 30. Previous citation analyses in sport have
17 shown greater in-degree average scores. For instance, Bruner, Erickson, McFadden, and Côté,
18 (2009) studied athlete development models noting 9 citations per article. In a recent study on
19 athlete burnout, Gustafsson and colleagues (2014) noted 10 citations per article. Our study
20 averaged 4 citations (median = 2.0) per article, despite focusing on a very specific participant
21 group (sport interactors). This discrepancy in the amount of interconnectivity compared to
22 previous studies warrants further attention, but first we present the visual representation of our
23 analysis.

1 Examining the picture (see Figure 1), several boxes and lines are embedded within. In
2 citation analysis, each box is referred to a node and represents a unique article in the network.
3 Each box also has a corresponding number between 1 and 115, which is traced back to the
4 original article list – again, available upon request from the first author. Larger nodes indicate a
5 higher in-degree centrality score (i.e., they were cited most often by other articles in the
6 networks), whereas smaller node denote little connectivity. The lines that connect the nodes are
7 called ties, which refer to an instance where one article cites another. Thus, visual
8 representations with many ties indicate high interconnectivity in a network. The top left portion
9 of Figure 1 has 6 numbers (18, 19, 28, 44, 93, and 107) with no connecting lines, meaning they
10 did not cite, nor where cited by, any articles in the network. As mentioned in the above
11 paragraph, our network had low interconnectivity between the articles, which is now witnessed
12 in the network picture. Many questions can be asked of this lack of interconnectivity, though
13 definite conclusions are premature at this time.

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

15 An important discussion is of the role of research on sport interactors. It is possible that
16 researchers are using sport interactors as a medium to investigate general theories of expertise
17 such as decision-making, perception, or stress, which can then be applied to other populations
18 such as athletes, medical professionals, or the military; therefore, researchers would cite
19 literature specific to their purposes (e.g., decision-making researchers would cite studies on
20 decision-making). This perspective, though helpful to understanding expert performance, would
21 not aim to accrue knowledge on sport interactors, possibly explaining the lack of
22 interconnectivity. To better understand this, it would be interesting to examine the references of
23 each article in the citation network in order to establish the ratio of specific articles (i.e., citing

1 referee papers) compared to general articles (i.e., citing decision-making papers). A second
2 possibility is that researchers who are interested in progressing the field might reference
3 literature from other types of sport officials such as monitors or reactors in order to inform their
4 research. Certainly it should be encouraged to incorporate the global body of literature on sport
5 officials, **which may be occurring**; however, this practice should not preclude the use of
6 interactor research to inform studies. Rather, it should supplement extant research on their
7 studied populations. These would be interesting queries to explore in the future.

8 Further visual inspection of the network picture led to the identification of three clusters
9 of nodes – the top left group, the bottom centre group, and the right side group. UCINET® 6
10 clusters nodes that share similar connections; therefore, we investigated the articles that
11 constituted each cluster. Interestingly, three distinct fields of sport interactors research emerged
12 in these clusters. For the top left group, the articles concentrated on personality (the most cited
13 (10 citations) was Purdy & Snyder, 1985), whereas the bottom centre group focused on stress
14 (the most cited (21 times) was Taylor, Daniel, Leith, & Burke 1990). The right side group, on
15 the other hand, targeted decision-making (the most cited (30 times) was Nevill et al., 2002).
16 While there are some connections in the network between the stress and decision-making as well
17 as stress and personality, there are very few connections between personality and decision-
18 making. This possibly demonstrates a narrow, compartmentalized approach to sport interactor
19 research, rather than a broad, inclusive approach. This compartmentalized approach to sport
20 official research probably contributes to its lack of connectivity and visibility. An additional
21 observation is that personality was the oldest topic included herein and had the least
22 connectivity, while decision-making was the most recent and had the most connectivity. Perhaps

1 with more electronic access to journals, sport officials researchers are better able to stay
2 informed, thus explaining this result.

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

22 ***** *INSERT TABLE 1 NEAR HERE* *****

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

11 Regarding the demographic of the sample studied, only 8 of the articles adequately
12 described their participants’ expertise, which again, varied tremendously from intramural
13 officials to professional and international referees. In the establishment of a valid and visible
14 field of research, it is important for future researchers to explicitly consider and state the
15 expertise level of the participants they studied. For instance, knowing the types of factors that
16 influence decision-making in intramural sport might be valuable, but could also be considerably
17 different from the environment of youth sport or professional sport. Hancock, Rymal, and Ste-
18 Marie (2011) offered a classification of sport officials that may be useful to describe the
19 participants of future studies: 1) recreational, 2) club, 3) varsity, 4) provincial (or state), 5)
20 national (or professional), and 6) international. Starting with these classifications, researchers
21 ought to be able to categorize their sample participants, thereby providing more clarity to
22 research on sport officials.

1 be a result of researchers: (1) using sport interactors to study general theories of expertise, (2)
2 frequently citing other types of sport officials, or (3) not having dedicated sport officials journals.
3 The second main result is for the top 12 papers. The most cited articles in the network typically
4 had the following features: (1) original papers, (2) published in a variety of journals, (3)
5 published during the past 15 years, (4) focused on male participants, (5) studied decision-
6 making, and (6) included sport interactors of varying expertise. This mix of characteristics
7 points to a lack of structure in the field, which might be improved through systematic studies
8 such as this one. We hope that this paper serves as a useful tool for researchers looking to
9 conduct future studies on sport officials – who can consider these key findings when creating and
10 publishing their studies – ultimately improving the structure and visibility of the discipline.

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1 Table 1

2 *Top-12 most cited articles in the citation network analysis*

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

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

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