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6   The art of athlete leadership: Identifying high-quality athlete leadership at the individual and

7   team level through Social Network Analysis.

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21 **Abstract**

22 This research aimed to introduce Social Network Analysis as a novel technique in sports

23 teams to identify the attributes of high-quality athlete leadership, both at the individual and at

24 the team level. Study 1 included 25 sports teams ($N = 308$ athletes) and focused on athletes'

25 general leadership quality. Study 2 comprised 21 sports teams ($N = 267$ athletes) and focused

26 on athletes' specific leadership quality as a task, motivational, social, and external leader. The

27 extent to which athletes felt connected with their leader proved to be most predictive for

28 athletes' perceptions of that leader's quality on each leadership role. Also at the team level,

29 teams with higher athlete leadership quality were more strongly connected. We conclude that

30 Social Network Analysis constitutes a valuable tool to provide more insight in the attributes

31 of high-quality leadership both at the individual and at the team level.

32 *Keywords:* athlete leaders, leader characteristics, leader attributes, shared leadership,

33 leadership roles, sport psychology

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35   The art of athlete leadership: Identifying high-quality athlete leadership at the individual and

36   team level through Social Network Analysis.

37   The quest for the perfect leader resembles the quest for the Holy Grail. If it could be

38   captured, distilled, and replicated, it would lead to guaranteed success for any government,

39   military organization, academic institution, and business organization that possessed it

40   (Medina, 2011). The same could be said for sports teams where leadership is seen as a key

41   factor for an optimal team functioning (Cotterill, 2013). Therefore, the question "What is

42   effective leadership?" has intrigued researchers for ages. The first leadership studies (around

43   1930-1950) were characterized by the Great Man theory of leadership. This theory adopted a

44   trait approach, thereby embracing the idea that effective leadership is rooted in the personality

45   of a person. That is, certain individuals have special innate or inborn characteristics that make

46   them effective leaders, and it is exactly these characteristics that differentiate them from non-

47   leaders (Northouse, 2010).

48   However, the fact that a common set of leadership characteristics was never found, has

49   forced researchers to adopt a drastically different view on leadership: the behavioral approach

50   to leadership. This behavioral approach emerged from the idea that effective leaders

51   demonstrated similar leadership behaviors, regardless of the situation (e.g., Tharp &

52   Gallimore, 1976). From this viewpoint, leadership could be learned and developed by

53   teaching the most effective behaviors to the leaders. Chelladurai's (1990) Multidimensional

54   Model of Sport Leadership went one step further by not only highlighting the importance of

55   leader and team member characteristics but also the importance of situational factors. For a

56   detailed review on the different approaches that have been used to study leadership, we refer

57   to the work of Chase (2010).

58   It should further be noted that leadership research in sport has mainly focused on the

59   influence of the coach (see Chelladurai, 1994; Chelladurai & Riemer, 1998 for reviews). In

60 this respect, coaches have been shown to influence athletes' identification with their team,

61 their team confidence, the team's cohesion, and the team's functioning (De Backer et al.,

62 2011; Felton & Jowett, 2013; Hampson & Jowett, 2012; Price & Weiss, 2013). While

63 effective leadership of the coach is vital to the team's functioning, more recent studies

64 demonstrate that also athletes can fulfill important leadership roles (Fransen, Vanbeselaere,

65 De Cuyper, Vande Broek, & Boen, 2014). In this regard, athlete leaders have been shown to

66 positively impact their teammates' satisfaction, their team confidence, the role clarity within

67 the team, the team communication, the team's task and social cohesion, and ultimately the

68 team performance (Crozier, Loughead, & Munroe-Chandler, 2013; Fransen, Haslam, et al.,

69 2015; Fransen et al., 2012; Price & Weiss, 2011; Vincer & Loughead, 2010). Given all these

70 positive outcomes, the quest for high-quality athlete leadership has made its entry into sport

71 research. The present study attempts to move athlete leadership research forward by using

72 Social Network Analysis (SNA) as a novel tool in sports contexts to provide a deeper insight

73 in high-quality athlete leadership, both at the individual and at the team level.

74 **Aim 1 – The Quest for Effective Athlete Leaders**

75   The majority of previous studies focused on traits that differentiate the athlete leaders

76 from the other players. In this regard, athlete leaders have been shown to demonstrate higher

77 levels of competitiveness, responsibility, dominance, and ambition (Klonsky, 1991).

78 Moreover, Glenn and Horn (1993) validated a shortened version of the Sport Leadership

79 Behavior Inventory, which included the following athlete leaders' characteristics: determined,

80 positive, motivated, consistent, organized, responsible, skilled, confident, honest, and

81 respected. In addition, an often studied attribute of athlete leaders has been sport competence,

82 also operationalized as athletes' playing time or their starting status (Loughead, Hardy, &

83 Eys, 2006; Moran & Weiss, 2006; Price & Weiss, 2011; Rees & Segal, 1984). Team tenure

84 also emerged as an essential characteristic with athlete leaders being typically the more senior

85   members of the team (Rees & Segal, 1984; Tropp & Landers, 1979; Yukelson, Weinberg,

86   Richardson, & Jackson, 1983). For instance, Loughead et al. (2006) provided support for

87   these findings among varsity student-athletes with four or five years of playing eligibility by

88   demonstrating that the majority of the athlete leaders were third- or fourth-year players.

89   More recently, attributes associated with the relation between leader and followers

90   have become more prominent. For example, friendship quality, which has also been termed

91   'peer acceptance' or 'social connectedness', was demonstrated to be an important attribute of

92   good athlete leaders (Moran & Weiss, 2006; Price & Weiss, 2011). Similarly, Yukelson et al.

93   (1983) found that strong off-field friendship was associated with higher leadership ratings

94   among college baseball and soccer players. However, when examining student-athletes'

95   perceptions of formal and informal team leaders, likeability was not seen as a necessary

96   attribute for good leadership (Holmes, McNeil, & Adorna, 2010). In this study, both men and

97   women reported that they could play for and respect a leader, even when the leader was not

98   popular or liked by other teammates.

99   Two main limitations that characterize previous research on the attributes of athlete

100   leaders will be addressed in the present article. First, previous research examined athlete

101   leadership by differentiating between 'no leader' and 'a leader'. However, it is conceivable

102   that, in order to optimize leadership within teams, it is not the presence or absence of

103   leadership that is the most important, but instead the *quality* of the leadership provided by

104   team members. Therefore, the present study investigated which leadership attributes are most

105   decisive for athletes' leadership *quality*. In other words, we did not assess what is required for

106   a player to be a leader, but more importantly, what is required for players to be perceived as a

107   *good* leader by their teammates.

108   Second, previous research has mostly focused on *the* leader of a sports team. Recently

109   however, it was established that athlete leaders could occupy different leadership functions.

110 Building upon the previous leadership categorization of Loughead et al. (2006), Fransen, et al.

111 (2014) distinguished between four different leadership roles that athletes can occupy: (1) the

112 *task leader*, who gives his/her teammates tactical advice and adjusts them when necessary; (2)

113 the *motivational leader*, who encourages his/her teammates on the field to perform at their

114 best; (3) the *social leader*, who develops a good team atmosphere outside of the playing field,

115 and (4) the *external leader*, who handles the communication with club management, media,

116 and sponsors. A better leadership quality on each of these roles was demonstrated to be

117 positively associated with teammates' identification with their team and their confidence in

118 the team's abilities (Fransen, Coffee, et al., 2014). Therefore, the present article includes two

119 studies. While Study 1 focuses on the attributes of athlete leaders' general leadership quality,

120 Study 2 goes more in depth and investigates the attributes of athlete leadership quality within

121 the four different leadership roles (i.e., task, motivational, social, and external leadership

122 role). As such, the present article will inform us not only on the attributes that are

123 characteristic for leadership quality in general, but also on the attributes that are characteristic

124 for high-quality athlete leadership on each of the four specific leadership roles (i.e., task,

125 motivational, social, and external leader).

126 **Team-Level Attributes of Teams with High Athlete Leadership Quality**

127   Having discussed the individual level (i.e., which attributes are characteristic of a

128 high-quality athlete leader), another question emerges: what are the attributes of teams with

129 high-quality leadership? In organizational settings, a number of studies have linked leadership

130 perceptions to individual-level outcomes, such as pay-raises and job-promotions (Hoppe &

131 Reinelt, 2010). However, the relationship between leadership perceptions and organization-

132 level outcomes remains unclear. Also in a sport setting, research on the attributes of an

133 individual leader is much more prominent than research linking the average leadership

134 qualities in the whole team to team-level characteristics. However, recent qualitative studies

135   demonstrated that the presence of athlete leaders in the team positively impacted a variety of

136   group dynamic constructs at the team level, such as role clarity within the team, team

137   cohesion, team communication, team resilience, and team performance (Crozier et al., 2013;

138   Morgan, Fletcher, & Sarkar, 2013, 2015).

139   To our knowledge, only one study to date has investigated the attributes of sports

140   teams with effective athlete leadership in a quantitative way. More specifically, Price and

141   Weiss (2011) found that effective athlete leadership was associated with higher levels of

142   collective efficacy and a stronger task and social cohesion. However, when looking more

143   closely at their methodology, the authors actually examined the correlations at an individual

144   level, namely the correlations between a player's leadership skills and the player's perceptions

145   of collective efficacy and team cohesion. In order to study team-level attributes, it is

146   necessary to gain insight in all leadership perceptions within the team.

147   **Social Network Analysis**

148   Social Network Analysis (SNA) is a novel but promising tool to obtain a full insight in

149   all leadership relations *within* a team and to identify differences in the leadership structure

150   *between* different teams. A social network approach views groups in terms of networks,

151   consisting of nodes (representing the individual actors) and ties (representing the relations

152   between the actors) (Wasserman & Faust, 1994). Over the past decade, the use of this network

153   approach has grown exponentially in a wide variety of areas, including sociology, politics,

154   terrorism networks, and organizational research (Borgatti, Mehra, Brass, & Labianca, 2009).

155   Organizational research has only recently included this network approach to the examination

156   of leadership. For example, Emery et al. (2013) demonstrated that group members'

157   personality traits (e.g., extraversion, openness to experience, and conscientiousness) predicted

158   the emergence of leaders in newly formed groups. Hoppe and Reinelt (2010), on the other

159 hand, revealed that leadership networks were characterized by attributes such as collaboration

160 and information sharing.

161 Although Nixon (1993) stated that SNA could be a valuable tool to analyze leadership

162 structures in sports teams, to our knowledge, no study has heeded Nixon's suggestion. Also

163 Lusher, Robins, and Kremer (2010) noted that sports teams are the ideal object of

164 investigation for SNA because they are a well-defined group of interdependent individuals, or

165 in social network terms, a full network. Moreover, the relations between the different athletes

166 might have a direct impact on measurable performance outcomes.

167 The few studies that have used social network measures in sports teams focused on the

168 relations between the players with regard to their interactive play (Cotta, Mora, Merelo, &

169 Merelo-Molina, 2013; Kyoung-Jin & Yilmaz, 2010; Passos et al., 2011). In these networks,

170 the players were considered as the nodes and the passes between teammates were viewed as

171 the relations. Three case studies did use SNA to examine the psychological interrelations

172 between the members of a sports team. Lusher et al. (2010) examined a football team, thereby

173 constructing a friendship network (based on the question "Who do you consider as a friend?")

174 and an influence network (based on the question "Who do you consider as influential?"). The

175 relationships with players' ability revealed that ability was not related with being nominated

176 as a friend but did positively correlate with being seen as influential by the teammates. The

177 second study (Lusher, Kremer, & Robins, 2013) constructed trust networks for three sports

178 teams, thereby mapping the extent to which team members trusted each other. Their findings

179 demonstrated that the trust-generating structures were found in the team with the highest

180 overall team performance. The third study (Bourbousson, R'Kiouak, & Eccles, 2015) used

181 social network analysis to identify patterns of awareness within basketball teams. More

182 specifically, in the constructed networks the nodes represented the team members and the ties

183 pictured members' awareness of other members during ongoing performance. A considerable

184   limitation of each of these case studies is that both used binary networks (i.e., relying on the

185   only possible answers being 'yes' or 'no'), which did not provide any information on the

186   strength of these relations.

187   **The Present Study**

188   To our knowledge, the present study is the first in a sport setting that uses SNA to

189   obtain more insight in the attributes of high-quality athlete leadership on four different

190   leadership roles, both at the individual and at the team level. Moreover, the present study does

191   not rely on binary networks (ties represented by 0 '*no leader*' or 1 '*a leader*'), but instead on

192   valued networks, in which the strength of the ties represents the athlete leadership quality,

193   ranging from 0 (*very weak leader*) to 4 (*very good leader*). The added value of this network

194   approach resided in the inclusion of the perceptions of all the players in the team. The current

195   research has three major aims.

196   **Aim 1.** To link an individual's leadership quality, based upon the perceptions of all

197   other teammates, with his/her personal characteristics. The investigated attributes included

198   both self-reported attributes (e.g., age, years of experience) as well as attributes rooted in the

199   perceptions of others (e.g., the extent to which each of the teammates feels connected to the

200   leader). Given the clearly distinct role content of the four leadership roles that are investigated

201   in the present study, we assume that different leader attributes will be predictive in

202   determining the leadership quality in a given role (H1). Three specific hypotheses are

203   formulated. First, the definition of social leader portrays this leader as the confidant of the

204   team who deals with interpersonal team conflicts. In this regard, it seems essential that team

205   members feel connected to the social leader, in order to call on this leader when needed.

206   Therefore, we expect that the perceived quality of social leaders is characterized by the extent

207   to which team members feel connected to their social leader (H1a). Second, because Mosher

208   (1979) noted that one of the key tasks of a captain is to represent the team at receptions,

209 meetings, and press conferences, we expect that captaincy is the most characteristic attribute

210 for external leadership quality (H1b). Third, previous research demonstrated that all of the

211 task leaders were starters, while the social leaders were divided between starters and non-

212 starters (Rees & Segal, 1984). Because the specific role of the task and motivational leader is

213 situated *on* the field, it is conceivable that playing time is a prerequisite for these leaders to

214 optimally fulfill their role. Therefore, we hypothesize that playing time will be the most

215 characteristic attribute for the perceived quality of the on-field leaders (i.e., task and

216 motivational leader) (H1c).

217   **Social connectedness.** It has been suggested that SNA is also a useful methodology to

218 explore the social relations among team members (Lusher et al., 2010; Warner, Bowers, &

219 Dixon, 2012). Therefore, we will use SNA not only to construct the leadership networks, but

220 also to construct a social connectedness network in which each player indicates how strongly

221 connected he/she feels with the other team members. Specific SNA analyses will provide

222 more insight in the relationship between the different leadership networks and this social

223 connectedness network, both at the individual level (Aim 2) and at the team level (Aim 3).

224   **Aim 2.** With regard to the individual level, we will first explore which type of athlete

225 leader (i.e., task, motivational, social, or external) relies most on the quality of his/her social

226 relations to be perceived as a good leader. Because the social leader is the team's confidant

227 and cares for a good atmosphere in the team, we believe that it is crucial for his/her perceived

228 leadership quality that teammates feel strongly connected to this leader, more than it is for

229 task, motivational, or external leaders (H2a).

230   Second, we will use specific SNA measures to provide more insight in what it

231 means— in social network terms—to be a high-quality athlete leader. In this regard, we

232 hypothesize that it is not only important that other team members feel strongly connected to

233   the leader, but that it is also important that a leader is able to bridge the gap between other

234   teammates (H2b).

235   **Aim 3.** In order to examine this purpose, we will move beyond the individual level

236   and examine the extent to which high average leadership quality within the team is connected

237   with the team's social connectedness (i.e., the extent to which all players feel connected with

238   each other). A study from organizational psychology with sales teams already demonstrated

239   that the position of the leader in a social connectedness network (i.e., the friendship ties with

240   the others) was related to more favorable leadership ratings by subordinates, peers, and

241   supervisors (Mehra, Dixon, Brass, & Robertson, 2006). In line with previous findings (Mehra

242   et al., 2006), we expect that at the team level, higher athlete leadership quality will be related

243   to higher social connectedness within the team. Because the specific role description of the

244   social leader focuses on the social relations with the other team members, we expect that also

245   at the team level the social leadership quality network will be most strongly related with the

246   social connectedness network (H3a).

247   Finally, we did not only investigate the average quality of leadership in a team, but

248   also the degree to which leadership is shared among team members. Previous organizational

249   research concluded that shared leadership is a better predictor of social integration between

250   the members of a team than vertical leadership, in which only one individual takes the lead

251   (Pearce, Yoo, & Alavi, 2004). In line with these findings, we propose that teams with higher

252   degrees of shared leadership are characterized by stronger social connectedness (H3b).

253   **Method**

254   **Procedure**

255   We adopted a stratified sampling technique by selecting an equal number of teams

256   with respect to sport, gender, and playing level. With regard to the playing level, we

257   differentiated between high-level teams (i.e., national competition level) and low-level teams

258   (i.e., provincial or regional competition level). In total, 71 coaches were invited via email to

259   have their team to participate in the study, resulting in 59 coaches agreeing to participate (i.e.,

260   a response rate of 83%). If coaches agreed to participate we asked for a complete player list of

261   the current season.

262   Data collection took place after a training session in the period between January and

263   March 2013 under the guidance of a research assistant. Informed consent was obtained from

264   all participants and anonymity was guaranteed. Furthermore, we stated that the players could

265   withhold their participation at any time. Subsequently, all players completed the questionnaire

266   individually, which lasted about 20 minutes. The research assistant was present to answer

267   possible questions. Ethical clearance for this research project was obtained from the lead

268   author's institution, the APA ethical standards were followed in the conduct of the study, and

269   no rewards were given for participation in the study. Data from this sample have been used in

270   two other articles (Fransen, Van Puyenbroeck, et al., 2015; Loughead, Fransen, Van

271   Puyenbroeck, Hoffmann, & Boen, 2015), but these articles examine different research

272   questions and used different variables of interest.

273   **Participants**

274   **Study 1.** In total, 35 sports teams participated in Study 1. Given that missing data in

275   social networks can lead to biased results, we used a minimum response rate of 75% of the

276   players as inclusion criterion for each team (Smith & Moody, 2013; Sparrowe, Liden, Wayne,

277   & Kraimer, 2001; Zohar & Tenne-Gazit, 2008). As a consequence, 10 teams ($N = 100$

278   athletes) were removed from our dataset. The average response rate of these 10 deleted teams

279   was 64%. The 25 remaining teams included 308 athletes, playing in six soccer teams, seven

280   volleyball teams, six basketball teams, and six handball teams. Fifteen male teams and 10

281   female teams participated, with 13 teams playing at high level (i.e., national level) and 12

282   teams playing at low level (i.e., provincial or regional level). The players were on average

283   24.9 years old (*SD* = 7.5), had 15.7 years of experience in their sport (*SD* = 7.0), and played

284   for 6.5 years in their current team (*SD* = 7.2).

285   **Study 2.** In total, 24 sports teams participated with no overlap in the samples of Study

286   1 and Study 2. Based on the cut-off of 75% for the response rate per team, three teams (*N* =

287   20 athletes) were removed from our dataset. The average response rate of these three deleted

288   teams was 58%. The 21 remaining teams (267 athletes) included seven soccer teams, eight

289   volleyball teams, and six basketball teams. Furthermore, the sample included 11 male teams

290   and 10 female teams, with12 teams playing at high level and 9 teams playing at low level. The

291   players were on average 24.3 years old (*SD* = 4.9), had 14.9 years of experience (*SD* = 5.8),

292   and played for 3.7 years in their current team (*SD* = 3.4).

293   **Measurements**

294   **Descriptive information.** In addition to several demographic characteristics (e.g., age,

295   years of experience, team tenure), we also assessed other characteristics that might be related

296   to a player's leadership quality. In this regard, players indicated their average playing time on

297   a 5-point Likert scale, ranging from 1 (*almost nothing; 0-25%*), over 3 (*50%*), to 5 (*almost the*

298   *whole game; 76-100%*). Furthermore, participants indicated to what extent leadership

299   qualities were important in their job or in their free time (e.g., as a leader in youth movement)

300   on a 7-point Likert scale, ranging from 1 (*not at all important*) to 7 (*very important*). Finally,

301   players had to indicate whether they occupied the function of team captain.

302   **Leadership quality networks.** To create a leadership network, each player on the

303   team rated each teammate with respect to their leadership quality on a 5-point Likert scale,

304   ranging from 0 (*very poor leader*) to 4 (*very good leader*). Based on the roster list, all the

305   names of the players in the team were listed in advance on the questionnaire. For each team,

306   this procedure resulted in a non-symmetric, directed *N*x*N* leadership quality network (with *N*

307   being the number of team members). The rows referred to the outgoing ties of the team

308   members (i.e., how players perceived other players' leadership quality), whereas the columns

309   referred to the incoming ties of team members (i.e., how players are perceived by other

310   players with regard to their leadership quality). By convention, the diagonal entries were

311   forced to be missing values, meaning that players do not rate their own leadership quality.

312   This approach resulted in a directed, valued network, meaning that (1) how player A

313   perceives player B's leadership qualities does not necessarily equal how player B perceives

314   player A's leadership qualities, and (2) players rated their teammates' leadership on 5-point

315   Likert scales in contrast with the binary approach (i.e., '*leader*' or '*no leader*') used in

316   previous studies (e.g., Lusher et al., 2010).

317   Study 1 included leadership networks with respect to the perceived quality of

318   leadership *in general*, based on the question "To what extent do you consider each teammate

319   as having good leadership qualities in general?" Study 2 constructed a specific leadership

320   quality network *for each of the four leadership roles*. As an example of these role-specific

321   leadership quality networks, we will outline the procedure for the task leadership quality

322   network. First, the definition of a task leader, as postulated in previous research (Fransen,

323   Vanbeselaere, et al., 2014), was presented to the participants. Subsequently, each participant

324   had to rate the quality of the task leadership of each of his/her teammates, whose names were

325   listed in advance. Players had to indicate for each of their teammates "how well they

326   perceived their teammate's task leadership qualities" on a 5-point Likert scale, ranging from 0

327   (*very poor task leader*) to 4 (*very good task leader*). Afterwards, the same procedure was

328   followed, which resulted in a non-symmetric *N*x*N* task leadership quality network for each

329   team with directed, valued relations. The same procedure was adopted to create a

330   motivational, social, and external leadership quality network, thereby relying on the

331   leadership definitions postulated by Fransen et al. (2014). The data of Study 2 thus resulted in

332   four role-specific leadership quality networks for each team.

333   All constructed leadership quality networks are thus bounded networks because all the

334   nodes (i.e., the different players of one sports team) are known. The ties between two nodes

335   (e.g., tie from player A to player B) characterize the extent to which player A perceived player

336   B as a good leader. As an example, Figure 1 presents the task leadership quality network for

337   one of the participating teams, namely a male basketball team. To maintain the clarity of this

338   figure, we visualized only the strongest leadership perceptions, in other words the perceptions

339   of very good task leadership (i.e., score of 4). The size of each node in the network

340   corresponds to the player's task leadership quality, as perceived by all other players in the

341   team (i.e., the player's indegree centrality). The node size thus does take into account all the

342   arrows, also the ones with scores lower than 4, which are not visualized in the figure. The

343   higher a player's task leadership quality as perceived by all teammates, the larger the node,

344   and the more central we positioned the player in the figure. The best task leader, whose node

345   is filled in Figure 1, thus has the largest node size and is positioned most central in the figure.

346   **Social connectedness network.** In order to construct a social connectedness network,

347   participants indicated for each teammate, whose names were listed, "to what extent they felt

348   connected to this person". Players rated their feeling of social connectedness on a 5-point

349   Likert scale, ranging from 0 (*not connected*) to 4 (*very connected*). This procedure resulted in

350   a non-symmetric, directed *N*x*N* connectedness network for each team, in which the AB entry

351   referred to the extent player A felt connected with player B. Also in this network, the

352   diagonal entries are forced to be missing values, representing that players do not rate the

353   connectedness with themselves. Also the social connectedness networks constitute bounded

354   networks, in which the nodes represent the different players of a sports team. The ties between

355   the nodes (e.g., tie from player A to player B) characterize the extent to which player A feels

356   connected to player B.

357 **Data Analysis**

358   UCINET 6 (Borgatti, Everett, & Freeman, 2002) was used to calculate the social

359 network measures and to perform the social network analyses, presented below.

360   **Social network measures at the individual level.** Three node-specific SNA measures

361 were used in the present study: degree centrality, closeness centrality, and betweenness

362 centrality, which are graphically illustrated in Figure 2. We will explain how each of these

363 measures can deepen our insight in the attributes of athlete leaders and in the leadership

364 structure of sports teams. First, *degree centrality* is a node-specific measure that refers to the

365 average strength of a node's ties. In directed networks, centrality can be further differentiated

366 into *indegree* centrality (i.e., the average strength of the incoming ties) and *outdegree*

367 centrality (i.e., the average strength of the outgoing ties). For the leadership networks, we will

368 only use the indegree centrality of a player, which is operationalized as a measure of the

369 leader's importance in the team and the extent in which the leader can influence other team

370 members (e.g., Hoppe & Reinelt, 2010). With regard to the social connectedness network,

371 both indegree and outdegree centrality will be used. A high indegree centrality in the social

372 connectedness network characterizes the players to which other team members feel strongly

373 connected. A high outdegree centrality in this network on the other hand characterizes the

374 players who feel strongly connected to their teammates.

375   Second, *betweenness* centrality of a node refers to the number of times this node falls

376 along the geodesic path (i.e., shortest path) between two other nodes (Freeman, 1979). This

377 measure is often considered as the potential for controlling flows or being a 'gate' in a

378 network (e.g., Balkundi & Kilduff, 2006; Freeman, 1979). The higher the betweenness

379 centrality of a node, the more frequently this node is located between other nodes on the

380 shortest path that connects them. In the present study, the betweenness centrality of all players

381 was calculated for the connectedness network. It should be noted that betweenness centrality

382 depends on network size. That is, the larger the network, the more opportunities for a node to

383 be positioned between two other nodes. This makes it difficult to compare centralities from

384 athletes from different teams. Therefore, the normalized betweenness was calculated as the

385 percentage of the maximum possible betweenness centrality of each actor (Everett & Borgatti,

386 1999).

387 Second, for undirected networks, which are solely constituted of symmetric relations,

388 *closeness* centrality is defined as the inverse of the number of steps it takes for a node to reach

389 all other nodes. In other words, this centrality measure is equal to one divided by the path

390 length of a node to reach all other nodes (Freeman, 1979). Because this study comprises

391 directed networks, we will use the in-closeness measure, which refers to the inverse number

392 of steps from all other nodes to a given node. This is an indication of how 'close' all team

393 members are to a given player. Again, this measure was normalized to increase its

394 comparability between teams, following the procedure as proposed by Freeman (1979).

395 For the two latter SNA measures (i.e., betweenness and closeness centrality), it is

396 crucial to identify the optimal paths between nodes. In contrast to binary networks (in which

397 the optimal path is the shortest path between two nodes), the interpretation is not that

398 straightforward in valued networks (Borgatti, Everett, & Johnson, 2013). For example, it is

399 not clear whether a long path that is composed of strong ties is less or more optimal than a

400 short path that is composed of weak ties. Therefore, we followed previous guidelines

401 (Borgatti et al., 2013) and dichotomized the connectedness network to calculate both

402 measures, so that tie strengths 3 (strong) and 4 (very strong) received value 1 (visualized by a

403 tie), while tie strengths between 0 and 2 received value 0 (no tie). That is, a tie from player A

404 to B in the dichotomized connectedness network exists when player A feels strongly or very

405 strongly connected with player B.

406   Furthermore, individual-level indicators such as betweenness and closeness centrality

407   require outgoing ties (i.e., perceptions of the other players). Therefore, we were unable to

408   calculate these indicators for players who did not attend the training session and consequently

409   did not complete the questionnaire. For this reason, these players were excluded from the

410   analyses that linked these individual-level SNA measures of the connectedness network with

411   leadership quality perceptions.

412   **Social network measures at the team level.** Two team-level SNA measures can be

413   distinguished. First, network *density* is a team-level measure that was computed for each team

414   with regard to the general leadership quality network (Study 1) and the four specific

415   leadership quality networks (Study 2), using the same procedure for valued networks as

416   described by Sparrowe, Liden, Wayne, and Kraimer (2001). More specifically, the density for

417   each network was computed by summing the values of all relations and dividing this result by

418   the number of all possible relations. As a result, high density scores refer to teams with on

419   average high-quality athlete leadership, whereas low density scores characterize teams with

420   on average low-quality athlete leaders.

421   Second, the use of network *centralization* has been recommended to assess the extent

422   of shared leadership (Mayo, Meindl, & Pastor, 2003; Small & Rentsch, 2010). In essence,

423   centralization can be considered as a measure of variance in the degree centrality measures of

424   a network and represents a measure of compactness (for the formula see Mayo et al., 2003, p.

425   204). Because this study focused on players' indegree centrality in the leadership quality

426   networks, only indegree centralization is a matter of interest in the present study. The term

427   centralization in the current study thus refers to indegree centralization. When leadership

428   behaviors revolve around a single individual (i.e., high centralization), the leadership network

429   is highly centralized and thus characterized by a low degree of shared leadership. In contrast,

430   a network in which all members are perceived to participate equally in displaying leadership

431 behaviors (i.e., low centralization) will be characterized by a high degree of shared leadership.

432 However, a team in which all players are perceived as poor leaders will also be characterized

433 by a low centralization score. Therefore, it can be concluded that teams with high-quality

434 shared leadership are characterized by the combination of a high network density (high

435 overall leadership quality) and a low network centralization (i.e., leadership is spread

436 throughout the team) (D'Innocenzo, Mathieu, & Kukenberger, 2014; Mayo et al., 2003).

437   **Social network analyses.** When correlating or regressing different networks, the

438 autocorrelated and interdependent structure of network data (Wasserman & Faust, 1994)

439 would lead to severe biases when using Ordinary Least Squares regression techniques

440 (Krackhardt, 1987). In the present study, we therefore used Quadratic Assignment Procedure

441 (QAP) hypothesis tests for each team separately to examine the relationships between the

442 different leadership networks and the connectedness network. Because QAP-tests are

443 nonparametric and use restricted permutation tests, these tests are robust against the problem

444 of autocorrelation (Dekker, Krackhardt, & Snijders, 2007; Krackhardt, 1988). More

445 specifically, we performed multiple regression quadratic assignment procedures (MR-QAP).

446 For more details on the QAP and MR-QAP regressions, we refer to Krackhardt (1987, 1988).

447 In Study 2, MR-QAP was used to model the ties in the social connectedness network (i.e., the

448 dependent variable), using multiple independent variables (i.e., the ties in the different

449 leadership quality networks) (Krackhardt, 1988). This analysis was performed for each team

450 separately to determine which leadership quality ties (task, motivational, social, or external)

451 are most predictive for social connectedness ties.

452   **Results**

453   Because Study 1 and Study 2 investigated the same hypotheses (i.e., Study 1 with

454 respect to leadership quality *in general* and Study 2 with respect to leadership quality *on the*

455   *four leadership roles*), we will present the results according to the sequence of our

456   hypotheses.

457   **Aim 1: Attributes of High-Quality Athlete Leaders**

458   First, we identified the attributes that determined athletes' leadership quality. Table 1

459   presents the linear regression analyses with the indegree centrality of the different leadership

460   networks as the criterion variable. This leadership quality measure refers to the degree to

461   which the other team members perceive a particular player as a good task, motivational,

462   social, or external leader. The demographic characteristics and two measures of the social

463   connectedness network, namely the indegree and outdegree centrality of a player in the social

464   connectedness network, served as predictor variables. The indegree centrality is a measure of

465   the extent to which other team members feel connected with the particular player (termed

466   'social connectedness from others'), whereas the outdegree centrality refers to the extent in

467   which a particular player him-/herself feels connected to the other team members (termed

468   'social connectedness towards others'). Because not all the predictors are networks, we could

469   not use the social network specific QAP-regression. Instead, normal linear regressions were

470   used, including the node-specific social network measures of degree centrality for the

471   included networks.

472   The correlations between the different predictor variables did not exceed .50, neither

473   in Study 1, nor in Study 2, except for the correlation between age and years of experience ($r =$

474   .82 in Study 1; $r = .74$ in Study 2). To exclude any possible bias due to multicollinearity, we

475   calculated the VIF scores for each predictor in all six regressions. All VIF scores appeared to

476   be smaller than 3.7, which is clearly below the limit of 10 above which concern for bias is

477   warranted (Bowerman & O'Conell, 1990; Myers, 1990). Furthermore, all tolerance scores

478   clearly exceeded the recommended .20 threshold (Menard, 1995).

479   First of all, it should be noted that some beta values are negative, suggesting a

480   negative relationship with leaders' perceived quality. However, further analyses in both

481   studies pointed out that when entering a single predictor variable in the regression, the

482   relationship with the perceived leadership quality in each of the roles was positive for each

483   predictor. In other words, the negative direction of the relationship is caused by the inclusion

484   of other predictors, known as the suppression effect (Cohen, Cohen, West, & Aiken, 2003, p.

485   78). Because some predictors are related with each other, the standard errors are misleadingly

486   inflated as a result of which the positive significance of some predictors turns into non-

487   significance or even into significance in the negative direction. More specifically, when years

488   of experience was entered in the regression as only predictor, the beta values for all leadership

489   roles were positive and significant ($p < .001$). Also for team tenure, the same procedure

490   resulted in all positive significant beta values ($p < .05$), with only one exception: team tenure

491   was not a significant predictor for external leadership quality. Finally, for social

492   connectedness towards others, all beta values were positive, but significance only emerged for

493   the perceived quality of task and social leadership ($p < .05$).

494   The results in Table 1 point to social connectedness from others as the most important

495   characteristic of an athlete's social leadership quality (i.e., revealed by the highest β compared

496   to the other attributes), thereby confirming H1a. Moreover, not only for the social leader, but

497   also for the task, motivational, and external leader, social connectedness seems to be the key

498   attribute determining an athlete's perceived leadership quality. In other words, the stronger

499   teammates felt connected to a specific player, the higher they rated this player's leadership

500   quality.

501   Moreover, further analyses across all the different leadership roles revealed that the

502   superiority of social connectedness holds for all the different sports (β's ranging from .21 to

503   .80, all p's $< .05$), for both male and female teams (β's ranging from .46 to .78, all p's $< .001$),

504   and for teams playing at high and at low level (β's ranging from .33 to .80, all p's < .01). This

505   finding thus contradicts H1: social connectedness emerged as the key attribute for all

506   leadership roles. Only one exception emerged; connectedness from others was not seen as a

507   significant predictor of the external leadership quality in male teams.

508   With respect to the other attributes, a number of substantial differences emerged

509   between the four roles (which is in line with H1). For example, captaincy emerged as a

510   significant predictor of athlete leadership quality in general and for task, motivational, and

511   external leadership in particular (in line with H1b), but not for social leadership. Further

512   analyses also revealed a number of differences as a function of sport, level, or team gender,

513   which temper the generalizability of these findings.

514   Age also emerged as an important predictor: the older the players, the better they were

515   perceived as leaders in general, and in particular with respect to the motivational and social

516   leadership role. However, there are some other differences that should be highlighted. More

517   specifically, age was only seen as a significant attribute of general leadership quality in soccer

518   teams and in female teams. Similarly, with regard to motivational leadership quality, age was

519   only a significant attribute for high-quality leaders in male teams. However, in both male and

520   female teams, age was a significant attribute of social leadership quality.

521   In line with H1c, playing time was a significant attribute of the leadership quality of

522   task and motivational leaders. For task leadership quality, playing time was the second most

523   predictive attribute after social connectedness. Leadership experience outside the sport

524   context was also seen as a significant predictor of the perceived leadership quality for the

525   task, motivational, and social leader, but not for the external leader. However, this leadership

526   experience was only a characteristic attribute of high-quality leaders in high competition level

527   teams, not in low competition level teams.

528   Both team identification and social connectedness towards others (i.e., the extent to

529   which a player feels connected with the other team members) failed to emerge as significant

530   predictors for high-quality leaders, neither for athlete leadership quality in general, nor for

531   leadership quality on any of the four roles. However, with respect to team identification, some

532   sport-specific differences emerged. For example, in basketball, a player's identification with

533   the team did emerge as a significant predictor of players' motivational ($\beta = .28$; $p < .01$) and

534   social leadership quality ($\beta = .21$; $p < .02$). Furthermore, soccer players who identified more

535   with the team were perceived as significantly better task leaders ($\beta = .19$; $p < .05$).

536   We can conclude that social connectedness from others emerged as the most important

537   characteristic of an athlete's leadership status, regardless of the leadership role, sport, team

538   gender, or competition level. Because both leadership and social connectedness were

539   measured by network structures, we used specific social network measures to further

540   investigate the link between the social connectedness network and the different leadership

541   networks, both at the individual level (Aim 2) and at the team level (Aim 3).

542   **Aim 2: The Leadership−Connectedness Relationship at the individual level**

543   **Which type of leader relies most on the quality of his/her social relations?** In order

544   to answer this question, we determined which leadership quality network explained most of

545   the variance in the social connectedness network. Therefore, multiple QAP-regressions were

546   conducted, in which the four different leadership quality networks functioned as predictor

547   variables and the social connectedness network functioned as criterion variable. The highest

548   average regression weight over all teams was found for social leadership quality (average $\beta =$

549   .34), which is in line with H2a. In other words, players felt most strongly connected to the

550   players whom they perceived as high-quality social leaders. Motivational leadership quality

551   was seen as second most predictive for social connectedness in the team (average $\beta = .23$).

552   The contributions of task and external leadership quality in explaining the variance in the

553   social connectedness network were very small (average β = .07 and -.01 respectively). We can

554   conclude that in most teams high-quality social leaders are positioned most central in the

555   social connectedness network, followed by the motivational, task, and external leaders, which

556   confirms H2a.

557   **What does it mean—in terms of social relations—to be perceived as a good**

558   **leader?** In order to address this question, we compared athletes' perceived leadership quality

559   with particular characteristics of those athletes in the social connectedness network. More

560   specifically, we compared the indegree centrality of an athlete in the leadership network with

561   three specific measures in the social connectedness network: (1) athlete's indegree centrality

562   (i.e., average extent to which other players feel connected to the athlete); (2) athlete's

563   betweenness centrality (i.e., number of times being the link between two other players); and

564   (3) athlete's closeness centrality (i.e., the inverse of the number of steps it takes for a player to

565   reach all other nodes). Table 2 presents the results for the different leadership networks. The

566   results for indegree centrality confirm our previous findings: the perceived quality of a leader

567   is strongly related with the extent in which the other team members feel connected to that

568   leader (i.e., indegree centrality in the social connectedness network). This finding holds for all

569   the different leadership roles. It can be noted though that, in line with the QAP-analyses, also

570   here the strongest relationship was found for the social and the motivational leadership

571   network.

572   Albeit to a lesser extent, the results demonstrated that a player's betweenness and

573   closeness centrality in the connectedness network were also significant predictors of his/her

574   perceived leadership quality. Again, correlations were the highest for social and motivational

575   leadership. In this regard, it should be noted that the correlation between indegree centrality

576   and closeness centrality of the connectedness network was moderate to high (i.e., .67 in Study

577   1, and .83 in Study 2). The fact that the investigated sports teams had more direct than indirect

578   connected ties might explain this finding (i.e., indegree centrality only relies on the direct ties,

579   whether closeness centrality relies on both direct and indirect ties). In contrast, a node's

580   betweenness centrality correlates only mildly with its indegree centrality in the connectedness

581   network. This measure thus provides additional information of the attributes of high-quality

582   leaders, which is not explained by the leader's indegree centrality. High-quality leaders thus

583   seem to bridge the gap between other players in their team, which confirms H2b. For social

584   leaders, this measure is most strongly related with their perceived leadership quality.

585   **Aim 3: The Leadership–Connectedness Relationship at the team level**

586   The third aim of the present article was to determine the extent in which a team's

587   average athlete leadership quality was related with the team's social connectedness. In

588   contrast to the previous research aims, we will now examine leadership quality and social

589   connectedness at the team level. As outlined in the method section, two measures can be used

590   to investigate leadership quality at the team level: network density (i.e., average leadership

591   quality in the team) and network centralization (i.e., degree of shared leadership).

592   First, we calculated the density values of the different leadership quality networks,

593   which can range between 0 and 4; a high density network has on average stronger ties (i.e.,

594   stronger leadership perceptions) than a low density network. Table 3 presents the densities of

595   the different leadership networks with the associated standard deviations, all averaged over

596   the analyzed teams. Second, we calculated the centralization values of the different networks,

597   which can range between 0% (maximally shared leadership) and 100% (maximally

598   centralized leadership). The centralization values of all 64 teams in our studies ranged

599   between 13.18% and 62.73% (across all leadership roles), thereby revealing that sports teams

600   are in essence characterized by shared leadership, in general, and with respect to each of the

601   four leadership roles. The degree to which leadership was shared was very similar across the

602   different leadership roles, with average centralizations ranging between 31.18% and 34.91%.

603   Aim 3 was to examine the extent to which the average quality and the sharedness of

604   the leadership networks were linked with the team's social connectedness. Therefore, Table 3

605   presents the correlations between both density and centralization of the leadership networks

606   and density of the social connectedness network. With regard to leadership density, the results

607   revealed that the perceived quality of leadership in general was significantly related with the

608   density of the connectedness network. With respect to the different roles, the perceived

609   quality of task, motivational, and social leaders was significantly correlated with perceptions

610   of social connectedness within the team. In line with H3a, the density of the social leadership

611   quality network was most strongly correlated with the density of the social connectedness

612   network. With regard to leadership centralization, results revealed a trend towards negative

613   correlations with the social connectedness density. In other words, the more leadership is

614   shared among the players, the higher the team's social connectedness, which is in line with

615   H3b. The non-significance of these correlations might be attributed to the limited number of

616   teams and the small variance in centralization scores.

617   It should be highlighted that shared leadership is not always effective: if all players

618   perceive all their teammates as very poor leaders, we obtain a centralization score of 0%

619   (maximally shared leadership), but a density score of 0 (no leadership quality in the team). A

620   measure of *effective* shared leadership is thus characterized by low centralization scores but

621   high density scores (D'Innocenzo et al., 2014; Mayo et al., 2003). To compare teams across

622   both dimensions, we conducted a mean-split procedure for both centralization and density.

623   The densities of the social connectedness networks for each of the combinations are displayed

624   in Table 4. For each of the leadership roles, the highest social connectedness was found in

625   teams characterized by a high leadership density. The differences between high/low

626   leadership centralization are negligible. In this regard, it should be highlighted that all teams

627   were characterized by shared leadership, so that the difference between high and low

628 centralization teams were fairly small. Given the fact that the total number of teams was

629 limited (i.e., 25 teams in Study 1 and 21 teams in Study 2), the analyses at the team level

630 should be considered as exploratory.

631   **Discussion**

632   It has been acknowledged that leadership effectiveness is determined in large part by

633 group members' perceptions of the leader (Haslam, Reicher, & Platow, 2011). Nevertheless,

634 there is only scarce research on leadership as a team-level construct in a sport setting. To our

635 knowledge, the present study is the first in a sport setting that uses Social Network Analysis

636 (SNA) to obtain more insight in the attributes of high-quality athlete leadership, both at the

637 individual and at the team level.

638 **Aim 1: Attributes of High-Quality Athlete Leaders**

639   First, we identified the most important attributes of an athlete's leadership quality as

640 perceived by the other team members. We distinguished between four different leadership

641 roles that a player can occupy (i.e., task, motivational, social, and external leader). The results

642 revealed that the degree to which athletes felt connected with their leader was most strongly

643 related to athletes' perceptions of that leader's quality. This finding holds both for leadership

644 quality in general and for the leadership quality on each of the four specific leadership roles.

645 These results challenge the widespread belief that the leadership quality of an athlete is not

646 related with his/her popularity within the team (Holmes et al., 2010). However, they do

647 corroborate earlier social network research in organizational settings, revealing that good

648 social relations between group leaders and both peers and followers lead to more secure

649 favorable leadership perceptions (Mehra et al., 2006). In addition, the results align with

650 previous sport research, demonstrating that teammates' perceptions of connectedness are

651 characteristic for athlete leaders (Moran & Weiss, 2006; Price & Weiss, 2011; Tropp &

652 Landers, 1979). Furthermore, it should be noted that the most predictive characteristic for a

653   leader's perceived quality was not the degree to which the leader felt connected with the other

654   team members, but instead, the degree to which the others felt connected to the leader. As a

655   consequence, the study findings support the idea that followers hold the key to effective

656   leadership (Haslam et al., 2011).

657   Although we hypothesized that different leader attributes would be predictive in

658   determining the leadership quality in the four different leadership roles (H1), the study

659   findings revealed that social connectedness is the key to effective leadership for every

660   leadership role. It should be noted though that only a limited selection of attributes was

661   assessed. Therefore, it is plausible that important role-specific characteristics were not

662   included in our questionnaire.

663   Moreover, with regard to other attributes that were measured, differences between the

664   four leadership roles did emerge, which does align with H1. For example, being a captain was

665   perceived as an important predictor for the perceived quality of task, motivational, and

666   external leaders (in line with H1b), but not for the perceived quality of social leaders. This

667   finding adds to the literature that the formal recognition of being a team captain is more

668   strongly linked with athletes' perceived leadership quality than characteristics such as age,

669   years of experience, and team tenure. Furthermore, in line with H1c, playing time was

670   demonstrated to be an important attribute for the leadership quality of task, motivational, and

671   external leaders, but not for social leaders, thereby confirming previous findings (Rees &

672   Segal, 1984). Finally, age was seen as an important characteristic for high-quality

673   motivational and social leaders, thereby confirming previous research that social leaders were

674   mostly seniors, whereas task leaders were spread amongst juniors and seniors (Rees & Segal,

675   1984). Age, as an indicator of accumulated relevant life experiences, can facilitate abilities

676   such as solving interpersonal conflicts or steering someone's on-field emotions in the right

677   direction (Grossmann et al., 2010; Staudinger & Baltes, 1996). Older players may have

678   acquired more control over their own emotions, which could make it easier to focus on others'

679   emotions and on the interpersonal relations within the team.

680   **Aim 2: The Leadership−Connectedness Relationship at the individual level**

681   Because social connectedness emerged as the key indicator of leadership quality, we

682   used specific social network measures to provide more insight in the relationship between

683   leadership quality and social connectedness. QAP-regressions thereby confirmed H2a by

684   revealing that social leaders rely more on the quality of their social relation with teammates,

685   than motivational, task, or external leaders. To be perceived as a good leader, it seems

686   important that other players feel closely connected to that leader, but also that the leader

687   bridges the gap between other teammates. Imagine a team in which player A feels connected

688   to the social leader, but not to player B. If the social leader feels connected to player B, this

689   gap bridging provides the social leader with power to solve interpersonal conflicts. This

690   finding holds for leadership in general, and for task, motivational, and social leadership in

691   particular, thereby confirming H2b. Furthermore, these results align with previous

692   organizational research indicating that betweenness centrality can be considered as a measure

693   of control and influence (e.g., Moolenaar, Daly, & Sleegers, 2010; Mullen, Johnson, & Salas,

694   1991).

695   **Aim 3: The Leadership−Connectedness Relationship at the team level**

696   The study findings suggest that social connectedness is not only an attribute of the

697   perceived leadership quality at the individual level, but also a team-level attribute for teams

698   with high-quality athlete leadership. In line with our expectations (H3a), the average social

699   leadership quality in the team was the most predictive variable for high levels of social

700   connectedness within the team. These findings are in line with previous studies that have

701   demonstrated the positive impact of leaders on the team's cohesion, both of coaches (De

702   Backer et al., 2011) and of athlete leaders (Callow, Smith, Hardy, Arthur, & Hardy, 2009;

703   Crozier et al., 2013; Vincer & Loughead, 2010).

704   It is noteworthy that, when looking back at the individual level of analysis and more

705   specifically to the regression analyses presented in Table 2, no significant relationship

706   emerged between a player's perceptions of task leadership quality and his/her perceptions of

707   connectedness. Although feeling closely connected with the motivational and social leader

708   was positively related to the perceptions of these leaders' quality, these social connectedness

709   perceptions did not matter when rating a player's task leadership quality.

710   At the team level by contrast, the team's task leadership quality was strongly related

711   with the team's connectedness. In other words, higher task leadership qualities in the team go

712   hand in hand with higher social connectedness among the members. A possible explanation is

713   that higher task leadership qualities within the team foster a task-oriented climate and higher

714   levels of collective efficacy (Fransen, Coffee, et al., 2014; Fransen, Haslam, et al., 2015). In

715   this regard, the observed findings correspond to previous studies demonstrating the beneficial

716   nature of a task-involving motivational team climate and collective efficacy for the formation

717   and development of not only task cohesion, but also of social cohesion (Boyd, Kim, Ensari, &

718   Yin, 2014; Eys et al., 2013; Heuze, Raimbault, & Fontayne, 2006). Although social

719   connectedness might not impact perceptions of task leadership quality at the individual level,

720   having high-quality task leaders in the team is important for having a strongly connected

721   team. As Boyd et al. (2014, p. 120) noted, "collective effort to improve group performance

722   where each player fulfills a distinctive role on the team, may serve to break down social

723   barriers subsequently generating player interdependence and team camaraderie on and

724   perhaps off the field."

725   Finally, we also assessed the leadership centralization of all teams (i.e., the degree to

726   which leadership is shared among team members). The low centralizations indicate that sports

727 teams are characterized by shared athlete leadership: not only *between* the different leadership

728 roles, but also *within* the different leadership roles. Furthermore, the results revealed a trend

729 towards a negative correlation between leadership centralization and social connectedness

730 density, thereby confirming H3b. In other words, the more leadership is shared among team

731 members, the stronger the team's social connectedness. These results align with previous

732 organizational research showing that there is more social integration in teams where

733 leadership is shared between the members (Pearce et al., 2004). However, when looking at the

734 interplay between density and centralization, the present study suggests that leadership

735 density is more decisive for the team's social connectedness than leadership centralization.

736 The small variance in leadership centralization across the different teams might explain this

737 finding.

738 **Strengths, Limitations, and Further Research Avenues**

739   A major strength of this study is the relatively large number of participating teams.

740 Previous studies using SNA in a sports setting tested one to three sports teams (Bourbousson

741 et al., 2015; Cotta et al., 2013; Kyoung-Jin & Yilmaz, 2010; Lusher et al., 2013; Lusher et al.,

742 2010; Passos et al., 2011; Warner et al., 2012). By conducting two studies, which together

743 encompassed the data of 46 teams, containing 575 players in total, the present article by far

744 exceeds the sample size of the previous network studies, which enhances the reliability and

745 generalizability of our findings. Nevertheless, it should be noted that caution is warranted

746 when interpreting the results at the team level of analysis, given the limited number of teams

747 (respectively $N = 25$ in Study 1 and $N = 21$ in Study 2).

748   A second strength is that in order to allow for the comparison between gender,

749 competition levels, and sports, the present study opted for a stratified sampling technique,

750 which resulted in a variety of male and female participating athletes, playing at low and high

751 competition levels in four different sports. Previous researchers have suggested that it is

752   important to examine issues such as gender and playing level when studying leadership in

753   sport (Price & Weiss, 2011). Nevertheless, most studies on athlete leadership have only

754   examined either male or female teams at a specific competition level, limiting comparisons on

755   these aspects. The only exception with respect to team gender is the study by Moran and

756   Weiss (2006), in which both male and female players were examined. These authors

757   identified gender differences in that the perceptions of athlete leader's quality, as rated by

758   teammates, included both psychological and social qualities (e.g., friendship quality) for

759   males, whereas for females, perceptions of athlete leadership quality were only related to

760   higher sport competence. The current article suggested a high degree of equivalence between

761   male and female players, between high and low competition level, and between the different

762   sports. For instance, within all these groups, the perceptions of social connectedness emerged

763   as key attribute for high-quality leadership. In contrast, significant differences between these

764   groups emerged, for instance with regard to the other leader attributes that were tested. Future

765   research should take into account that findings on athlete leadership cannot automatically be

766   generalized, regardless of team gender, competition level, or sport.

767   In addressing the limitations of the present research, several opportunities for future

768   research emerge. First, in terms of the study design, we explored only for a limited selection

769   of attributes whether they were characteristic for high-quality athlete leaders and for teams

770   having high athlete leadership quality. In doing so, we demonstrated that the social network

771   approach constitutes a novel and pioneering tool to study leadership attributes in sports

772   settings. Future research could use this network approach to examine a wider variety of

773   leadership attributes, thereby perhaps identifying other characteristic attributes of high-quality

774   athlete leadership.

775   Second, although the findings of the present study highlight the link between athlete

776   leadership quality and social connectedness, the cross-sectional nature of the study does not

777 allow determining the direction of this relationship. It could be that the more players feel

778 connected to their leader, the better they rate his/her leadership qualities. However, it could

779 also be that the more players perceive their leader as a good leader, the more they feel

780 connected to him/her. It seems likely that the relationship between connectedness and

781 perceived leadership quality is reciprocal (i.e., both constructs influencing each other).

782 Therefore, future research should try to determine the relative strength of this bidirectional

783 association by using experimental designs.

784 Such experimental designs could also provide more insight in the effectiveness of

785 shared leadership, compared with vertical leadership (i.e., a single leader). In the present

786 research, all teams were characterized by shared leadership, as a result of which no proper

787 comparison was possible. Future research could experimentally manipulate the degree of

788 shared leadership in sports teams and investigate the effects on social connectedness and on

789 other team outcomes.

790 Another fruitful line for further research concerns the advancement of an effective

791 athlete leadership development program. The present study demonstrated the importance of

792 high-quality athlete leadership for social connectedness. In addition, previous research

793 emphasized several other positive outcomes of high-quality athlete leaders, such as team

794 resilience, team cohesion, athletes' satisfaction, team confidence, team identification, and

795 team performance (Fransen, Coffee, et al., 2014; Fransen, Haslam, et al., 2015; Fransen et al.,

796 2012; Morgan et al., 2013, 2015; Price & Weiss, 2011; Vincer & Loughead, 2010). Therefore,

797 future research should further clarify the processes through which effective leadership skills

798 can be developed. In doing so, the effectiveness of leadership development programs should

799 be evaluated within different sports and at different levels.

Theoretical and Practical Implications

One important research challenge for social psychologists, following from previous research (e.g., Haslam et al., 2011; Thomas, Martin, & Riggio, 2013), was to demonstrate that the group processes associated with leadership have more explanatory power than the more leader-centric approaches to leadership. We have demonstrated that SNA constitutes a novel and potentially valuable tool for obtaining a deeper insight in athlete leadership within teams, thereby taking into account the surrounding team context. By including a team-level perspective on athlete leadership, we counterbalanced the leader-centered approach that has dominated athlete leadership research so far. In fact, the degree to which others felt connected to the leader (i.e., a typical team-level construct) appeared to be more decisive for a leader's perceived leadership quality on each of the leadership roles than typical leader-centered attributes (e.g., age, years of experience, sport competence).

In addition, the findings of the present study involve practical implications that could be considered by coaches, sport psychologists, and other sport professionals. First of all, SNA can be applied to identify the leadership structures in a sports team. Identifying the key leaders in the team for each of the four leadership roles is a first step in a leadership development program. The findings of the present study can then be used to develop a specific program for each of the leaders in order to obtain role-specific high-quality athlete leadership. Moreover, the technique of SNA can also be used to map the social connectedness relations within a team. The visualization of such a network might offer additional insights to the coach by revealing potential cliques within the team. A coach with knowledge of the key relational structures within the team can more effectively lead the team to success, and SNA provides a promising avenue to reach this aim.

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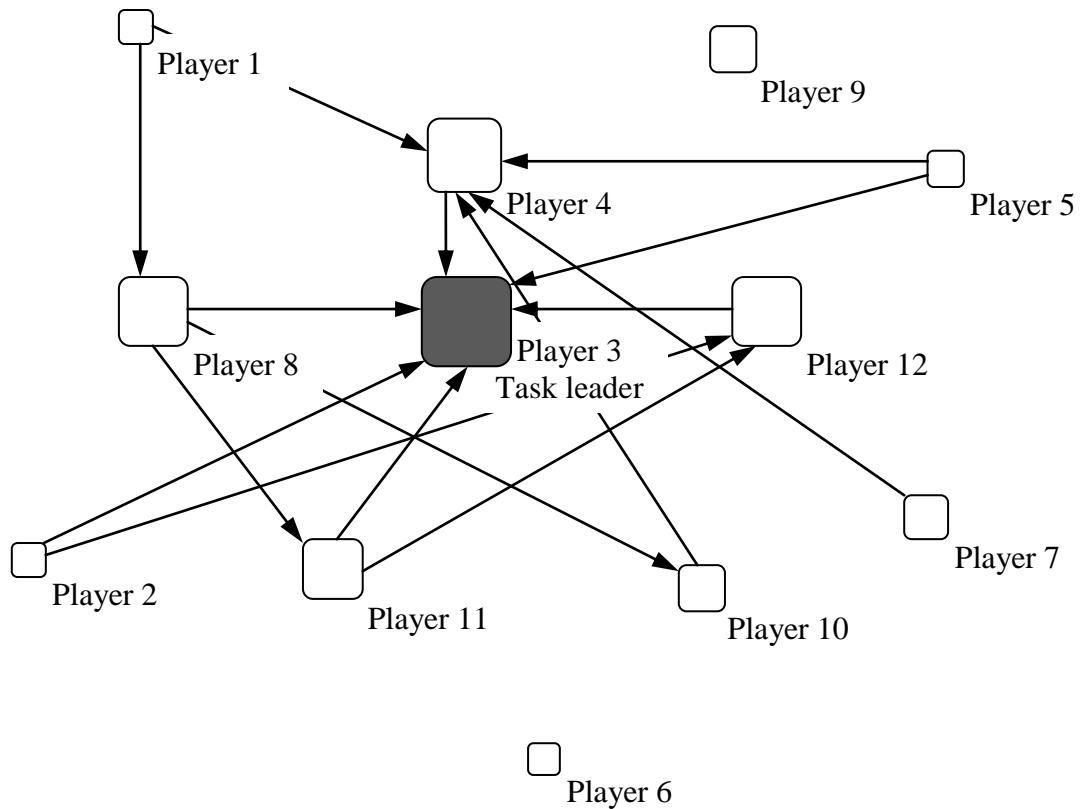
1021

1022   *Figure 1*. Task leadership quality network of one specific participating basketball team. A

1023   directed line from Player A to Player B means that Player A perceives Player B as a very

1024   good task leader (i.e., score of 4). The other scores are not visualized. The node size

1025   corresponds to the indegree centrality: the higher a player's task leadership quality as

1026   perceived by all teammates, the larger the node, and the more central the player is positioned

1027   in the figure. The node of the best task leader is filled.

1028
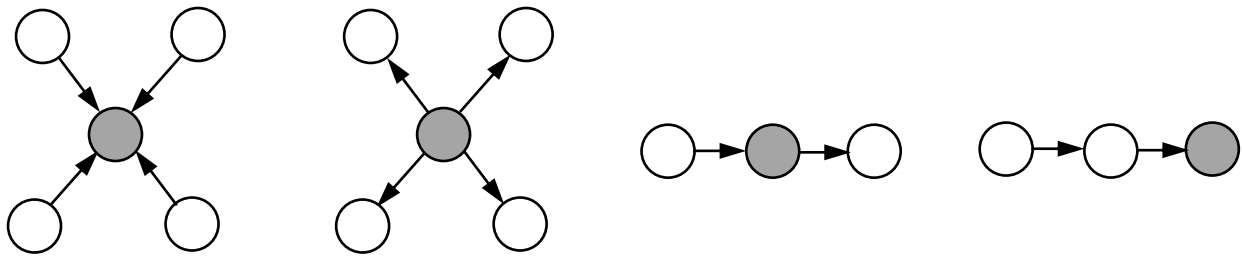
A. Indegree centrality   B. Outdegree centrality C. Betweenness centrality   D. Closeness centrality

1029

1030   *Figure 2*. Illustration of the different centrality measures. The marked node has the largest (A)

1031   indegree, (B) outdegree, (C) betweenness, and (D) incloseness centrality.

1032

1033 Table 1.

1034 *The standardized regression coefficients (β) of the regression analyses with players' indegree*

1035 *centrality within each of the leadership quality networks as dependent variable.*

	Leadership quality in general[1]	Task leadership quality[2]	Motivational leadership quality[2]	Social leadership quality[2]	External leadership quality[2]
Age	$.23^{**}$	.10	$.20^{**}$	$.22^{**}$	.10
Leadership outside sport	$.11^{**}$	$.10^{*}$	$.09^{*}$	$.10^{*}$	.06
Years of experience	$.19^{**}$	.01	$-.15^{*}$	$-.20^{**}$	$.17^{*}$
Team tenure	$-.13^{**}$	-.06	-.06	-.03	$-.12^{*}$
Captaincy[3]	$.25^{***}$	$.18^{***}$	$.15^{**}$	.08	$.23^{***}$
Playing time	$.29^{***}$	$.25^{***}$	$.13^{*}$	.07	$.18^{**}$
Team identification	.02	.07	.08	.07	.06
Social connectedness from others[4]	$.34^{***}$	$.48^{***}$	$.61^{***}$	$.68^{***}$	$.29^{***}$
Social connectedness towards others[5]	-.04	-.07	-.09	-.04	-.09
R^2	.59	.60	.59	.59	.42

1036 $^{*}p < .05;$ $^{**}p < .01;$ $^{***}p < .001$

1037 [1]These analyses are based on Study 1. [2]These analyses are based on Study 2. [3]Captaincy is a

1038 dichotomous variable indicating whether the player is a captain or not. [4]Social connectedness

1039 from others refers to the player's indegree centrality within the social connectedness network.

1040 [5]Social connectedness towards others refers to the player's outdegree centrality within the

1041 social connectedness network.

1042

1043   Table 2.

1044   *Correlations between the indegree centrality of athletes in the different leadership networks*

1045   *and athletes' indegree centrality, betweenness centrality, and closeness centrality in the*

1046   *social connectedness network.*

	Social connectedness network		
	Indegree centrality	Betweenness centrality	Closeness centrality
Indegree centrality of …			
General leadership network	.47**	.20**	.32**
Task leadership network	.66**	.18*	.54**
Motivational leadership network	.71**	.23**	.61**
Social leadership network	.73**	.30**	.66**
External leadership network	.48**	.12	.35**

1047   *p < .01; **p < .001

1048

1049   Table 3.

1050   *Means and standard deviations of the density and centralization of the different leadership*

1051   *networks, as well as their correlations with the density of the social connectedness network.*

Leadership quality networks	*Density* *M (SD)*	*Centralization* *M (SD)*	Correlation between social connectedness density and …	
			Leadership density	Leadership centralization
1. General leadership[1]	1.92 (.22)	34.56 (8.58)	.57**	-.16
2. Task leadership[2]	2.18 (.24)	34.72 (8.35)	.60**	-.41
3. Motivational leadership[2]	2.34 (.28)	32.39 (8.90)	.48*	-.31
4. Social leadership[2]	2.43 (.22)	31.18 (6.94)	.61**	-.12
5. External leadership[2]	1.80 (.53)	34.91 (13.09)	.39	-.02

1052   *p < .05; **p < .01; ***p < .001

1053   [1]These analyses are based on Study 1. [2]These analyses are based on Study 2.

1054

1055   Table 4.

1056   *Density values of the social connectedness network across different levels of density and*

1057   *centralization of the leadership networks.*

	Leadership networks characterized by…			
Density of the social connectedness network	Low density – Low centralization	Low density – High centralization	High density – Low centralization	High density – High centralization
General leadership[1]	2.40	2.57	2.78	2.74
Task leadership[2]	2.62	2.66	2.94	2.71
Motivational leadership[2]	2.66	2.63	2.82	2.91
Social leadership[2]	2.71	2.61	2.82	2.82
External leadership[2]	2.62	2.66	2.80	2.81

1058   [1]These analyses are based on Study 1. [2]These analyses are based on Study 2.