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The Art of Athlete Leadership: Identifying High-Quality Athlete Leadership at the Individual and Team Level Through Social Network Analysis. — [Source link](#)

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The art of athlete leadership: Identifying high-quality athlete leadership at the individual and team level through Social Network Analysis.

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Abstract

This research aimed to introduce Social Network Analysis as a novel technique in sports teams to identify the attributes of high-quality athlete leadership, both at the individual and at the team level. Study 1 included 25 sports teams ($N = 308$ athletes) and focused on athletes' general leadership quality. Study 2 comprised 21 sports teams ($N = 267$ athletes) and focused on athletes' specific leadership quality as a task, motivational, social, and external leader. The extent to which athletes felt connected with their leader proved to be most predictive for athletes' perceptions of that leader's quality on each leadership role. Also at the team level, teams with higher athlete leadership quality were more strongly connected. We conclude that Social Network Analysis constitutes a valuable tool to provide more insight in the attributes of high-quality leadership both at the individual and at the team level.

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

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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

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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.

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110 Building upon the previous leadership categorization of Loughhead 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

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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

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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

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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,

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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

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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; Loughhead, 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

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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, with 12 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 $N \times N$ leadership quality network (with N
307 being the number of team members). The rows referred to the outgoing ties of the team

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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 $N \times N$ 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.

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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 $N \times N$ 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

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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.

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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

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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'Connell, 1990; Myers, 1990). Furthermore, all tolerance scores
478 clearly exceeded the recommended .20 threshold (Menard, 1995).

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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 $< .001$),

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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.

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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

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553 social connectedness network were very small (average $\beta = .07$ 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

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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%.

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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

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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

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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

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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, & Slegers, 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

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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

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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

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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

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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 & Loughhead, 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.

800 **Theoretical and Practical Implications**

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

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

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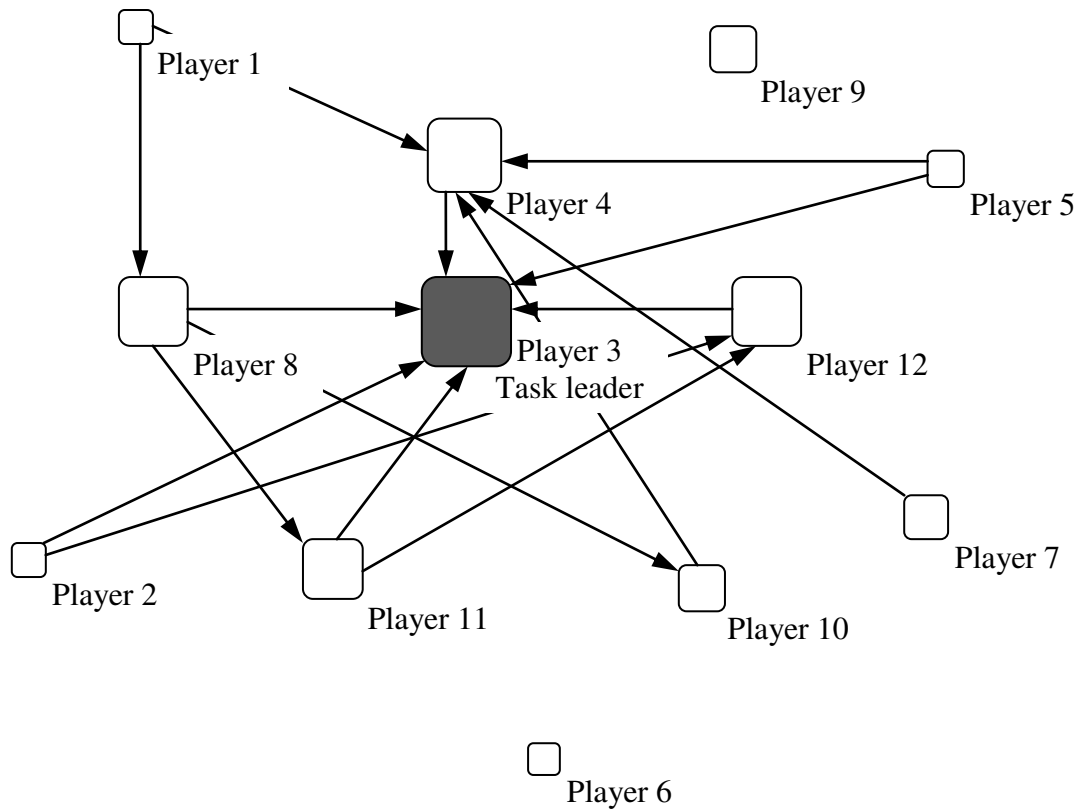
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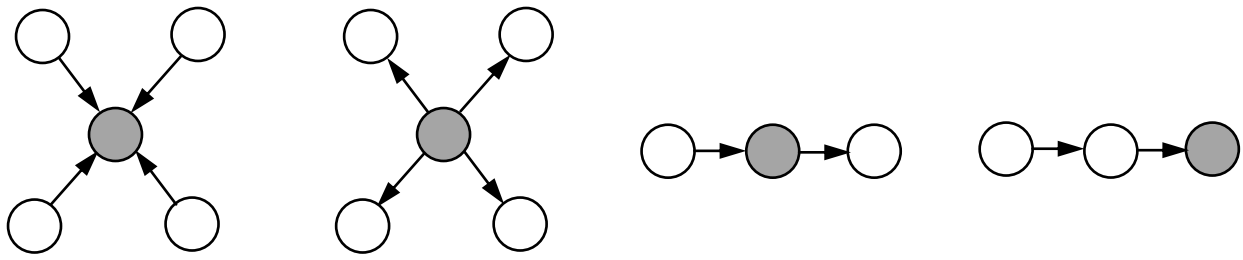


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1022 *Figure 1.* Task leadership quality network of one specific participating basketball team. A
1023 directed line from Player A to Player B means that Player A perceives Player B as a very
1024 good task leader (i.e., score of 4). The other scores 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.

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

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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.

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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
<i>R</i> ²	.59	.60	.59	.59	.42

1036 * $p < .05$; ** $p < .01$; *** $p < .001$

1037 ¹These analyses are based on Study 1. ²These analyses are based on Study 2. ³Captaincy is a
 1038 dichotomous variable indicating whether the player is a captain or not. ⁴Social connectedness
 1039 from others refers to the player's indegree centrality within the social connectedness network.
 1040 ⁵Social connectedness towards others refers to the player's outdegree centrality within the
 1041 social connectedness network.

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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 * $p < .01$; ** $p < .001$

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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	<i>Density</i> <i>M (SD)</i>	<i>Centralization</i> <i>M (SD)</i>	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 ¹These analyses are based on Study 1. ²These analyses are based on Study 2.

1054

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1055 Table 4.

1056 *Density values of the social connectedness network across different levels of density and*
 1057 *centralization of the leadership networks.*

<i>Density of the social connectedness network</i>	Leadership networks characterized by...			
	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 ¹These analyses are based on Study 1. ²These analyses are based on Study 2.