

University of Groningen

"Good, better, creative"

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Published in:
Journal of Sports Sciences

DOI:
[10.1080/02640414.2018.1459153](https://doi.org/10.1080/02640414.2018.1459153)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Final author's version (accepted by publisher, after peer review)

Publication date:
2018

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Kempe, M., & Memmert, D. (2018). "Good, better, creative": the influence of creativity on goal scoring in elite soccer. *Journal of Sports Sciences*, 36(21), 2419-2423.
<https://doi.org/10.1080/02640414.2018.1459153>

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4 **“Good, better, creative”: The influence of Creativity on Goal Scoring in Elite Soccer**

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1 Abstract

2 This study investigated the level of creativity of goals scored in football. Therefore, all goals
3 in the Football FIFA World Cup 2010 and 2014, as well as the Football UEFA Euro 2016 were
4 qualitatively examined. Three Football experts evaluated the last eight actions before each
5 goal using a creativity scale ranging from 0 to 10 (0 = not creative, 10 = highly creative) of all
6 goals scored via open play (311 goals in 153 matches). Level of creativity was revealed using
7 an Analysis of Variance and the frequency of high highly creative goals using a Kruskal- Wallis
8 Test. The results showed that the closer the actions to a goal, the more creative they were
9 evaluated. Teams that advanced to the later rounds of the tournament demonstrated
10 greater creativity than teams that failed to do so. High creativity in the last two actions
11 before the actual shot on goal proved to be the best predictor for game success. In
12 conclusion, this study is the first one to show that creativity seems to be a factor for succes
13 in high level football. Thereby it provides an empirical basis for the ongoing debate on the
14 importance of creativity training in football.

15

16 **Keywords:** *Creativity, Match analysis, Individual performance, Talent selection*

17

1 “Good, better, creative”: The influence of Creativity on Goal Scoring in Elite Soccer.

2

3 **Introduction**

4 To win at the highest stage in soccer, individual excellence of players and excellence in
5 group performance is needed as the margin between the top teams is close to zero. In many
6 cases just one special moment or one set of actions can make the difference between
7 winning and losing as the last three mayor international championships (World and
8 European Championship) were each decided by just one goal (Clemente, 2012; Kempe,
9 Vogelbein, & Nopp, 2016). Especially in one on one situations attacking players are
10 encouraged to use unpredictable and creative ways to beat their opponent and create goal
11 scoring opportunities (Duarte et al., 2012). To enable players to perform those creative
12 actions, several studies on how to best train creativity in soccer had been conducted in
13 recent years (Santos et al., 2018, Dos Santos, Memmert, Sampaio, & Leite, 2016, Rasmussen
14 & Østergaard, 2016). Even cognitive parameters had been discussed to be beneficial for
15 creativity of soccer players (Furley & Memmert, 2015). Despite all this research, there is no
16 empirical evidence that creativity is an actual factor for success in elite soccer. By now the
17 influence of creativity or more precisely the level of creativity of the actions (soccer specific
18 motor activities, see Table 1) leading to a goal has been not explored in official soccer
19 matches yet. Therefore, the present study investigates the level of creativity of each isolated
20 goal of the Football FIFA World Cup 2010 and 2014 and the Football UEFA Euro 2016 and to
21 what extent this level is related to success in these tournaments.

1 Creativity is commonly defined as “the ability to produce work that is both novel (i.e.,
2 unexpected, original) and appropriate (i.e., useful)” (Sternberg & Lubart, 2014, p. 3).
3 Applying this definition to soccer, creativity (divergent tactical thinking) is understood to be
4 the surprising, original and flexible production of tactical and/or motor response patterns
5 (Memmert & Roth, 2007). Examples of such tactical patterns with divergent motor and
6 cognitive solutions could be no look passes, dribbling’s, or running routes to get somebody
7 open for a pass.

8 The importance of the producing creative solution in team sports has been
9 emphasized by researchers and practitioners in recent years (for a review, Memmert,
10 2015a). Next to methodological principles for training units (Memmert, 2015b) a Creativity
11 Developmental Framework (CDF) has been develop consisting of five incremental creative
12 stages (beginner, explorer, illuminati, creator and genius) which combines them in
13 multidisciplinary training approaches to support the coaches’ understanding of creativity
14 development issues (Dos Santos, Memmert, Sampaio, & Leite, 2016). A recent survey with
15 soccer trainers also named creativity as an important attribute in regard to the player
16 selection process (Leso, Dias, Ferreira, Gama, & Couceiro, 2017). Furthermore, creativity,
17 measured via standard psychological assessments, was correlated with the number of goals
18 and assists that players had scored during two seasons after testing in a longitudinal study
19 (Vestberg, Gustafson, Maurex, Ingvar, & Petrovic, 2012). Taken those evidence into account,
20 a sufficient amount of research was conducted to improve (tactical) creativity in children
21 and younger adults (Cleland, 1994; Kovac, 1998; Memmert & Roth, 2007). The results could

1 demonstrate that creativity can be learned as well as trained and therefore influence soccer
2 coaching, especially at the youth level.

3 However, as Morris (2000) pointed out, it still remains unclear if and to what extent
4 tactical creativity and creative motor actions are related to actual game outcome. Using
5 Small-Sided Games (Torrents et al., 2016) showed that the level of creativity is pronounced
6 in specific game situations and leads to favorable situations which are beneficial for game
7 performance. However, no research so far has evaluated tactical creativity in real elite
8 soccer matches and its' relation to actual game performance and game outcome (winning,
9 tying, or losing).

10 The proposal of this approach is to evaluate if and how creativity is linked to actual
11 game performance by evaluating the set of actions that led to a goal during games from the
12 European and World Cup championships.

13 The most reliable key performance indicator in soccer is goal scoring (Delgado-
14 Bordonau, Domenech-Monforte, Guzmán, & Méndez-Villanueva, 2013; Sarmiento et al.,
15 2014).

16 The evaluation of creativity in team sports is mostly conducted via expert ratings (for
17 an overview, Memmert, 2013; Morris, 2000). In order to standardize the evaluation
18 procedure, Memmert and Roth (2007) used specific game-test situations in which each
19 action of a player is rated based on a judgment sheet resulting in a creativity score for each
20 player. This test scenario was later adapted to soccer (Memmert, 2010), creating a valid
21 evaluation tool. To measure the level of creativity the creativity performance rating by
22 Memmert and Roth (2007) was adapted for this study. Using this adapted version creativity

1 of the last eight actions leading to a goal were assessed during the 2010 and 2014 FIFA
2 World Cup and the European Championship 2016. The last eight actions were studied
3 following Hughes and Franks (2005), who showed that 84% of goals were scored after just 4
4 passes and over 95% of analyzed goals were scored within a maximum of just 8 passes. It
5 was expected that creativity would vary during the action sequence with a steady increase
6 of creativity scores towards the goal. Further, it was investigated if creativity (in goal
7 scoring) is a factor for team success by comparing the numbers of creative goal scoring with
8 importance of the goal and performance in the group stages of the tournaments (Sarmiento
9 et al., 2014). We assume that successful teams are more creative when scoring a goal and
10 have a greater relative contribution of highly creative actions to score goals.

11

12 **Methods**

13 The present research fully complies with the highest standard of ethics and participant
14 protection which followed the guidelines stated in the Declaration of Helsinki (2013) and
15 was approved by the ethics committee of the German Sport University.

16 **Data collection**

17 A total of 166 official games of the FIFA World Cup 2010, FIFA World Cup 2014, and
18 the UEFA Euro 2016 were monitored and recorded via the official broadcasting signal.
19 Thirteen games had to be excluded because no goal was scored within regular or extra time.
20 Matches analysed using the “MathBall”-notation software (Algorithmia Ltd., 2009,
21 www.mathball.com). The software enables to mark desired variables (Table 1) within the
22 video footage per mouse click and in advance automated type out offensive actions. With

1 the help of this software tool, different standard game-related statistics for passing,
2 shooting, ball control, and ball possession were recorded and video clips of all goals scored
3 in regular and extra time were cut in preparation to assess creativity. Of the 424 goals
4 scored in the 153 games, all 311 goals scored via open play were assessed for their level of
5 creativity. Furthermore, each goal was classified due to their importance in the game (Table
6 2).

7 **** Table 1 near here****

8

9 *** Table 2 near here ***

10

11 **Creativity assessment**

12 In order to assess the role of creativity in goal scoring, the last eight actions of the
13 chain of actions leading to a goal were categorised and rated (action eight directly resulted
14 in a goal). Creativity rating of each action was completed via an established approach
15 previously used in game test situations (Cleland, 1994; Memmert, 2010). The tactical
16 behaviors in on- and of-the-ball-movements as well as motor actions like dribbling, crossing,
17 passing, or ball transport were assessed by three raters using four different scales
18 respectively (1 to 10, cf. in depth Memmert & Roth, 2007). A rating of one is seen as
19 marginal creative ('Way below average') and a rating of ten as highly creative ("Way above
20 average"). All three raters were soccer experts (UEFA A-License or UEFA Pro-License) and
21 were trained to work with the scale (see Memmert & Roth, 2007, for more details). At a

1 minimum of .89, .90 and .92 respectively, the inter-judge reliability coefficient as a measure
2 of creativity was above the crucial limit of 0.80 (intraclass correlation coefficient).

3 **Data Analysis**

4 All teams were divided into four success groups according to their performance during
5 each tournament (see Table 3). Means and standard deviations are given as descriptive
6 statistics (Table 4). The assumption of normality distribution as a prerequisite for an ANOVA
7 analysis was investigated using the Kolmogorov-Smirnov test with Lilliefors correction and
8 analysis of homogeneity was also done using the Levene test. Normality distribution could
9 not be established in all dependent variables. However, since $n \geq 30$, using the Central Limit
10 Theorem we assumed the assumption of normality (Akritas & Papadatos, 2004). As
11 homogeneity was not found in all cases, a post-hoc analysis of the ANOVA was done using
12 Dunnett's T_3 . All analyses were executed in IBM® SPSS Statistics for Windows, version 25.0
13 (IBM Corp., Armonk, NY) and the statistical significance was set at $p\text{-value} < .05$.

14

15 *** Table 3 near here****

16

17 Differences in the creativity rating of the eight actions leading to a goal were
18 compared by success groups with a 4 (success groups) x 8 (action) analysis of variance with
19 repeated measures on the last factor and importance of the goal as a covariate. This analysis
20 has been done for all goals in the group stage to not over-represent the more successful
21 teams in the analysed sample. To further evaluate the importance of creativity on team
22 success goals were grouped into two categories. Goals with one of their actions rated eight
23 or higher are seen as highly creative, goals without one action rated eight or higher are seen

1 as normal or less creative goals based on the scheme of Memmert and Roth (2007).
2 Differences in the frequencies of highly creative and less creative goals of the success
3 groups were analysed using a Kruskal-Wallis test. A second Kruskal-Wallis test was
4 performed with the importance of the goal as the between-subject factor.

5 *****Table 4 near here*****

6

7 **Results**

8 Descriptive results indicate that the level of creativity increases the closer the action is to
9 the goal, with action Nr. 7 (the assist) possessing the highest mean value for creativity
10 (Figure 1). This increase in creativity is further shown by the significant main effect action (F
11 $(1,7) = 266.28, p < .001, \text{Eta}^2 = .564$). The between-subject factor success group was also
12 significant ($F(1,3) = 2.79, p < .05, \text{Eta}^2 = .039$). There was no significant effect on the
13 importance of goal neither for the interaction action x success group nor for the interaction
14 action x importance of goal. Post-hoc analysis of the repeated measure factor action
15 revealed no significant differences between Action 1, 2 and 3 and between Action 6, 7, and
16 8. However, it did show significant differences between the first three actions and the last
17 three, as well as differences for action 4 and 5 for each of the other actions. Furthermore,
18 post-hoc analysis on the between-subject factor success group did show a significant
19 difference between SG 1 and SG 3.

20 *** Figure 1 near here ***

21

1 Fifty-two percent of all goals scored in the group stage of the three championships
2 could be categorized as highly creative. A Kruskal-Wallis test to differentiate between the
3 frequencies of highly and less creative goals showed a significant effect on the factor
4 success group ($H(3) = 8.313, p < .05$). In addition post-hoc analysis yielded a significant
5 difference only between-subject group 1 and 3 (see Figure 2). An additional Kruskal-Wallis
6 test for the importance of goal as a between subject factor was not significant.

7

8 *** Figure 2 near here ***

9

10 **Discussion**

11 Tactically creative solutions are of outstanding relevance to success in high performance
12 sports (Memmert, 2013) and a component of talent development and selection systems
13 (Williams, 2013). In soccer, for example, the midfield players have the responsibility of
14 controlling the build-up play with smart tactical, original, and unexpected choices. Similarly,
15 playmakers in handball and basketball are able to initialize the closing option of their
16 teammates with creative solutions.

17 Our results indicate that creativity differs within the sequence of actions that lead to
18 a goal and between successful and less successful teams. Within the last eight actions that
19 lead to a goal a steady increase of creativity was determined. The last three actions before a
20 goal, the “hockey”-assist, the assist, and the actual shot on goal, proved to be significantly
21 more creative than the previous ones. The assist had the highest mean creativity score of all
22 actions, scoring slightly above the mean of the creativity scale. This also indicates that highly
23 creative actions are quite seldom. Overall just 172 of 1819 (9.5%) recorded actions were

1 rated as an above average or highly creative which means that they were rated 8 or higher
2 on the creativity scale. However, 46% of all scored goals in the three tournaments included
3 at least one highly creative action. The most successful teams did even show a proportion of
4 63% “highly” creative goals. Analysing the mean creativity ratings and the distribution of
5 highly creative goals both showed significant differences between success groups revealing
6 that more successful teams were more creative when scoring a goal and scored more highly
7 creative goals. Given this results, tactical creativity seems to be a crucial factor for team
8 success not just in small sided games (Torrents et al., 2016) and in children (Cleland, 1994;
9 Kovac, 1998; Memmert & Roth, 2007) but in the highest competitions in soccer. This
10 assumption is in line with the findings by Vestberg et al. (2012) who showed that creativity
11 is a predictor for individual success. This also confirms the opinion of soccer coaches who
12 see creativity as an importation skill when selecting a player (Leso et al., 2017).

13 In line with the findings of Hughes and Franks (2005) it could be demonstrated by the
14 fact that the last three actions before scoring a goal are the most important and most
15 creative ones. Especially the assist and “hockey”-assist that leads to goal seemed to be the
16 most creative part of the goal scoring sequence as 52% of all highly creative actions were
17 either one of those.

18 In conclusion the question drawn up by Morris (2000) could be answered with the
19 fact that creativity is actually related to actual game performance in elite soccer. By
20 evaluating the goals, the most reliable key performance indicator in soccer (Delgado-
21 Bordonau et al., 2013; Sarmiento et al., 2014), of three of the four major soccer events held
22 from 2010 to 2016 with an established creative performance rating we could demonstrate

1 that successful teams used more highly creative actions to score goals. This finding is of
2 great importance to the scientific community as it provides empirical evidence that
3 creativity is a decisive factor for success in soccer. Our findings further support the
4 implications of Duarte and colleagues (2012) that creative solutions are especially important
5 for attacking players as the last three actions before a goal yielded the highest creativity
6 scores. In addition, it can be implied that training of creative behavior should not only be
7 implemented in youth but also in the training regimes of professional soccer players.

8 As tactical creativity can be increased via training, there are already some instruction
9 materials to integrate creativity training approaches into youth soccer coaching (Memmert,
10 2015a). Most of those approach use differential learning as the key to implement a
11 beneficial environment to improve creative decision making (Santos et al., 2018; Rasmussen
12 & Østergaard, 2016). They further advocate using drills and game situation that provide
13 players with several possible solutions and a high frequency of such situations. Additionally,
14 coaches should provide a culture that encourages players to use creative solution although
15 they might not always work.

16 Besides using “typical” soccer training, research also suggests cognitive training programs as
17 an additional approach to enhance creative decision making (De Dreu, Nijstad, Baas,
18 Wolsink, & Roskes, 2012, Vestberg et al., 2012). Especially, working memory training
19 paradigms are broadly discussed as beneficial for elite soccer players (Furley & Memmert,
20 2015).

21 To sum up, it is still seen as one of the top research questions how to implement those
22 approaches into day to day training of proficient players (Dos Santos et al., 2016). Therefore,

1 this recent study might provide some more statistical evidence to encourage coaches to also
2 use these approaches in the highest level of soccer.

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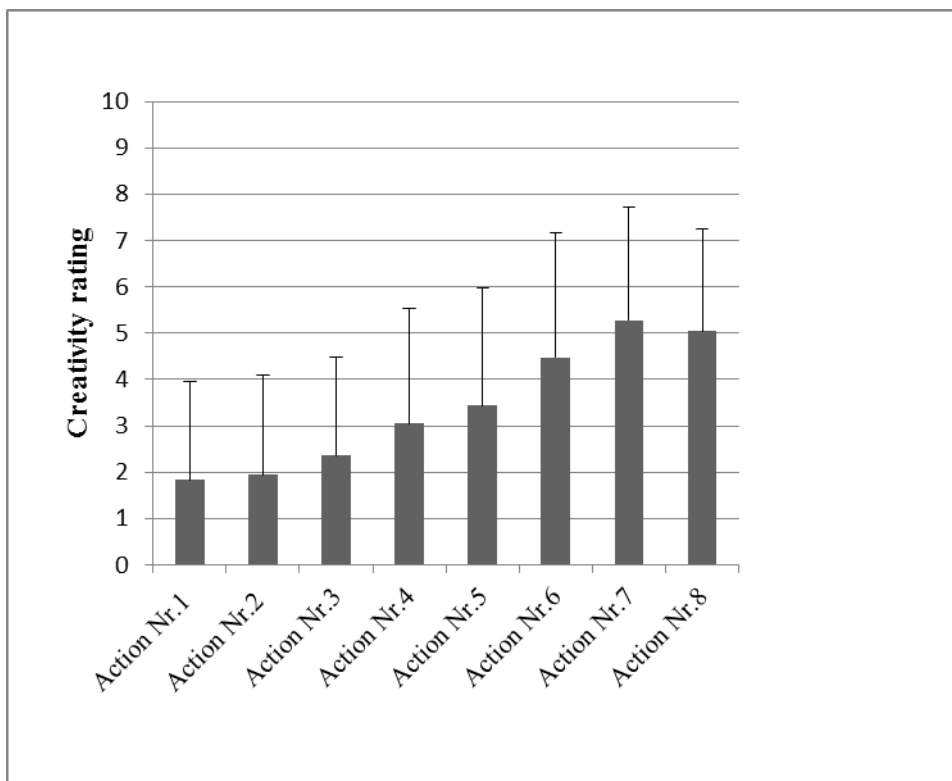
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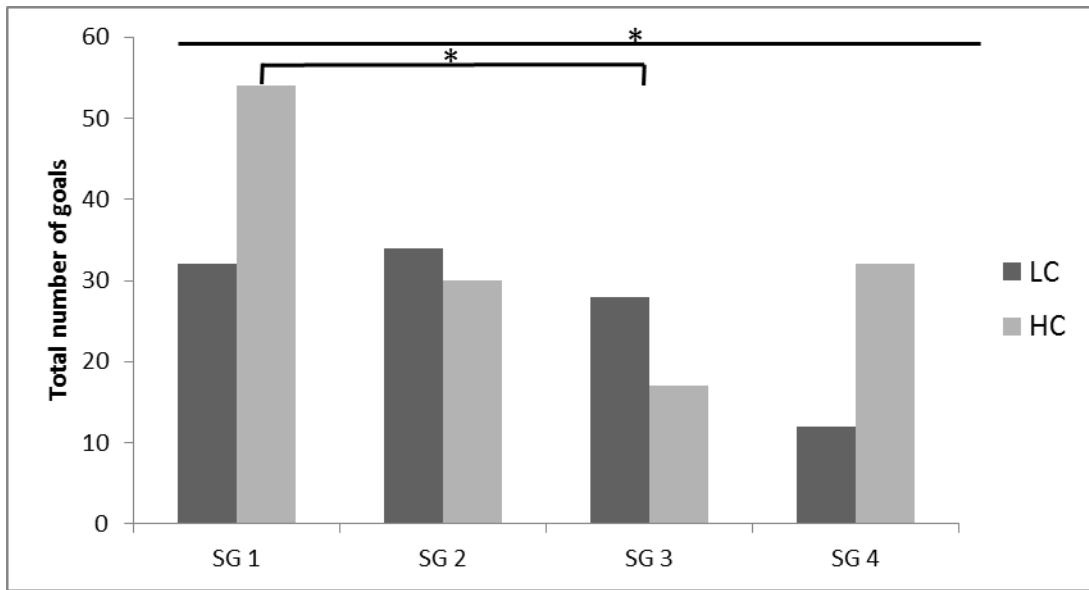
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2 Figure 1. Mean values and standard deviations of creativity ratings for actions leading up to a goal

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Figure 2. Total number of highly creative goals (creativity rating >7; HC) and less or normal creative (creativity rating <8; LC) for each success group (SG).

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6

1 Table 1. Variables obtained via MATHBALL as basis for the creativity rating

Variable	Name	Description
PS	Pass	An intentional played ball from one player to another
HE	Header	Activity of a player in which he consciously plays the ball actively with his head
SH	Shoot	Any goal attempt
BC	ball reception and ball carrying	A maximum of two controlled touches of the ball
AO	Taking advantage of openings	Creation of play-in possibilities or free spaces through movement
CR	Cross	A pass from a wide position into a specific area in front of the goal
DR	Dribbling	An attempt by a player to beat an opponent in possession of the ball
IC	Interception	A player intentionally intercepts a pass by moving into the line of the intended ball
FO	Foul	Any infringement that is penalised as foul play by a referee
HI	Hit	Ball touches of a player that occur involuntarily and without any recognizable purpose or intention
TA	Tackle	A tackle is awarded if a player wins the ball from another player who is in possession
CL	Clearance	A defensive action where a player kicks the ball away from his own goal with no intended recipient of the ball

2

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1 Table 2. Description of importance of a goal

Level of goal importance	Description
1	Every goal that leads to equalisation or to one goal difference
2	Every goal that leads to two goal difference
3	Every goal that leads to a minimum difference of three goals

2

3

1 Table 3. Categorization of Success

Round	Number of teams	Success Group
Quarterfinal	24	SG 1
Second round	24	SG 2
3 rd in Group stage, but not qualified to the second round as one of the best 3 rd placed teams (Euro 2016)	18	SG 3
4 th in Group stage	22	SG 4

2

3

1 Table 4. Means and standard deviations for action of the goal scoring sequence

<u>Variable</u>	<u>Mean ± standard deviation</u>		Total number of highly creative actions (rating ≥ 8)
	Group stage	Final round	
Action 1	1.84 ± 2.11	1.60 ± 1.86	3
Action 2	1.94 ± 2.15	2.00 ± 1.94	5
Action 3	2.35 ± 2.13	2.47 ± 2.62	8
Action 4	3.04 ± 2.47	2.47 ± 2.12	15
Action 5	3.43 ± 2.55	2.97 ± 2.47	19
Action 6	4.47 ± 2.68	4.23 ± 2.66	41
Action 7	5.27 ± 2.46	4.60 ± 2.60	49
Action 8	5.04 ± 2.22	4.71 ± 2.46	32

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