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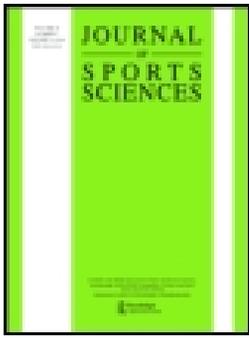
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## “Good, better, creative”: the influence of creativity on goal scoring in elite soccer

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### ABSTRACT

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

### ARTICLE HISTORY

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### KEYWORDS

Creativity; match analysis; individual performance; talent selection

### Introduction

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

Creativity is commonly defined as “the ability to produce work that is both novel (i.e., unexpected, original) and appropriate (i.e., useful)” (Sternberg & Lubart, 2014, p. 3). Applying this definition to

soccer, creativity (divergent tactical thinking) is understood to be the surprising, original and flexible production of tactical and/or motor response patterns (Memmert & Roth, 2007). Examples of such tactical patterns with divergent motor and cognitive solutions could be no look passes, dribbling’s, or running routes to get somebody open for a pass.

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

However, as Morris (2000) pointed out, it still remains unclear if and to what extent tactical creativity and creative

**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 |

motor actions are related to actual game outcome. Using Small-Sided Games (Torrents et al., 2016) showed that the level of creativity is pronounced in specific game situations and leads to favorable situations which are beneficial for game performance. However, no research so far has evaluated tactical creativity in real elite soccer matches and its' relation to actual game performance and game outcome (winning, tying, or losing).

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

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

The evaluation of creativity in team sports is mostly conducted via expert ratings (for an overview, Memmert, 2013; Morris, 2000). In order to standardize the evaluation procedure, Memmert and Roth (2007) used specific game-test situations in which each action of a player is rated based on a judgment sheet resulting in a creativity score for each player. This test scenario was later adapted to soccer (Memmert, 2010), creating a valid evaluation tool. To measure the level of creativity the creativity performance rating by Memmert and Roth (2007) was adapted for this study. Using this adapted version creativity of the last eight actions leading to a goal were assessed during the 2010 and 2014 FIFA World Cup and the European Championship 2016. The last eight actions were studied following Hughes and Franks (2005), who showed that 84% of goals were scored after just 4 passes and over 95% of analyzed goals were scored within a maximum of just 8 passes. It was expected that creativity would vary during the action sequence with a steady increase of creativity scores towards the goal. Further, it was investigated if creativity (in goal scoring) is a factor for team success by comparing the numbers of creative goal scoring with

importance of the goal and performance in the group stages of the tournaments (Sarmiento et al., 2014). We assume that successful teams are more creative when scoring a goal and have a greater relative contribution of highly creative actions to score goals.

## Methods

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

## Data collection

A total of 166 official games of the FIFA World Cup 2010, FIFA World Cup 2014, and the UEFA Euro 2016 were monitored and recorded via the official broadcasting signal. Thirteen games had to be excluded because no goal was scored within regular or extra time. Matches analysed using the "MathBall"-notation software (Algorithmia Ltd., 2009, [www.mathball.com](http://www.mathball.com)). The software enables to mark desired variables (Table 1) within the video footage per mouse click and in advance automated type out offensive actions. With the help of this software tool, different standard game-related statistics for passing, shooting, ball control, and ball possession were recorded and video clips of all goals scored in regular and extra time were cut in preparation to assess creativity. Of the 424 goals scored in the 153 games, all 311 goals scored via open play were assessed for their level of creativity. Furthermore, each goal was classified due to their importance in the game (Table 2).

## Creativity assessment

In order to assess the role of creativity in goal scoring, the last eight actions of the chain of actions leading to a goal were categorised and rated (action eight directly resulted in a goal). Creativity rating of each action was completed via an established approach previously used in game test situations (Cleland, 1994; Memmert, 2010). The tactical behaviors in on- and of-the-ball-movements as well as motor actions like dribbling, crossing, passing, or ball transport were assessed by three raters using four different scales respectively (1 to 10, cf. in depth Memmert & Roth, 2007). A rating of one is seen as marginal creative ("Way below average") and a rating of ten as highly creative ("Way above average"). All three raters were soccer experts (UEFA A-License or UEFA Pro-License) and were trained to work with the scale (see Memmert & Roth, 2007, for more details). At a minimum of .89, .90 and .92 respectively, the

**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    |

inter-judge reliability coefficient as a measure of creativity was above the crucial limit of 0.80 (intraclass correlation coefficient).

### Data analysis

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

Differences in the creativity rating of the eight actions leading to a goal were compared by success groups with a 4 (success groups)  $\times$  8 (action) analysis of variance with repeated measures on the last factor and importance of the goal as a covariate. This analysis has been done for all goals in the group stage to not over-represent the more successful teams in the analysed sample. To further evaluate the importance of creativity on team success goals were grouped into two categories. Goals with one of their actions rated eight or higher are seen as highly creative, goals without one action rated eight or higher are seen as normal or less creative goals based on the scheme of Memmert and Roth (2007). Differences in the frequencies of highly creative and less creative goals of the success groups were analysed using a Kruskal-Wallis test. A second Kruskal-Wallis test was performed with the importance of the goal as the between-subject factor.

Table 3. Categorization of success.

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

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

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

### Results

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

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

### Discussion

Tactically creative solutions are of outstanding relevance to success in high performance sports (Mermert, 2013) and a component of talent development and selection systems (Williams, 2013). In soccer, for example, the midfield players have the responsibility of controlling the build-up play with

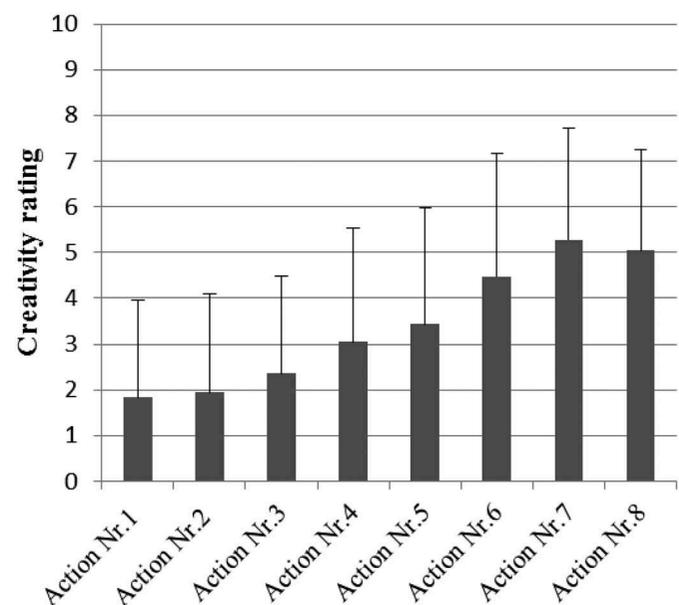
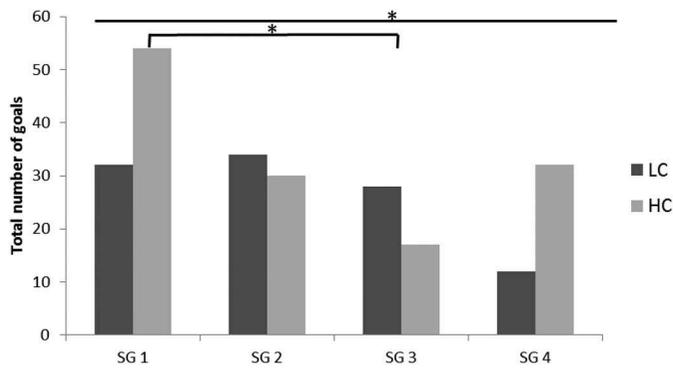


Figure 1. Mean values and standard deviations of creativity ratings for actions leading up to a goal.



**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).

smart tactical, original, and unexpected choices. Similarly, playmakers in handball and basketball are able to initialize the closing option of their teammates with creative solutions.

Our results indicate that creativity differs within the sequence of actions that lead to a goal and between successful and less successful teams. Within the last eight actions that lead to a goal a steady increase of creativity was determined. The last three actions before a goal, the “hockey”-assist, the assist, and the actual shot on goal, proved to be significantly more creative than the previous ones. The assist had the highest mean creativity score of all actions, scoring slightly above the mean of the creativity scale. This also indicates that highly creative actions are quite seldom. Overall just 172 of 1819 (9.5%) recorded actions were rated as an above average or highly creative which means that they were rated 8 or higher on the creativity scale. However, 46% of all scored goals in the three tournaments included at least one highly creative action. The most successful teams did even show a proportion of 63% “highly” creative goals. Analysing the mean creativity ratings and the distribution of highly creative goals both showed significant differences between success groups revealing that more successful teams were more creative when scoring a goal and scored more highly creative goals. Given this results, tactical creativity seems to be a crucial factor for team success not just in small sided games (Torrents et al., 2016) and in children (Cleland, 1994; Kovac, 1998; Memmert & Roth, 2007) but in the highest competitions in soccer. This assumption is in line with the findings by Vestberg et al. (2012) who showed that creativity is a predictor for individual success. This also confirms the opinion of soccer coaches who see creativity as an importation skill when selecting a player (Leso et al., 2017).

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

In conclusion the question drawn up by Morris (2000) could be answered with the fact that creativity is actually related to actual game performance in elite soccer. By evaluating the

goals, the most reliable key performance indicator in soccer (Delgado-Bordonau et al., 2013; Sarmiento et al., 2014), of three of the four major soccer events held from 2010 to 2016 with an established creative performance rating we could demonstrate that successful teams used more highly creative actions to score goals. This finding is of great importance to the scientific community as it provides empirical evidence that creativity is a decisive factor for success in soccer. Our findings further support the implications of Duarte and colleagues (2012) that creative solutions are especially important for attacking players as the last three actions before a goal yielded the highest creativity scores. In addition, it can be implied that training of creative behavior should not only be implemented in youth but also in the training regimes of professional soccer players.

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

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

To sum up, it is still seen as one of the top research questions how to implement those approaches into day to day training of proficient players (Dos Santos et al., 2016). Therefore, this recent study might provide some more statistical evidence to encourage coaches to also use these approaches in the highest level of soccer.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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