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Difference in shot's attributes between winning and losing teams in the 2018 FIFA World Cup

الفرق في سمات التسديد بين المنتخبات الفائزة والخاسرة في كأس العالم لكرة القدم 2018

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Abstract: The aim of this study is to investigate the relationship between shot attributes and match outcome (Winning vs losing) in the 2018 FIFA World cup. Shot's attributes are: Pattern of play, Origin, Outcome, Player (shooter) and coordinate of shots. 1313 shots from 105 unbalance game by team were studied. Data was provided by StatsBomb company. The results showed that, comparing to losing teams, winning teams use more shots from set pieces (P<0.05; ES=0.25), shoot more often from a counter attack (P<0.05; ES=0.22), and from regular play (P<0.05; ES=0.28), have more successful shots (P<0.001; ES=0.42), more ratio of success(P<0.01; ES=0.38), tend to involve more their attacking-midfield(P=0.087; ES=0.18), and forward (P=0.86; ES=0.2) at shooting, and their successful shots are mostly concentrated closer to target (P=0.06; ES=0.3), and relatively centered (P<0.05; ES=0.32). Coaches can use these findings to enhance their own players' performance.

Keywords: FIFA World Cup 2018, Shots, Match outcome

الملخص: الهدف من هذه الدراسة هو التحقيق في العلاقة بين سمات التسديد ونتائج المباراة (الفوز مقابل الخسارة) في كأس العالم 2018. سمات التسديدة هي: نمط اللعب، الأصل، النتيجة، اللاعب وموقع التسديدات. تمت دراسة 1313 تسديدة من 105 مباراة غير متوازنة لكل فريق. تم توفير البيانات من قبل شركة StatsBomb. أظهرت النتائج انه مقارنة بالفرق الخاسرة ، فأن الفرق الفائزة تستخدم المزيد من التسديدات من الكرات الثابتة (P <0.05 ؛ (ES = 0.25 ، وتسديد أكثر من هجوم مضاد (P <0.05 ؛ (ES = 0.22 ، ومن اللعب العادي (P <0.05 ؛ (ES = 0.28 ، لديها تسديدات أكثر نجاحًا (P <0.001 ؛ (ES = 0.42، نسبة نجاح أكبر (P <0.01 ؛ (ES = 0.38 ، تميل إلى إشراك المزيد من لاعبي خط الوسط المهاجم (P = 0.087 ؛ (ES = 0.18، والأمام (P = 0.86 ؛ (ES = 0.2 ، وتتركز لقطاتهم الناجحة في الغالب بالقرب من الهدف (P = 0.06 ؛ (ES = 0.3 ، وتمركز نسبيًا (P <0.05 ؛(ES = 0.32 .. يمكن للمدربين استخدام هذه النتائج لتحسين أداء لاعبيهم.

- **الكلمات المفتاحية:** كاس العالم 2018, التسديدات، نتيجة المباراة

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Introduction

Performance analysis (PA) consists of quantifying, analyzing and objectively studying the factors that define performance during it events in competition and training. It "is a tool aimed specifically at improving future performances through the analysis and dissemination of information relating to previous training and match performances to an athlete or player" (Mackenzie & Cushion, 2016, p. 540) and a team. With technological development, performance analysis has been closely linked to technological tools in order to become dependent. Baca (2015, p. X) defines it as "the objective way to record and interpret sports performance using the latest technologies so that key elements can be quantified in a valid and consistent manner. This knowledge is then used to enhance athlete performance and effective decision-making" through practical exercises or theoretical-mental practice (Guettaoui & Boumasjed, 2020).

In soccer, science has tried to find keys to identify performance among technical and tactical attributes. It has been shown that, in soccer, success is linked to passes (Lago-Peñas & Dellal, 2010; Oberstone, 2009), successful passes (Rampinini et al., 2009), possession (Castellano et al., 2012), duel (Liu, Gomez, et al., 2015), off-side (Zhou et al., 2018) and corner (Hadji et al., 2020). On the other hand, the lack of success was linked to crosses (Sarkar, 2018; Vecer, 2014), foul committed (Hadji et al., 2020; Oberstone, 2009), passes (Harrop & Nevill, 2014). In almost all previous studies that focus on performance indicators, shot and shot on target were always major part of the analysis.

For shots. It has been shown that successful teams in FIFA World cup made more shots than other teams: 1990 World Cups (Hughes & Franks, 2005) 2002 (Szwarc, 2004), 2006 and 2010 (Castellano et al., 2012) 2014 (Liu, Gomez, et al., 2015) and 2018 (Alves et al., 2019). Similar results were observed in the

domestic competitions: La Liga (Spanish) 2008/09 (Lago-Ballesteros & Lago-Peñas, 2010) and Serie A (Italian) 2004/05 (Rampinini et al., 2009). The top four Spanish teams (2008/09) make more shots than those from the middle or bottom of the table (16, 13 and 13 respectively) (Lago-Ballesteros & Lago-Peñas, 2010). The analysis of the shots is always related to its success, each shot is identified as "on target " or "off target". The researchers placed great importance on this difference in relation to success in football. Liu, Gomez, et al. (2015) showed that at the 2014 World Cup, shots and shots on target increased the chances of victory by 13% and 48%, respectively. In addition, a previous study found similar results, suggesting that total shots and shots on target are crucial to winning during the 2002, 2006 and 2010 World Cups (Castellano et al., 2012). Although, Szwarc (2004), reported that the winning teams made only four more shots than the defeated teams, but the efficiency of their shots was three times higher. Similar results were obtained by Yamanaka et al. (1993) for the national teams participating in the 1990 World Cup in Italy. It would seem that what best discriminates a team's performance is the number of shots on target, not the total number of shots. It appears that high-performing teams only use to shoot when the situation is fortunate to score a goal, unlike other teams that use it in the absence of clear and safe solutions. The FIFA report (FIFA, 2018) reports a decline in the number of "shots per goal between" 2010 and 2018 and (12.8, 10 and 9.8 respectively). It is important to point out that this index reflects the use of shots with regard to scored goals, the lower the value, the better the efficiency. At the 2018 World Cup, France and Croatia recorded very small values (6 and 8.5 respectively) compared to the tournament average (9.8). This confirms that the number of shots is not an absolute performance index in itself against its effectiveness (successful shots). From another angle, Lago (2007) and Moura et al. (2014) reveal that the number of shots and shots on target is related to the

performance in the group stage of the 2006 World Cup. On the other hand, Lago (2007) finds no difference in the knockout matches between the winners and the losers.

Problematic of the study : The very nature of the competition itself can affect the technical-tactical activity and performance indicators. As far as we know, no previous research has investigated only shots attribute and its relation with success in soccer. With regard to all differences and opposite conclusions we investigate the following question: ***Are shot attributes linked to the match outcome in the 2018 FIFA World Cup?***

The Aim of the study : The aim of this study is to identify which shot attributes are linked to successes in the 2018 World Cup tournament. Once these attributes are found, they can be used as augmented feedback to enhance individual and collective performance (Chettouh et al., 2020).

Methods

We use descriptive approach to conduct this research.

Data: The match-related data was obtained from the company StatsBomb in JSON format files (StatsBomb, 2019). StatsBomb is one of the most reliable companies in the market that provides data and analysis of all European league and worldwide competition (Bundesliga, La Liga, Ligue 1, Serie A, MLS). Data specification was provided with the dataset (V 1.1) (StatsBomb data specifications, 2020). A Python package was used to parser the JSON's data files into separate CSV files (Package from Khan (2020) in GitHub). CSV's files were then managed by the Microsoft Excel to extract different specifications related to shots. Data specifications for shot attributes are used as operational definitions in this study (see Table 1). For the coordinate, originally the axis starts at the right-down corner. We change the axis in a way to express distances far from the

target (opponent goal) in Y coordinate, and center of the target for X coordinate (see Fig. 1).

Sample: From sixty-four (64) games in the World Cup, we used fifty-one (51) games that end with a winner and a loser outcome (unbalanced games). A total of 1313 shots were analyzed in 102 (51 x 2) team game.

Table 1. Operational definition used by the StatsBomb (StatsBomb data specifications, 2020, p. 34)

Shot's attributes	Definition
Shot	An attempt to score a goal, made with any (legal) part of the body
Pattern of play	
Free Kick	shot is from a set-piece
Open Play	shot is from an open play
Origin	
From Corner	Shot direct from a corner kick
From Counter	Shot is from a counter-attack
From Free Kick	Shot is from a direct free kick
From Goal Kick	Shot is from a set-piece "Goal kick."
From Keeper	Shot is from the keeper's long pass
From Kick Off	Shot directly from kick off
From Throw-In	Shot directly after a throw in
Outcome	
Blocked	A shot that was stopped from continuing by a defender
Goal	A shot that was deemed to cross the goal-line by officials
Off Target	A shot that's initial trajectory ended outside the posts
Post	A shot that hit one of the three posts
Saved	A shot that was saved by the opposing team's keeper
Wayward	An unthreatening shot that was way off target or did not have enough power to reach the goal line (or a miskick where the player didn't make contact with the ball)

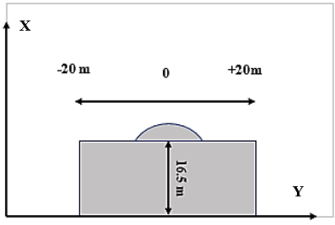


Fig. 1. X and Y coordinate used for shot location.

Statistics: Data were presented as means (M) and standard deviations (SD). A non-parametric test was used (Mann-Whitney) to compare shots attributes

between teams that won and lost. Rank-biserial correlation is used as Effect size (ES). All statistical analyses were computed using JASP (Version 0.13.1) (www.jasp-stats.org). A significance level was set at $p \leq 0.05$.

Results

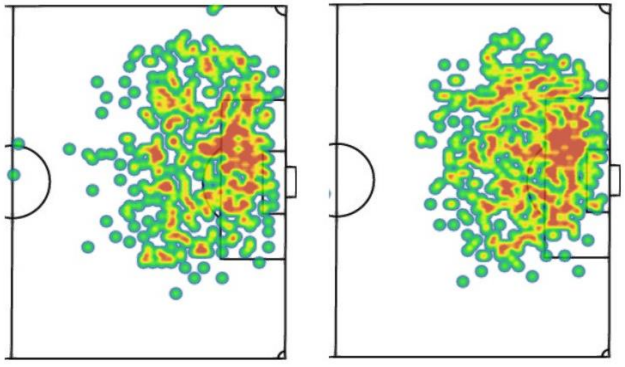
Table 2. Comparison of shots attributes between losing and winning teams

Shots attributes	Losing team	Winning team	U	P-Value	ES
Pattern of play					
Free Kick	(N=51) 0.45±0.58	(N=51) 0.88±0.91	972	**0.016** *	0.253
Open Play	(N=51) 11.43±5.61	(N=51) 12.59±4.97	1069	0.122	0.178
Free Kick%	(N=51) 3.98±5.31	(N=51) 7.5±7.93	991.5	**0.027** *	0.238
Open Play%	(N=51) 96.03±5.31	(N=51) 92.5±7.93	1609.5	**0.027** *	0.238
Origin					
From Corner	(N=51) 2.1±2.06	(N=51) 2.18±1.85	1224	0.604	0.059
From Counter	(N=51) 0.33±0.68	(N=51) 0.65±0.82	1014.5	**0.023** *	0.220
From Free Kick	(N=51) 2.35±1.74	(N=51) 2.51±1.55	1189.5	0.450	0.085
From Goal Kick	(N=51) 0.33±0.59	(N=51) 0.37±0.69	1292	0.945	0.007
From Keeper	(N=51) 0.12±0.33	(N=51) 0.14±0.4	1297.5	0.976	0.002
From Kick Off	(N=51) 0.1±0.36	(N=51) 0.06±0.24	1327.5	0.686	0.021
From Throw-In	(N=51) 2.14±1.81	(N=51) 1.73±1.22	1438.	0.348	0.106
Regular Play	(N=51) 4.39±3.13	(N=51) 5.82±3.33	938	**0.015** *	0.279
Outcome					
Blocked	(N=51) 3.57±2.73	(N=51) 3.71±2.11	1177	0.407	0.095
Goal	(N=51) 0.47±0.7	(N=51) 1.94±1.14	302	**<.001****	0.768
Off T	(N=51) 4.33±2.37	(N=51) 4.39±2.1	1263.5	0.805	0.028
Post	(N=51) 0.06±0.24	(N=51) 0.26±0.44	1045.5	**0.007****	0.196
Saved	(N=51) 2.55±1.99	(N=51) 2.55±1.80	1270.5	0.841	0.023
Wayward	(N=51) 1.04±0.98	(N=51) 0.88±1.13	1466	0.240	0.127
Player					
AM	(N=51) 0.65±0.96	(N=51) 1.26±1.67	1067.5	**0.087**	0.179
CB	(N=51) 1.33±1.4	(N=51) 1.33±1.49	1313.5	0.931	0.010
DM	(N=51) 0.69±1.21	(N=51) 0.67±1.09	1223	0.545	0.060
F	(N=51) 2.92±2.24	(N=51) 3.71±2.44	1047	**0.086**	0.195
M	(N=51) 2.71±2.52	(N=51) 3.22±3.2	1251.5	0.742	0.038
W	(N=51) 2.71±2.33	(N=51) 2.28±2.75	1483.5	0.210	0.141
WB	(N=51) 1±1.02	(N=51) 1.28±1.17	1133.	0.242	0.129
Total Shots	(N=51) 12.02±5.64	(N=51) 13.73±4.85	977.5	**0.030** *	0.248

Significance levels: *:0.05; **:0.01; ***:0.001. AM: attacking-midfield; CB: central-back; DM: defensive-midfield; F: forward; M: midfield; W: wing; WB: wing-back.

For the pattern of play, most shots recorded were from open play for both losing and winning teams (93%-96% respectively) with less than 8% from a free kick. Although in average by game, winning team shoots more often from a free kick than the losing team (0.88±0.91; 0.45±0.58; P=0.016; ES=0.25). For the origin of the shot, winning team recorded more shots from counter-attacks (0.65±0.82; 0.33±0.68; P=0.023; ES=0.22) and from regular play (5.82±3.33; 4.39±3.13; P=0.015; ES=0.28). No difference was found for other origin's attributes (Corner, Free Kick, Goal Kick, Keeper, Kick Off and Throw In). With regard to the outcome, winning teams recorded more shots on target for both goals (1.94±1.14;0.47±0.7; P<0.001; ES=0.77) and on the post shots (0.26±0.44; 0.06±0.24; P=0.007; ES=0.19) than the losing teams. Which means that winning teams score one goal from a shot every 46 Mn, compared to one goal every 190 Mn for the losing team. For players involved in shots, attacking midfield (AM) and forward (F) from the winning team tend to shoot more often than their counterparts from the losing teams (1.26±1.67; 0.65±0.96; P=0.087; ES=0.18 and 3.71±2.44; 2.92±2.24; P=0.086; ES=0.2 respectively).

Figure 1. Shots distribution on the field for winning and losing teams



Losing team Winning Team

Table 3. Comparison of shots success between winning and losing team

Shots success	Losing teams	Winning teams	U	P-Value	ES
Unsuccessful	(N=51) 8.94 ± 4.40	(N=51) 8.98 ± 3.55	1211	0.55	0.069
Successful	(N=51) 3.08 ± 2.11	(N=51) 4.75 ± 2.37	754.5	**<.001*** **	0.42
% Success	(N=51) 25.4% ± 14.8%	(N=51) 35.3% ± 14.2%	811.5	**0.001****	0.376

Successful shots = (Goal + Post + Saved); Unsuccessful shots = (off target + Wayward + blocked).

Significant level; **=0.01; ***=0.001

For the unsuccessful shots, no significant differences were found between the losing and the winning team. However, the winning team record more successful shots than the losing team (4.75 ± 2.37;3.08 ± 2.11; P<0.001; ES=0.42), that's mean 50% more successful shot for every game. For success ratio, winning teams' shots are more accurate than the losing teams (35.3% ± 14.2%; 25.4% ± 14.8%; P=0.001; ES=0.38).

Table 4. Comparison of shot location between losing and winning teams.

Shots attributes	Losing team	Winning team	U	P-Value	ES
Outcome coordinate					
Blocked_X	(N=48) 17.79±5.34	(N=50) 17.74±4.26	1193.5	0.966	0.005
Goal_X	(N=19) 12.8±5.61	(N=50) 9.93±4.91	615	**0.061**	0.295
Off T_X	(N=48) 17.99±5.46	(N=50) 18.54±5.94	1129	0.616	0.059
Post_X	(N=3) 13±12.17	(N=13) 17.31±7.79	12.5	0.381	0.359
Saved_X	(N=44) 15.77±4.36	(N=45) 15.45±6.16	1119	0.291	0.130
Wayward_X	(N=35) 11.88±6.5	(N=28) 12.23±6.77	485.5	0.956	0.009
Blocked_Y	(N=48) 3.85±8.27	(N=50) 4.47±5.72	1154	0.746	0.038
Goal_Y	(N=19) 8.45±5.61	(N=50) 5.22±6.01	629	**0.039 ***	0.324
Off T_Y	(N=48) 5.15±6.6	(N=50) 5.59±5.36	1195.5	0.977	0.004
Post_Y	(N=3) 5±1.73	(N=13) 5.77±11.92	18	0.893	0.077
Saved_Y	(N=44) 4.99±7.36	(N=45) 5.64±6.58	972	0.886	0.018
Wayward_Y	(N=35) 4.69±7.28	(N=28) 2.14±7.41	580	0.215	0.184
Average Location					
X	(N=51) 16.74±2.64	(N=51) 16.19±2.65	1418.5	0.432	0.091
Y	(N=51) 29.76±3.49	(N=51) 29.73±2.93	1289.5	0.944	0.008

The shot outcome doesn't show a relation with the location of execution when comparing losing and winning teams (P>0.05), except for the Y coordinate of goals that appear to be closer to the goal-line when winning than when losing (5.22±6.01; 8.45±5.61; P<0.01; ES:0.32). Also, the X coordinate for goals when winning tends to be different from losing. The winning team have a tendency to score more goals when they shoot near to the center of the field (9.93±4.91; 12.8±5.61; P=0.061; ES=0.3).

Shots average location for both teams show no difference for neither distance from the goal-line and distance from the axial line. For all shot outcome and for both teams, the mean location from the axial-line tends to be left-sided. Figure 1 shows how winning team shots are less dispersed, closer to the goal-line and the axial-line compared to losing team.

Discussion

The aim of this study was to search for the relationship between shots attributes and success (match outcome) in the 2018 Russia FIFA World Cup games. This study indicated that successful teams attempt more shots from set pieces than unsuccessful teams. Carmichael et al. (2000) also found that successful teams were more efficient than unsuccessful teams in scoring from set plays. Kubayi and Toriola (2020) found that African teams (unsuccessful) conceded more goals from set pieces. Those finding light up the importance of set pieces in modern soccer in both way defensive and offensive approach.

The study also shows that successful teams shoot more often from a counter-attack and from regular play. Hughes and Franks (2005) found that there were significantly more shots per possession at longer passing sequences than there were at shorter passing sequences for successful teams. The conversion ratio of shots to goals is better for direct play than for possession play. Which indicates that successful teams are more able to create chances of

shooting from both direct and indirect play. It seems that they aim to make their good shooters in the best condition to increase the accuracy of shots. In regular play, by moving collectively fast, the team creates space in front of the penalty area that can give space and time for midfielder to shoot without a big pressure.

The shot's outcome shows only differences in "Goal" and "On post" attributes. Successful teams are more accurate at shooting (Table 3). Those results are in good agreement with other studies which have shown that shot on target are one of the most powerful performance indicators has ever been identified (Broich et al., 2014; Castellano et al., 2012; Delgado-Bordonau et al., 2013; Hadji et al., 2019, 2020; Hughes & Bartlett, 2002; Lago-Ballesteros & Lago-Peñas, 2010; Lago-Peñas et al., 2011).

The result show that attacking-midfield and forwarded from the winning team are more involved in shooting. Which highlights the importance of those two playing-positions in the attacking success. A team that have, especially, midfield players with offensive traits are more likely to be successful. A similar conclusion was reached by Liu, Gómez, et al. (2015) in the Spanish First Division Professional Football League. They found that forward and midfielder belonging to the top 3 teams have recorded more shots and shots on target than those from bottom 3 teams.

With regard to shot location on the field, the results show no difference in overall shots or outcome shots, except for shots ending with goals. Successful teams tend to score goals from closer regions to the target and from centred-area. Kapidžić et al. (2010) showed that shots from inside the penalty area are the most powerful predictor of success in the 2008 European championship. Oberstone (2009) found that the ratio of goals from outside the penalty area is one of the predictors of the final league ranking in the English Premier League. Successful teams' shots are also less dispersing, tends to be much closer to the

penalty area and more centered. A good team organization at the offensive phases will led to a better collective possession which give the ability to take the ball as closer as possible to the target. This shot distribution don't mean that these teams have lineup the best shooters to achieve it. It means that these teams are able to produce plays' configuration that will create enough time-space windows allowing higher number of shots with higher probability of success.

Conclusion

The main purpose of the study is to inspect the relation between shots attributes and success in the 2018 FIFA World Cup. We showed that shot attributes are indeed linked to success. Our results demonstrated that winning teams when compared to losing teams:

- Uses more shots from set pieces;
- Shoot more often from a counter-attack and from regular play;
- Have more successful shots and higher accuracy when shooting;
- Involve more their attacking-midfield and forward at shooting;
- Shots are mostly concentrated closer to target and relatively centred.

Recommendation for practical use

Those finding can be used by coaches to improve tactical and technical training. Training should be oriented to improve shots accuracy from different areas on the field. Working on developing team ability of making a lot of configurations that allow midfielders to be frequently in a shot situation. Teach players how to make the right decision when it comes to choosing between shooting and passing, shots are great goals' source but also a big source of ball loose.

Future investigations are necessary to validate the kinds of conclusions that can be drawn from this study. Future studies could investigate shot

attributes with more contextual variables, as line score, home advantage and part of execution.

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