Observational and Notational Analysis in Sports

Dr. Gibson Moreira Praça
Universidade Federal de Minas Gerais
Brazil

FUNDED BY
European Commission | Erasmus+

Personal introduction

- Graduated in Physical Education
- Master in Sports Sciences
- Ph.D in Sports Sciences
- CBF Coach Educator
- FIFA Coach Educator
- Head of the CECA/UFMG

Agenda

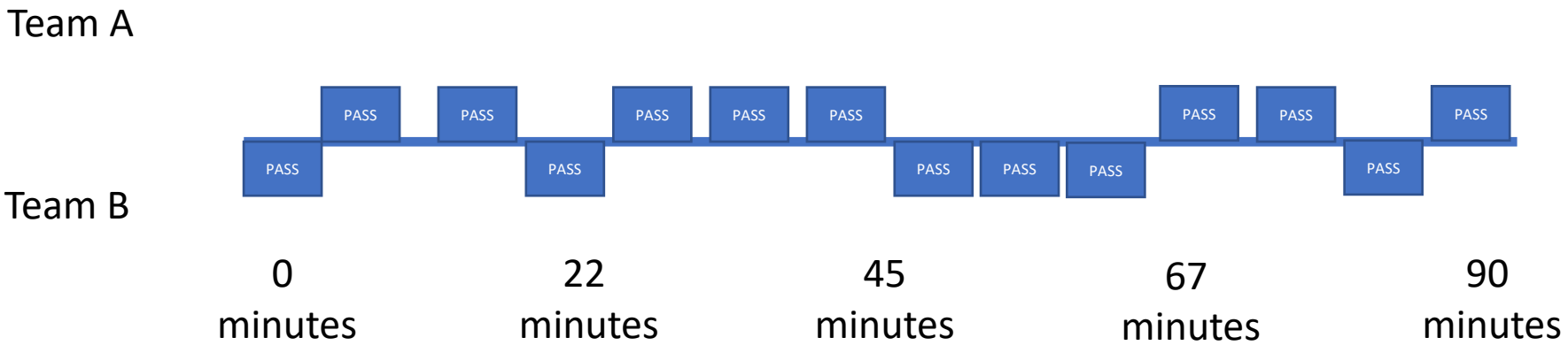
- Basic concepts on Observational Analysis
- Definitions of tactical and technical-related events
- Paying attention to the details!
- Practical example of coding technical-tactical events
- Research on observational analysis in sports

Basic concepts on Observational Analysis

What is an event?

Basic concepts on Observational Analysis

What is a TAG?



Basic concepts on Observational Analysis

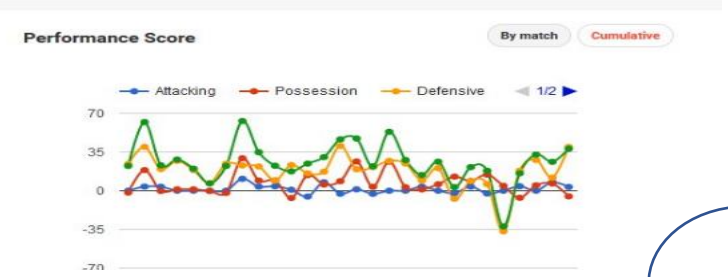
- Notational analysis is a means of recording events in which there is an objective and precise process to describe what actually happened. In this context, notational analysis allows a reliable record that "does not lie" (of course, if the process of collecting information is reliable and if the observation system allows answering the right questions) (Carling, Williams and Reilly, 2008).

What does notational analysis mean?

Figure 1. Dashboard developed in the LongoMatch Software.

Basic concepts on Observational Analysis

Performance Score	Total Appearances	Total Goals Scored
738	28	0
Shot Accuracy	**Squawka Awards**	**Total Chances Created**
40%	13/3	15
Avg. Pass Accuracy	**Avg. Pass Length**	**Avg. Duels Won**
90%	17m	56%

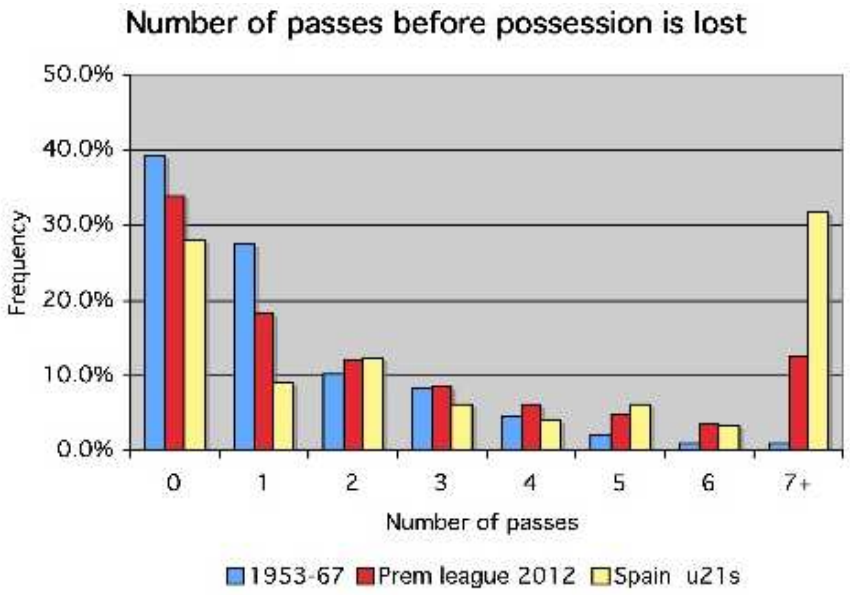


Well played, boys. High passing accuracy!

What a bad performance! No one attempted shooting on goal!

"Each individual brings his or her bias to the game and may see it from a partisan viewpoint. Even the best coaches are often unable to recall sequences of events correctly and fail to appreciate where successful plays originated or mistakes began. (Carling, Williams and Reilly, 2008, p.24).

Basic concepts on Observational Analysis

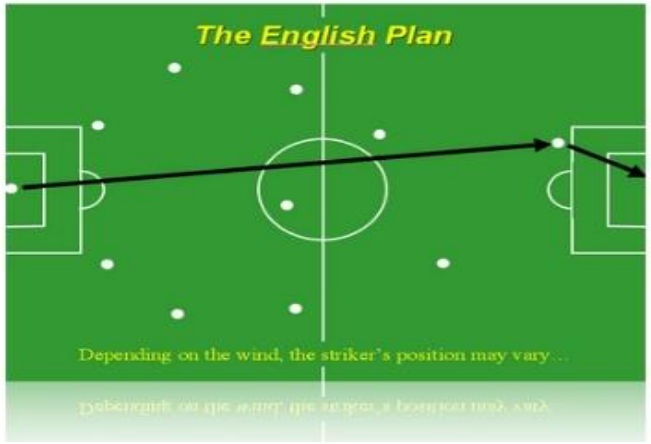


The distant past?

Charles Reep

First meaningful analysis of football 1950-1967

- **90%** of all possessions end in less than 4 passes



The importance of interpreting the data contextually.

Source

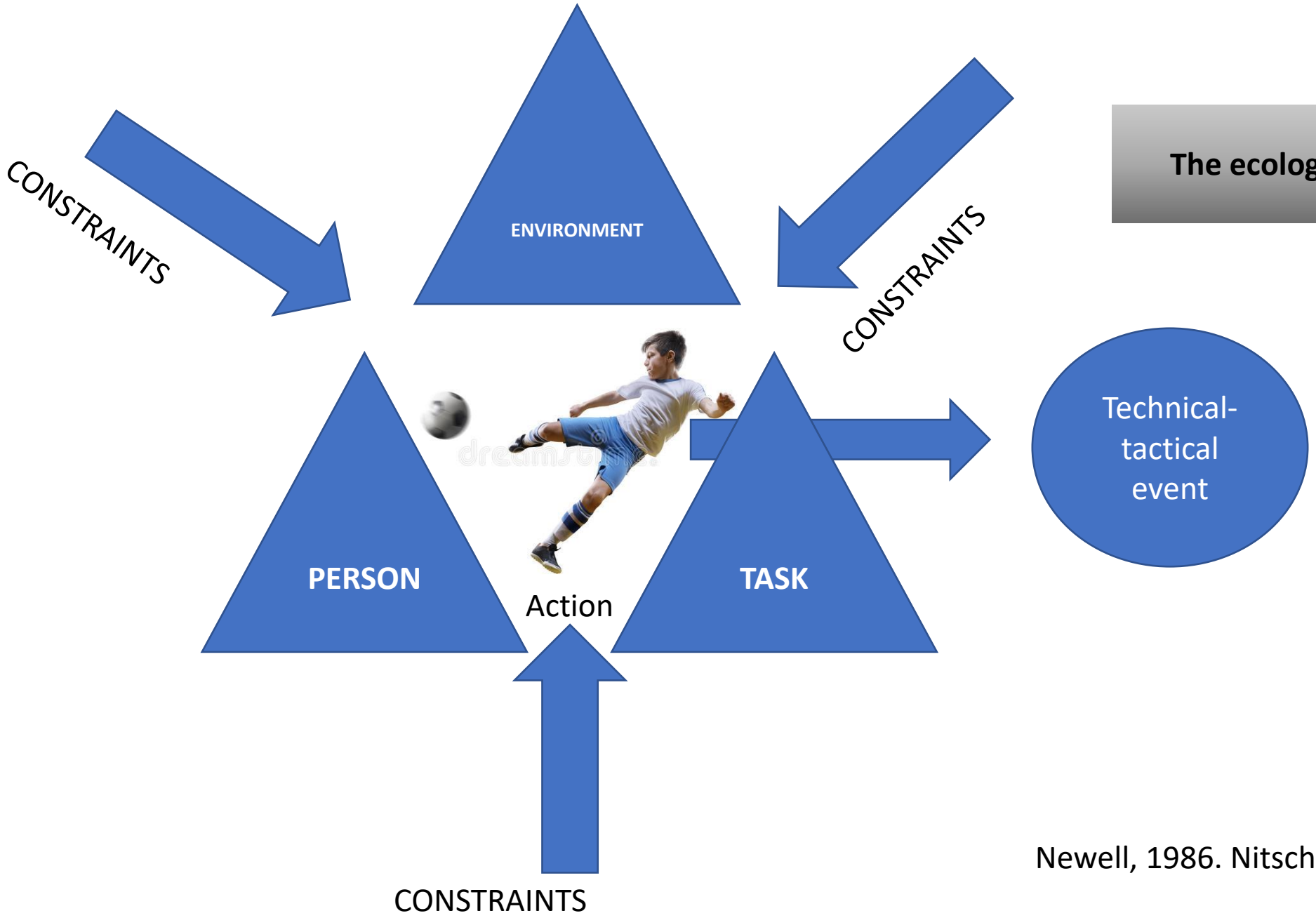
Definitions of tactical and technical-related events

The traditional perspective

Tactical event: the observable decision-making action.

Technical event: the observable motor action.

The ecological perspective



Newell, 1986. Nitsch, 2009

Paying attention to the details!

Ensuring internal consistency periodically

How able are you in collecting events?

What you consider X today, was the same Yesterday?

	Moment 1	Moment 2	Absolute difference	Difference in %
Event A	2	3	1	50%
Event B	2	2	0	0%
Event C	4	5	1	25%
Event D	6	8	2	33%
Event E	7	7	0	0%
Event F	9	6	3	33%
		Average Difference	1,167	24%

Internal consistency: the consistency between observations made by the same observer, in different moments

Paying attention to the details!

Ensuring external consistency periodically

How able are you in collecting events?

What you consider X today, was the same Yesterday?

	Observer 1	Observer 2	Absolute difference	Difference in %
Event A	2	3	1	50%
Event B	2	2	0	0%
Event C	4	5	1	25%
Event D	6	8	2	33%
Event E	7	7	0	0%
Event F	9	6	3	33%
		Average Difference	1,167	24%

External consistency: the consistency between observations made by two different observers during the same events.

Is this a real problem?

There is a high within and between-session variability in technical-tactical events.

Original Article

Institution of MECHANICAL ENGINEERS
Journal of SPORTS ENGINEERING AND TECHNOLOGY

How reliable are the tactical measures obtained in soccer small-sided games? A test-retest analysis of observational instruments and GPS-based variables

Gibson Moreira Praça, Cristóvão de Oliveira Abreu, Marcelo Rochael and Pedro Drumond Moreira

Proc IMechE Part P: J Sports Engineering and Technology 1–10
© IMechE 2022
Article reuse guidelines: sagepub.com/journals-permissions
DOI: 10.1177/17543371221113925
journals.sagepub.com/home/pip
SAGE

Table 3. Within-session reliability values.

Variable	ICC	95% confidence interval Lower bound	Upper bound	SEM	SEM%	p-value
Length (m)	0.841	0.711	0.918	1.865	9.77	< 0.001*
Width (m)	0.911	0.839	0.954	1.368	8.68	< 0.001*
SEI (m)	0.500	0.063	0.752	0.833	11.92	0.015*
FUT-SAT Offensive	0.355	−0.159	0.664	16.15	23.41	0.071
FUT-SAT Defensive	0.119	−0.583	0.541	15.41	25.37	0.329
GPET Decision-making	−0.944	−2.495	−0.014	0.189	27.96	0.977
GPET Execution	−0.172	−1.107	0.389	0.176	27.29	0.680
SNA Degree Centrality	0.204	−0.431	0.585	0.083	40.89	0.219
SNA Degree Prestige	0.423	−0.037	0.699	0.083	36.09	0.033*
SNA Page Rank	0.361	−0.150	0.667	0.212	29.12	0.067

SEI: spatial exploration index; SNA: Social Network Analysis.
*Significant differences ($p < 0.05$)

Table 4. Between-sessions reliability values.

Variable	ICC	95% confidence interval Lower bound	Upper bound	SEM	SEM%	p-value
Length (m)	0.933	0.808	0.977	0.800	4.19	< 0.001*
Width (m)	0.944	0.545	0.985	0.888	5.63	< 0.001*
SEI (m)	0.705	0.156	0.897	0.467	6.68	0.012*
FUT-SAT Offensive	0.755	0.293	0.915	6.18	8.96	0.002*
FUT-SAT Defensive	0.307	−0.481	0.725	8.53	14.04	0.188
GPET Decision-making	0.415	−0.674	0.796	0.054	7.99	0.155
GPET Execution	0.651	0.062	0.875	0.054	8.37	0.011*
SNA Degree Centrality	0.307	−0.907	0.758	0.044	21.67	0.243
SNA Degree Prestige	0.506	−0.414	0.827	0.054	23.48	0.092
SNA Page Rank	0.387	−0.755	0.786	0.130	17.86	0.177

SEI: Spatial exploration index; SNA: Social Network Analysis.
*Significant differences ($p < 0.05$)

Paying attention to the details!

Reporting the most adequate summary measures

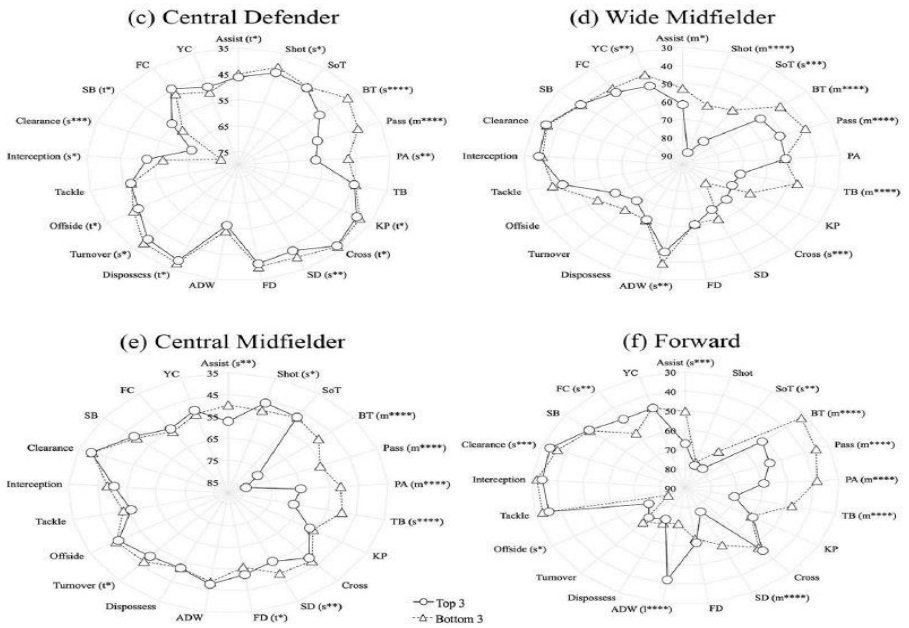


Table 1. Descriptive statistics of match performance profiles of players from Top3 and Bottom3 teams (results are counts, except for Pass Accuracy).

	All Players (n = 1583)		Full Back (n = 382)		Central Defender (n = 415)		Wide Midfielder (n = 183)		Central Midfielder (n = 402)		Forward (n = 201)	
Variable	Top3	Bottom3	Top3	Bottom3	Top3	Bottom3	Top3	Bottom3	Top3	Bottom3	Top3	Bottom3
Assist	0.2 ± 0.4	0.1 ± 0.2	0.1 ± 0.3	0.0 ± 0.2	0.0 ± 0.2	0.0 ± 0.1	0.3 ± 0.5	0.1 ± 0.3	0.2 ± 0.4	0.1 ± 0.3	0.3 ± 0.6	0.1 ± 0.4
Shot	1.4 ± 1.9	1.1 ± 1.4	0.6 ± 0.9	0.4 ± 0.7	0.6 ± 0.8	0.4 ± 0.7	4.0 ± 3.2	2.0 ± 1.4	0.9 ± 1.1	1.2 ± 1.3	3.3 ± 2.0	3.1 ± 2.0
Shot on target	0.5 ± 1.0	0.4 ± 0.7	0.2 ± 0.4	0.1 ± 0.3	0.2 ± 0.4	0.2 ± 0.4	1.5 ± 1.6	0.7 ± 0.8	0.3 ± 0.6	0.3 ± 0.6	1.5 ± 1.3	1.1 ± 1.0
Ball touch	71 ± 27	53 ± 16	79 ± 24	59 ± 15	58 ± 21	48 ± 15	63 ± 18	53 ± 13	86 ± 30	59 ± 18	61 ± 24	41 ± 10
Passes	52 ± 26	34 ± 15	50 ± 22	30 ± 12	44 ± 21	32 ± 14	41 ± 15	31 ± 10	70 ± 30	45 ± 18	44 ± 23	26 ± 8
Pass Accuracy (%)	82 ± 11	75 ± 12	83 ± 10	73 ± 12	81 ± 14	75 ± 13	78 ± 9	78 ± 10	85 ± 9	77 ± 11	82 ± 9	70 ± 11
Through ball	0.5 ± 1.0	0.1 ± 0.4	0.2 ± 0.5	0.0 ± 0.1	0.1 ± 0.3	0.1 ± 0.3	0.9 ± 1.1	0.1 ± 0.4	0.8 ± 1.2	0.2 ± 0.5	0.9 ± 1.2	0.2 ± 0.5
Key pass	1.0 ± 1.3	0.9 ± 1.2	0.9 ± 1.0	0.6 ± 0.8	0.2 ± 0.5	0.2 ± 0.4	2.1 ± 2.0	1.6 ± 1.4	1.3 ± 1.3	1.2 ± 1.4	1.4 ± 1.1	1.4 ± 1.6
Crosses	1.8 ± 2.6	2.1 ± 3.2	2.9 ± 2.7	2.5 ± 2.3	0.1 ± 0.4	0.1 ± 0.3	4.5 ± 4.4	6.3 ± 4.4	1.8 ± 2.4	1.6 ± 2.9	1.3 ± 1.5	1.7 ± 2.5
Successful dribble	0.9 ± 1.4	0.6 ± 0.9	0.8 ± 1.1	0.4 ± 0.8	0.3 ± 0.5	0.1 ± 0.4	1.5 ± 1.6	1.2 ± 1.2	0.9 ± 1.2	0.6 ± 0.9	2.0 ± 2.0	1.0 ± 1.2
Foul drawn	1.2 ± 1.3	1.2 ± 1.3	1.2 ± 1.1	0.8 ± 1.0	0.6 ± 0.9	0.5 ± 0.8	1.9 ± 1.6	1.9 ± 1.5	1.3 ± 1.2	1.5 ± 1.3	1.9 ± 1.7	2.1 ± 1.4
Aerial duel Won	1.5 ± 1.7	1.7 ± 1.8	1.2 ± 1.4	1.3 ± 1.2	2.2 ± 1.9	2.0 ± 1.6	1.2 ± 1.7	0.7 ± 1.0	1.4 ± 1.6	1.5 ± 1.8	0.9 ± 1.3	3.5 ± 2.7
Dispossessed	1.1 ± 1.3	0.9 ± 1.2	1.0 ± 1.0	0.5 ± 0.7	0.2 ± 0.5	0.2 ± 0.4	1.6 ± 1.4	1.6 ± 1.3	1.0 ± 1.2	1.1 ± 1.1	2.3 ± 1.7	2.2 ± 1.4
Turnover	0.9 ± 1.2	0.7 ± 1.0	0.8 ± 0.9	0.6 ± 0.7	0.3 ± 0.5	0.2 ± 0.5	1.8 ± 1.5	1.4 ± 1.2	0.9 ± 1.0	0.7 ± 0.8	1.9 ± 1.6	1.7 ± 1.5
Offside	0.3 ± 0.7	0.2 ± 0.6	0.1 ± 0.4	0.1 ± 0.3	0.1 ± 0.3	0.0 ± 0.2	0.6 ± 1.0	0.4 ± 0.7	0.1 ± 0.4	0.1 ± 0.3	0.9 ± 1.1	1.2 ± 1.2
Tackle	2.1 ± 1.8	2.1 ± 1.7	2.7 ± 2.0	2.8 ± 1.8	2.0 ± 1.5	2.0 ± 1.6	1.7 ± 1.7	1.3 ± 1.2	2.7 ± 2.1	2.5 ± 1.9	0.9 ± 1.0	0.6 ± 0.9
Interception	1.7 ± 1.6	1.7 ± 1.7	2.2 ± 1.7	2.1 ± 1.7	2.1 ± 1.5	2.5 ± 1.9	0.6 ± 0.8	0.8 ± 1.0	1.9 ± 1.7	1.7 ± 1.5	0.5 ± 0.8	0.3 ± 0.6
Clearance	2.7 ± 3.3	3.7 ± 3.9	2.5 ± 2.0	4.0 ± 2.6	6.3 ± 3.7	8.0 ± 4.2	0.6 ± 1.0	0.7 ± 0.9	1.5 ± 1.8	1.5 ± 1.7	0.3 ± 0.8	0.9 ± 1.5
Shot block	0.3 ± 0.6	0.3 ± 0.6	0.3 ± 0.5	0.3 ± 0.5	0.5 ± 0.8	0.6 ± 0.9	0.1 ± 0.2	0.1 ± 0.3	0.3 ± 0.6	0.3 ± 0.6	0.1 ± 0.3	0.1 ± 0.3
Foul committed	1.3 ± 1.3	1.3 ± 1.3	1.3 ± 1.4	1.2 ± 1.1	1.0 ± 1.1	1.2 ± 1.1	1.1 ± 1.2	1.0 ± 1.0	1.6 ± 1.4	1.7 ± 1.6	1.2 ± 1.3	1.7 ± 1.5
Yellow card	0.2 ± 0.4	0.3 ± 0.4	0.1 ± 0.4	0.3 ± 0.5	0.2 ± 0.4	0.3 ± 0.4	0.2 ± 0.4	0.1 ± 0.3	0.3 ± 0.4	0.3 ± 0.5	0.2 ± 0.4	0.2 ± 0.4

Paying attention to the details!

Getting high-quality videos for coding

- Upper position
- Minimum HD resolution
- Getting the whole match at once (tactical camera)
- Different perspectives
- Minimum HD resolution

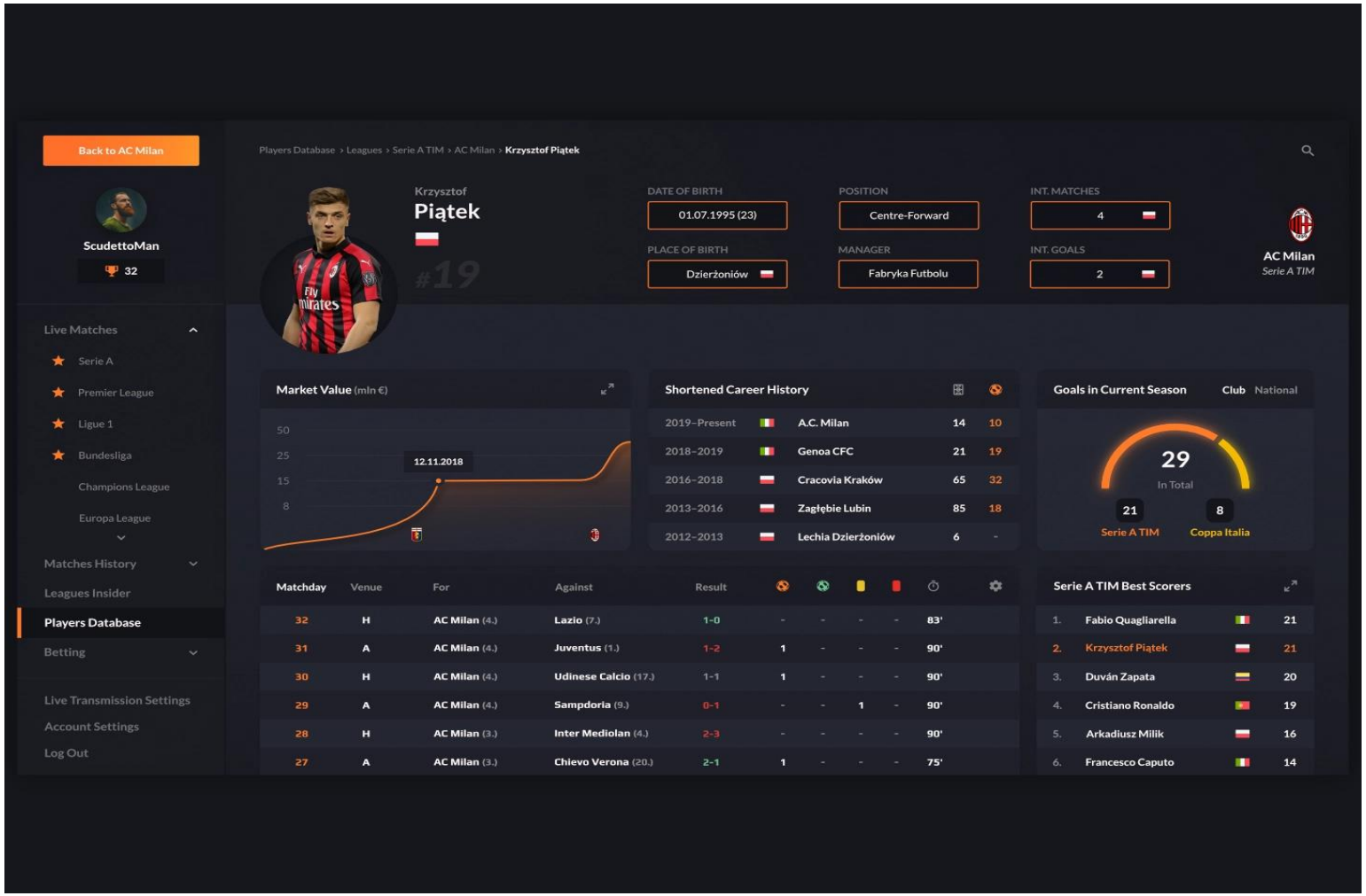
Paying attention to the details!

Creating online backups and dashboards

OneDrive

Google Drive

Power BI



Paying attention to the details!

OBSERVATIONAL METHODOLOGY IN SPORT SCIENCES

La metodología observacional en el ámbito del deporte

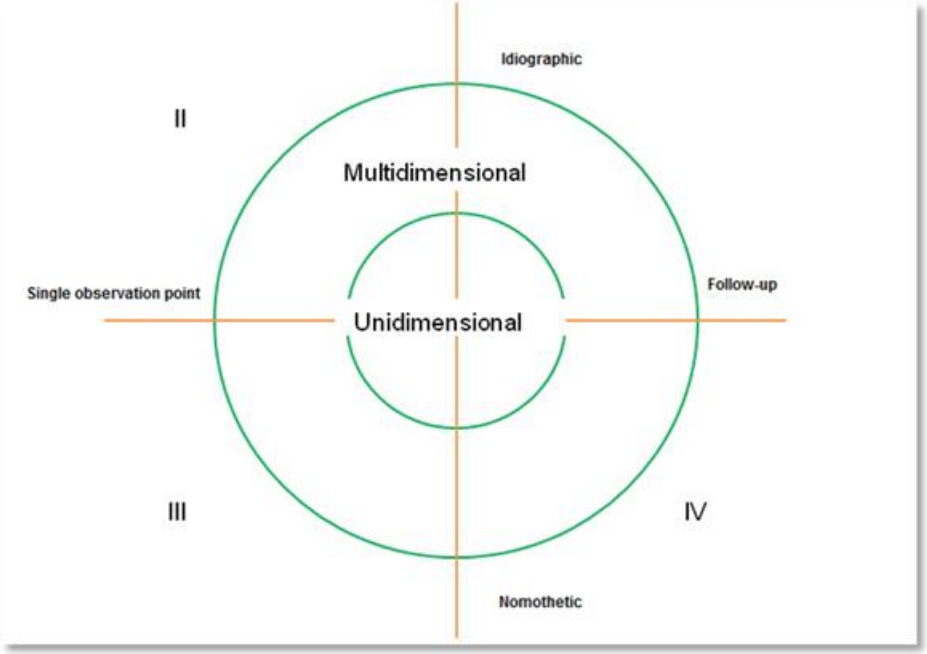
M. Teresa Anguera
University of Barcelona

Antonio Hernández Mendo
University of Málaga

Correspondence:
Antonio Hernández Mendo
Facultad de Psicología.
Campus de Teatinos, s/n.
Universidad de Málaga.
29071 MÁLAGA (SPAIN)
Mail: mendo@uma.es

Recibido: 10/08/2013
Aceptado: 16/10/2103

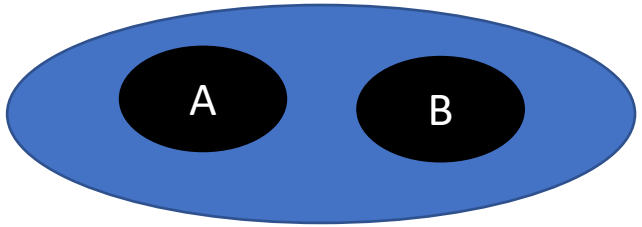
How should I define the items of my observational instrument?



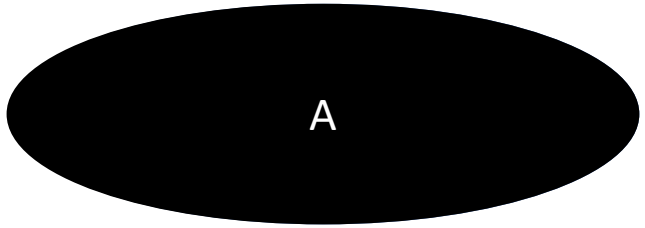
Paying attention to the details!

How should I define the items of my observational instrument?

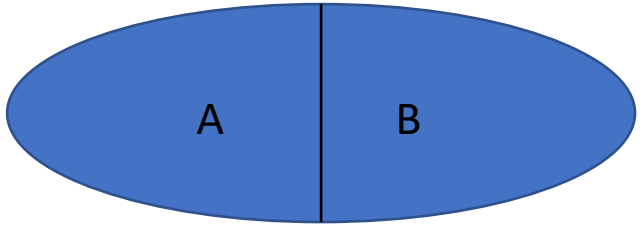
Mutually Exclusive



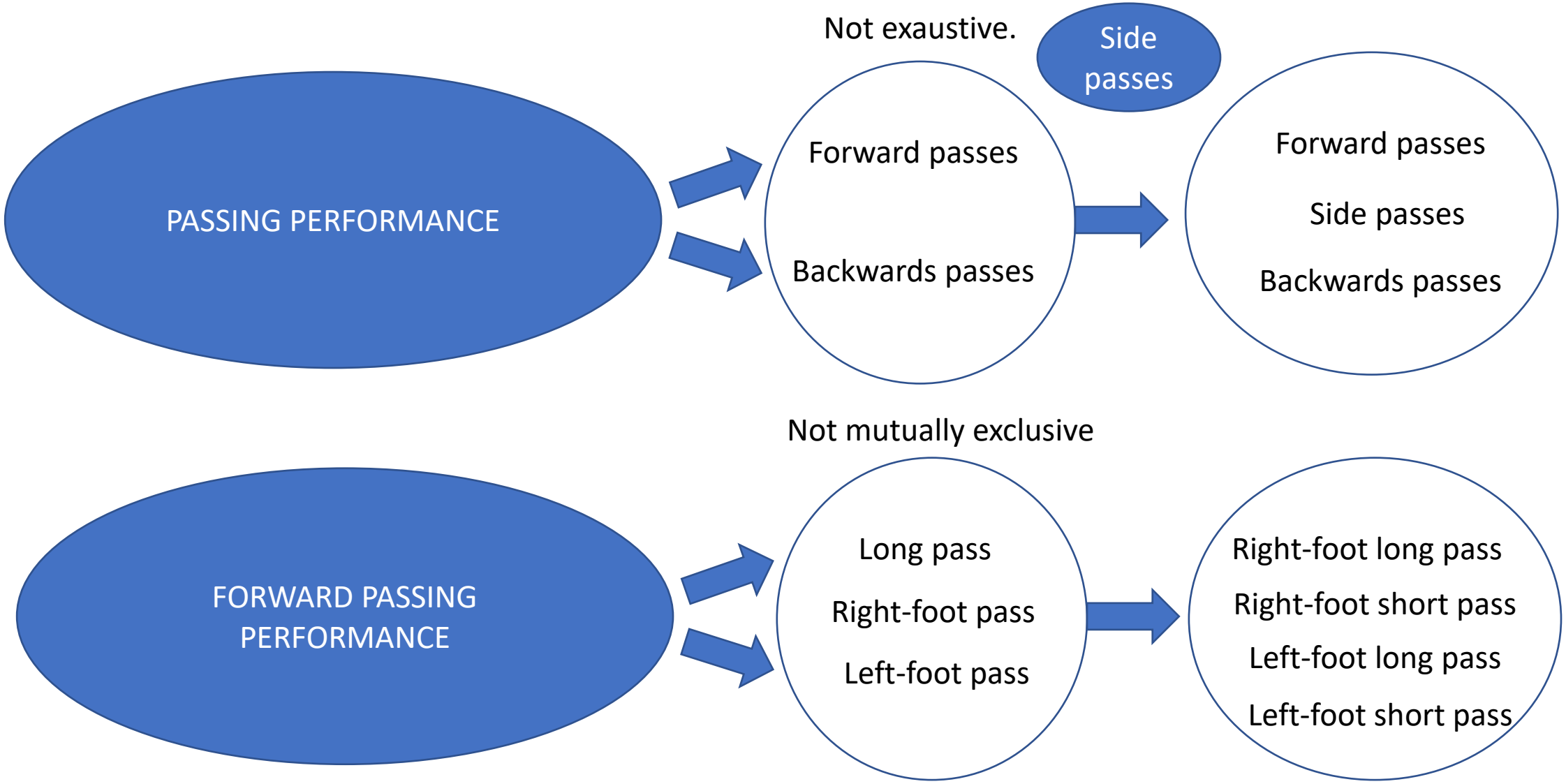
Exaustive



Mutually Exclusive and Exaustive



Paying attention to the details!



Practical example of coding technical-tactical events

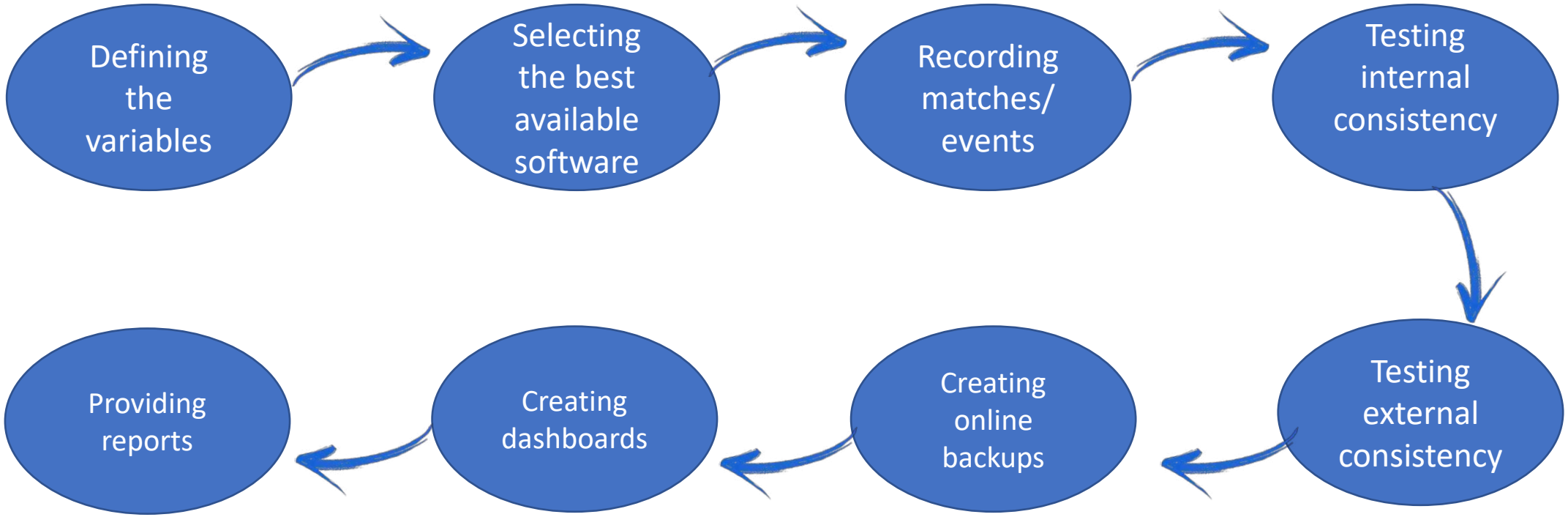
LONGOMATCH

LONGOMATCH
https://longomatch.com/en/pro/

LINCE PLUS
https://observesport.github.io/lince-plus/

Practical example of coding technical-tactical events

Observational Analysis Flow



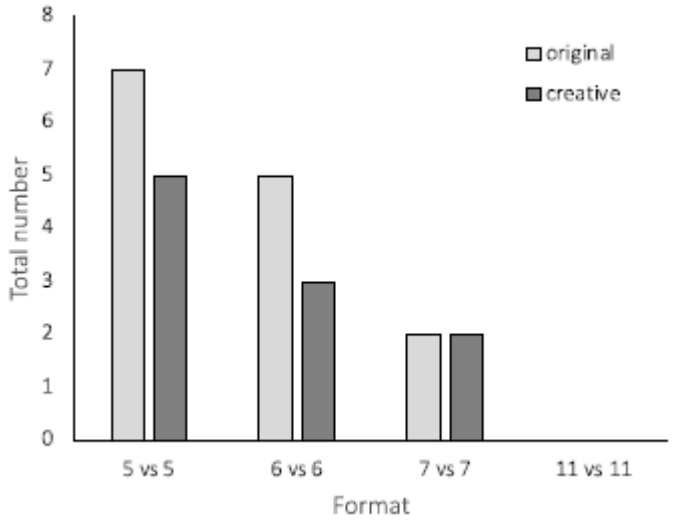
Research on observational analysis in sports

ELSEVIER

Psychology of Sport and Exercise
Volume 48, May 2020, 101645

Variability and creativity in small-sided conditioned games among elite soccer players ☆

Simone Caso, John van der Kamp



Technical events

Small-sided games with fewer players induce a higher frequency of creative on-the-ball actions. No creative actions were observed in the formal 11-a-side match.

The observational data support using smaller SSG formats to nurture creativity in soccer players.

Access the article here

Research on observational analysis in sports

Technical events

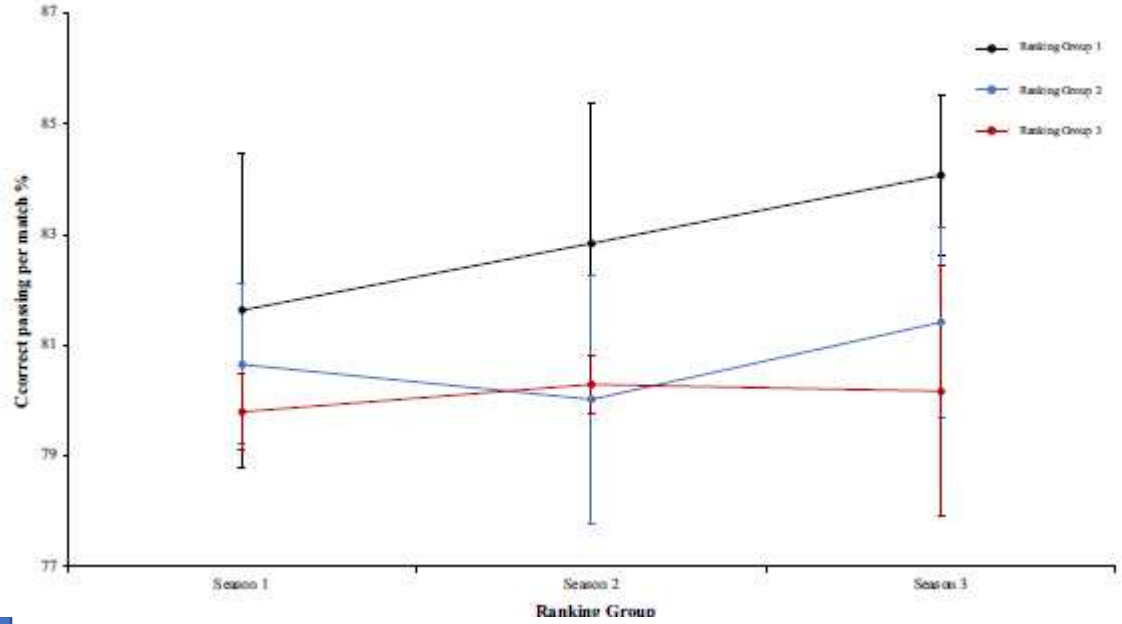
scientific reports

Check for updates

OPEN

Variations in the physical demands and technical performance of professional soccer teams over three consecutive seasons

Zeki Akyildiz[1], Hadi Nobari[2,3✉], Francisco Tomás González-Fernández[4], Gibson Moreira Praça[5], Hugo Sarmento[6], Aytek Hikmet Guler[7], Esat Kaan Saka[8], Filipe Manuel Clemente[9,10] & António J. Figueiredo[11]



Elite teams are passing the ball more and more successfully over the seasons.

Access the article here

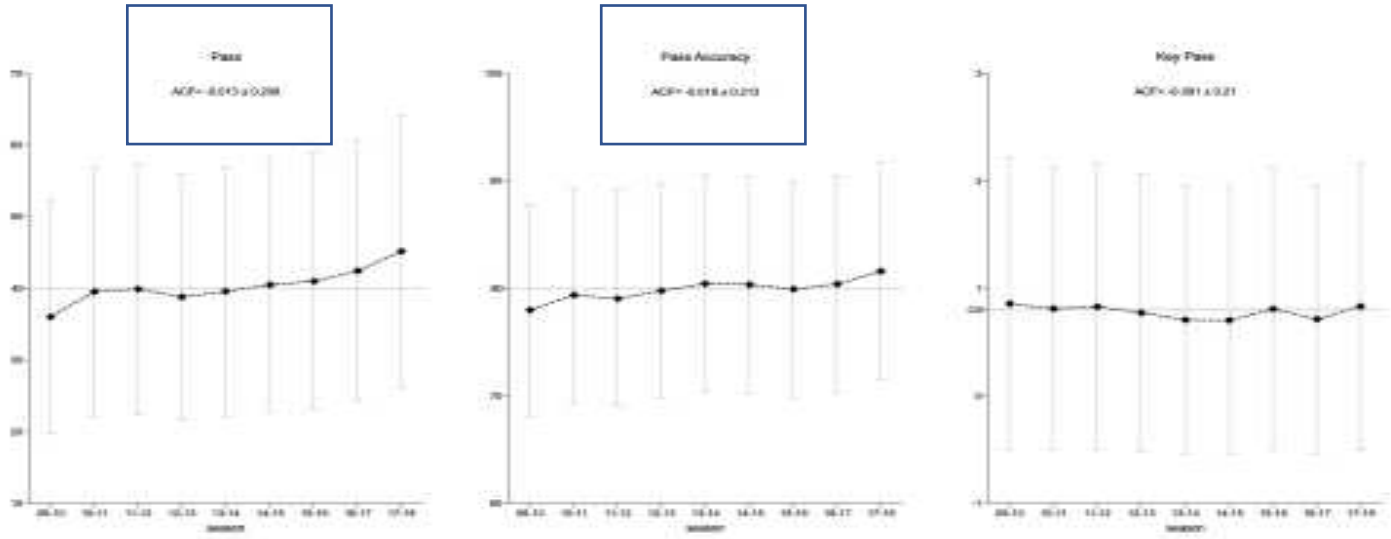
Research on observational analysis in sports

Evolutionary Trends of Players' Technical Characteristics in the UEFA Champions League

Qing Yi[1,2,3], Hongyou Liu[4], George P. Nassis[1,5] and Miguel-Ángel Gómez[6]*

[1] School of Physical Education and Sport Training, Shanghai University of Sport, Shanghai, China, [2] Shanghai Key Lab of Human Performance, Shanghai University of Sport, Shanghai, China, [3] Key Laboratory of Diagnosis & Analysis of Skills & Tactics in Sports, Shanghai University of Sport, Shanghai, China, [4] School of Physical Education & Sports Science, South China Normal University, Guangzhou, China, [5] Department of Sports Science and Clinical Biomechanics, Faculty of Health Sciences, SDU Sport and Health Sciences Cluster, University of Southern Denmark, Odense, Denmark, [6] Facultad de Ciencias de la Actividad Física y del Deporte (INEF), Universidad Politécnica de Madrid, Madrid, Spain

Players are performing more passes and showing a higher pass accuracy over time.



[Access the article here]

Research on observational analysis in sports

2022, *Retos*, *43*, 171-176
© Copyright: Federación Española de Asociaciones de Docentes de Educación Física (FEADEF) ISSN: Edición impresa: 1579-1726. Edición Web: 1988-2041 (https://recyt.fecyt.es/index.php/retos/index)

How Reaching the Pitch's Final Third is Related to Scoring Opportunities in Soccer?

Cómo la invasión del último tercio del campo se relaciona con las oportunidades de marcar en el fútbol?

João Pedro Araújo Guimarães, Marcelo Rochael, André Gustavo Pereira de Andrade, Sarah da Glória Teles Bredt, Gibson Moreira Praça

Universidade Federal de Minas Gerais (Brazil)

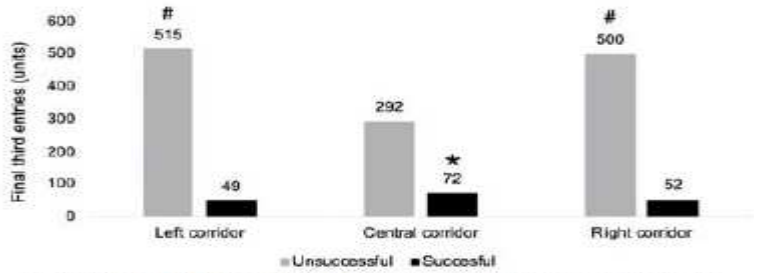


Figure 4. Successful and unsuccessful final third entries according to criteria of the category 'where'.
Notes.
Positive association between the criterion and the unsuccessful outcome.
* Positive association between the criterion and the successful outcome.

There are fewer final third entries in the central corridor, although they are more successful there than in the lateral corridors.

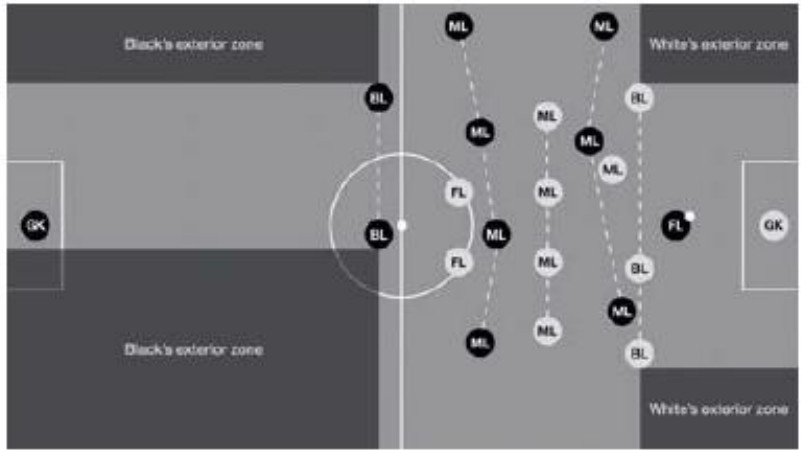


Figure 2. Illustration of spatial pattern of interaction between teams.
Notes. GK: goalkeeper; BL: back line; MF: midline; FM: offensive line.

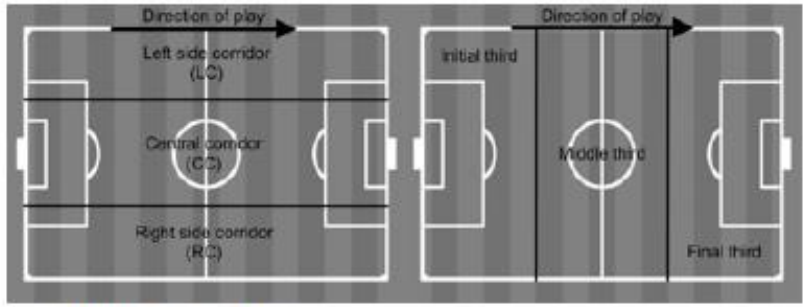


Figure 3. Pitch corridors and thirds.

[Access the article here]

Research on observational analysis in sports

HUMAN MOVEMENT (ISSN 1899-1955)
2021; 22(2): 22–31

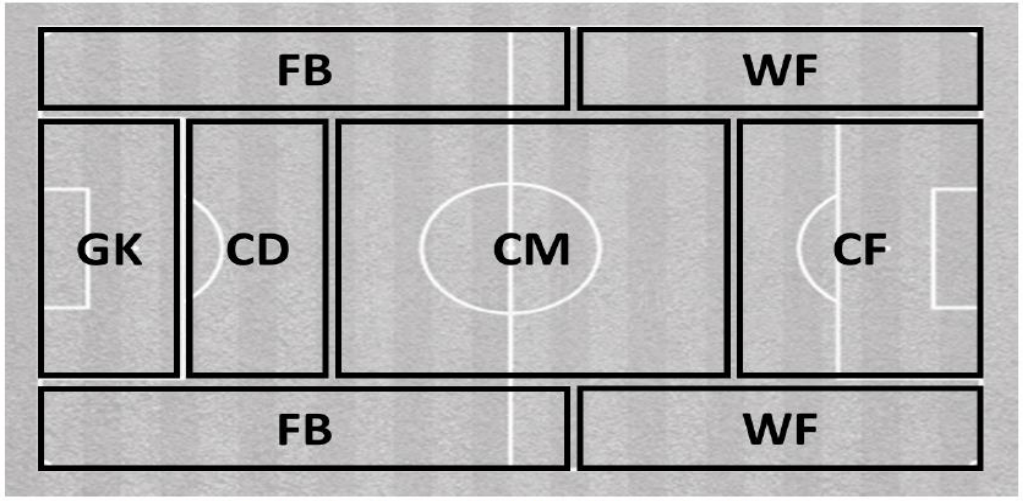
THE INFLUENCE OF PLAYING POSITION ON THE PHYSICAL, TECHNICAL, AND NETWORK VARIABLES OF SUB-ELITE PROFESSIONAL SOCCER ATHLETES

© University School of Physical Education in Wroclaw

original paper
DOI: https://doi.org/10.5114/hm.2020.100010

GIBSON PRAÇA[1], LAURA BEATRIZ FALEIRO DINIZ[1], FILIPE MANUEL CLEMENTE[2,3], SARAH DA GLÓRIA TELES BREDT[1], BRUNO COUTO[1,4], ANDRÉ GUSTAVO PEREIRA DE ANDRADE[1], ADAM LEE OWEN[5,6]

[1] Universidade Federal de Minas Gerais, Belo Horizonte, Brazil
[2] Escola Superior de Desporto e Lazer, Instituto Politécnico de Viana do Castelo, Viana do Castelo, Portugal
[3] Instituto de Telecomunicações, Delegação da Covilhã, Covilhã, Portugal
[4] University of the Sunshine Coast, Queensland, Australia
[5] Claude Bernard Lyon University, Lyon, France
[6] Seattle Sounders Football Club, Seattle, Washington, USA



GK – goalkeeper, CD – central defender, FB – fullback, CM – central midfielder, WF – wide forward, CF – central forward

Figure 1. Classification of playing positions depending on the area mainly occupied in the field

Table 2. Players' network measures and technical responses depending on playing position

Measure	Central defenders	Fullbacks	Central midfielders	Wide forwards	Central forwards	*p*	Effect size	Pairwise comparisons
Degree centrality (AU)	0.16 (0.04)	0.14 (0.05)	0.07 (0.03)	0.03 (0.01)	0.02 (0.01)	0.001*	0.651	CD, FB > CM, WF, CF
Degree prestige (AU)	0.06 (0.03)	0.10 (0.03)	0.10 (0.04)	0.13 (0.05)	0.09 (0.04)	0.023*	0.242	CD < WF
Page rank (AU)	0.04 (0.03)	0.08 (0.02)	0.11 (0.04)	0.12 (0.01)	0.15 (0.03)	0.001*	0.509	CD < CM, WF, CF; FB < CF
Successful passes (*n*)	41.58 (22.38)	43.10 (17.37)	25.85 (15.68)	15.00 (5.47)	9.17 (3.81)	0.001*	0.383	CD, FB > CF
Successful passes (%)	83.37 (19.83)	79.19 (7.70)	75.44 (12.63)	70.23 (12.61)	63.21 (15.63)	0.085	0.181	
Shots (*n*)	0.67 (0.65)	0.56 (0.72)	2.54 (2.02)	1.75 (0.50)	3.17 (1.47)	0.001*	0.400	CD, FB < CM, CF
Lost balls (*n*)	0.25 (0.45)	2.33 (1.80)	3.23 (1.83)	4.50 (1.29)	2.83 (2.13)	0.001*	0.462	CD < FB, CM, WF, CF
Recovered balls (*n*)	2.42 (1.83)	3.80 (1.39)	4.00 (2.51)	3.25 (2.21)	1.33 (1.03)	0.047	0.209	

AU – arbitrary units, CD – central defender, FB – fullback, CM – central midfielder, WF – wide forward, CF – central forward
* significant differences

The closer the opposing goal, the less successful the passes are.

Access the article here

Research on observational analysis in sports

INTERNATIONAL JOURNAL OF PERFORMANCE ANALYSIS IN SPORT
https://doi.org/10.1080/24748668.2020.1753979

Routledge
Taylor & Francis Group

Check for updates

Players' match demands according to age and playing position in professional male soccer players

Changjing Zhou[a], Alberto Lorenzo[a], Miguel-Ángel Gómez[a] and José M. Palao[b]

[a]Facultad de Ciencias de la Actividad Física y del Deporte (INEF), Universidad Politécnica de Madrid, Madrid, Spain; [b]Department of Health, Exercise Science and Sport Management, University of Wisconsin-Parkside, Kenosha, WI, USA

Players from those highly physically-demanded positions experience a more prominent age-related drop in performance.

Table 1. Data distribution according to age group and playing position (values expressed in occurrence and percentage).

Position	Group 1 (17–22.9 yr)	Group 2 (23–28.9 yr)	Group 3 (29–34.9 yr)	Group 4 (35–40.9 yr)	Total
Central defender	516 (9%)	2,929 (49%)	2,211 (37%)	350 (6%)	6,006
Fullback	659 (12%)	3,591 (63%)	1,337 (24%)	85 (1%)	5,672
Central midfielder	702 (10%)	3,517 (48%)	3,022 (41%)	148 (2%)	7,389
Wide midfielder	897 (16%)	3,476 (63%)	1,062 (19%)	72 (1%)	5,507
Attacker	262 (7%)	2,045 (51%)	1,579 (40%)	87 (2%)	3,973
Total	3,036 (11%)	15,558 (54%)	9,211 (32%)	742 (3%)	28,547

Access the article here

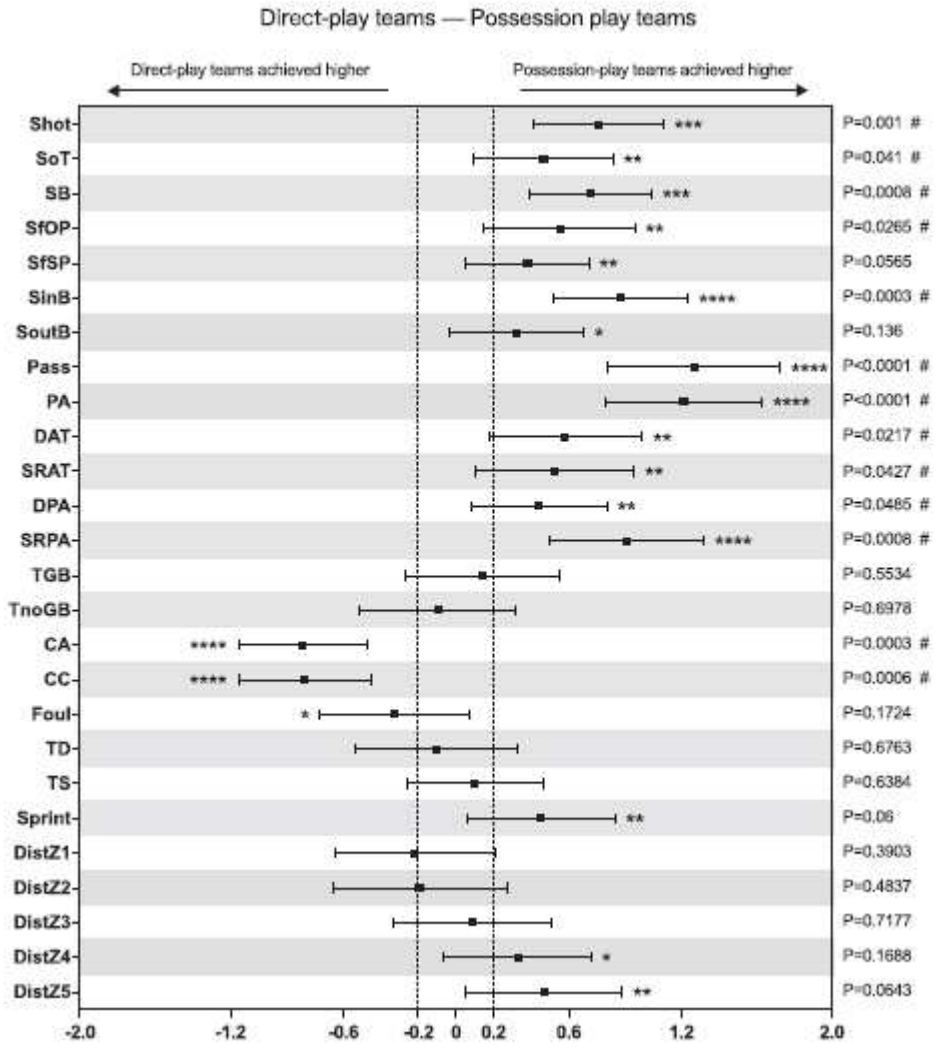
Research on observational analysis in sports

Technical and physical match performance of teams in the 2018 FIFA World Cup: Effects of two different playing styles

Qing Yi[a,b], Miguel A. Gómez[b], Lei Wang[c,d], Guohu Huang[c,d], Hengliang Zhang[c,d] and Hongyou Liu[c,d]

[a]School of Physical Education and Sport Training, Shanghai University of Sport, Shanghai, China; [b]Facultad de Ciencias de la Actividad Física y del Deporte (INEF), Universidad Politécnica de Madrid, Madrid, Spain; [c]School of Physical Education & Sports Science, South China Normal University, Guangzhou, China; [d]National Demonstration Centre for Experimental Sports Science Education, South China Normal University, Guangzhou, China

Possession-play teams achieve more shots, shots on target, passes, and passing accuracy than direct-play teams in the World Cup.



Access the article here

Take Home Message

Ensuring the quality of your observational data is mandatory.

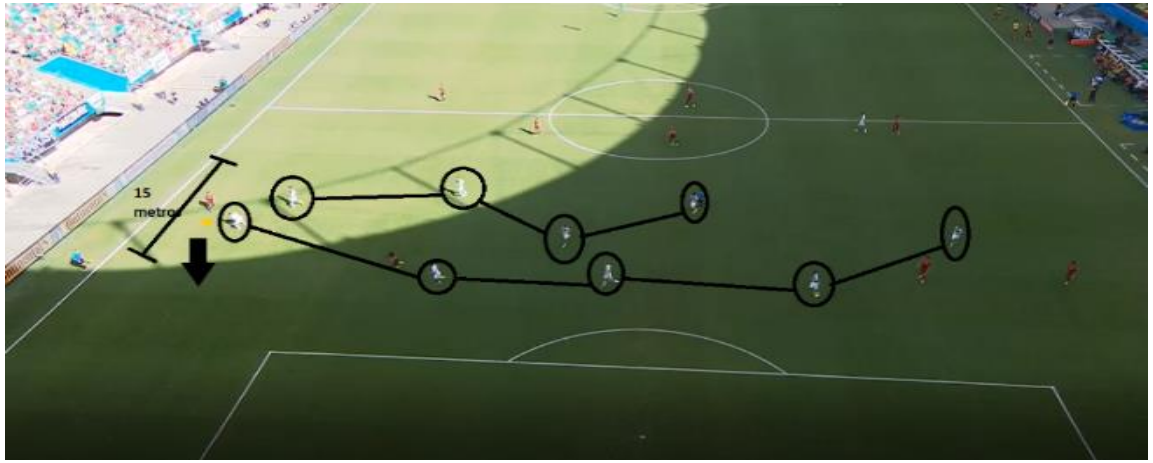
Getting high-quality videos will facilitate the data-gathering process.

Dealing with tagging software requires practice. Take your time!

More than getting lots of information, asking the right questions will improve the quality of the analysis.

"I've never scored a goal in my life without getting a pass from someone else" (Abby Wambach)

Gibson Moreira Praça
Sports Department
CECA
UFMG Soccer Science Center
EEFFTO/UFMG/Brazil
gibson_moreira@yahoo.com.br



@gibsonmoreira
Gibson Moreira Praça
@GibsonPraca
Gibson_Praça