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Press Release No. 67/2020

10 July 2020

Collective behaviour research reveals secrets of successful football teams

Research team with participation of the University of Konstanz analyses movement profiles and teamwork of football teams

Collective behaviour researchers have applied a new tool for analysing the movement of football players that goes beyond looking at individual athletes to capturing how the team operates as a whole. The tool, which comes from statistical physics but has never been used for sports analysis, finds clear differences in collective dynamics between winning and losing teams and can even predict the market value of players.

The scientists analysed five full matches played by nine teams from a German Bundesliga season. They employed a tool borrowed from statistical physics, the directional correlation techniques, that describes how similar the motion of the players is to each other in terms of their directions. From this the scientists created a metric – the HCS (highly correlated segments) – which reveals how players perform together within their group and against the opponent players. So rather than analysing only individual performance metrics, for example how much or how fast a player runs in a game, the study examined cooperation and coordination among players in order to reveal collective strategies associated with team performance.

Published by an interdisciplinary research team, from the Research Center in Sports Sciences, Health Sciences and Human Development in Portugal, the Cluster of Excellence "Centre for the Advanced Study of Collective Behaviour" at the University of Konstanz and the co-located Max Planck Institute of Animal Behaviour in Germany, the study can aid football teams in identifying talent and can give extra value for assessment for coaching staff.

Read the full article in *campus.kn*, the online-magazine of the University of Konstanz: https://www.campus.uni-konstanz.de/en/science/collective-behaviour-research-reveals-secrets-of-successful-football-teams

Facts:
- Collective behaviour researchers have applied a new tool for analysing the movement of football players that goes beyond looking at individual athletes to

- capturing how the team operates as a whole.
- The tool – directional correlation techniques – comes from statistical physics but has never been used for sports analysis.
- By analysing full matches played by teams from the German Bundesliga, the study finds clear differences in collective dynamics between winning and losing teams and can even predict the market value of players.
- Researchers include scientists from the Research Center in Sports Sciences, Health Sciences and Human Development in Portugal, the Cluster of Excellence "Centre for the Advanced Study of Collective Behaviour" at the University of Konstanz and the co-located Max Planck Institute of Animal Behavior in Germany.
- Funded by the Portuguese Foundation for Science and Technology, the DFG Cluster of Excellence 2117 "Centre for the Advanced Study of Collective Behaviour" (ID: 422037984), the Hungarian Academy of Sciences.
- Original paper: Marcelino R, Sampaio J, Amichay G, Gonçalves B, Couzin ID, Nagy M (2020) Collective movement analysis reveals coordination tactics of team players in football matches. *Chaos, Solitons & Fractals*. URL: https://doi.org/10.1016/j.chaos.2020.109831

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