

# Determining stable and unstable game states to aid the identification of perturbations in football

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## Abstract

The majority of existing Performance Analysis (PA) research has adopted a reductionist approach which considers only selected events such as number of shots or pass success rates for analysis (Mackenzie & Cushion, 2013). A different approach is the dynamical systems perspective which considers how a game changes between stable and unstable situations as a consequence of perturbations. Previous research has attempted to identify perturbations in football (Hughes et al., 1997 and Hughes & Reed, 2005), however there were no operational definitions of stability, instability or perturbations suggesting some subjectivity for determining these events. The purpose of this paper was to establish operational definitions for determining stable and unstable game states to facilitate the identification of perturbations. English Premier League matches (n=18) from the 2015-16 season were analysed resulting in 6 situations, deemed unstable game states; CA (Count Attack), RAD (Ratio of Attacking to Defending players), SCiPB (Successful Cross into Penalty Box), SP (Set Piece), PBP (Penalty Box Possession) and S (Shot). A total of 989 unstable situations (54.9 per match) preceded 474 shots (26.3) and 47 goals (2.6), of which 365 were as a consequence of a PBP and 52 a RAD. Home teams created more unstable situations in winning (M = 34.6, SD = 10.6; Cohen's d = 0.7), drawing (M = 37.8, SD = 16.9; Cohen's d = 0.7) and losing situations (M = 23.3, SD = 6.9; Cohen's d = 1.1) than away teams (M = 28.2, SD = 7.5; M = 27.6, SD = 12; M = 15.9, SD = 6.3 respectively). Similarly, Opponent quality affected the number of unstable situations created (F = 4.583, df = 2, 33, p < 0.05) with less against top teams (M = 20, SD = 8.9) than middle (M = 33.2, SD = 14.4) or bottom teams (M = 29.3, SD = 8.6). The incidence of unstable situations appeared to differentiate teams based on match location and outcome. Operational definitions for unstable situations were devised as opposed to perturbations as these proved more problematical. This methodology is being tested for reliability so that future studies can identify the mechanisms that determine perturbations (on and off the ball activity) and then areas of strength and weakness in teams.

## Reference

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