

Best Team Not Guaranteed World Cup Success

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Credit: Christopher Bruno

The World Cup offers fans of the globe's most popular sport the chance to thrill and agonize over the ups and downs of their nations' teams. For scientists, whether or not they are fans, it's another chance to collect data and test hypotheses about how close the final match results reflected the relative skill and performance of the two teams -- and if they used the best possible winning strategies.

An Imperfect Game, Tournament?

When the dust clears after the [World Cup](#) concludes next month, it's likely that the champion will not be the team that played the best, said Gerald Skinner, an astrophysicist at the University of Maryland in College Park.

Following up on a lunchroom discussion with his avid fan tablemates, Skinner, who admits not being a great sports enthusiast, published a research paper in 2009 that worked out the details of his claim using statistical techniques familiar to astronomers. The findings backed up his posturing.

"It's not entirely a [random process](#), but the result of an individual football match has got a very large element of chance and [randomness](#) in it," said Skinner.

The average World Cup match in 2006 featured a combined total of 2.3 goals. By analyzing the number of goals and their distribution, which is best described by a statistical phenomenon called a Poisson distribution, Skinner was able to show that if a match were replayed, the number of goals in a match and even the winner could vary considerably even if both teams played exactly as well -- partially because soccer is such a low-scoring game.

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For a team that won by a commanding score such as 3-0, fans can be pretty certain that the better team won, but Skinner said that a 2-1 or 1-0 game is not as clear-cut. For example, he found that for 2-1 matches almost one-third of the time the better team does not win.

That uncertainty influences the entire tournament. Skinner said that the first round of the World Cup will likely identify the better teams because each team plays each of the other three teams in the group. But the following rounds are single elimination, and the uncertainties of the outcomes of four successive games add up. Skinner found that the likelihood that the best team would win the World Cup is around 28 percent.

"It's really the knockout stage that introduces the uncertainty into the process," said Skinner. "You've got four times that you've got to win given the chance of an unlikely result."

Skinner said that changing the game to increase the average number of goals scored would decrease the chance of lucky wins. Options include increasing the size of the goal or forcing teams to play until there was a significant goal difference, but added "I have to admit these aren't really realistic."

For some fans, the chance that anything could happen is one of the great things about sports. No matter how unlikely the victor, the bragging rights last four years.

Should Teams Attack More?

Maybe it's because soccer is a low-scoring sport or because teams fear giving up a fluke goal and losing the match, but many teams appear to defend much more than they attack. A model developed using game theory -- which can be used to find an optimum strategy given that a foe or foes are also trying to find their optimum strategies -- suggested that this approach may be counterproductive.

Developed to analyze optimal strategies in soccer, the model is the work of Ricardo Manuel Santos, an economist at the Instituto Tecnológico Autónomo de México in Mexico City. "What I do is to compare how teams should play given by the model and how teams actually do play given by the data and I find strong departures," he said.

Santos analyzed nine years of data from the UEFA Champions League, which pits the best European professional teams against each other and helpfully tracks numerous statistics. He used a technique called factor analysis, which he described it as a way to study something that is not

directly observable, like happiness or team behavior.

From the UEFA statistics, Santos estimated team strategy based on the total number of shots, corner kicks, fouls, and other factors. The model reflected the way strategy impacts the game.

"I'm able to get the probability of scoring any number of goals as well as conceding any number of goals," said Santos. "I can see how [teams] play, how it will affect the probability of winning or losing the game."

Santos admitted that the Champions League is not the same as the World Cup, but he believes the findings should be applicable to it. And he allowed that coaches may not direct their teams to attack because it could tire them out too early in the match or for another reason not captured by the statistics.

It may be that coaches are simply too conservative.

"What I get is that teams should attack much more than they apparently do," said Santos. "They should attack a lot when in the real world they seem to defend a lot."

Could an attacking team take note of this research, catch a couple of lucky breaks and win the World Cup? Possibly.

But one thing is for sure: the world will be watching.

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