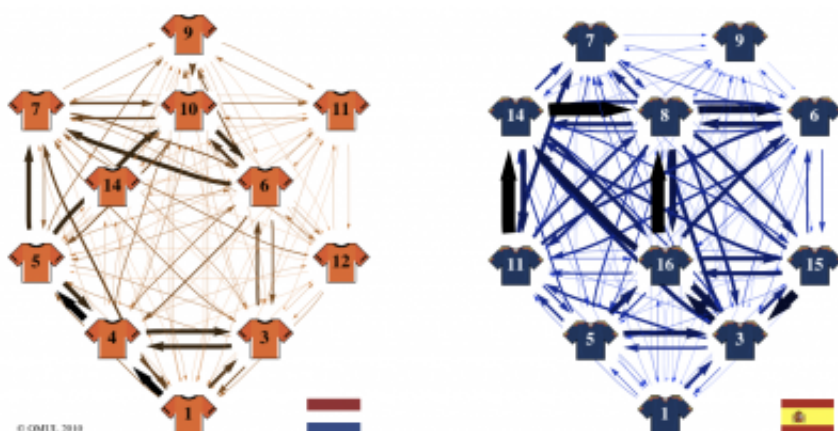


Mathematical formula predicts clear favorite for the FIFA World Cup

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A team's strategy in one graph. By Javier López Peña and Hugo Touchette
School of Mathematical Sciences, Queen Mary, University of London

A sophisticated new analysis of team tactics predicts a Spanish win in Sunday's FIFA World Cup final and also shows why England were beaten by Germany.

Mathematicians and football supporters Dr Javier López Peña and Dr Hugo Touchette from Queen Mary, University of London have collected ball passing data from all of the FIFA [World Cup](#) games and analysed it to reveal the nations' different styles of play.

Using the mathematical technique called Graph Theory, they have

revealed the gaping holes in England's tactics against Germany game and made predictions about the Netherlands-Spain final that could rival the psychic octopus.

For each national side, Drs López Peña and Touchette have drawn up a 'network' of passes between players throughout the tournament and analysed how these networks compare between teams. Dr Touchette explains: "Each player in the network is given a score called centrality which measures how vital they are to the network. The higher the centrality score, the bigger the impact if that player wasn't there. This method is most commonly used to make [computer networks](#) more robust, but it can also be used to plan football strategy."

Graph Theory is used to analyse different types of network, most commonly to investigate computer networks - such as the internet - and to model what would happen if different parts of the networks were suddenly removed. This type of research, which takes place in Queen Mary's School of Mathematical Sciences, can make computer networks more robust and less susceptible to disruption.

The Netherlands-Spain prediction

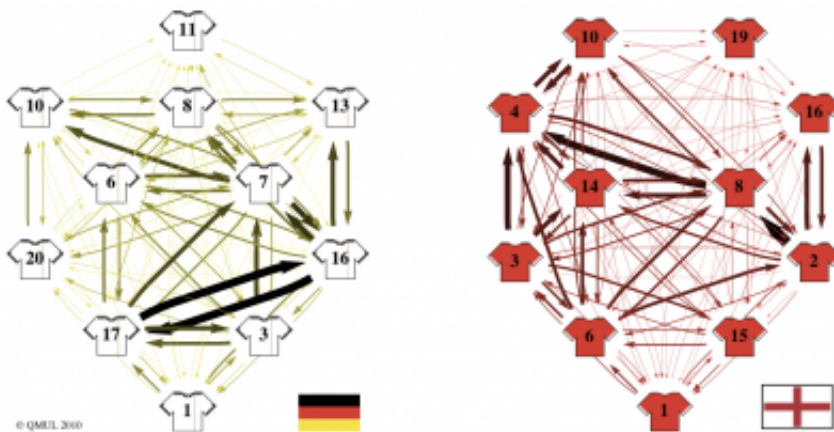
The networks reveal Spanish players have made a strikingly high number of passes this tournament, almost 40 per cent more than Germany and twice as many as the Dutch. "The team relies on swift passes that are well distributed among all players, especially between those playing mid-field," said Dr López Peña.

David Villa, the tournament's highest goal scorer, has received an average of 37 passes per game, more than any other forward from all the teams. Dr López Peña said: "Villa's performance has been impressive compared with Fernando Torres, who has not scored any goals this tournament. This was reflected in the successful Spanish tactics, with

Torres only receiving an average of 13 passes per match, and 37 to Villa."

Conversely, the Dutch gameplay is clearly offensive, involving a very low number of passes between players, most of which are aimed at the strikers. Dr López Peña said: "The low number of passes shows the Dutch prefer quick attacks and counterstrikes rather than intricate playing. Their goals are often scored from set pieces such as free kicks and they use their physical presence to beat their opponents."

The England-Germany match



The analysis shows the English squad to have a balanced line-up with no single player more important than the team as a whole. Dr López Peña said: "The good midfield work of Frank Lampard, Steven Gerrard and Gareth Barry doesn't appear to transfer very well to the forwards, with Wayne Rooney receiving on average three times more passes than Jermain Defoe. This makes the English attack very predictable and

easily stoppable by blocking Rooney, who is usually forced to give the ball back to Gerrard."

The German network appears even more balanced than the English one, with a higher number of passes, suggesting more circulation of the ball. "Particularly relevant are the passes between Philipp Lahm and Bastian Schweinsteiger and most of the German attacks are built up from the defenders. Mesut Oezil makes good work connecting both sides of the field on the attack, making the German offensive game very effective and hard to defend against. The key player in the German strategy remains Schweinsteiger, who was effectively blocked by the Spanish midfielders' characteristic fast circulation in their semi-final defeat," said Dr López Peña.

Provided by Queen Mary, University of London

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