

## When a butterfly beats its wings by Stuart Fuller

The Theory of Complexity and Chaos

Most economic theory is modelled on the laws of motion developed in the 17th century under the ideology that for every action there is an outcome. The recent TV deal agreed by the Premier League is a great example of this. The action? Sky and BT paying an eye-watering £5.14 billion for the rights to show live football. The outcome? An increase in subscription costs to fund this investment, resulting in more fans turning to illegal, free web streams. The action? Putting out a weakened team in the FA Cup? The outcome? A humiliating thrashing. The action? A player is sent off. The outcome? They have to play at a disadvantage with one less man. The action? Picking a team for the European Championships based on reputation rather than form? The outcome? Get knocked out in utter national shame to a country a 20th of our size.

If the footballing world does indeed behave like this then why do we find it so hard to correctly predict what will happen in games when certain actions occur? Austrian economist Friedrich Hayek believed that economic actions were far too complex to model and if we turn our attention to football, we can see that predictable, regular actions by players does not necessarily lead to a predictable result for the team. Whilst you can shoot every time you get the ball, there is no guarantee that you will win, or even score.

The reason for the unpredictable is described in the famous Butterfly Effect, coined by Edward Lorenz back in 1960. He suggested that a butterfly flapping its wings in Brazil could lead to a cyclone in Texas. His theory into chaos often comes from the chain reaction of tiny effects weren't observed as people think from his study of meteorology, but from watching any football game you can understand what his theory means. The game between Portugal and Croatia is a classic example. It was a terrible game and it seemed the millions watching on TV were being punished with an extra thirty minutes of extra-time. With just 90 seconds left in the match Croatia threw everyone forward, trying to avoid the lottery of penalties. A corner was put right into the six yard box and was met with the head of the Croatian centre-back. The ball struck the foot of the post. Less than 45 seconds later Ricardo Quaresma headed into an empty net, taking Portugal through to the Quarter-Finals. Had that ball taken a trajectory one inch either way, it is doubtful Quaresma would have scored.

Twenty years ago we saw the theory in action again in Rotterdam when Ronald Koeman pulled down David Platt in a game between Netherlands and England. Koeman should have been sent off. He wasn't and he then went and scored a decisive goal at the other end that ended England's hopes of qualifying for the 1994 World Cup and thus Graham Taylor lost his job. Oh, and the phrase "Do I not like that".

Last season what would have happened if Jimmy Muitt hadn't picked up a serious injury in our third game of the season? Would he have scored the goals that would have turned draws into wins? Would that have led to manager Steve Brown believing he could push up the table and not quitting?

Football is unpredictable. The same team, playing in the same formation against the same opposition two games in a row will perform differently due to external factors such as the pitch, the weather and the referee. That's what makes the game so beautifully unpredictable and complex. And that, ladies and gentlemen is the basis of the theory of Complexity and Chaos.