Euro 2004 and the Red Advantage

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Summary

In our *Nature* article we were able to show that wearing red bestows an advantage on contestants in one-on-one combat sports. We also suggested that red may be important in team sports and here we expand on our example from football to show how this appears to be the case. At Euro 2004, five teams wore both a predominantly red shirt and a shirt of a different colour over the course of the competition. All five teams had significantly better results in their red shirts (Figure 1) and this fact remains true once we control for differences in the quality of opposition that teams faced while wearing the two different shirt colours (Figure 2). It appears that when wearing red shirts teams score more goals, with their opponents adopting a more defensive and possibly more aggressive approach. These findings are not the result of red shirts simply being easier to see and suggest that the colour of sporting attire may be highly important in deciding the outcome of contests in a wide variety of competitive sports.

Previous studies have shown that home-field advantage is a significant determinant of the outcome of sporting contests. In order to determine whether wearing red confers a similar advantage we took advantage of the fact that during the Euro 2004 soccer tournament the same teams wore different colour shirts in different matches. Since all teams (except the hosts, Portugal) are effectively playing away from home we were able to control for each team's intrinsic quality by comparing their performance when they wore a predominantly red strip with their performance when in a different colour.

There is a significant effect of red shirt colour on the overall result of the game (Figure 1: paired t-test, $t = 4.00$, df = 4, $p = 0.016$). Since the quality of the opposition will also be an important influence on the outcome of games, opposition quality needs to be held constant in order to confirm that teams have an advantage when playing in their red shirts. After controlling for opposition quality, all teams still had better results when playing in their red rather than their other shirt colour (Figure 2: paired t-test, $t = -3.15$, df = 4, $p=0.034$), largely as a result of scoring more goals (paired t-test, $t = -2.98$, df = 4, $p=0.041$). With opposition quality held constant, the mean difference in number of goals scored versus conceded in each game improved by 0.94 goals when wearing red shirts, primarily through an additional 0.97 goals scored.

The proximate mechanisms underlying this increased performance are less clear. There is evidence that opposition players adopt a more defensive approach, since teams that did not play in red, but faced both red and other-coloured opposition, had fewer shots at goal when facing a red team (paired t-test, $t = -2.62$, df = 7, $p = 0.034$). Furthermore, in matches involving a red team, non-red teams were "booked" (disciplined by the referee for offences) more frequently (t-test, $t = -2.23$, df = 19, $p = 0.038$) and made more tackles (t-test, $t = -2.03$, df = 19, $p = 0.056$).

One alternative explanation for these results is that red shirts are more easily detected by primate visual systems (as trichromacy may have evolved to detect red fruit against a green background). If this were the case, we would expect teams to have increased accuracy in passing the ball to team mates when playing in red. We find no such effect (paired t-test, $t = -0.53$, df = 4, $p > 0.5$).

Although many factors influence sporting outcomes, it is interesting to note that the most successful teams in English league football over the last few decades (Liverpool, Manchester United and Arsenal) have all worn red. If the effects we have documented are reflected in other data sets, the implications for the evolutionary psychology of colour and for ensuring a level playing field in sports will be general and far-reaching.
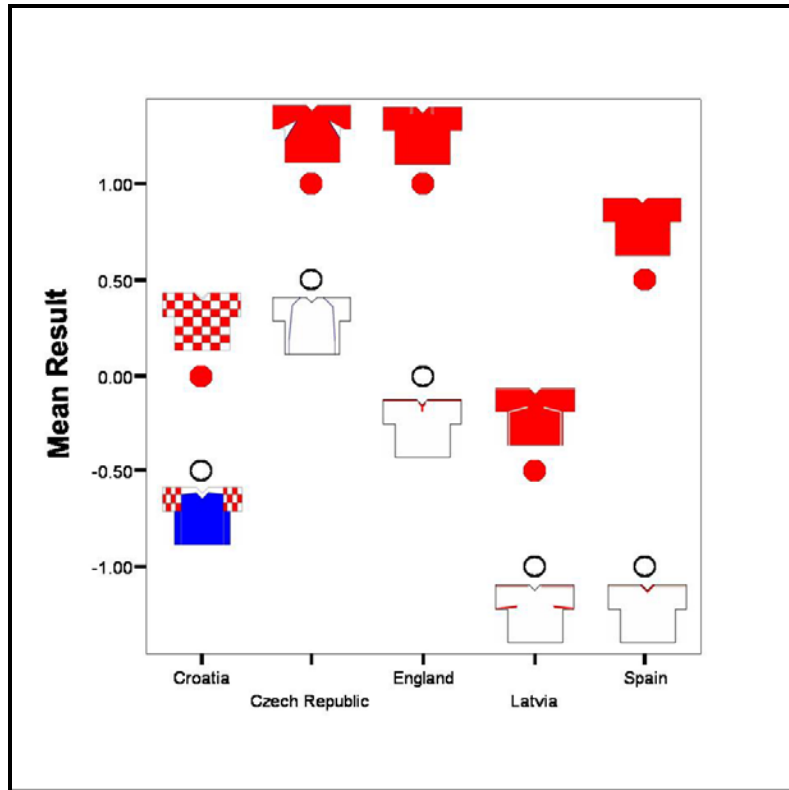
Figure 1: Performance of football teams at Euro 2004 when playing in red and their other shirt colour based on the overall result of game (scored as 1 for a win, 0 for a draw and -1 for a loss). A team's mean performance in each shirt colour is indicated by the circles, with the associated images representing the colour of football shirts worn during those games. In all cases the performance of the team is greater when in red shirts.
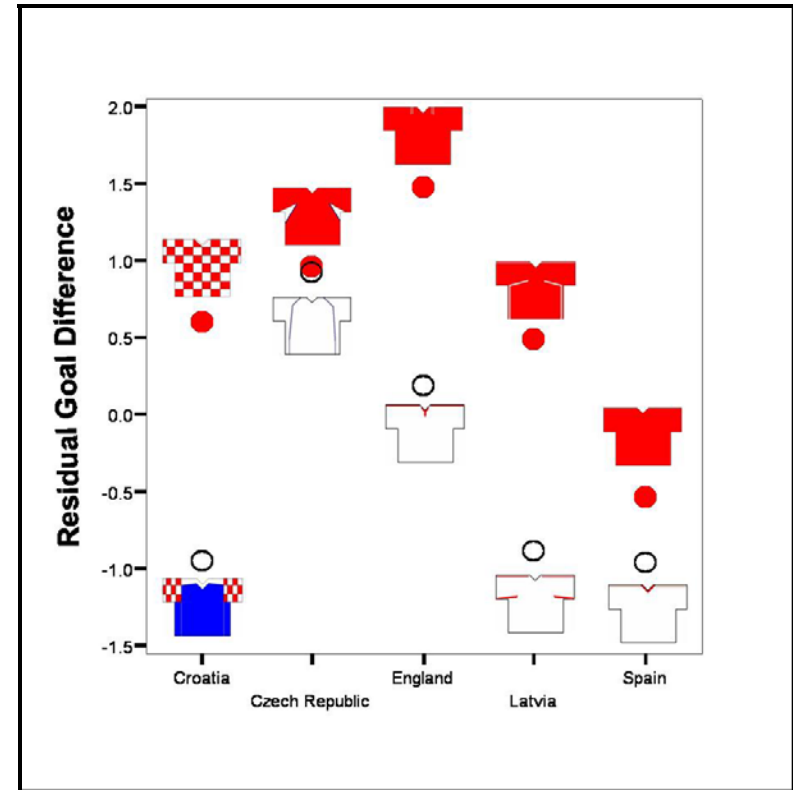
Figure 2: Performance of football teams at Euro 2004 when playing in red and their other shirt colour, controlling for opposition quality. To control for the quality of opposition, we initially conducted a regression analysis between the dependent variable and the difference in FIFA world ranking (in June 2004) of the two teams (taken from http://www.fifa.com/en/) in each match. Subsequent analyses were then conducted on the residuals from the regression analyses as the dependent variable. In the results presented we control for difference in world ranking on goal difference in the game ($r^2 = 0.236$, $F_{(1,29)} = 8.97$, $p = 0.006$) and on goals scored ($r^2 = 0.103$, $F_{(1,60)} = 6.87$, $p = 0.011$).

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