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On Thin Ice: Does Uniform Color Really Affect Aggression in Professional Hockey?

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Abstract

Past research suggests that wearing either a black or a red uniform leads to increased aggression or an increase in perceived aggression during professional sports. However, this research suffers from a number of limitations, including an inability to manipulate the independent variable. A recent change in the National Hockey League's uniform policy created the possibility of a naturally occurring experiment that allowed the authors to examine whether aggression levels were higher when teams wore black or red jerseys. The authors compared games against the same opponent in which home teams wore red or black jerseys for one game and their usual color for another game on several measures of aggression. They found no evidence that either black or red uniforms were related to higher levels of aggression in professional hockey games.

Keywords

aggression, violence, evolutionary psychology, motivation and performance, research methods

Of the many variables researchers have identified as contributing to aggression, perhaps the most intriguing is the color worn by the aggressor. To test the effect of color in a real-world setting, researchers have examined the number of aggressive acts performed by athletes during sporting events. Findings from these studies suggest that athletes who wear either black or red may be more aggressive than athletes who wear other colors.[1]

Investigators examining the relation between black uniforms and aggression point to the widely recognized association between black and badness (Frank & Gilovich, 1988). We commonly speak of black moods and the bad guys wearing black hats. Research on the affective meanings of colors finds that black is associated with death and evil in virtually all cultures (Adams & Osgood, 1973). Because in most contexts aggression is considered a negative behavior, black also is associated with aggression. Research tying red uniforms to aggression is often based in biological and evolutionary concepts. In particular, biologists have identified the importance of red in intraspecies competition. In many species, the amount or intensity of red is associated with status and dominance (Pryke, Andersson, Lawes, & Piper, 2002; Setchell & Wickings, 2005). During competitive interactions between males, red is typically indicative of dominance, which gives the male who expresses more or more intense red an advantage. In humans, we commonly associate a red face with anger, a face drained of color with fear.

Uniform Color and Aggression

Frank and Gilovich (1988, Study 2) examined the relation between uniform color and penalties in professional football and hockey players. Over a 16-year period, they found consistent evidence that teams wearing black uniforms were penalized more often than teams wearing nonblack uniforms. The researchers also point to two hockey teams that switched from nonblack to black uniforms during this period. In both cases, the teams were penalized more often after the switch than before. The investigators correctly point out the referees' perception also might have been affected by the players' uniform color. Thus, whether the findings reflect the actual number of fouls or the referees' perception that the team in black was committing more fouls is difficult to tease apart. In follow-up studies, Frank and Gilovich found evidence that both of these processes might be operating.

Hill and Barton (2005b) examined the effect of red uniforms in four combat sports (boxing, tae kwon do, Greco-Roman wrestling, freestyle wrestling) during the 2004 Olympics. The two contestants in each round of these competitions were randomly assigned to wear either red or blue protective gear. The researchers found that the athlete wearing the red uniform was victorious significantly more often than could be attributed to chance. In another investigation, these researchers also found that English football teams wearing red jerseys had better

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won–loss records than teams wearing other colors (Attrill, Gresty, Hill, & Barton, 2008).

Several hypotheses have been put forth to account for the advantage of wearing red uniforms. It may be that the athlete responds to the color he or she is wearing and performs more aggressively (Hill & Barton, 2005a, 2005b). But it might also be the case that seeing an opponent in red disrupts the performance of the athlete not wearing red (Elliot, Maier, Moller, Friedman, & Meinhardt, 2007). Alternatively, red may simply be easier or more difficult for opponents to see, which can affect performance (Rowe, Harris, & Roberts, 2005). Finally, as with football, it may be the case that judges are affected by the uniform color and may award points differently for competitors in red and nonred uniforms (Hagemann, Strauss, & Leissing, 2008).

Limitations of the Extant Research

The notion that professional athletes either act more aggressively or are seen as acting more aggressively when they wear certain colors is intriguing and has theoretical implications for the relation among external stimuli, identity, and behavior (Frank & Gilovich, 1988). At a practical level, if the effect is powerful enough to influence the outcomes of important sports events like the Olympics, steps should be taken to neutralize the unfair advantage given to some competitors. However, a close examination of the studies demonstrating the effect suggests that the evidence for a causal link between uniform color and aggression might not be as strong as many believe.

In fact, there are several limitations in this research. First, the study that found more aggression in football and hockey players when the players wore black uniforms did not manipulate the independent variable (Frank & Gilovich, 1988). That is, whether a team wore black or some other color was not random. Professional sports teams are free to select their own uniform colors. No doubt many factors come into play when making this decision, but key among these reasons is the kind of image owners and management want to portray. Indeed, professional sports has become a multi-billion-dollar enterprise, and many of the issues surrounding branding and marketing that concern other large businesses most likely are important to the sports industry as well. Selecting black for the team color is no accident. If, as Frank and Gilovich (1988) argue, black has a strong association with intimidation and aggression, then making black the team color is a strong indication of the general style of play owners and management want and expect out of their athletes. This expectation is likely to affect team performance in many ways. Most obviously, teams trying to develop a reputation for toughness and aggression can select players with matching reputations. The message also can be delivered through advertising and other team promotions that feature aggressive attitudes and play. Perhaps most important, players can be encouraged directly or indirectly by owners, coaches, teammates, and perhaps even fans to play more aggressively. Through these and other channels, a team that wants to promote an aggressive image is likely to practice and play within an aggressive team culture. As a result, without random assignment, it is impossible to know whether wearing black uniforms makes teams more aggressive (or makes them appear more aggressive to referees) or whether teams that want to be more aggressive select black uniforms.

Second, the studies linking red uniforms and aggression did not measure aggression directly. Rather, the investigators examined how often the red-clad competitor won in a combative sport (e.g., wrestling). Although increased aggressiveness may heighten the chances of winning, many other skills, tactics, and attributes also affect the outcome of these matches. Among other possibilities, competing against someone in a red uniform might be disruptive (Elliot et al., 2007) or intimidating (Ioan et al., 2007). The extent to which the red uniform is visible against the background could also account for the effect (Rowe et al., 2005). Finally, more aggression does not necessarily mean more success. It could be the case that being too aggressive sometimes hurts performance in these sports.

Third, research examining uniform colors may suffer from confounds because of the location of the event and the competition. In team sports, uniform color is almost always confounded with whether a game is played at home or away. Typically in professional football and hockey, the home team wears the team color and the visiting team wears white. This is particularly problematic in that home teams win a higher percentage of games. In American professional sports, the percentage of games won by home teams during the 2009 season ranged from 54.8% in baseball to 59.8% in basketball. There also is evidence that the home team may be called for fewer fouls than the visiting team (Anderson & Pierce, 2009). In addition, in some sports like football or judo, competitors may play each other only once, which makes it impossible to eliminate effects from specific matchups between opponents or the dynamics of a particular game (Timmerman, 2007).

Fourth, the dependent measure used in the research examining aggression in football games is a concern. Frank and Gilovich (1988) used the total number of yards the team was penalized as their measure of aggression. They correctly point out that aggressive penalties tend to draw more yards than less aggressive penalties. However, overly aggressive play is but one reason for being penalized in football. The most common penalties (e.g., false starts, holding, offsides), and even some of the most costly penalties (e.g., pass interference) are not very good indicators of aggression. Thus, a better measure of aggression for football players would look only at penalties that clearly reflect aggressive acts. This limitation is less of a concern for the hockey data because hockey penalties are primarily the result of overly aggressive play.

The Present Study

Conclusively determining whether uniform color affects aggressiveness or perceived aggressiveness requires a study with either random assignment of uniform or a within-subjects design in which a team wears different colors on different occasions. Moreover, the study needs to look at clear and

direct indicators of aggressive behavior and eliminate confounding factors such as where the game was played and who the opponent was. Fortunately, a recent change in the National Hockey League (NHL) uniform policy provides an opportunity to conduct a study that meets all of these requirements.

As in most sports, professional hockey has an established protocol for uniform colors. Traditionally each team has two uniforms. One uniform has a dark jersey in the team's color and is normally worn for home games. The other uniform has a white jersey and is normally used for away games. However, during the 2008–2009 and 2009–2010 seasons, the NHL allowed teams to wear a third jersey for a limited number of home games. Some teams used their existing home color and simply changed the logo to create the third jersey. However, other teams selected a different color for their third jersey. Teams using a third jersey wore that jersey for a limited number of prespecified home games.

Among the teams that used a different color for their third jersey, eight selected the color black. This development created a situation in which eight teams wore both their traditional colored jerseys and, on limited occasions, black jerseys for home games. For example, the San Jose Sharks regularly wore black jerseys for games played on Tuesdays or Thursdays and their traditional teal colored jerseys for games played on other days. Moreover, because NHL teams may play the same opponent at home more than once in a season, some teams played an opponent one time wearing black jerseys and another time wearing their normal home colored jersey during the same season. A similar situation developed for red jerseys. Six teams selected a third jersey that created a situation in which sometimes they wore a red jersey (either as their primary home jersey or as the third jersey) and sometimes they wore a different colored jersey for home games. Again, over the course of a season, these teams could play the same opponent at home once wearing a red jersey and once wearing a nonred jersey.

The use of the third jersey allows for a repeated measures design with the unit of analysis being a pair of games. That is, we can compare the same two teams playing in the same arena in which the home team wore black or red for one game and a nonblack or nonred color for the other game. The visiting team wore light colored jerseys for both games. This design eliminates many of the problems found in earlier studies. The jersey color is not confounded by the location of the game or the specific opponent. Since teams wear their third jerseys throughout the season, there is no systematic order effect for jersey color. Using pairs of games in the same season also ensures that the vast majority of players will be the same in both games and that a change in team colors does not reflect a new team strategy.

Finally, professional ice hockey is a particularly good vehicle for testing the effects of color on aggression. Most of the penalties in hockey are for aggressive behavior (e.g., roughing, spearing, slashing), and fighting is an accepted part of the game. Conn Smythe, a long-time player and coach for whom the playoff most valuable player award is named, summed up his philosophy by remarking, "If you can't beat'em in the alley, you can't beat'em on the ice" (Levin, 2006).

Method

We reviewed NHL team web sites to identify teams that wore both a black (or red) jersey and a different colored jersey for home games during the 2008–2009 and 2009–2010 seasons. We obtained a list of the dates when the third jersey was worn and reviewed season schedules to determine whether the home team also played the same opponent that season while not wearing the third jersey. Over the two seasons, there were 102 pairs of games in which the home team played the same opponent within a single season while once wearing black and once wearing nonblack jerseys.[2] The two games in the pair were separated by an average of 24.65 games ($SD = 17.01$), and in 46% of the pairs the black jersey was worn in the first game. After identifying the relevant games, we used official score sheets to obtain the final score and number and type of penalties in each game. We followed the same process to create pairs of games in which the home team wore red and another color of jersey. We identified 61 pairs of games over the two seasons. The two games were separated by an average of 24.16 games ($SD = 16.71$), with red jerseys being worn in the first game 57% of the time.

We examined three fairly unambiguous measures of aggression and two indirect measures of aggression. First, we looked at the total number of penalty minutes assessed to the team (most infractions carry a 2-minute penalty). We conducted this analysis for both the home team and the visiting team. Second, we looked at the number of severe penalties. We created a composite measure by summing the number of penalties for three particularly violent infractions, roughing (a punch or punching motion normally directed to the head), fighting (continued punching), and game misconduct (normally given if a penalized behavior leads to an injury). Again, we examined this measure for both the home and visiting teams. Third, we looked at the number of games that became atypically violent, as indicated by the total number of penalty minutes assigned to both teams. Although not necessarily an indicator of aggression, like some earlier investigators, we also examined two performance measures. First, we looked at whether the home team won the game. Second, in the NHL, teams earn two points for a win, one point for a loss in overtime, and no points for a loss in regulation play. We looked at how often the home team earned at least one point.

Results

The Effect of Black Jerseys

We began by looking at the total number of penalty minutes per game. In games in which black jerseys were worn, the home team was penalized an average of 13.70 minutes ($SD = 10.0$). This did not differ significantly from the games in which the home team wore its regular jerseys ($M = 13.12$, $SD = 7.63$), $t(101) = 0.47$, $p = .64$. A similar pattern was found for visiting teams. Visiting teams were penalized an average of 14.74 minutes ($SD = 8.94$) when the opponent wore black and 13.83 minutes ($SD = 7.42$) when it did not, $t(101) = 0.84$, $p = .40$.

Because hockey is generally an aggressive sport, it may be the case that uniform color affects only the frequency of extreme acts of aggression. To test this possibility, we also examined the number of times teams were penalized for severe instances of aggression. We counted the total number of roughing, fighting, and misconduct penalties for each team per game. Because these penalties are relatively rare, we used a nonparametric Wilcoxon signed ranks test for related measures for these analyses. Overall, the results were similar to those for penalty minutes. When wearing black, the home team received an average of 1.38 severe penalties ($SD = 1.76$) compared to 1.33 severe penalties ($SD = 1.40$) when wearing its standard jersey. This difference is not significant ($p = .97$). There also was no significance difference in these penalties for the visiting team when the opponent wore black ($M = 1.36$, $SD = 1.63$) versus when the home team wore its standard jerseys ($M = 1.24$, $SD = 1.32$; $p = .45$). Controlling for the time between games and the order of the games did not change the results.

Even though jersey color is unrelated to penalties and severe penalties, it is possible that when one team wears black, the general level of aggression is prone to escalation. That is, aggression may get out of hand during some games, resulting in an excessive number of penalties. To test this, we calculated the total penalty minutes for all 204 games ($M = 27.69$, $SD = 15.73$) and identified games in which total penalty minutes were one standard deviation or more above the mean. Of the games 15% exceeded this threshold when the home team wore black, compared to 11% of the games in which black was not worn. The difference between these proportions is not significant ($z = 1.10$).

Finally, we also examined whether home teams were more successful when they wore black jerseys rather than their normal jerseys. When home teams wore black, they won 57% of their games and scored points (either a victory or an overtime loss) in 67% of the games. When home teams wore their standard jersey, they won 50% of the time and scored points in 60% of the games. The color of jersey worn by the home team was not significantly related to the proportion of wins, $\chi^2(1, N = 102) = 1.11$, $p = .58$, or games in which points were received, $\chi^2(1, N = 102) = 1.06$, $p = .60$.

The Effect of Red Jerseys

We used the same analytic strategy to compare the effect of red jerseys. In games in which the home team wore red, the home team was penalized an average of 12.02 minutes ($SD = 6.52$). When the home team wore a nonred jersey, it was penalized an average of 13.30 minutes ($SD = 9.82$). The difference is not statistically significant, $t(60) = 0.97$, $p = .34$. Similarly, the visiting team was penalized an average of 13.39 minutes ($SD = 8.61$) when the home team wore red jerseys and 15.07 minutes ($SD = 8.75$) when the home team wore another color. This difference also is not statistically significant, $t(60) = 1.25$, $p = .21$.

When the home team wore red, it committed an average of 1.25 severe penalties ($SD = 1.37$). When the team wore nonred jerseys, the average number of these penalties was 1.30 ($SD = 1.77$). When the visiting team played against a team wearing red jerseys, it committed an average of 1.23 severe penalties ($SD = 1.24$). The visiting team committed an average of 1.44 of these penalties ($SD = 1.73$) when the opponent did not wear red. Wilcoxon signed ranks tests for related measures showed no significant differences in the severe penalties committed in the two games by the home team ($p = .72$) or the visiting team ($p = .75$).

We again looked at whether the number of highly penalized games differed depending on the home team jersey color. The average number of total penalty minutes across all 122 games was 26.89 ($SD = 15.21$). When the home team wore red, 8% of the games had a penalty total that was at least one standard deviation above the mean. When the home team did not wear red, 15% of the games met this threshold. This difference is not significant ($z = 1.50$).

Finally, when the home team wore red, it won 47% of the games and scored points in 62%. When the home team wore a nonred jersey, it won 56% of the time and earned points in 61% of the games. The color of jersey worn by the home team was not significantly related to the proportion of wins, $\chi^2(1, N = 61) = 0.99$, $p = .62$, or the proportion of games in which points were received, $\chi^2(1, N = 61) = 0.11$, $p = .74$.

Discussion

The notion that uniform color causes aggression in sports is an intriguing one. It has been used to support the ideas that cultural artifacts (e.g., "black hat") can shape behavior or that mechanisms observed in other species (e.g., status systems among red widowbirds) can influence complex human actions. Although these ideas are provocative, making unequivocal statements about the connection between uniform color and aggression seems at best premature.

The pattern in the data we collected is remarkably consistent. No matter how we measured aggression—total penalty minutes, number of severe penalties, likelihood that a game would have an excessive number of penalty minutes, and team success—we found no evidence that wearing either a black or a red jersey increases the amount of aggression in hockey games.[3] This research represents more than a failure to replicate. Rather, it is the first study that eliminates or controls for several limitations that plagued earlier investigations. We examined clear measures of aggression, controlled for game location and opponent, and compared games in which the uniform color was randomly assigned. At least two other investigations also have failed to find support for the notion that athletes wearing black uniforms are more aggressive (Mills & French, 1996; Tiryaki & Scedilfik, 2005). However, these studies also had some of the methodological limitations as the studies reporting an effect for color.

Of course, failure to find a connection between uniform color and aggression does not mean the effect does not exist. It is possible that researchers who control for the limitations we identify might yet find the effect when looking at different

sports or perhaps when using different measures of aggression. Nonetheless, until more data are available, the most appropriate conclusion from the literature seems to be that there is little evidence either that wearing black or red uniforms causes athletes to act more aggressively or that athletes wearing these colors are perceived by officials as being more aggressive.

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Notes

1. Rowe, Harris, and Roberts (2005) report that competitors randomly assigned to wear blue rather than white during the 2004 Olympics judo competition won more often than would be expected by chance. However, Dijkstra and Preenen (2008) found that after controlling for confounding factors, such as the time between matches and seeding in those matches, the effect disappears.
2. If a home team played the opponent once while wearing the third jersey and more than once wearing the normal jersey, we selected the game closest in time to create the pair.
3. The failure to find significant effects cannot be easily attributed to a lack of power. The sample size for games with black jerseys and for games with red jerseys is within the recommended range for uncovering medium-sized effects (Cohen, 1992).

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