Psychologie
Faculteit der Sociale Wetenschappen

The Impact of Colours of Football Outfits on Perceived Fouls of Referees

Master Thesis Social and Organisational Psychology
Faculty of Social and Behavioral Sciences – Leiden University

Tim van Os (s1290991) in cooperation with Jordan Martir (s1250507)
Coordinator: Wolfgang Steinel

9th September 2017

Abstract

The primary aim of this study is to explore with the help of video material displaying fragments of real football matches whether decisions of fouls taken by football referees are influenced by the colour of football outfits. The second aim is to identify whether these decisions influenced by the colour of football outfits are related to a perception of aggression and/or dominance. The term 'uniform colour' is used because in this study the entire outfit of football players is one of the manipulated variables and not just the jerseys. It was expected that tackles committed by teams wearing a red uniform would be rated higher as a foul than tackles committed by teams wearing a different colour when no actual foul is committed. Furthermore it was expected that referees perceive teams playing in red committing a tackle as more aggressive and dominant than teams not playing in red committing a tackle. Results showed that referees perceived a tackle committed by a player wearing a red uniform as higher rated than when a player wearing a non-red uniform committed a tackle when no real foul was committed. Furthermore based on the results of the video clip experiment referees did not perceive red uniforms more aggressive and dominant compared to non-red uniforms. In contrast referees did perceive the colour red as more aggressive and more dominant compared to other colours.

Tim van Os (s1290991)
Faculty of Social Sciences - Leiden University

The Impact of Colours of Football Outfits on Perceived Fouls of Referees.

Referees in football are having a tough job nowadays. Situations in sport can change very rapidly, and referees view on-field situations from a different perspective than players and crowds. Acting in a dynamic environment involving lots of responsibilities like a football match makes it difficult for referees to judge situations correctly (Oudejans et al., 2000). As a result, their judgements may show biases, like those found in other social judgements (Frank & Gilovich, 1988; Plessner & Haar, 2006). Economists assume that people behave rationally and make rational decisions but social psychologists know differently (Edwards, 1954).

The pressure on making the right decisions is higher than ever before, because the amount of money depending on their decisions is higher than ever. Wrong decisions can have serious consequences for clubs or individual players. To maximize the chance of correct decisions the amount of referees per game has been upgraded to five since 2014. One of the benefits of having five officials on the pitch is that in-field situations are viewed from different angles. Although more referees pay attention to what's happening on the field perceptual biases do still occur. For example attention directly modulates the perceived motion speed of moving stimuli. Specifically, attention lets the brain believe that attended moving stimuli move faster (Turatto, Vescovi & Valsecchi, 2006). Although the angles change per official, the amount of attention and the perception of attended moving stimuli should not differ (Nathans, Thomas & Hogness, 1986).

One of the most common and relevant stimuli for all humans is the distinction of colours. Colour is essential in perceiving the world and its objects around us. The perception of colours ensables sport teams and officials to easily distinguish between teams.

Tim van Os (s1290991)
Faculty of Social Sciences - Leiden University

The perception of colours

The perception of colours affects our functioning (Valdez & Mehrabian, 1994). Earlier research by Goldstein (1942), showed for example that red and yellow were associated with stimulation of physiological reactions in emotional experience (with negative arousal), to have an outward focus, and to produce forceful action, whereas green and blue were associated with a psychological state of relaxing, and encourage an inward focus, and to produce calm and stable action. Elliot and Maier (2012) have proposed colour-in-context theory, which draws on social learning, as well as biology. Color-in-context states that responses to colours are not only biologically driven (e.g. blood flow modulations and aggressiveness), but also by social learning, particular by concepts and messages. For example, the colour red may not only increase evaluations of attractiveness when viewed on someone's face (e.g. blushes), but also when viewed on a piece of clothing. In general colour influences performance and psychological functioning and it does so via learned associations that may be embedded in deeply ingrained predispositions (Elliot, Meier, Moller, Friedman, Meinhardt, 2007).

Perception of red

The deeply ingrained predisposition of learned associations originates from animals. In many animals (e.g. primates) the colour red is perceived as a testosterone-based indicator of dominance in aggressive encounters (Setchell & Wickings, 2005). The association of the colour red and dominance may transfer from physiological stimuli to artificial stimuli; for example sports jerseys (Elliot & Maier, 2015). As mentioned before the colour red stimulates physiological reactions in emotional experience with negative arousal. Red is perceived as an

active colour (Adams & Osgood, 1973). In achievement contexts (i.e. success and failure) red is associated with danger. (Elliot et al., 2007).

Perception of red in sports

Sports (for example: football) is an achievement context. Hill and Barton (2005a) found that colour is thought to influence human mood, emotions and expressed aggression in competitive sport interactions through emotional arousal. In sports the colour red is associated with dominance and aggression (Drummond & Quay, 2001). Other research has differentiated viewing red from wearing red and found that in achievement contexts teams or opponents wearing red are perceived to be more dominant, intimidating, competitive, and assertive (Feltman & Elliot, 2011; Greenlees et al., 2008; Ten Velden et al., 2012 & Furley et al. 2012). Several hypotheses have been put forth in favour of wearing red uniforms. The term uniform is used because in this study the entire outfit of football players is one of the manipulated variables and not just the jerseys. There is a possibility that football players respond to the colour they are wearing and perform more aggressively (Hill & Barton, 2005a, 2005b). But there is also a possibility that seeing an opponent wearing red disrupts the performance of the football player viewing red (Elliot et al., 2007). Alternatively, red may simply be easier for opponents to see. This will have a positive effect on performance (Rowe, Harris, & Roberts, 2005).

Referees are affected by the uniform colour and may award points or certain fouls differently for competitors in red and non-red uniforms (Hagemann, Strauss, & Leissing, 2008). Caldwell and Burger (2011) found no evidence that, especially for home-playing (ice-hockey) teams, wearing red uniforms increases the amount of aggression in sports. Nevertheless teams wearing red were punished with more penalty minutes per game than teams not wearing red.

They found no mediating relation between dominance or aggressiveness and the amount of penalty minutes per game. Research of Danìelsson (2016) suggest that overall aggression increases in matches where a red team is present because both teams were given more two-minute suspensions compared to matches were no red team was present. People are likely to respond to perceived aggression with aggression themselves (Anderson & Bushman, 2002) and often respond to this aggression with more aggression (Krahé, 2013; Buss, 1961).

Research question

The primary aim of this study is to explore whether the decisions of fouls taken by football referees are influenced by the colour of football outfits through evaluating video material showing moments of real football matches. The second aim is to identify whether decisions are being influenced by a perception of aggression. Third the study aims to identify whether decisions are being influenced by a perception of dominance. Based on the literature mentioned above three research questions will be addressed about wearing red during football matches. The first question is whether football referees are influenced by uniform colour. If so, will football referees attribute tackles of players wearing red (R) rated as higher fouls rather than tackles of players with a different colour uniform (NR)? If so, can it be related to the two best predictors of fouls; aggression and dominance? So secondly, will football referees view players wearing red as more aggressive than players with a different colour uniform? Thirdly, will football referees view players wearing red as more dominant than players with a different colour uniform?

This study will have a specific aim to actual non-foul situations because it's more interesting to know whether referees will evaluate non-fouls committed by players more as fouls, than

whether they evaluate fouls as fouls (confirmation) committed by players. The outcomes can be interesting when no actual fouls are committed and referees perceive high rated tackles.

Hypotheses

To answer the main question about the effects of red coloured football outfits on fouls perceived by referees in football games three hypotheses are formulated. Based on the literature the following hypotheses are formulated.

Hypothesis 1: *Tackles committed by teams wearing a red uniform will be rated higher as fouls than tackles committed by teams wearing a different colour when no actual foul is committed.*

Hypothesis 2: *Referees perceive teams wearing a red uniform as more aggressive than teams wearing a different colour.*

Hypothesis 3: *Referees perceive teams wearing a red uniform as more dominant than teams wearing a different colour.*

Method

Participants

The study was involved 90 participants (86 males, M_{Age} = 33.5, SD_{Age} = 14.1) who filled in the questionnaire. Participants were contacted by email, Facebook groups for referees and by the Dutch referee union. Participants were selected on having at least one-year experience as a football referee (M_{Exp} = 6.98, SD_{Exp} = 7.56). 79 participants were referees on amateur level in the Dutch football competitions. Six participants were referees on higher level in the Dutch football competitions and the level of the rest of the participants is unknown. Eighteen participants acted in the second, third or fourth highest level of the Dutch football league as

their highest accomplishment. Participants were asked to complete a survey which contained eighteen different video clips showing specific moments of football matches. Participants could complete the survey from their own computers and were not forced to complete the survey. Participants who did not complete the survey were not included in the analysis. To motivate participants to participate they were offered a chance of winning a 50-euro gift certificate. The winners were contacted by email after finishing the analysis.

Material

In the survey eighteen video clips were being presented in a non-predictable order so participants could not foresee any logic in the order of video clips. These video clips came from Youtube and displayed debatable moments of fouls during football matches. Most of the teams shown in the clips played second or third division of the Dutch semi-professional football league. The teams displayed were specifically selected to reduce the chance of any supporters' bias. The video clips that were selected covered six conditions which will be described in the design and procedure section below.

The videos were edited so as to reduce the amount of decision influencing factors. Each video took between 5 and 12 seconds and stopped right after a player committed a foul. The video clip stopped at the moment when still no reaction was to be seen from the other players on the field because this could influence the participants. Participants had focus on the fouls and should not be distracted or influenced while making their decisions. In order to achieve this logos and names of clubs or channels were blurred. The scoreboard containing the score and time was blurred. Every official who came into picture was blurred. Each clip contained the same sound of the audience in the background. This was a neutral sound to eliminate any possible influence of aroused or suppressed sound of the audience and to eliminate the

possibility of influencing sounds of the referee in the video clip. After each clip the participants were directed automatically to the questions and were not able to go back for a review of the video clip.

The edited videos were uploaded in an online survey (Qualtrics). Participants received a link which directed them to the online survey. Participants could use that link only once to eliminate the chance of seeing the video clips more than once. After the clips the participants were asked to give answers to statements about colours.

Coding

Eighteen edited videos were shown to the participants in an unpredictable order. The video clips were manually coded to conduct a correct analysis afterwards. The coding was only visible for the researchers. The coding consisted of four variables: the number of the video clip, the uniform colour of the home-playing team, the uniform colour of the away-playing team and the outcome of the referees' decision of a foul. The uniform of a team was coded as red if at least 50% of its coloured, non-white part of the uniform was red. If the uniform of the home-playing or away-playing team was considered red, then it was coded as 'R'. The uniform of a team was coded as non-red if there was no red in the uniform. If the uniform of the home-playing or away-playing team was considered non-red, then it was coded as 'NR'.The fourth coding variable was the outcome of the official referees' decision during the match of the video clip. If the official referee during the match of the video clip decided that a foul was committed by a player, the video clip was coded as a foul concerning the team who committed it 'f'. If the official referee during the match of the video clip decided that no foul was committed by a teams player, the video clip was coded as a non-foul concerning the team

who committed it 'nf'. For example, when a R player committed no foul against a NR player, the coding was: Ex_R(nf)_NR.

Design and Procedure

This study contains a within-subjects design with 3×2 conditions. Participants were asked to answer questions about video clips covering all six conditions.

The six conditions are described as:

Teams playing in R against teams in NR where R did commit a foul; R(f) - NR.

Teams playing in R against teams in NR where R did *not* commit a foul; R(nf) - NR.

Teams playing in R against teams in NR where NR did commit a foul; R - NR(f).

Teams playing in R against teams in NR where NR did *not* commit a foul; R - NR(nf).

Teams playing in NR against teams in NR where one NR did commit a foul; NR - NR(f).

Teams playing in NR against teams in NR where one NR did *not* commit a foul; NR - NR(nf).

To start the experiment participants could click on a link to direct them to the online survey. Participants were informed about the setup of this study and what was expected of them. Participants were asked to open the survey in Google Chrome browser because that was the most suitable for the playability of the video clips. Besides that they were asked to close other webpages or programmes for complete focus and concentration on the survey.

The survey started with demographic questions, such as; ''Gender'', ''Age'', and questions about the personal experience as a referee, such as''Are you still active as a football referee?'', What is your current level of participation as a football referee?'', ''How many years of experience have you had as a football referee?'', ''What is your highest noted level at which you participated as a football referee?''.

After these questions, the experiment started with a priming task. A priming task should make sure that the participants could practise first and sharpen their vision by being primed. Participants were shown an example video clip and received feedback on their answers to the questions. Participants received questions as ‘’Would you act? Yes/No’’, ‘’How would you rate this situation? Penalty/Schwalbe’’. After they made their decision they received feedback depending on their answers. Feedback varied from ‘’Well done! You have correctly assessed the situation. Keep it up!’’ to ‘’Unfortunately, in this situation the referee opted for a penalty’’.

After the example fragment the real experiment began. Participants were shown eighteen fragments of a debatable tackle in an unpredictable order. After each fragment, participants were asked questions about how they would rate the tackle on a 7 point-scale. Each fragment was followed by the following questions: “Would you act after this situation?”, “How would you rate this foul?”, “Would you give this player a card?”, “How dominant is this player?”, and “How aggressive is this player?”.

Results

Hypothesis 1: *Tackles committed by teams wearing a red uniform will be rated higher as fouls than tackles committed by teams wearing a different colour when no actual foul is committed.*

To confirm hypothesis 1 and answer the question whether football referees perceive higher rated tackles from teams wearing a red uniform vs. a non-red uniform, multiple t-tests were used. A paired samples t-test was used to compare the mean scores on how referees would rate the tackles in the specific situations. The mean scores for the following conditions were measured and compared, with R(nf)-NR (M_{ZWA} = 2.77, SD_{ZWA} = .931), R-NR(nf) (M_{ZWA} = 2.43, SD_{ZWA} = .832) and NR-NR(nf) (M_{ZWA} = 2.39, SD_{ZWA} = 1.13.).

Table 1. *Rated fouls of R players and NR players when a foul or no foul was committed.*

Condition	$Mean_{ZWA}$	SD_{ZWA}
R(nf) - NR	2.77	.931
R - NR(nf)	2.43	.832
NR - NR(nf)	2.39	1.13

The paired samples t-test showed a significant difference between the three conditions, with pair one: R(nf)-NR and R-NR(nf), with $t(89) = 3.37$, $p = .001$. There was a significant difference as well in pair two: R(nf)-NR and NR-NR(nf), with $t(89) = 2.84$, $p = .006$. There was no significant difference between the mean scores how referees would rate a foul between the conditions R-NR(nf) and NR-NR(nf). Furthermore a repeated measures ANOVA was conducted to measure the difference in mean scores for the 3 conditions with rate of foul as factor when no foul is committed. The repeated measures ANOVA shows a significant difference in mean scores between the R(nf)-NR ($M_{ZWA} = 2.77$), the R-NR(nf) ($M_{ZWA} = 2.43$) and the NR-NR(nf) ($M_{ZWA} = 2.39$) conditions with $F(2,88) = 7.365$, $p = .001$, $\eta^2 = .020$. This means that participants perceived a tackle committed by a player wearing a red uniform as a higher rated tackle then when a player wearing a non-red uniform committed a tackle when no real foul is committed. The first hypothesis is confirmed.

Hypothesis 2: *Referees perceive teams wearing a red uniform as more aggressive than teams wearing a different colour.*

To confirm hypothesis 2 the colours which were rated by the participants as most aggression-encouraging were compared. Figure 1 shows that the mean of answers to the question ‘’I think that white/black/yellow/etc. is an aggressive colour’’ on a 7-point scale. Figure 1 shows that the colour red ($M_{AGG} = 4.90$) and black ($M_{AGG} = 3.78$) are rated the most aggression exciting by participants. To show the difference between the perceived aggression of red and

other colours a paired sample t-test was conducted between red and the second highest rated aggression-encouraging colour (black). A paired sample t-test shows that there is a significant difference between the perceived aggression of the colours red (M_{AGG} = 4.90, SD_{AGG} = 2.12) and black (M_{AGG} = 3.78, SD_{AGG} = 2.08), with $t(89)$ = 4.62, $p < .001$. This means participants rated the colour red highest compared to other colours on the question ‘’I think that white/black/yellow/etc. is an aggressive colour’’. A repeated measures ANOVA with pairwise comparison was conducted to measure if participants reported more perceived aggression between R and NR teams than between NR and NR teams. The mean scores for the following conditions were measured and compared, with R(f)-NR (M_{AGG} = 3.02, SD_{AGG} = 1.21), R(nf)-NR (M_{AGG} = 2.37, SD_{AGG} = 1.01), NR-NR(nf) (M_{AGG} = 2.77, SD_{AGG} = .933) and NR-NR(f) (M_{AGG} = 2.28, SD_{AGG} = .903).

Table 2. *Rated aggression of R players and NR players when a foul or no foul was committed.*

Condition	$Mean_{AGG}$	SD_{AGG}
R(f) - NR	3.02	1.21
R(nf) - NR	2.37	1.01
NR - NR(f)	2.28	.903
NR - NR(nf)	2.77	.933

There was a significant difference between these conditions, with $F(3,87) = 20.07$, $p < .001$, $\eta^2 = .167$. A paired sample t-test showed that there was a significant difference between the conditions where a red player committed a tackle against a non-red player (M_{AGG} = 2.37) and between a non-red player committed a tackle against a non-red player (M_{AGG} = 2.77), with $t(89) = 4.19$, $p < .001$. This means that referees perceived a player committing a tackle wearing a red uniform as less aggressive than a player wearing a non-red uniform when no real foul is committed. The second hypothesis is not confirmed based on the video clips

experiment although the participants reported perceiving red as the most aggressive colour compared to other colours.

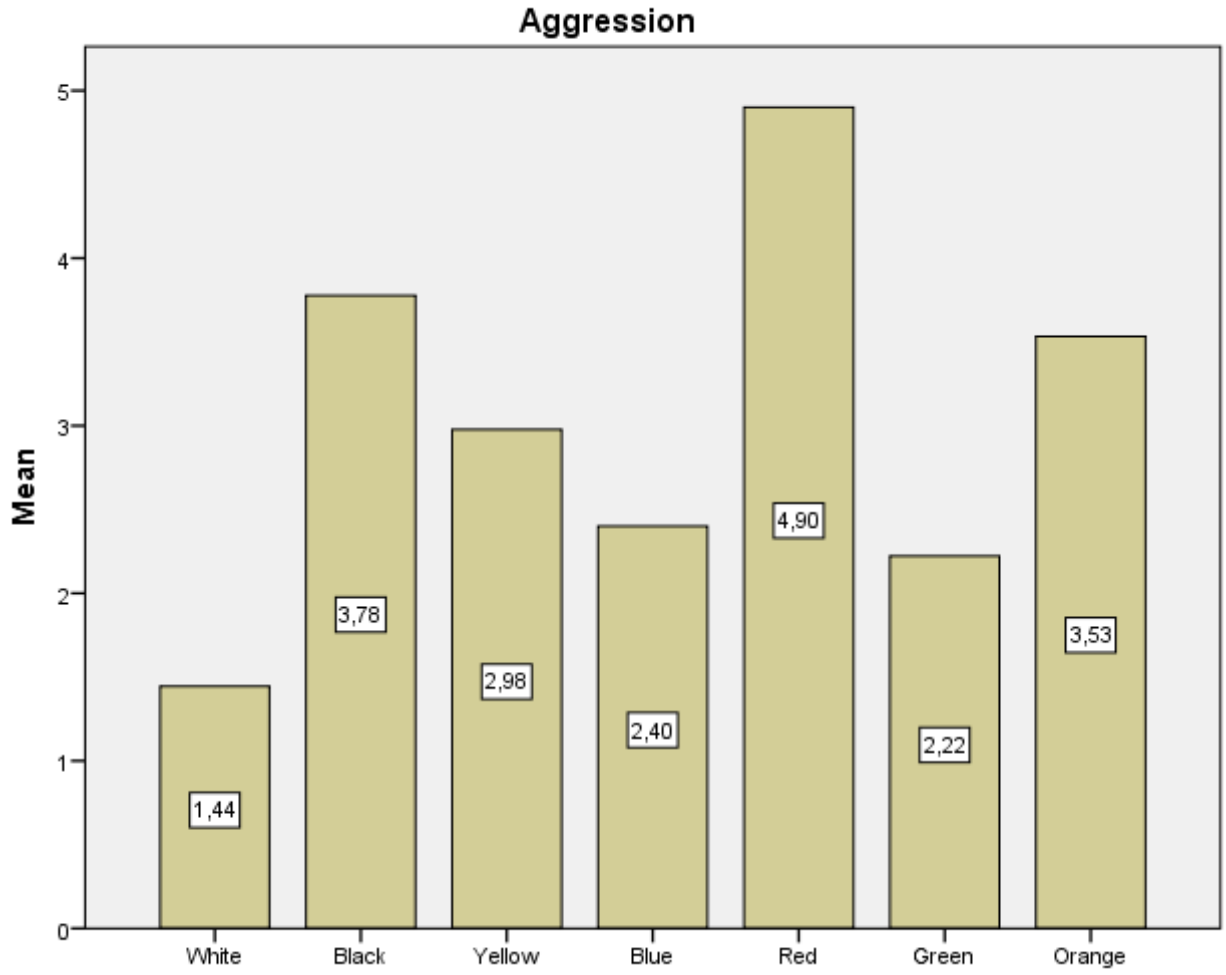

Figure 1. The means of the statements about the perceived aggressiveness and colour.

Hypothesis 3: *Referees perceive teams wearing a red uniform as more dominant than teams wearing a different colour.*

To confirm hypothesis 3 the colours that were rated by the participants as most dominance-inducing were compared. Figure 2 shows that the mean of answers to the question ‘’I think that white/black/yellow/etc. is a dominant colour’’ on a 7-point scale. Figure 2 shows that the colour red (M_{DOM} = 5.09) and orange (M_{DOM} = 3.83) are perceived as most dominant by

participants. To show the difference between the perceived dominance of red and other colours a paired sample t-test was conducted. A paired sample t-test shows that there is a significant difference between the perceived dominance of the colour red (M_{DOM} = 5.09, SD_{DOM} = 1.88) and orange (M_{DOM} = 3.83, SD_{DOM} = 1.87), with $t(89)$ = 7.70, p < .001. This means participants rated the colour red highest compared to other colours on the question ‘’I think that white/black/yellow/etc. is a dominant colour’’. A repeated measures ANOVA with pairwise comparison was conducted to measure if participants reported more perceived dominance between R and NR teams than between NR and NR teams. The means for the following conditions were measured and compared, with R(f)-NR (M_{DOM} = 2.97, SD_{DOM} = 1.17), R(nf)-NR (M_{DOM} = 2.63, SD_{DOM} = .990), NR-NR(nf) (M_{DOM} = 2.90, SD_{DOM} = .914) and NR-NR(f) (M_{DOM} = 2.84, SD_{DOM} = 1.12).

Table 2. *Rated dominance of R players and NR players when a foul or no foul was committed.*

Condition	$Mean_{DOM}$	SD_{DOM}
R(f) - NR	2.97	1.17
R(nf) - NR	2.63	.990
NR - NR(f)	2.90	.914
NR - NR(nf)	2.84	1.12

There was a significant difference between these conditions, with $F(3,87)$ = 4.54, p = .005, η^2 = .018. A paired sample t-test showed that there was a significant difference between the condition where a red player committed a tackle against a non-red player and between the condition where a non-red player committed a tackle against a non-red player, with $t(89)$ = 2.97, p = .004. This means that participants perceived a player committing a tackle wearing a red uniform as less dominant than a player wearing a non-red uniform when no real foul is committed. The third hypothesis is not confirmed based on the video clips experiment

although the participants reported perceiving red as the most dominant colour compared to other colours.

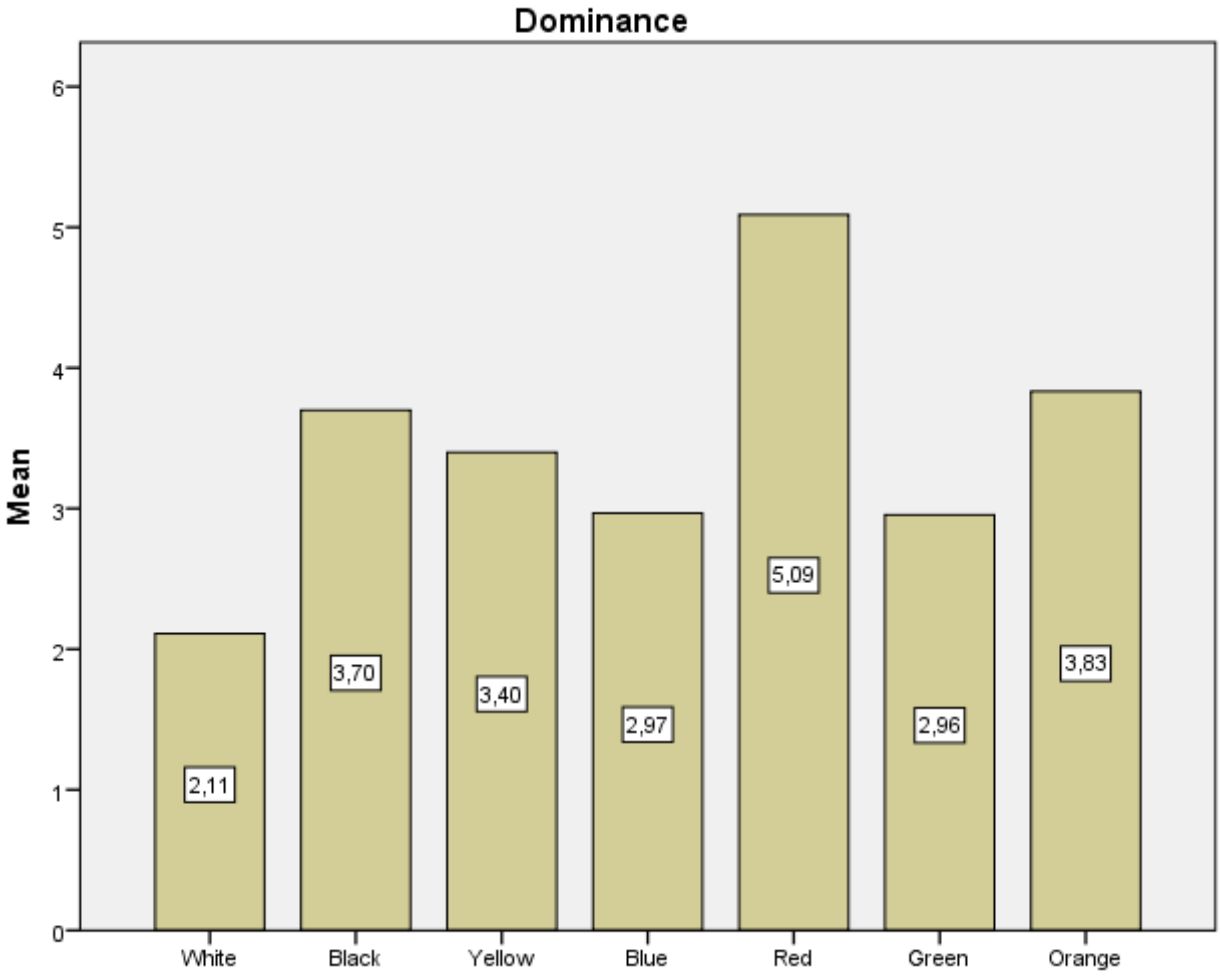

Figure 2. The means of the statements about the perceived dominance and colour.

Discussion

This study explored the influence of uniform colour on the perceived fouls committed by football players. It was expected that red uniforms would elicit higher rated perceived tackles than non-red uniforms (Elliot et al., 2007; Drummond & Quay, 2001; Hagemann et al., 2008). Referees perceived a tackle committed by a player wearing a red uniform as a higher rated

tackle than when a player wearing a non-red uniform committed a tackle when no real foul was committed. Furthermore the aggressiveness and dominance of the same players were measured. Following the results of the video clip experiment referees did not perceive red uniforms as more aggressive and dominant compared to non-red uniforms. Although referees rated the colour red as more aggressive and more dominant than other colours in general.

One of the main strengths of this study is that it's an empirical study with real situations and real decisions by referees. The aim of the study was to create an environment where referees had to make a split second decision just like referees have to in real-life-situations. Unlike to the master thesis of Daníelsson (2016) where only archival data was used. Another strength of this study is that data were collected from 90 participants. These participants provided data about eighteen video clips which provided enough data for a trustworthy result. The details of the footage that was used were made unrecognisable so the chance of club preference or other influencing factors was eliminated.

Theoretical implications

The most important theoretical implication is the contrast in results between the relationship between aggression, dominance and the colour red. The results of the video clip experiment did not show a higher rate of aggression or dominance in teams with a red uniform when players did not commit a foul compared to teams with a non-red uniform although that was to be expected following earlier research (Wiedemann et al.,2015; Krenn, 2014; Hagemann et al., 2008). These researchers did find a connection between uniform colour and aggression or dominance. Hagemann et al. (2008) found that sportsmen wearing red were perceived as more dominant than sportsmen wearing blue within a competitive and contact sports setting. In contrast to football the research of Hagemann et al. (2008) contained data of a combat sport

setting, which football is not. It is possible that in combat sports there's a higher overall tendency of dominance compared to a non-combat sport like football and that may explain why there's no effect of higher perceived dominance and tackles found in this study.

Wiedemann et al. (2015) did find a relation outside of a competitive setting. There is a possibility that a competitive setting calls for aggression independently from uniform colour. Krenn (2014) found some empirical support concerning the association between uniform colour red and aggression. In Krenn's (2014) research tackles committed from behind by a player wearing red were judged more harshly than those of a player wearing a non-red uniform (like blue, yellow and green).

Krenn (2014) did not find a relation between overall tackles, uniform colour and aggression and used video clips as part of their research setup, familiar to this study. An explanation for the discrepancy in the research findings of Krenn (2014) was that there is a relation between tackles from behind, danger, aggression and the colour red. Overall tackles are (despite committed by R or NR playing teams) not directly related to danger and aggression and thus are not perceived as aggressive. In this study no tackles from behind were committed. That means that the outcome of hypothesis 2 is in line with the outcome of Krenn (2014).

Caldwell and Burger (2011) did not succeed either in finding a relation between uniform colour and aggression. They used archival data to search for a relation, like score sheets. The design of this study is more experimental and therefore differs from Caldwell and Burger (2011) design. Although two designs differed a relation between uniform colour and aggression was not found. There is a possibility that the participants in this study did not perceive the players as aggressive or dominant because they were looking at video clips instead of being in real life football situations. There is a possibility that the video clips were

too short in length for the participants to get cognitively connected to the moments and therefore did not perceive the tackles as aggressive or dominant per se. Another explanation is that overall tackles are just not perceived as aggressive or dominant as tackles from behind, like in Krenn's (2014) research. If a tackle from behind is carried out incorrectly, the chance of injuring an opponent increases compared to other (overall) tackles. In this regard, FIFA also emphasized in the laws of the game that a tackle from behind which endangers the safety of an opponent has to be sanctioned by a red card (FIFA, 2013). Referees are aware of those laws and therefore perceive overall tackles probably as less aggressive.

The failure to find a relation between uniform colour and aggression does not mean the relation does not exist. It is possible that researchers who take the limitations of this study into account might find the effect when using different procedures or measures of aggression and dominance. Nonetheless the most appropriate conclusion from this study and the literature mentioned above seems to be that there is little evidence either that football players wearing red uniforms are perceived by referees as being more aggressive and dominant.

Another theoretical implication is that the mean scores of the measurements of rates of fouls were all below three on a 7 point-scale. That mean scores that the participants did not rate the tackles as heavy. A mean score of below three on a 7 point-scale is low but comprehensible because the footage showed debatable moments. If the mean scores of the measurements would have turned out higher it would possibly suggest that the footage did not show debatable moments but clear violations.

The results of this study could have implications for further research. For example in the domain of colour psychology or sports psychology. But also in the domain of decision making in social psychology. This study focuses on controversial situations where it is not clear when

someone crossed a line and commited a foul. If this effect was to be projected to research about negotiations or bargaining it could have consequences. In these contexts it is possible that one person attributes more aggression or dominance in a debatable situation to the other person than is at stake because of the influence of a red shirt or environment.

Practical implications

This study does not solve the problem why referees perceive higher rated tackles made by teams playing in red uniforms compared to teams not playing in red uniforms. That's why no concrete recommendations can be made based on this study. This study showed that in debatable moments referees perceive tackles as higher rated when actually no foul was committed by teams wearing red. A red uniform might not be the best choice (for example in the away-kit of a sports team) because it can create a disadvantage throughout a whole season. On an annual basis lots of unnecessary fouls can be avoided. On the other hand it is important for referees to know that they have to keep this information about the effect of uniform colour in mind. Coaches could use the information about the impact of red uniforms. They can use it to train their defenders in a certain way to avoid causing unnecessary penalties when playing in red. Even sport clubs can use this information to inform parents on the side line to react appropriately to red uniforms of the junior teams. In order to minimize their perceived aggression and/or dominance.

Limitations and suggestions for future research

This study contains a couple of limitations. This study did not clearly state what causes referees to perceive debatable fouls as rated higher in red teams than in non-red teams. Participants showed that the colour red relates to aggression and dominance but the causation

is not clearly investigated. Furthermore the coding of the footage (whether a foul was a foul or a non-foul) depended on the decision made by the referee in the real football match. There is a possibility that a certain decision about a debatable foul was made incorrectly during the time of the real match. Although every video clip was debatable and the real outcome of the foul was not relevant, it is a limitation because using other video clips in the analysis could show a somewhat stronger or weaker effect.

Another limitation is that a lot of participants dropped out. 621 referees participated but the responses of only 90 participants were useful. One explanation could be that the link directing to the online survey could only be used once by each participant. This decision was made because otherwise it would be possible to watch the video clips multiple times and correct the pre-made decisions.

The third limitation is that the invasion of light was not homogeneously corrected for all the video clips. The result of this might be that referees were influenced by the part of the day a video clip was shot and played. The colour red is more notable during the morning or afternoon than in the evening when being seen compared to other colours.

A fourth limitation about this study is that the question ‘’How would you rate this foul?’’ provides no direction. There is a possibility that referees rated a foul as three on a 7 point-scale meaning that the other player made an irreverent dive instead of meaning the actual player committed a foul of rating three.

Before real recommendations can be made from this (area of) study it is important to deepen this area even more. For example by studying the relationship between red (e.g. blood) and impactful and painful memories of referees and players. The color-in-context states that

responses to colours are partly driven by social learning (Elliot et al., 2007). It should be valuable to investigate the relationship between social learning and perceived aggression and dominance of the colour red.

Conclusion

In conclusion, this study showed that referees perceived a foul committed by a player wearing a red uniform as a higher rated tackle than when a player wearing a non-red uniform committed a tackle when no real foul is committed. Furthermore based on the results of the video clip experiment referees did not perceive red uniforms more aggressive and dominant compared to non-red uniforms. In contrast referees did perceive the colour red as more aggressive and more dominant compared to other colours.

Literature

Adams, F., & Osgood, C. (1973). A cross-cultural study of the affective meanings of colour. *Journal of Cross-Cultural Psychology, 4*, 135-156.

Anderson, C. A., & Bushman, B. J. (2002). Human aggression. *Psychology, 53*, 27.

Atrill, M. J., Gresty, K. A., Hill, R. A. & Barton, R. A. (2008). Red shirt colour is associated with long-term team success in English football. *Journal of Sports Sciences, 26*, 577-582.

Buss, A. H. (1961). *The psychology of aggression.* Hoboken, NJ: John Wiley.

Caldwell, D. F. & Burger, J. M. (2011). On Thin Ice: Does Uniform colour Really Affect Aggression in Professional Hockey? *Social Psychological and Personality Science*, 1-5.

Daníelsson, P. (2016). Seeing Red: The Effect of the Color Red on Two-Minute Suspensions in Team Handball (Master's thesis, Leiden University, The Netherlands). Retrieved from Master Thesis coordinator.

Edwards, W. (1954). The theory of decision making. *Psychological Bulletin, 4*, 380-417.

Elliot, A. J. & Maier, M. A. (2012). C*olor-In-Context Theory.* (63-103). Oxford: Academic press.

Elliot, A. J. & Maier, M. A. (2015). colour psychology: effects of perceiving colour on psychological functioning in humans. *Annual Review of Psychology, 65*, 95-120.

Elliot, A. J., Maier, M. A., Moller, A. C., Friedman, R. & Meinhardt, J. (2007). colour and Psychological Functioning: The Effect of Red on Performance Attainment. *Journal of Experimental Psychology, 136*, 154-168.

Feltman, R., & Elliot, A. J. (2011). The influence of red on perceptions of dominance and threat in a competitive context. *Journal of Sport Exercise Psychology, 33*, 308–314.

FIFA. (2013). *The laws.* Retrieved from http://www.fifa.com/classicfootball/history/ the-laws/from-1863-to-present.html.

Frank, M. G., & Gilovich, T. (1988). The Dark Side of Self- and Social Perception: Black Uniforms and Aggression in Professional Sports. *Journal of Personality and Social Psychology, 54*, 74-85.

Furley, P., Dicks, M., & Memmert, D. (2012). Nonverbal behavior in football: the influence of dominant and submissive body language on the impression formation and expectancy of success of football players. *Journal of Sport Exercise Psychology, 34*, 61–82.

Greenlees, I., Leyland, A., Thelwell, R., & Filby, W. (2008). football penalty takers' uniform colour and pre-penalty kick gaze affect the impressions formed of them by opposing goalkeepers. *Journal of Sport Science, 26*, 569–576.

Hagemann, N., Strauss, B., & Leissing, J. (2008). When the referee sees red. *Psychological Science, 19*, 769-771.

Hill, R. A. & Barton, R. A. (2005). Red enhances human performance in contests. *Nature, 365*, 293.

Hill, R.A. & Barton, R.A. (2005). Sporting contests: Seeing red? Putting sportswear in context. *Nature, 437*, 10–11.

Krahé, B. (2013). *The social psychology of aggression*. Psychology Press.

Krenn, B. (2014). The impact of uniform colour on judging tackles in association football. *Psychology of Sports and Exercise, 15*, 222-225.

Nathans, J., Thomas, D., & Hogness, D. S. (1986). Molecular genetics of human colour vision: The genes encoding blue, green, and red pigments. *Science, 232*, 193-202.

Olde Rikkert, J., De Haes, V., Barsingerhorn, A. D., Theelen, T. & Olde Rikkert, M. G. M. (2015). The colour of a football outfit affects visibility and team success. *Journal of Sport Sciences, 33,* 20, 2166-2172.

Oudejans, R. R., Verheijen, R., Bakker, F. C., Gerrits, J. C., Steinbruckner, M., & Beek, P. J. (2000). Errors in judging 'offside' in football. *Nature, 404*, 33.

Plessner, H., & Haar, T. (2006). Sports performance judgments from a social cognitive perspective. *Psychology of Sport and Exercise, 7*, 555–575.

Rowe, C., Harris, J., & Roberts, C. (2005). Seeing red? Putting sportswear in context. *Nature, 435,* E10.

Setchell, J. M., & Wickings, E. J. (2005). Dominance, status signals, and colouration in male mandrills (Mandrillus sphinx). *Ethology, 111*, 25–50.

Ten Velden, F. S., Baas, M., Shalvi, S., Preenen, P. T. Y., & De Dreu, C. K. W. (2012). In competitive interaction displays of red increase actors' competitive approach and perceivers' withdrawal. *Journal of Experimental Social Psychology, 48,* 1205–1208.

Turatto, M.,Vescovi, M. & Valsecchi, M. (2006). Attention makes moving objects be perceived to move faster. *Vision Research, 47,* 166-178.

Valdez, P., & Mehrabian, A. (1994). Effects of colour on emotions. *Journal of Experimental Psychology, 123*, 394-409.

Wiedemann, D., Burt, D. M., Hill, R. A. & Barton, R. A. (2015). Red clothing increases perceived dominance, aggression and anger. *Biology letters, 11*:20150166.