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The influence of jersey colour on decision making of the referee.

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Abstract

The aim of this study was to question whether the colour red had an influence on a football referee judging a tackle. This was tested with an online questionnaire containing 18 video clips in a random order consisting different tackle situations. After the video clips there were a few statements about the perception of colour. The football referees that participated to this study had to have at least one-year experience as a football referee at any level. By analysing the data, we saw that if the tackling player wears a red jersey, his or hers foul would be rated more as an actual foul than players wearing a different colour jersey. The most interesting finding was that this also occurred when the player in the red jersey tackled in a non-rule violating way. Football teams wearing a red jersey were also perceived as more dominant and aggressive than teams wearing a different colour jersey. This study suggests that based on the results, football referees are influenced by colour and that wearing a red colour jersey has the most influence on the referee.

Introduction

It is the 13th of October 1993, the striker from the English national football team is heading towards the goal from the Netherlands. The Dutch captain and defender Ronald Koeman tries to intercept the ball, but instead tackles the English striker. Everybody knows that this is going to be a red card and a bad start for the Dutch national team. Instead, the referee decides that it is going to be a penalty and a yellow card for Ronald Koeman. The English penalty kicker misses the penalty and later on Ronald Koeman opens the score with a free kick, which leads to a 2-0 win for

the Netherlands. Due to this result the English team cannot qualify for the World Championships in USA.

Nowadays referees are getting more help in judging fouls during a football match than 24 years ago. There is more at stake, which means that every faulty decision by the referee can lead to huge consequences. Therefore the FIFA (the international federation for football) decided to introduce new ways to help the referee and minimalize the chances of faulty decisions. Football started with one referee and two assistant referees during the match. Since 2014 the FIFA added two extra assistant referees to gain more viewpoints on the field, so that every decisions can be made as clear as possible. This is only available during international football matches. Since 2016 the FIFA is also testing the possibility of a video referee, similar to the model in field hockey. These changes have been devised to minimalize the probability of a wrong decision by the referee, which could lead to drastic consequences. The main idea by these changes is that by adding more viewpoints, the probability that anything will be missed will decrease. All of these technical support systems do not solve the problem of erroneous referee decisions, because referee's decisions might also be biased by cognitive factors. For example, Oudejans, Verheijen, Bakker, Gerrits, Steinbruckner and Beek (2000) found that for assistant referees the position of the assistant referee influences the perception on players being offside or not. This problem could be reduced, because adding more referees, adds more viewpoints, which can reduce the probability of a wrong decision. But there are also cognitive factors that influence the referee's decision, which cannot be illuminated that easily. An example of a cognitive factor that cannot be illuminated easily is the influence of colour. This research aims to investigate if the colours

influence the perception of referee's on fouls. Next, I will describe the literature on the perception of colour, the perception of the colour red and colour in sports. I will end the introduction with the hypothesis of our research questions.

Perception of colour

Prior research shows that colour has an influence on the perceiver (Goldstein, 1942; as described by Elliot, 2015). Based on Goldstein's results many researchers were interested in doing research on the effect of colours. Goldstein (1942; as described by Elliot & Maier, 2012) found that colours have different influences on the psychological responses of the perceiver. For example, Goldstein found that the colours red and yellow are more stimulating and disagreeable; they help to focus your attention to the outward environment and produce forceful actions. Many researchers tried to replicate his research and (later) added that these findings can be defined by the fact that colours have different wavelengths. Colours are very important in sports, for colours divide the teams, the yellow or red card can rate a foul and colours divide the referees from the players. Some colours have more influence on the perceiver than others. Colour information happens automatic and unconscious (Ling & Blades, 1996). This means that the process behind seeing colour is automatic and unconscious. This makes it therefore more difficult to reduce the effects of colour information on the perceiver.

The Colour-in-Context Theory (Elliot and Maier, 2012) explains and predicts the relations between colour and affect, cognition and behaviour. First, the theory explains that colour has meaning. This means that colours have meaning to the perceiver, next to their aesthetic values. Second, colours influence psychological

functioning. Colours associated with positive values promote approach-orientated psychological processes, where colours with a negative value promote avoided-orientated psychological processes. Third, colour effects are automatic. This means that the effects of perceiving colours happen automatic, this also happens when the perceiver is not aware of the colour. Next, colour responses are biologically and learned driven. For example, theorists believe that our eyes improved, because it raised our chances on survival. And colour gives a signal to certain objects in the wild, therefore species learned for example which fruit to eat and which fruits are inedible. Relations between colour perception, affect, cognition and behaviour work reciprocal. This means that your response to colour can define your psychological state. These responses to colour are context specific, which means that various colours are related to different responses depending on the context where the colour has been showed.

Perception of the colour red

Jacobs and Suess (1975) state that red and yellow are more arousing than blue and green. This arousal results in a higher unpleasantness towards the colours yellow and red. It also results in higher results on multiple anxiety tests. These results are an example of the fact that the colour red has an influence on the perceiver. Other research has found that the colour red is associated with dominance. Hill and Barton (2005) found that the colour red signals dominance in aggressive situations for non-human animals. This is a cue that the colour red is biologically associated with dominance in aggressive situations. Drummond and Quay (2001, as described in Elliot, 2015) state that aggressive encounters lead to a rise of testosterone and that

makes the face redder. These results suggest that the colour red is associated with dominance and aggressiveness. Wiedemann, Burt, Hill and Barton (2015) state that wearing red biases the perception of the perceiver. They state that strangers that are wearing red are perceived as more dominant, aggressive and angry. The limitation with this result in comparison with our research is that these results are found in a non-competitive setting. We are wondering if this result will be comparable in a competitive setting.

Colours in sports

Earlier research was primarily based on jersey colour and winning or the emotions that are associated with jersey colour. Caldwell and Burger (2010) found that there is no evidence for a higher level of aggressiveness for black and red jerseys in professional ice hockey. This research was based on the idea that black is highly associated with something bad (Frank & Gilovich, 1988). These results suggest that the colour red is associated with dominance and aggressiveness. Krenn (2013) did research on the influence of jersey colour and the perception of fouls in American Football. He found that participants with an understanding of the rules of American Football reported more fouls from behind by players with a red jersey than for other colours. Krenn thinks that this is little evidence for the link between the colour red and the perception of aggressiveness.

Barton and Hill (2005) state that wearing red in sports may cause dominance and could lead to a competitive advantage. The researchers found during the European Football Championships in 2004 that teams who played with a red jersey

showed better results than whenever they played with a jersey with a different colour. It is thought that the colour red influences the player's mood, emotions and expressed anger. And according to Barton and Hill (2005) this enhances the performance by the players who wear red jerseys. Further research based on the jersey colour red in football found that teams that wore red jerseys in the English Football leagues are associated with long-term success (Atrill, Gresty, Hill & Barton, 2007). The researchers think that this is caused by the fact that there is a possibility that perceiving red impairs performance. This means that the opponent's performance impairs whenever they see a competitive red team, but this idea by the researchers need more evidence.

In football matches there are many situations where aggression is exposed. The referee has to rate and evaluate these situations and may have to respond to it. The most common aggressive situation that the referee has to evaluate is a foul. A foul is an illegal tackle by a player to an opponent that leads to a free kick, or a penalty kick when conducted in the penalty area. Referees have to judge these fouls and decide if these fouls should be awarded with a card or not. The FIFA thinks that by adding extra referees and a video referee, the amount of wrong decisions will decline. According to Caldwell and Burger (2010) the jersey colours black and red are not related to a higher level of aggression in professional ice hockey. Earlier we stated that the colours black and red are associated with aggression and dominance. It is possible that this is not the case with ice hockey, due to the fact that it is allowed to fight during professional ice hockey matches.

Hypotheses

In professional football different rules apply than in ice hockey and therefore further research on the influence of jersey colour could lead to different results. In the present study we are specifically looking at the influence of jersey colour on the referees perception. As previously stated, the colour red is associated with dominance and aggression (Drummond & Quay, 2001). Therefore we expect to see the following hypothesises.

Hypothesis 1: We expect that fouls, committed by teams wearing a red jersey, will be rated more as an actual foul than teams wearing a different colour.

Hypothesis 2: The teams with a red jersey will be evaluated as more aggressive comparing to teams wearing a different coloured jersey.

Hypothesis 3: The teams with a red jersey will be evaluated as more dominant than teams wearing a different coloured jersey.

Method

Participants

The study was conducted with 621 participants with 90 participants finishing the questionnaire; the questionnaire consisted of 4 females and 86 males (M_{Age} = 33.46, SD_{Age} = 14). The participants were contacted by email, referee groups on Facebook and by the Dutch referee union. The participants are classified on their experience as a referee ($M_{Experience} = 6.98, SD_{Experience} = 7.56$). The participants

must have at least one-year experience as a football referee. The participants were not forced to finish the questionnaire, but the participants with missing variables were deleted in the analysing phase. The participants who finished the questionnaire got a chance on winning a 50-euro gift certificate. The winners were contacted by email after the research was finished.

Design and procedure

This research is a 3x2 design, with a non-red player tackling a red player, a red player tackling a non-red player and a non-red player tackling a non-red player vs foul, non-foul. The questionnaire starts with information about the research. After the demographic questions, the real experiment begins with an example video clip of a tackle. Participants watched this 9 seconds clip showing a tackle during a football and are subsequently asked if they would react as a referee. Depending on their answer, the participants will get feedback on their decision. This feedback is based on the decision of the referee during the actual match. We did this to prime the participants to their roll as a referee. After the example fragment, participants are shown 18 fragments of tackles in a random order. After each fragment, participants were asked to rate it. The participants did not get any feedback after the following situations. Each video clip consists of 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?". The videos are divided in six conditions (R-NR foul, R-NR non-foul, NR-R foul, NR-R non-foul, NR-NR foul and NR-NR non-foul). Each scale is a 7 point-scale. The clips are shown in a random order.

Dependent measures

After each clip, participants were asked "would you react as a referee?", "How would you rate this moment?", "Would you give this player a card? If yes, which one?", "How dominant is this player?", "How aggressive is this player?" and "Do you have something to add to this situation?". After the participants watched and rated the 18 clips, the participants were asked statements about colours and the participants perception on aggressiveness and dominance, for example "I think that white is a dominant colour" and "I think that black is an aggressive colour". The participants were asked to give an answer on a 7 point scale, were 1 is "not true" and 7 "very true". The colours were based on the same colours that are showed in the clips. Finally the participants had to choose a colour when they thought about dominance and aggressiveness.

Materials

We have collected 18 tackle situation video clips from YouTube originated from the Tweede and Derde Divisie from the Netherlands (semi-professional football leagues). We have selected these divisions to reduce any supporters' bias. The video clips are selected on red (R) and non-red (NR) teams. Some clips consisted of a foul and the other clips did not show a foul. The clips are divided in a player in a red team tackling a player from a non-red team in a forbidden way (R-NR foul), a player from a red team tackling a player from a non-red team in a non-rule violating way (R-NR non-foul), a player from a non-red team tackling a player from a red team in a forbidden way (NR-R foul), a player from a non-red team tackling a player from a red team in a non-rule violating way (NR-R non-foul), a non-red player tackling a non-red player in a forbidden way (NR-NR foul) and a player from a non-red team

tackling a player from a non-red team in a non-rule violating way (NR-NR non-foul). Each clip has been edited; each clip has the same background sound, the clip stops right after the moment of the tackle, the referee and his assistants are blurred, the names of the teams are blurred and the reaction of the referee is blurred out. Each situation takes between 5 and 10 seconds. We have edited the clips with the idea that the participants will be focused on the tackle itself and have no distractions or influences on their decisions.

The edited videos are uploaded on an online questionnaire (Qualtrics). Participants could click on an open link that directs them to the questionnaire. The questionnaire consisted of the 18 video clips at a random order. Each clip consisted with the same questions. After the clips we have asked the participants to give answers to statements about colours.

Results

First, we try to give an answer to the question if the colour red has an influence on the decision of the referee. To test this question we computed a mean of the scores of the question "Would you rate this as a foul?". These scores are divided in the four condition groups. The means of the R-NR non-foul and NR-R non-foul situations will be compared to give an answer to the question whether the colour red influences the decision of the referee. If the colour red does not have any influence on the decision, we expect to see that the participants will rate non-fouls as an actual non-foul. A paired samples t-test was conducted to compare R-NR non-foul (M = 2.7667, SD = .93142) and NR-R non-foul (M = 2.4296, SD = .83201). There was a

significant difference between the conditions $t(89) = 3.370, p = .001$. This partially confirms that the colour red has an influence on the decision of the referee. We have conducted a paired samples t-test between R-NR non-foul and NR-NR non-foul ($M = 2.3889, SD = 1.12873$) to check if there is a difference between groups. There is a significant difference between the conditions $t(89) = 2.835, p < .025$).

To confirm the first hypothesis more, a repeated measures ANOVA is conducted to measure the difference in means for the 3 conditions (R-NR, NR-R, NR-NR) when non-foul is committed and the factor rate of foul. The repeated measures ANOVA F(1.759) = 5.460, p < .01 shows a significant difference in means between the ‘’R-NR-non-foul’’ (M = 2.767), the ‘’R-non-foul-NR ‘’ (M = 2.430) and the ‘’NR-NR-non-foul’’ (M = 2.389) conditions.

We have computed multiple paired-samples t-test to test whether people see the teams with a red jersey as more aggressive than non-red teams. We have tested t-tests to test whether people think that the colour red ($M = 5.09, SD = 1.882$) has difference in dominance than the colours white ($M = 2.11, SD = 1.386$), black ($M = 3.70, SD = 1.887$), yellow ($M = 3.4, SD = 1.779$), blue ($M = 2.97, SD = 1.547$), green ($M = 2.96, SD = 1.323$) and orange ($M = 3.83, SD = 1.868$). Every combination was significant ($p < 0.05$). Check Table 1 for the exact statistics.

Table 1: paired sample T-tests dominance

	Mean	SD	t	df	p
Red-	2.978	2.109	13.393	89	.000

White					
Red - Black	1.389	2.108	6.251	89	.000
Red - Yellow	1.689	1.924	8.330	89	.000
Red - Blue	2.122	1.936	10.398	89	.000
Red - Green	2.133	1.762	11.484	89	.000
Red - Orange	1.256	1.547	7.697	89	.000

Table 1. This table contains the exact statistics of the paired samples t-tests on dominance and colours. All effects are significant.

These results state that there is a difference in dominance between the colour red and the other colours. We have added Figure 1 to check if the colour red is more dominant than the other colours. Figure 1 shows that the mean for the statement "I think that red is a dominant colour" ($M = 5.09, SD = 1.882$) is higher than the other statements. Based on Figure 1 and Table 1 we can state that our participants think that red is more dominant than the other colours.

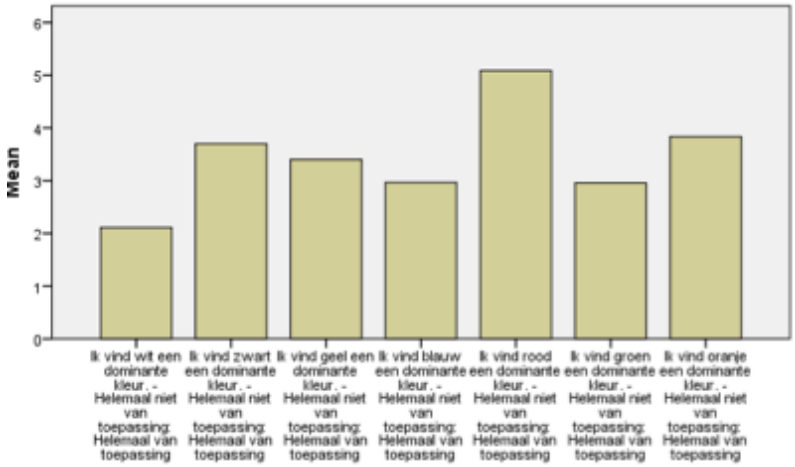

Figure 1. This figure shows the means of the statements about the perceived dominance and colour.

To answer if teams with a red jersey are more dominant than non-red teams, we have conducted the same t-tests as in the second hypothesis, but now we are comparing the scores on aggressiveness between the colour red and the other colours. The results on the paired-samples t-tests are reported in table 2.

Table 2: paired sample T-tests aggressiveness

	Mean	SD	t	df	p
Red-White	3.456	2.204	14.874	89	.000
Red - Black	1.122	2.307	4.615	89	.000
Red - Yellow	1.922	1.996	9.138	89	.000
Red - Blue	2.500	2.073	11.440	89	.000

Red - Green	2.678	1.942	13.081	89	.000
Red - Orange	1.367	1.575	8.230	89	.000

Table 2. This table contains the exact statistics of the paired samples t-tests on aggressiveness and colours. All effects are significant.

The results in table 2 show that the participants significantly perceived a difference in aggressiveness between the colour red and the other colours. Figure 2 shows that the mean of the strength of their view on the statements is highest for the colour red ($M = 4.90, SD = 2.115$).

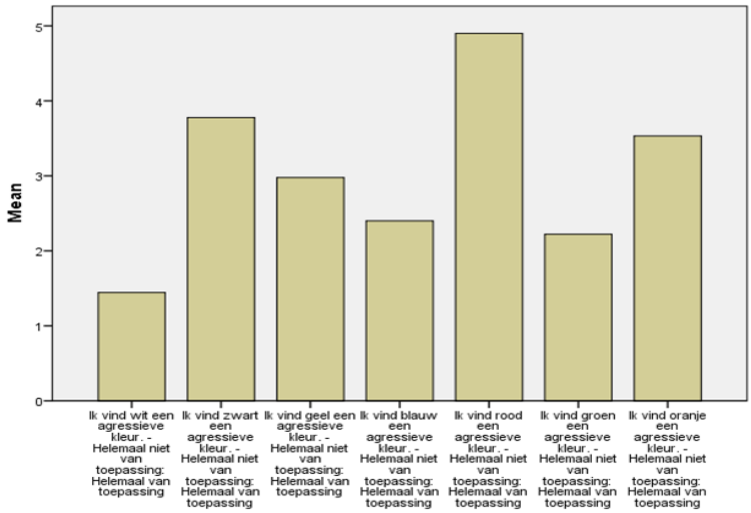

Figure 2. This figure shows the means of the statements about the perceived aggressiveness and colour.

The scores on the statement "I think red is a dominant colour" and "I think red is an aggressive colour" are strongly correlated $r(90) = .838, p < .001$. This result suggests that participants who score high on one of the items will also score high on the other item. This statistic shows that dominance and aggressiveness are traits in the same direction. Therefore, we expect to see no significant difference in what

participants score on both statements. The paired samples t-test between these statements is not significant, which means that there is no difference between the scores on both statements.

The participants that rated non-fouls by red playing teams as an actual foul are strongly correlated with their perception on dominance ($r(90) = .713, p < .000$) and aggressiveness ($r(90) = .694, p < .000$).

Discussion

The available evidence of our research seems to suggest that referees are influenced by colour. The present data seems to suggest that the colour red has the most influence on referees. We claim this finding on the fact that in our study the participants rated more fouls for non-fouls by red playing teams than for non-red playing teams. This is the most interesting part in our study; because this implies that there are more factors than rules alone that rate tackles. This could mean that adding referees to judge a situation does not have to mean that they will judge the tackle correctly.

Dominance and aggression are traits that have an influence on judging tackles. The data based on our study suggests that participants perceive dominance and aggression are highest on judging the colour red. This confirms the previous findings by Wiedeman et. al (2015) that wearing red influences the perception of the perceiver. In this case, wearing red as a football player shows traits of dominance and aggressiveness to the perceiving referee. Our findings suggest that wearing red could

be disadvantageous for the team, because this biases the judgment on their tackles. This could lead to more rated fouls while the tackle should not be judged as a foul.

We cannot imply that adding referees to a football match won't work, because the FIFA probably based their decision on adding referees on research. We do suggest that there are factors that influence perceivers unconsciously and that the perceivers should be aware of these factors.

Implications and future research

Our findings are statistically not very strong, due to the fact that our hypotheses are confirmed by paired samples t-test. This is statistically not the strongest way of doing research. Further research should try to answer different research questions that have to be answered with different analytical tests. We do think that our present study is strong enough, because this is an incoming research field and further research based on our research is possible.

Another implication of our present study is that it is based on the judgment of one participant only. In a real setting, referees have multiple assistant referees who can help with their judgment on situations. These assistant referees can have the final decision in certain situations when the referee cannot judge the situation accurately. There is a possibility in future research that people have to work in teams to judge tackles or situations, because in a real setting referees also discuss situations. If a similar study is indeed carried out, then the researchers should take time in to account. Referees have to make judgments in a split-second, where there is little time to

discuss the situation. This should be replicated in the experiment if researchers decide to do a similar study as this example.

Our research group ($N = 90$) is statistically useful, but during our research we had a lot of dropout. We think that this mainly happened due to the fact that we started our search on participants on Facebook. Many people could feel that they want to participate in our research, but had to dropout as soon as they saw that they had to have at least one-year experience as a referee. This means that they started the questionnaire not knowing that they eventually had to dropout. We have also seen in our results that people stopped the questionnaire during the video clips and we think that this happened due to the fact that it took too many time for the participant to finish the questionnaire. In our defense, we have clearly stated at the beginning of our research how much time it would take to finish the questionnaire and that participants had to have at least one-year experience to participate to our research. We conclude that people who stopped during the questionnaire were not intrinsically or extrinsically motivated enough to finish our questionnaire.

Our main result is based on the question "Would you rate this foul?", this suggests a subjective answer. To explain, this means that someone does not have to react to the tackle if the referee gives the tackle a "2" on a 7 point scale. This makes it highly subjective, because another participant could whistle for a foul that has been rated as "2" on a 7 point scale. This means that it is difficult to conclude on which score someone would react. This is what it also makes it a sport, because there is enough space for the referee to control the game in a way that people like it, without

violating the actual rules. This problem solved itself, because the means were closely to 3, suggesting that the participant would judge the tackle or situation as a foul.

Finally our study consisted of highly discussable situations, which was needed otherwise the situations would be too obvious and we would probably not see significant results. This also means that participants judged the situation, but could not elaborate who made the foul. In some situations it was possible that a player dived before the tackle. In a real situation the diving player would get a yellow card and a free kick for the opposing team. In our study a similar situation could mean that the participant was judging the other team and that influences our result. We think that the participants were primed in a way that they were mainly focused on the tackling player. We think that when a participant thought that a player dived that they would judge the situation as a non-foul by the tackling player.

There is enough to discuss and think about our research, but we do think that the results can trigger future research.

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