Process and Validity of Offside Fouls

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ABSTRACT

This study aims to review the effects of evaluating a problem that grows in difficulty, while also measuring eyemovements, saccades, and fixation, which are all data points obtained by eye tracking.

KEYWORDS

eye tracking, visual attention, cognitive load, offside, fixation duration, saccades

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1 INTRODUCTION

The importance of how to correctly determine an offside foul is an important skill for a futbol referee. Even in such a valued position, the referee is able to make changes that are pivotal to the outcome of the game. (reference) According to PGMO, referees make 355 offside calls, and 49 of those calls are incorrect. Due to the advancement of technology, FIFA (International Federation of Association Football) aims to decrease the amount of erroneous calls made by the referee. The way this is achieved is by the use of VAR (Video assistant referee), which provides the referee with a still image of the play. The referee then makes a revaluation if to keep the same ruling on the play, or have it overturned. FIFA enacted this rule to account for human error made by the linesman/referee. First of all, we need to know the latest offside rule, and secondly, understand the application of eye tracking technology combined with the football offside rule judgment skills and the convenience it brings. More precise offside calls can be made can be enhanced by using eye tracking devices, fixation duration will show how long a participant looks at the offside line, passer, receiver, and the saccade movements will show how often the participant shifts focus between objects. The goal of this paper is to illustrate how the difficulty of the review of an offside call will affect the participants saccadic movements, and its fixation duration. We hypothesize that being presented a difficult review will increase the number fixations, and having easier ones will increase the number amplitude of saccades.

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Figure 1: Figure 1: Visual of participant evaluating an offsides call, using a Gazepoint GP3 eye tracker.

2 BACKGROUND

Previous experiments done by (FIND AUTHORS), the participants used were novice linesman and professional linesman. The purpose of the experiment was to show whether there was a discrepancy on offside calls between ranking of professions. The experiment was conducted by having two teams of 11 going against each other. Outside of the environment were the linesman who had attached to them eye tracking equipment. The linesman then had to observe the team simulating a real life offsides call, to ensure that an offsides play would occur, the players from both sides were instructed on what kind of offside calls were needed to be made. The three focal points of each of the plays were the passer, the second to last defender (offside line) , and the last attacker. 3 causes were attributed to the incorrect calls, the first being that the linesman wasn't in the proper position towards the offside line. This is the easiest to fix, as the only adjustment that must be made is make sure that the linesman is in line with the second defender. The second cause was due to a perceptual illusion called the flash-lag effect. "A continuously moving object typically is perceived to lead a flashed object in space when the two retinal images are physically aligned", meaning that due to the momentum of the attacker moving away from the defender, it appears that the attacker is farther away from the offside line when the pass is made. The third cause is the shift-gaze affect. This effect occurs when the eyes must complete a saccade to a fixation of a point. Errors in judging offside were due to the time taken to shift gaze from the player releasing the ball to the player receiving the ball, implying a time delay.

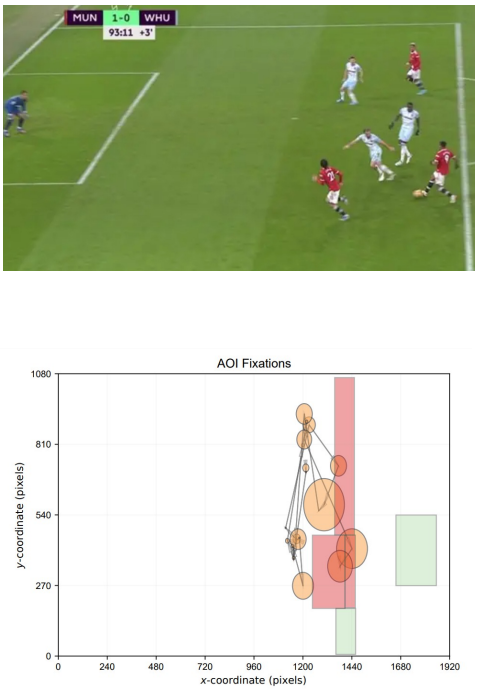

Figure 2: Top image is what the Participant has to evaluate. Bottom image is the fixations and saccadic movements of a controversial offside call

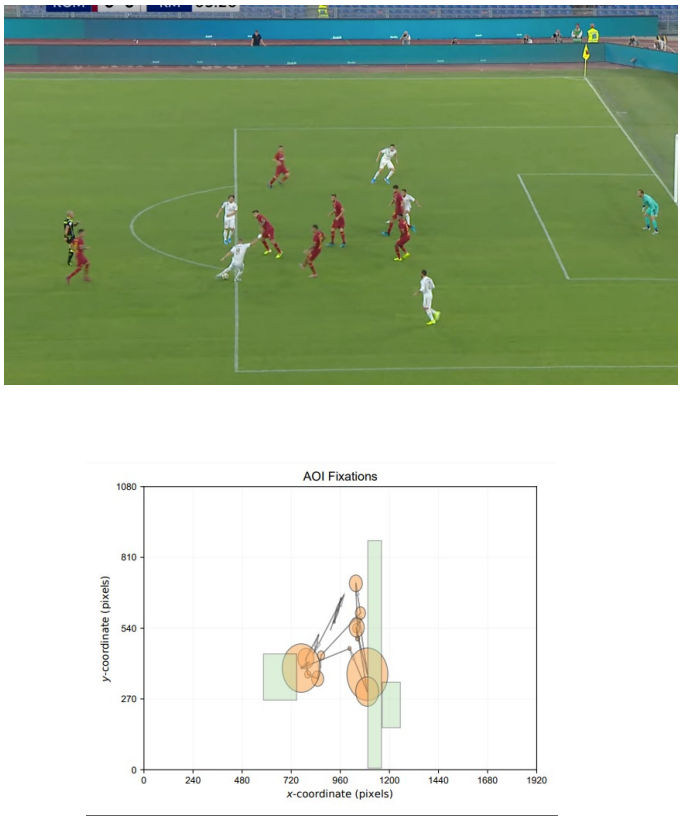

Figure 3: Top image is what the Participant has to evaluate. Bottom image is the fixations and saccadic movements of a controversial offside call

3 METHODOLOGY

3.1 Apparatus

The program was displayed on a 60 mm desktop monitor with a resolution of 1920 x 1080. The computer used was a Dell P2213 with a refresh rate of 60 Hz. A Gazepoint GP3 eye tracker (sampling rate: 60Hz; accuracy: 0.5-1 degree), mounted at the bottom of the desktop monitor, was utilized in this experiment. The participants were seated at a distance of around 65 cm from the eye tracker. This is used to track the eye movements of the subject while they are evaluating offside calls.

3.2 Participants

This experiment was able to gather a sample size of 11 college students. All of them were contacted in person, or phone, and were willing to participate in the experiment. The participants were all stated that they had normal vision, or had aided vision for the tests. It seemed like at first that a familiarity test would be made, but all participants proved to have a background in futbol. Only one test had to be removed due to participant error during testing.

3.3 Procedure

Before the start of the experiment, participants will be introduced to a short crash course on what an offside is. To stay consistent, all participants will experience the same lesson on what an offside is. If needed, questions can be asked to further clarify the rules. Then, a tutorial will be shown to the participants, in this tutorial each type of offside difficulty will be shown, and how the keyboard will be used to determine whether the image shows an offside or not. In the experiment a calibration will be made before the tests. Then 6 (Figure2) images will be shown for 5 seconds each, after each image passes, the participant will give their answer on whether the image shows an offside foul, via keyboard input. Then, data from the experiment will be collected.

3.4 Stimuli

There will be 6 images to choose from. Each image was chosen specifically so that there was a clear passer, receiver, and offside line (Figure 3). The images also had to have a clear direction of what side the attacker running to (the left side, or right side), this is prevent the participant from getting confused on whether a call can be made to be offside or onside. Another attribute of the image that was looked for was the angle the picture was taken from, previous experiments have shown that when the referees are given an angled image of still play, they are more likely to make a mistake. This is due to missing parts of the body that would create the offside line that the attacker must be behind.

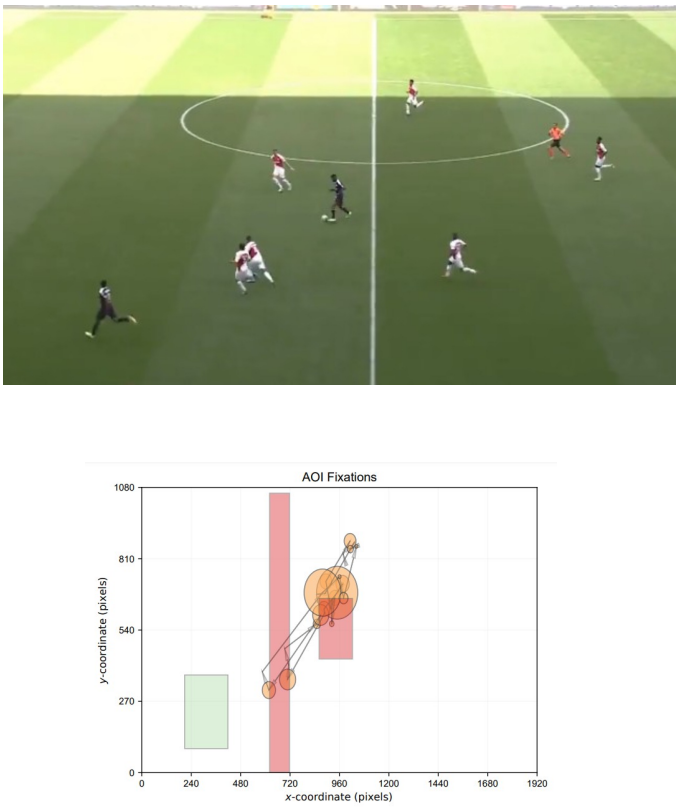

Figure 4: Top image is what the Participant has to evaluate. Bottom image is the fixations and saccadic movements of an easy offside call

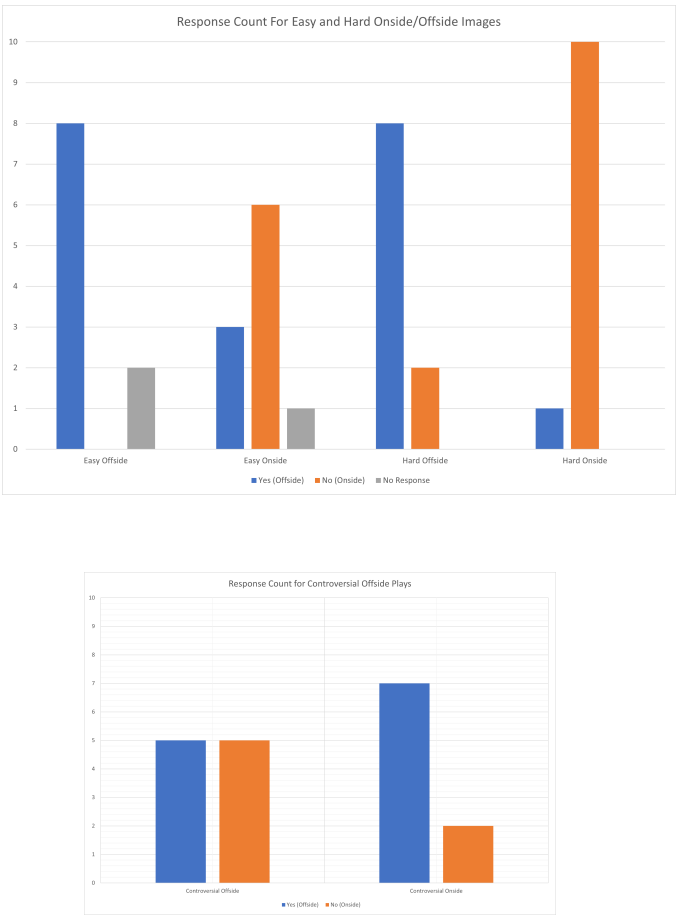

Figure 5: Top image shows what the participants got right/wrong for easy and hard images. Bottom image is what participants got right/wrong for controversial images.

3.5 Experimental Design

Each participant will experience 3 offside situations of different difficulty, each difficulty will be evaluated by the participant 2 times, and will make a judgement whether the offside situation occurs through keyboard input. For each participant, the 6 pictures will be displayed in random order and each picture will be displayed for 5 seconds. All participants will have the same photos to ensure that data isn't skewed. The independent variable of the experiment is the difficulty of the call. For the control setting, we will collect data from the eye movements of each participant while they are evaluating the offside call. Accuracy of the offside analysis will be observed, which is a data point that reflects whether the participant was able to correctly make the call. The Gaze data of AOI (passer, receiver, offside line) will be properly evaluated, this data is observed to record what at participants focus on when making a call. Finally, the trend of data , which is the data of those who made correct offside calls.

4 RESULTS

With the 11 participants testing we found that easy offside calls had a 100 percent of correct calls made, and the easy onside calls had a 50 percent chance of making the correct call. We found that the high amount of correct scores may be due to how far away the player is from the offside line. As for the Hard Offside/Onside calls, and the controversial Offside/onside calls, there was a bigger deviation of data.

We found that the amount of fixations actually grew as the officiating call became more difficult, our answer to this is that since the attacking player is so close to the offside line, there must more concentration in a more dense area. Since controversial/hard calls present the attacker to be very close to the offside line.

Although there was a higher fixation in the hard calls, it seemed that since the participant had more time to observe, and with help of a still image, they got most of the calls right.

5 CONCLUSION

We concluded the more difficult the image was to officiate, then the higher fixation occurred per image. For Mean saccade amplitude, we found that the controversial was the highest due to the complexity of the call, the user had to keep looking back and forth between player, passer, and offside line.

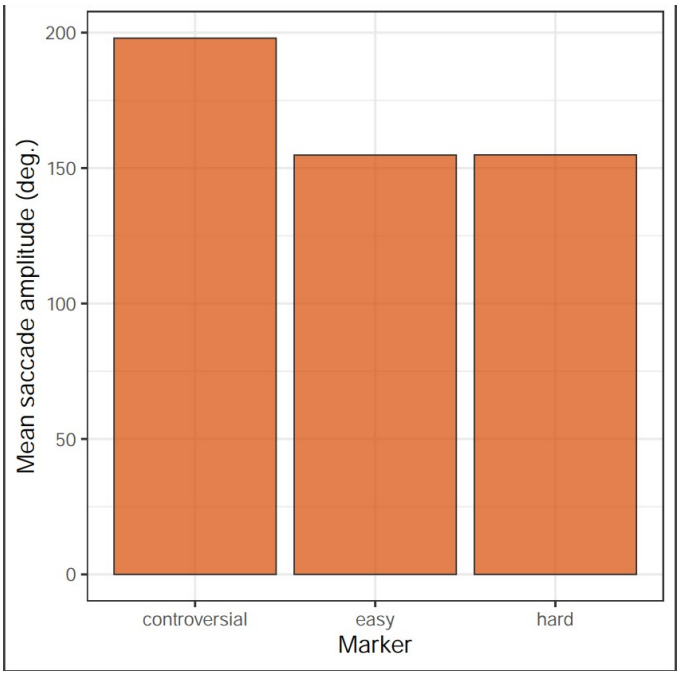

Figure 8: Mean Fixation of points for Controversial, Easy, and Hard images

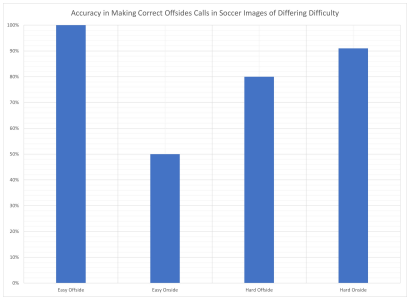

Figure 6: Accuracy of decisions participants made for offside calls

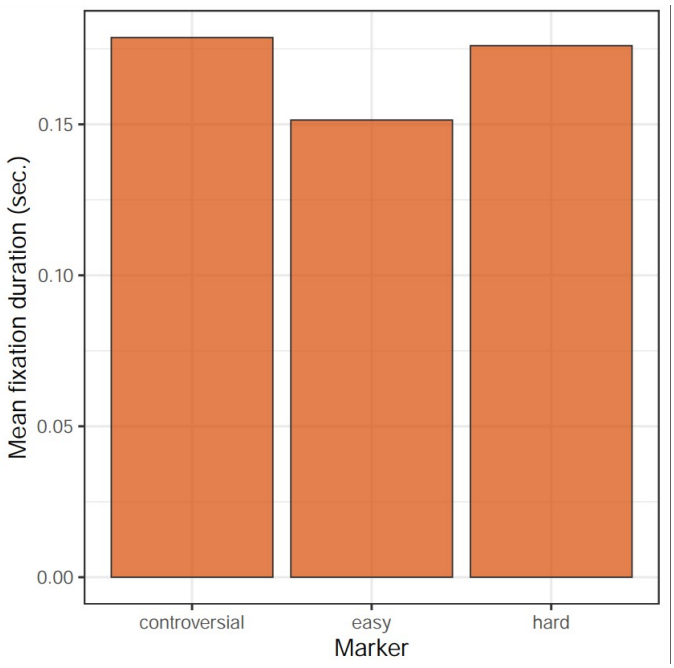

Figure 7: Mean Fixation of points for Controversial, Easy, and Hard images

REFERENCES