Introduction

For a long time, how to correctly determine the offside situation is an important basic skill for the football referee. With the development of eye tracking technology, we can better observe and judge football offsides by using eye tracking devices, and learn more interactive information. First of all, we need to know the latest offside rule, and secondly, I can understand the application of eye tracking technology combined with football offside rule judgment skills and the convenience it brings.

A player is in an offside position if he is in “a position closer to the opponent’s end line than the opponent’s player and the ball next to the opponent’s end line”.

A player is not in an offside position when:

• the player is in his own half;

• The player is on the same end line and parallel to the opponent’s player next to the opponent’s end line;

• The player is on the same end line parallel to the last two opposing players;

A player who is in an offside position will only be called for an offside foul if his own team touches or has the ball and the referee believes that the player in the offside position has:

• affected the flow of the play;

• Attempting to take advantage of an offside position;

We hypothesize that looking at the offside line will provide a better angle for judging
offside situations than looking at the passer and receiver.

A comparison of fixation position (offside line vs. 'non-offside line') and decision accuracy showed that if the offside line was fixated, there was a tendency to judge more accurately.

**Apparatus**

The program was displayed on a 22-inch desktop monitor with a resolution of 1680 x 1050. 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. No chin rest was used; however, participants were asked to keep their heads steady throughout the experiment.

**Background**

Previous experiments done by (FIND AUTHORS), the participants of 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.

**Stimuli**

The stimuli will vary between 3 types, one being easy, one being hard, and another will be one that have been controversial (call that what was reviewed to be incorrect post game).

In the picture on easy difficulty, we can see the direction of where the attacker is going, and we can see that the attacker is behind or ahead the second-to-last defender is more than 1 m.

In the medium difficulty picture, we can see the direction of where the attacker is going, and we can see that the attacking team is behind or ahead the second-to-last defender is no more than 1 m.
In the controversial picture, we can see the directions of where the attacker is going, and we can see that the attacking team is almost at the same level as the second-to-last defender.

Easy Call

Challenging Call
Participants

Controversial Call

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.

**Procedures**

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 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.

At the end of the experiment, each participant will be given their individualized results of the experiment.

Then, data from the experiment will be collected.