# Gaze Behaviour of Assistant Referees during the Judging of Offside in Football

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## Introduction

The offside rule in football is one the most controversial rules in sports due to its importance and the relatively high error rate. The occurrence of judgment errors is unsurprising as the task of the assistant referee (AR) is to judge whether an attacker is in offside position at the exact same moment of an attacking pass on another part of the field.

**Gaze shift hypothesis**
Sanabria et al. (1998) argued that errors occur because ARs shift their gaze from the attacker with the ball to the offside line at the moment of the pass.



Fig. 1. Gaze shift hypothesis.

**Gaze shift hypothesis rejected**
Yet, this hypothesis was rejected by studies of Oudejans et al. (2000) and Catteeuw et al. (2009). However, methodological suboptimalities make it rather premature to discard the gaze shift hypothesis completely on the basis of aforementioned studies.

**Critique on studies rejecting gaze shift hypothesis:**
• Helmet cam rather than gaze behavior (Oudejans et al.).
• Computer simulations rather then on-field (Catteeuw et al.).
• Relatively predictable situations (Catteeuw et al.; Oudejans et al).

## Objective

Therefore, the aim of this study was to investigate gaze behavior of ARs on the field during the judging of offside.

## Method and Materials

Three expert- (FIFA) and 3 near-expert (First League) ARs judged 36 complex, predetermined situations (see Figures 2 and 3).



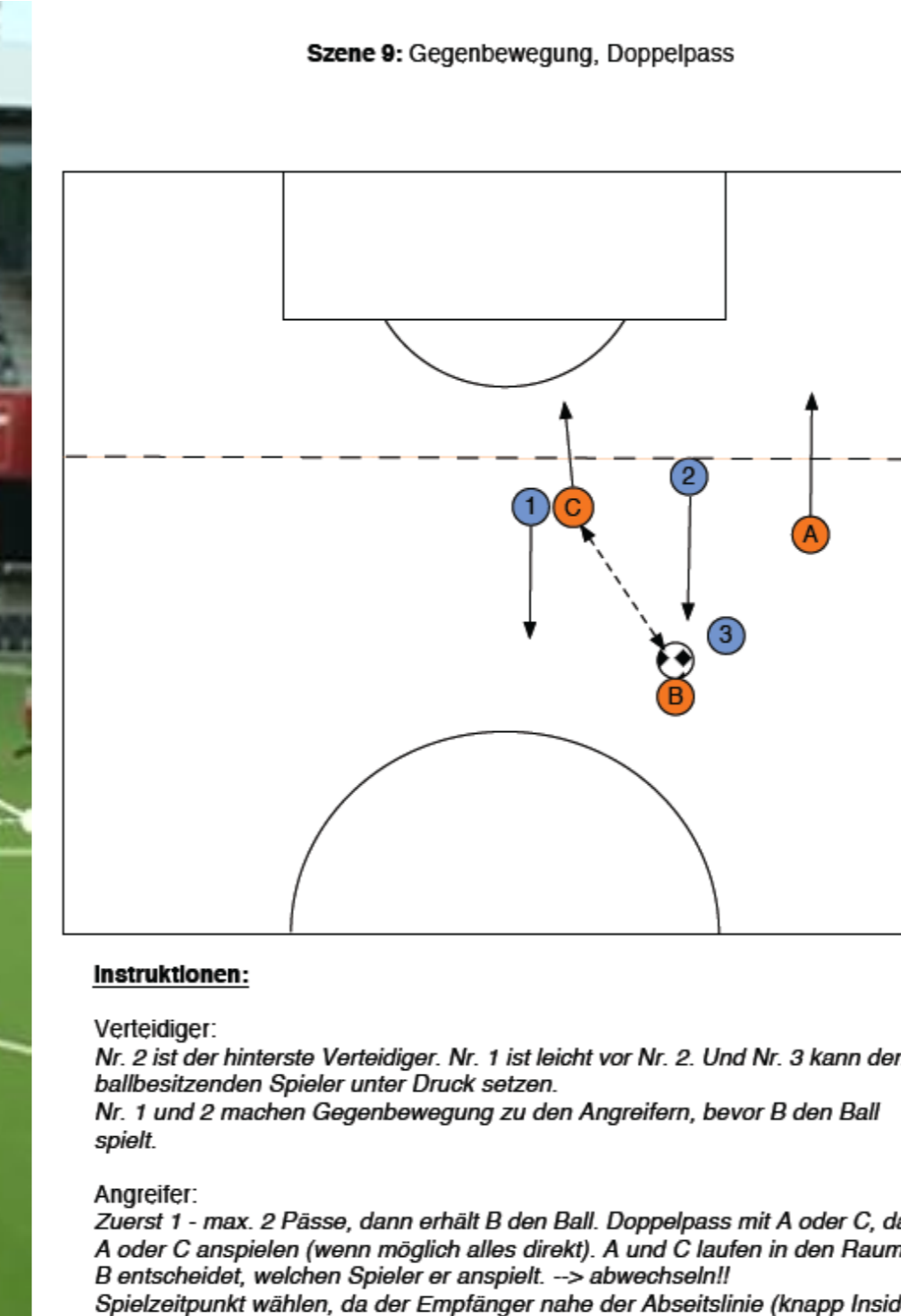Fig. 2. Video images to determine on- and offside.      Fig. 3. Situation description.

ARs wore a lightweight, mobile eye tracking device (EyeSeeCam) connected to a laptop worn in a backpack (see Figures 4 and 5).
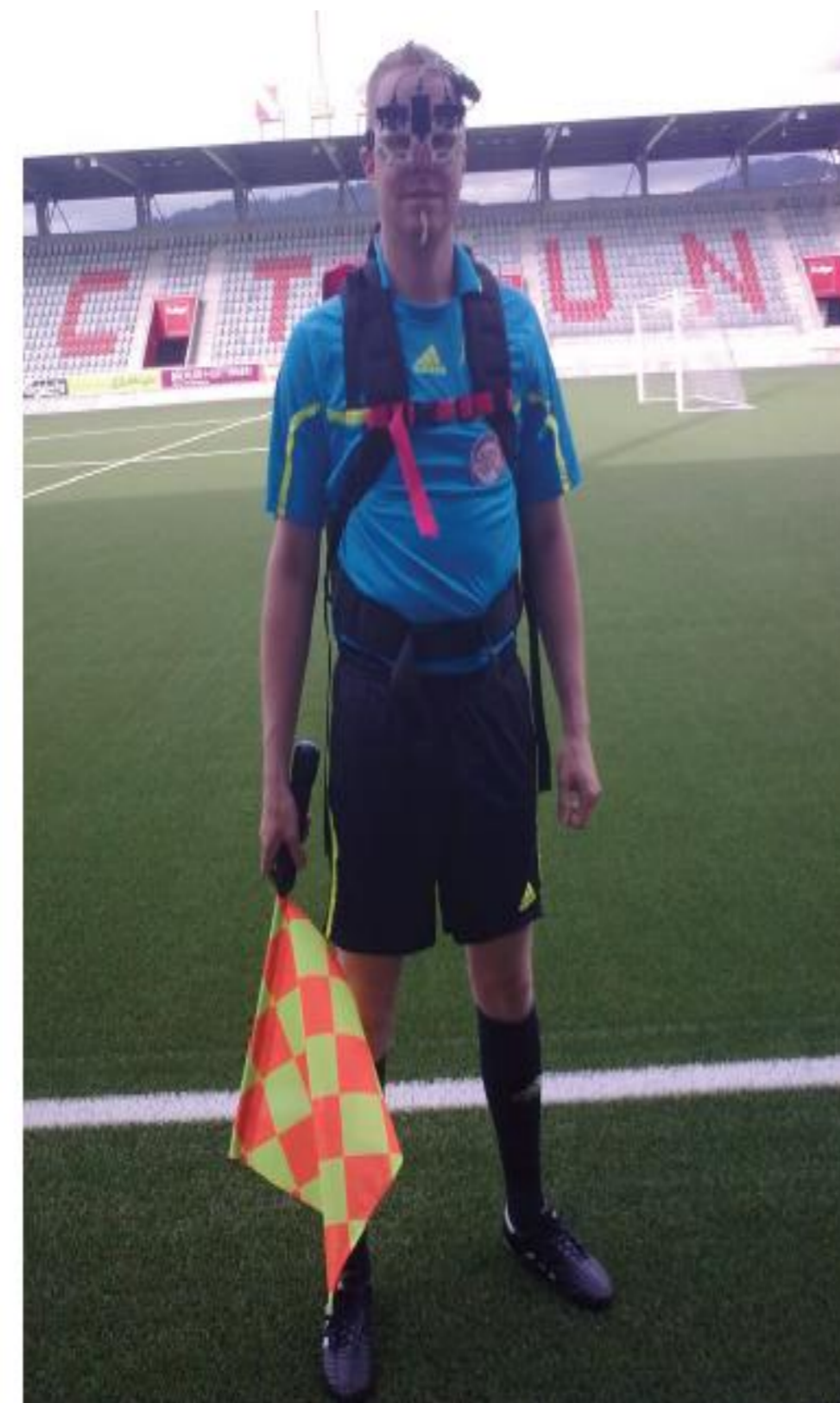


Fig. 4. AR with EyeSeeCam.      Fig. 5. AR with EyeSeeCam and lap top in a back-pack.

## Results

Results show that on average the experts incorrectly judged 12% of the situations compared to the near-experts who erred in 17% of the situations. The majority of these errors were Flag Errors (the AR flagged, but the receiving attacker was not offside; 11 and 16% for Experts and Near-Experts, respectively).

Analyses show that ARs, irrespective of expertise and situation type, rarely fixate the offside line during the moment of the pass.

Over the course of a situation the Experts and Near-Experts seem to have similar numbers of fixations.
(Experts: $M=3.35$, $SD=2.16$; Near-Experts: $M=3.42$, $SD=2.32$).

However, the number of fixations tended to be lower for correct compared to incorrect decisions.
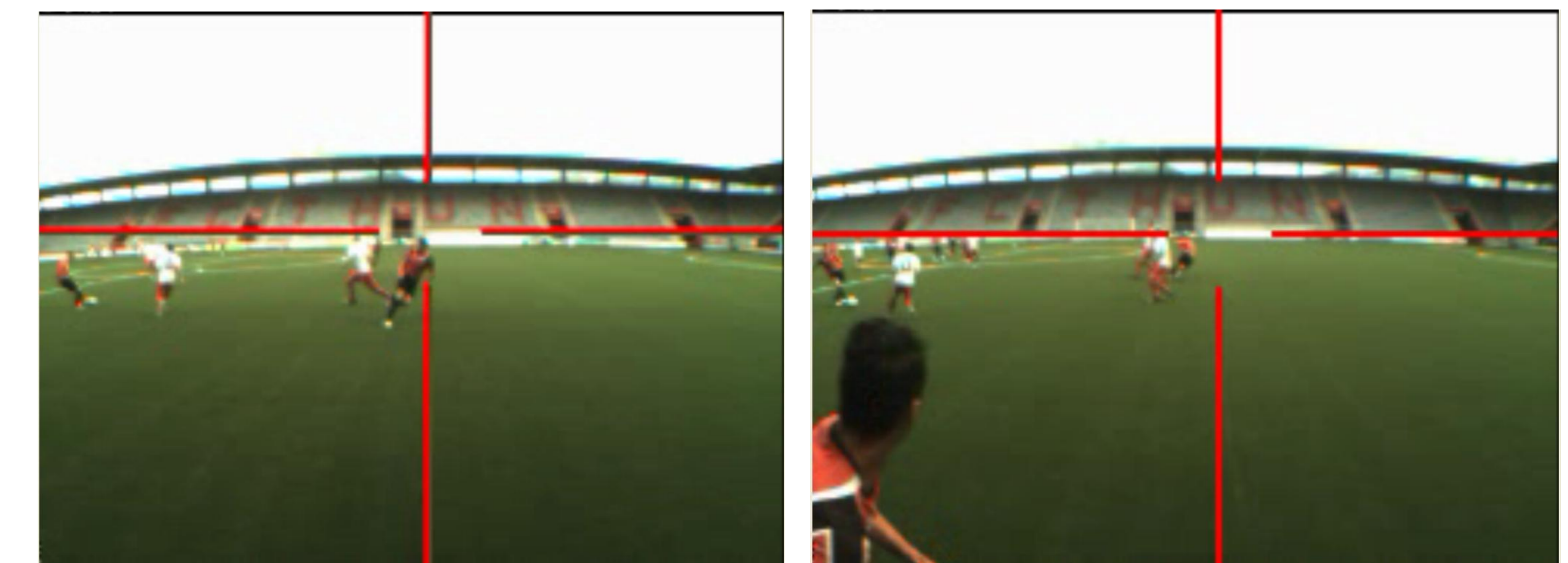(Correct: $M=3.05$, $SD=2.22$; Incorrect: $M=3.71$, $SD=2.26$).



Fig. 6a, & 6b. Typical fixation locations of an expert AR on the moment of the pass.

## Discussion

• Our results are in line with earlier findings suggesting that Expert ARs do not fixate the offside line at the moment of the pass (Catteeuw et al., 2009; Oudejans et al., 2000).
• To our knowledge, this experiment investigated visual search behavior of expert referees for the first time on the field.

### References
Catteeuw, P., Helsen, W., Gilis, B., Van Roie, E., & Wagemans, J. (2009). Visual scan patterns and decision-making skills of expert assistant referees in offside situations. *Journal of Sport & Exercise Psychology, 31,* 786-797.

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

Sanabria, J., Cenjor, C., Marquez, F., Gutierrez, R., Martinez, D., & Prados-Garcia, J.L. (1998). Oculomotor movements and football's Law 11. *Lancet, 351.* 268.

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