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**Franks, Benjamin, Roberts, William M ORCID logoORCID:
<https://orcid.org/0000-0001-5736-5244> and Jakeman, John
(2019) Investigating the representative nature of perceptual
research experiments:(Re)understanding football goalkeepers
expertise. In: Expertise and Skill Acquisition Network (ESAN),
1-3 May, 2019, St Mary's University, Twickenham.**

EPrint URI: <https://eprints.glos.ac.uk/id/eprint/7001>

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Investigating the representative nature of perceptual research experiments: (Re)understanding football goalkeepers expertise

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Introduction and Broader Context

Amidst the continued theorising and objective epistemological approach to perceptual research (Michaels and Beek, 1995), there remains little clarity regarding what information athletes use to direct decision making in performance settings (Dicks et al, 2010). There is now a consensus that skilled performance is subject to an athletes ability to locate and interpret key specifying information (Vickers, 2006). However, experimental design often fails to represent the performance environment (Vaeyens, 2007; Williams and Grant, 1999). The Quiet Eye (QE) depicts the final fixation towards a specific location within 3° of visual angle for a minimum of 100m/s (Vickers, 2016). It is reasonable to suggest that QE describes the variable to examine the relationship between perception and action (Panchuk and Vickers, 2006).

Research Aims

The study aimed to compare the traditional penalty kick protocol, against a more representative 1 v 1 situation in order to understand expertise in the performers 'natural habitat'. From this, implications can be drawn as to ensuring when assessing expertise, more representative task designs are utilised. It is hypothesised that significantly different functional gaze behaviours will emerge between the two task conditions. Particularly, it is assumed that in the more complex task shorter QE durations, and later onsets will occur.

Methodology and Data Analysis

4 (n=4) expert goalkeepers (26.3 years (y) ±4.2) and 6 (n=6) right footed male kickers (21.5y ±5.9) volunteered for the experiment. The kickers and goalkeepers had at least two seasons of competitive playing experience (Level 1-3 in the English Football League System) and had normal or corrected to normal vision.

Eye Tracking Glasses (SMI-ETG) were used to capture eye behaviour of professional goalkeepers. QE data will be collected in the traditional penalty kick design (Dicks et al, 2010; Piras and Vickers, 2011) and a dynamic representative task.

A total of 228 of the recorded trials were appropriate for use across both task conditions.

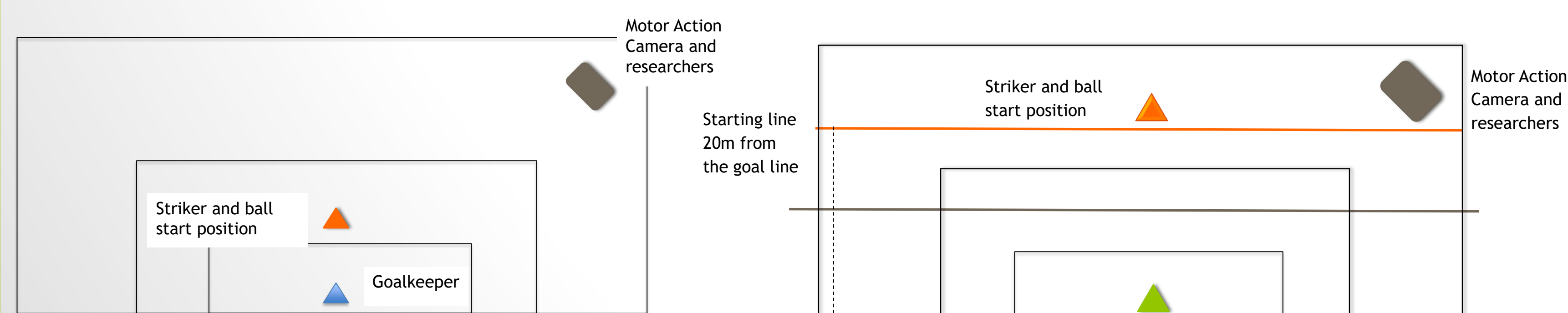


Figure 1: Experimental conditions. Traditional penalty kick on the left. Dynamic representative task design on the right.



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Results



Figure 2: Mean fixation location and frequency, L=PK, R=DK. Small – Large circle = Low – High fixation frequency. Transparent – Opaque circle = Short – High fixation length.

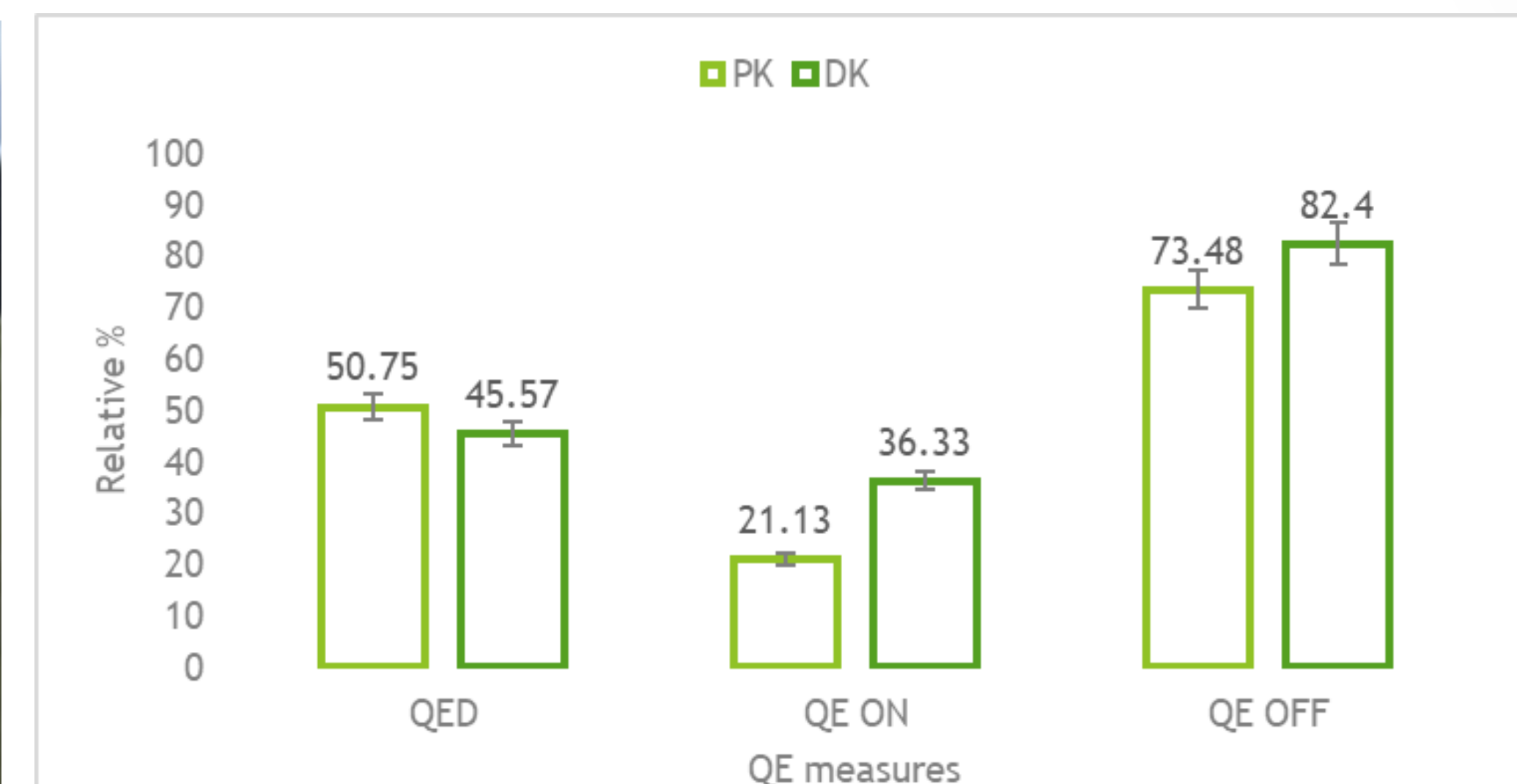


Figure 3: Penalty Kick v Dynamic kick relative QE measures
 Table 1: Penalty Kick v Dynamic kick relative QE mean scores and significance

	QED %	QEON %	QEOFF %
PK	50.75 ± 2.84	21.13 ± 4.21	73.48 ± 1.58
DK	45.57 ± 0.93	36.33 ± 4.30	82.40 ± 3.79
Significance	$t_2=2.66, p = 0.03$	$t_2=4.75, p \leq 0.02$	$t_2=3.36, p \leq 0.03$

Significant differences ($t_2=3.27, p \leq 0.05$) were observed within trial for QE location. In PK, a greater number of fixations were directed towards the ball (6.75 ± 2.22) than the VP (2.25 ± 1.26). However, in DK, there was no significant differences between mean number of fixations at the ball (7.75 ± 2.22) and VP (6.25 ± 3.5).

Discussion

Consistent with Klostermann et al. (2018), the more representative task was not replicable to the penalty kick condition, strengthening the argument of task-specificity and the constraint-individual interaction highlighted in the ecological dynamics domain (Dicks et al. 2010).

- Navigating expertise utilising the scientific underpinning of ecological dynamics may provide a better platform to understand expertise as a functional relationship with the environment and its defining information, rather than current isolated models of proficiency in single tasks.
- Opportunities to act, or, affordances, are governed by multiple information sources. These information sources, as depicted in this study as being the ball or visual pivot, are observed to be tightly coupled to the dynamics of the environment. The visual pivot emerging more prominently in the dynamic task where more information sources were able to emerge and decay according to the representative performance constraints in that moment.

In Summary

Presented here is a protocol that captures the plethora of athlete – environment interactions present in performance environments, providing an account for the multitude of information sources that may govern and inform goalkeeping actions. Experimental conditions that intend on reflecting the environment which athletes demonstrate their expertise must therefore transfer into the contextual environment. If experimental conditions fail to transfer into the performance environment, the true nature of the expertise being studied may be called into question, due to the tight coupling between perceptual behaviour and task dynamics.



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