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Exploring the Responses of Skilled Basketball Players to Deceptive Passes

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ABSTRACT

Purpose: Deception in sport is one of the most common skills used to improve performance and performance outcomes. Therefore, how athletes react to and respond to deceptive actions is important to understand. This study is one of the first to analyse response times in response to deceptive actions in an experimental sport setting.

Design/methodology: A total of 10 participants who were part of the University of Portsmouth's Men's Basketball 1st and 2nd teams took part. Participants were required to wear Tobii Pro eye tracking glasses and were told to attempt to intercept fifty passes aimed at two defenders either side of the participant.

Findings: The lateral movement response time was significantly slower when faced with non-deceptive passes compared to deceptive passes. The responses for both were initiated prior to the delivery of the pass. The eye movement response time was also significantly slower when facing non-deceptive passes compared to deceptive passes. Response accuracy was also significantly higher for non-deceptive passes compared to deceptive.

Practical Implications: The findings demonstrate the power of deception in sport and how even skilled athletes suffer performance detriments. Future research should examine if specific gaze patterns and fixations result in an increased response accuracy.

Originality/value: This study is the first to analyses movement response times in response to deceptive actions in sport in an experimental setting.

Keywords: Basketball; Anticipation; Response; Deception; Skilled

Introduction

Research into sport has highlighted the importance of deceptive actions to improve performance but as of yet has failed to identify how eye movement patterns vary when viewing deceptive and non-deceptive passes[1-3]. Deceptive actions are described as providing little or misleading information about one's actions[4]. The ability to anticipate deceptive passes is proven to be down to skill level[5]. Further, links can be drawn from magic where the same concept of deception is utilized and therefore research into magic has been used to inform the formulation of this study[6].

Therefore, this study aims to analyses how expert level basketball players anticipate deceptive and non-deceptive passes and assess the differences in eye movements during non-deceptive and deceptive passes.

Guldenpenning, Kunde and Weigelt conducted a meta-analysis to review empirical work on deceptive actions in sports and provide issues that have arisen recently in this field. Athletes worry about the expected costs of a missed deception; therefore, they are more likely to judge an action as deceptive. The first issue discovered was response bias. Experts are familiar with deceptive actions as opposed to novices, who do not frequently

experience deception. Further, that expertise biases decisions of deceptive and non-deception actions[5].

Schmidt et al. looked at disguised actions and misleading cues[4]. For example, in a disguised action, in badminton, the player at the net would attempt to hide for as long as theycan before playing a drop shot or smash[7]. A misleading cue, for example, involves head faking in basketball to create the impression that an individual is passing in one direction before passing the ball the other way. However, the core assumptionfor both types of deceptive actions is that providing misleading information or as little information as possible about one's actions increases the chances of deceiving an opponent[8]. Most of the studies included in Guldenpenning's meta-analysis revealed that deceptive actions fooled both skilled and unskilled participants[5]. However, the performance of skilled athletes did not decrease as much as their unskilled counterparts. Thisis because the motor and visual expertise benefit from recognizing deceptive actions as skilled athletes are able to learn the behaviour used in deceptive actions faster than unskilled individuals so are quicker at adapting[9]. Further, because skilled athletes are more successful at initiating faster motor responses, so have faster reactionary speeds to correct their initial response to being deceived[10].

Research in magic has further paralleled this finding as skilled magicians were better at anticipating the deceptive action in the track compared to novice magicians[11]. Phillips, et al examined differences in the contributions of an expert and a novice magician to the act of deception known as the French Drop[11]. It was discovered that there were significant variations in motion and muscular behaviors between successful and unsuccessful performances. Minimal more smooth movements that have a more exaggerated transfer of muscular tension produced a better deception. It was also evident thatthe greatest deception was experienced when there was little difference in the two grasp magnitudes in the routines in the pro and anti-deception conditions. Therefore, these finding helped inform the current study when informing the passer how to deceive the participants toproduce a more powerful deception and to make their movements during the pro deception and anti-deception conditions as similar and consistent as possible to maximize the effect of the deception.

The art of deception in sport is a well-research ideal. However, little research has acknowledged the similarities between magic and sport. A critical study outlining how a magician utilizes deception was carried out by Kuhn and Land[6]. The study used eye- tracking to demonstrate how magicians can distort our subjective perception. The study included two trials: pro-illusion and anti-illusion. In the pro-illusion condition, the magician looked up whilst pretending to throw the ball and in the anti-illusion condition, the magicianlooks at the hand he has concealed the ball in. The effectiveness of the deception was strongly dependent on the influence of the social cues utilized by the magician. As 68% of participants experienced the illusion in the pro-illusion compared to 32% in the anti-illusion condition, demonstrating how social cueing mediated the illusion. The results also showed that where participants said they were looking deviated from where the eye-tracking softwareshowed they were looking. Magicians during tricks such as this rely on the concept of representational momentum, which is when viewing a moving object that suddenly disappears and an individual believes the final position of the object to be further along its path of motion than its actual final position[12]. This study provides the foundation and inspiration for the current study as it is essential to investigate how an attacker's eye movement affects the anticipation accuracy of defenders.

Moreover, sport can learn from magic due to the subtlety of the actions used in magic to maximise the effects of the deception. This is because once an individual has been subject to a deceptive action in sport, they begin to predict the skill outcome better[13]. However, in magic magicians constantly change how they deceive an individual in order to maintain the power of the illusion and also to not give away the trick. Magicians make sure they are always at least one step ahead of an individual and this is where sport literature can learn[14]. A large portion of the magic literature also employs the Swiss cheese model where magicians believe that deception should be subtle yetelaborate[15]. The Swiss cheese model of deception demonstrates that eachcomponent of the deception is a layer of cheese with imperfections (represented as holes).

Effective deceptions use many thin subtle layers that cause participants to rarely see throughthe holes and see through the deception. Whereas an ineffective deception utilized several thick elaborate layers, therefore the holes of each slice line up, allowing for participants to see through the deception[15]. Utilizing this model in deception in sport would help researchers reduce demand characteristics, improve blinding and further increase study generalizability.

Jackson, et al. investigated the anticipation performance of attacking movements in rugby[16]. They discovered that performance differences between novices and experts were caused by a decrement in performance in novices for deceptive trials. Therefore, they suggest that what separates skilled and novice athletes is anticipating play and deception within their sport. Further, in some sports, superiority is based on motor expertise (the ability to execute motor skills successfully) rather than visual experience[17].

However, research has also shown that some experts, especially football goalkeepers, deem some actions over deceptive and therefore over analyses non-deceptive actions to the point where they believe them to be deceptive[18]. This finding is consistent to that found in Guldenpenning's meta-analysis suggesting response bias is a reason for over-analysis. Over-analyzing deceptive action refers to the participant convincing themselves that a regular non-deceptive action is deceptive[1]. The idea of over analyzing deceptive actions draws comparisons with the idea of representational momentum first mentioned in deception literature by Kuhn and Land as in the context of sport the point of gaze of an individual follows the trajectory of where theindividual anticipates the ball is going but the ball actually follows a different path.

The finding by Abernethy and colleagues was consistent with Mori and Shimada[9]. Mori and Shimada used eye movement recordings to analyses the anticipation of a deceptive movement in rugby (sidestep). The findings indicated that although experienced players were superior in anticipating deceptive passes, experienced players anticipated non- deceptive actions less accurately than novices, implying that their expectations of deceptive actions acted negatively on their judgment of non-deceptive actions. A key finding in this study that is consistent with magic research is that expert players fixated for

longer on the honest signals which are defined as areas where the center of mass is located such as the players hip, whereas novices fixate more on deceptive signals such as the player's chest.

Kuhn and Tatle[19] analyzed the eye movements of a group of participants to a magic trick in which a magician makes a cigarette 'disappear'. They discovered that participants spent longer fixating on the 'misleading' hand than on the hand that dropped the cigarette, again showing that novices focus on deceptive signals.

Anticipating deceptive actions relies heavily on motor resonance[19]. This is because observing an action induces an ability to execute the action and therefore having the motor ability to reproduce the action increases perpetual sensitivity to comparable actions, improving perpetual resonance. This is why novices struggle to anticipate deceptive actions as they need to possess a similar motor ability to the individual performing the deceptive action as their motor representations are not as good as skilled athletes. Skilled athletes can delve into their movement repertoire when anticipating deceptive actions, indicating why skilled athletes have a more significant performance level than novices. There is abundant literature analyzing the differences in anticipating deception between skilled and novice athletes, but no studies have analyzed differences in reaction to deception between skilled athletes.

Numerous research uses occlusion methods to measure anticipatory behaviour between skilled and novice athletes. In occlusion studies such as Loffing, et al[20], it was discovered that novice athletes rely on patterns of movements to read deceptive actions and often need to view a movement pattern multiple times before anticipating more successfully. In the study, the participants would be shown a video clip of a volleyball player about to strike the ball before occluding the video, so the participants had to guess what kind of shot would be taken (lob, smash). The limitation of this methodology is that it does not allow forexact identification of the cognitive mechanisms underlying anticipatory behaviour; instead,the participant's overreliance on pattern continuation made them neglect kinematic cues.

Therefore, future research is suggested to utilize gaze behavior to analyses visual informationpick-up strategies.

However, a finding from the research provided by Henry et al.,[21] that must be considered is that although experts could anticipate passes better if they fell for a fake, they were better able to recover and correct that wrong response due to superior movement times. Additionally, results may be made askew due to the 'right on time hypothesis'[22]. The right on time hypothesis indicates why expert athletes may move later, as they await more reliable information before deciding to move but then perform the motor response quicker then perform the motor response quicker[23]. However, the ability to perform a motor response quicker depends on the athlete's action capabilities, which would affect the accuracy and timing of the movement response behaviour[24].

Magic research has demonstrated how sports can make actions more deceptive by focusing on subtle misdirection and simple social cues to deceive participants[6]. The pro-illusion action in magic, as evident from the literature, has a profound effect on deceiving individuals and therefore adopting this same approach within the sport when utilizing a 'no-look' pass should lead to increased effectiveness of deception. Also, little research into deception in basketball fails to recreate the in-game aspect. This is because moststudies use videos and pictures to explore the participant's accuracy of anticipating deception[16]. Therefore, the current study will aim to recreate a competitive match environment as the defender will be anticipating a pass from an attacker inperson.

The current study, therefore, aims to analyses the differences in lateral movement response times of skilled basketball players to deceptive and non-deceptive passes. The study's primary objective is to assess differences in expert level basketball players' ability to anticipate deceptive and non-deceptive passes. The study's secondary objective is to examine the differences in eye movement response time by analyzing the athletes gaze patterns and fixations. Furthermore, to analyze response accuracy when faced with deceptive and non-deceptive trials.

Methods

Participants

The participants consisted male skilled basketball players from the University of Portsmouth 1st and second teams (n=10) with inter-regional competition experience and who consented to participate[25]. The small sample size was due to time constraints and limited availability of the athletes due to their respective competition and training schedules. Further due to the limited number of athletes on the university basketball teams.

Participants were recruited for the study in May 2022 and the data collection took place during the months of May and June 2022. The exclusion criteria included those who have notplayed BUCS or at inter-regional level or are not in the first or second team at the university. Participants were removed from the study if they carried an injury that inhibited them from completing the minimal physical activity or impaired their ability to anticipate correctly, resulting in anomalous results.

Procedure

The study consisted of an experimental method and adapted the methods used by Kuhn and Land (2006). Participants anticipated a pass performed by an attacker to one of two confederates to the defender's right and left-hand side. The two confederates receiving the pass will be members of the research team. The participants faced a total of fifty trials comprised of ten blocks of five trials. Each block of five trials were randomly put together to mix between pro-deceptive and anti-deceptive passes. Some blocks contained one or even two deceptive trials whereas some blocks contained no deceptive trials. The experiment tookplace over a number of weeks in the University of Portsmouth's Sport and Exercise Science Department facilities. The experiment took place over two locations on a Sport's Hall floor tomaintain the same surface that would be used during a basketball match.

The attacker will be passing the ball at a distance of 2.2m from the participant (see black arrow, figure 1). The confederates receiving the ball will be standing on a cone that is located 4m away from the attacker (see orange arrow, figure 1). The attacker will be given a brief before each set of three passes as to how they throw the ball based on the height and wingspan of the participant to give the participant a realistic chance of intercepting the pass. **(Figure 2)** provides a full breakdown of the trial dimensions. The passer was instructed on how to

deceive by looking with their eyes and head in one direction and then throwing the pass in the other direction. Each participant anticipated fifty passes in total divided into ten blocks offive. The sequencing of passes follows Kuhn and Land's (2006) study of misdirection in magic. The participant was informed before each set to anticipate and attempt to intercept all passes. The order of the trials varied between participants to maximize the effect of the pro- deception trials.

The participant wore Tobii pro software glasses. This mobile eye tracking system is attached to the head and does not contain any lenses. The glasses contain a set of tiny cameras that surround the outside of the glasses around the eye and produce a detailed and close up image of the eye. The glasses compute a point of gaze within a scene through calculation of a vectorbetween the cornea and the pupil of the participant. A positional cursor is then presented on the laptop screen via Bluetooth to highlight the precise gaze position. When the cursor shows on the screen, calibration begins to ensure the point of gaze of the individual matches the point of gaze displayed on the screen through the Tobii software. Calibration involved the participant holding up a piece of card with a circle containing a cross in the middle and staring at the cross until it matched up on the laptop screen. The glasses recorded the experiment in 100 frames per second and was subjected to frame-by-frame analysis followingtesting.

Two iPads were placed on tri pods, one at the front of the setup to capture the response accuracy of the participant and to gauge their first lateral movement. The second iPad was placed at the back of the experiment to capture the passers movements (see **Figure 1**). The manual camera app was utilized and filmed the experiment at 120 frames per second and wasalso subject to frame-by-frame analysis through Kinovea.

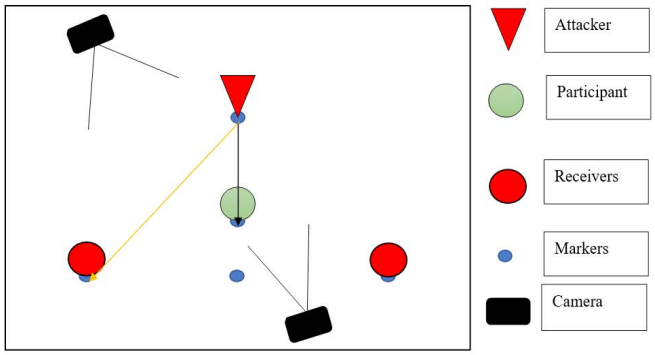

Figure 1: The attacker (red triangle) will attempt a deceptive or non-deceptive pass to two receivers (red circles) whilst the participant (green circle) attempts to anticipate the direction of the pass and intercept.

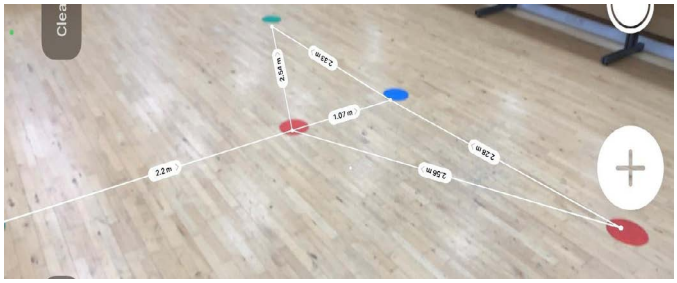

Figure 2: Trial dimensions.

The study was reviewed and approved by the University of Portsmouth's ethic committee. The participants were provided with a participant information sheet which was emailed to them upon agreeing to take part in the study. Participants then provided informed consent by ticking a box at the bottom of the questionnaire which was provided to them when they arrived for participation in the study. Participants were informed that they could remove consent by stopping the experiment or refusing for their data to be shared for use for analysis.

Dependent measures

Demographic data. Demographic information was collected included age, highest playing level, current playing level and years playing competitively.

Response initiation. The response initiation was defined as an individual's first lateral movement in anticipation of the pass direction and was recorded using iPads. The videos from the iPads were then imported into Kinovea software and coded and timestamped for the first lateral movement in reference to the pass time. The response initiation time was recordedon a google sheets document and deducted from the time of the pass time to determine if the movement was prior to or after the pass to provide an indication of an anticipatory response or a reactionary response. If the value produced was negative, this indicated that the movement was initiated prior to ball release, therefore indicating a more anticipatory response. If the value produced was positive, this indicated that the movement was initiated after ball release and would therefore suggest a more reactionary response.

Eye Movement Reaction Time. Eye movement reaction time was defined as the time from when the pass was released for the main fixation of the participant to catch up to the ball if at all. This measured was recorded in seconds. Eye movement reaction time was recorded using the Tobii pro glasses which the participants wore during the duration of the experiment. The Tobii pro glasses then recorded and monitored participant eye gaze behaviour and provided arecord of their eye movements in response to the deceptive pass and the non-deceptive passes. The eye-tracking software was linked up to a laptop via Bluetooth to view and analyse the eye-tracking movements.

Interception accuracy. Video recording took place on a separate camera to view and analyse the drill and record the accuracy of the anticipation and the response time to react to the pass. A rating scale from 1 to 4 (see **Table 1**) was used to rate the success of the anticipationwhen intercepting the passes.

Table 1: Movement Response Rating Scale.

Rating	Description of movement response
4	Participant successfully intercepts the pass, by catching the ball, blocking and regathering or making contact
3	Participant moves in the correct direction and attempts to make contact with the interception but fails
2	Participant moves in the correct direction but does not attempt to intercept
1	Participant does not move from their central position
0	Participant makes any movement in the opposite direction to where the ball was passed

Data Analysis

A total of sixteen trials (eight pro-deceptive and eight anti-deceptive) were selected and utilised in data analysis per participant. The eye-tracking movements were analysed through the Tobii software on a laptop, where eye movement patterns

can be tracked as well as fixations. Therefore, differences in eye-tracking patterns and fixations can be analysed between participants. Further, using the video camera set up to film the experimental task, the reaction times and accuracy of the anticipation could be reviewed and compared between participants. So, the eye movement patterns can be coupled with the anticipation accuracy to determine whether specific eye movement patterns lead to more accurate anticipation and interception of the passes. Further if the lateral movement reaction times differed to the eye movement reaction time. The primary analysis of the defender reaction videos took place on Kinovea and the analysisof the eye movements on Tobii software. Once the data had been coded and correctly timestamped. The data was then transferred for analysis using IBM SPSS statistics software.

Results

A total of ten participants were recruited and took part in the study (mean ± SD: age = 21.3 ±2.00). All participants who took part in the study were male. A total of 30 per cent of participants reported their highest playing level being County level. A further 30 per cent reported a highest playing level of National League. 20 per cent of participants reported theirhighest playing level being BUCS (British Universities and Colleges Sport). 10 per cent reported a highest level of Regional trials and a further 10 per cent reported a highest level ofNCAA (National Collegiate Athletic Association).

Response Initiation

The mean score for all participants for response initation times to deceptive passes was -.0386 (SD = .0779). The mean score for all non-deceptive passes for all participants was -.0889 (SD = .0795). There was a statistically significant difference between responses to deception and non-deception trials determined by the Paired Sample T-Test ($F(2,658) = 9$, $p= 0.013$). The means reported demonstrated that lateral movement response time was significantly slower when facing deceptive passes as the movement response in relation tonon-deceptive passes was initiated earlier.

Eye Movement Response Time

The mean score for all participants for eye movement response time to deceptive passes was.454 (SD = 0.198). The mean score for all participants for response time to non-deceptive passes was .0719 (SD = 0.0579). There was also a statistically significant difference in eye movement response times in deceptive trials and non-deceptive trials determined by the Paired Sample T-Test ($F(6,124) = 9$, $p = <.001$). The means reported demonstrated that eye movement response time was also significantly slower when facing deceptive passescompared to non-deceptive passes **(Table 2)**.

Interception Accuracy

The mean score for response accuracy for all participants for deceptive trials was 1.90 (SD =.738) and the mean response accuracy for non-deceptive trials was 3.90 (SD = .316). Only participants six and 10 failed to achieve a perfect mean score of 4 for response accuracy for non-deceptive trials (see **Table 3**). A Wilcoxon signed-rank test elicited a statistically significant difference in response accuracy for deceptive trials and non-deceptive trials ($Z = -2.232$, $p = 0.026$).

Table 2: Response Initiation and Eye Movement Response Times.

Participant	Response Initiation				Eye Movement Response			
	Deception		Non-Deception		Deception		Non-Deception	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	-.0800	.0741	-.121	.109	.254	.267	.0473	.0687
2	-.120	.130	-.259	.0987	.203	.247	.0638	0641
3	.0125	.0659	-.103	.101	.560	.216	.0550	.0748
4	.0325	.0614	-.0400	.0672	.720	.199	.0125	.0354
5	-.0400	.0796	-.0375	.0503	.375	.253	.0313	.0584
6	.0188	.0919	-.0488	.106	.303	.318	.0699	.0412
7	-.00250	.0894	-.0175	.0663	.577	.264	.0363	.0566
8	.0750	.100	-.0100	.0604	.241	.283	.0861	.109
9	-.144	.0888	-.181	.0724	.673	.201	.0974	.0906
10	-.139	.123	-.0713	.0714	.630	.260	.220	.264
Total	-.0386	.0779	-.0889	.0795	.454	.198	.0719	.0579

Table 3: Mean Response Accuracy Score.

Participant	Deception		Non-Deception	
	Mean	SD	Mean	SD
1	2.25	1.67	4.00	.000
2	2.38	1.41	4.00	.000
3	2.13	1.64	4.00	.000
4	0.50	1.41	4.00	.000
5	1.75	1.59	4.00	.000
6	2.75	1.17	3.88	.354
7	1.63	1.85	4.00	.000
8	3.00	1.31	4.00	.000
9	0.75	1.04	4.00	.000
10	0.88	1.36	3.25	1.39
Total	1.90	.738	3.90	.316

Discussion

The purpose of the current study was to assess differences in athlete responses to deceptive and non-deceptive passes. Further to analyse difference in eye movement response times andresponse initiation times. Moreover, to assess the response accuracy of skilled basketball players when faced with deceptive passes.

Response Initiation

Participants recorded a statistically significantly slower response initiation time when faced with non-deceptive trials compared to deceptive. The mean response time to non-deceptive passes was -.0386s compared to -.0889s for deceptive passes. Both statistics are negative, indicating the movement response was initiated prior to the execution of the pass, suggestingthat responses to both conditions were anticipatory. The difference in response times was .0503s with the movement response to non-deceptive passes being initiated earlier and this implies that the participants were able to anticipate the direction of the non-deceptive passesmore easily so therefore could initiate their movement response earlier.

All participants mean scores for response initiation when facing non-deceptive trials was negative indicating that all participants initiated their response before the ball had been passed, displaying a more anticipatory response. Four participants mean score for response initiation was positive

when faced with deceptive trials indicating they initiated their responseafter the pass had been executed (see Table 2) indicating a reactionary response due to being deceived in the pass direction. Or were more wary of being deceived so did not want to make an anticipatory judgement and therefore not be able to intercept the ball as it is evident from the literature that skilled players even when deceived, their performance success does not decrease as much due to having a superior and faster motor response[26,8,27]. The findings from the current study are consistent with the contention by[28] that skilled players although initially deceived, can quickly correct their initial response which is difficult to see in the results produced from the current study. Therefore, it is difficult to from the data if the participants were deceived asfurther studies have shown that skilled athletes wait for the deceptive action and rely on a fastreactionary response and motor production to intercept or predict the direction of a pass[8,29].

Eye movement Response

The eye movement response time refers to the time it takes for the participants gaze after ballrelease to catch up to the ball. Participants also recorded a statistically significantly slower eye movement response time when facing non-deceptive passes compared to deceptive passes. The mean eye movement response time to non-deceptive passes was .0473 comparedto .254 when facing deceptive passes. The eye movement response time when facing deceptive passes was 0.207 seconds slower suggesting that participants took longer to catch up to the ball after ball release and this coupled with the other variables is due to their movement initiations being in the incorrect direction, therefore it was harder to catch up withthe ball quicker.

Every participant had a slower eye movement response time when faced with deceptive trials compared to non-deceptive. Therefore, in the deceptive trials participants' gaze took longer tocatch up to the ball. This finding is consistent with further literature that due to focusing on deceptive signals, it takes individuals longer to then catch up to the ball to intercept[30,31]. Although the distance between fixations was not measured in the current study, individuals will have taken longer to catch up to the ball with their gaze due to focusing on deceptive cues which for passing are normally the eyes andhead of the passer. So, it would have taken the participants a longer time to catch up with the ball due to following the deceptive cues[9].

Response Accuracy

The response accuracy was statistically significantly less when facing deceptive passes at a mean score of 1.90 compared to a mean score of 3.90 when facing non-deceptive passes. The score of 1.90 when facing deceptive passes meant that on average participants moved in the correct direction but did not attempt to intercept the pass (as per **Table 1**). The score of 3.90 when facing non deceptive passes meant that on average participants moved in the correct direction and successfully contacted or retrieved the ball. Only two participants did not achieve a perfect score of 4.00 for non-deceptive passes, therefore showing the ease that the skilled participants had in anticipating and intercepting non-deceptive passes.

Mori and Shimada analyzed the effect of expertise on anticipating deceptive actions[8]. They discovered that experienced players anticipated nondeceptive actions less accurately than novices, as the skilled players experiences and expectations of deceptive actions negatively worked on their judgement and anticipation of nondeceptive actions. With not all participants in the current study achieving an expected perfect score, the findings therefore agree with this contention. However, the main finding that deceptive passes resulted in a lower response accuracy is consistent with a wide range of literature, especially in magic[6,15] and further to sporting contexts[32,26]. Both magic and sport literature are consistent with the finding that even skilled individuals focus on deceptive cues causing a detriment to performance level.

Strengths

Several strengths and weaknesses of the current study should be mentioned. Firstly, to the best of our knowledge, this is the first study to measure and analyses differences in response imitation time and eye movement response time in an experimental sport setting. Previous studies have analyzed differences between novices and experts[33,28] in response times but not differences within and similarities with expert level athletes. The use of the Tobii Pro Glasses and software provided accurate measurements of participants gaze positions and gaze times due to the high frames per second of the recording.This was also true for the iPads used, so this enabled the research team to precisely pinpoint and timestamp the videos.

Limitations

Some limitations must also be mentioned. Firstly, the sample size was very small with only ten participants. This was due to participant availability and due to the low number of athletesmaking the inclusion criteria, therefore affecting the generalizability of the results. Also, therewere some variations in conditions for each participant that must be considered and mentioned. Not all passes delivered were delivered with the same speed and bounced in the same area each pass. Further the way the passer deceived the defender was not always consistent through the blocks of trials, which although difficult to control could affect the generalizability of the results. A further issue is in order to compare findings across previous research the analysis approach used was to average data across participants and trials.

However, utilizing this approach is predicated on the reinforcement that all participants adopta universal perpetual strategy. The tendency to average data in the analysis of statistics may have masked individual differences in performances as only a handful of trials were selected for analysis out of the fifty trials the participants took part in. The experimental bias explainswhy the transfer efficacy of perpetual training methods are inconclusive.

Future Research

Ideally in the future there would be the same passer to each defender however, due to the availability of the participants this was not possible in the current study. Further research could be conducted to evaluate whether specific gaze patterns or fixations on a particular arearesult in not only faster and more anticipatory response times but also whether they correlate to greater response accuracy. Future research should also examine differences between male and female athletes to deceptive actions in sport to assess potential difference in male and female sport. Further, it is important to understand the most powerful type of deception, whether deception with the eyes, faking a pass one direction or subtle changes in hand and wrist position result

in a more powerful deception. This finding could therefore be taken intonot just elite sport but also at grassroot level to help improve performance. Moreover, the gaze behaviour findings derived from the eye tracking software has underpinned the content of programmed delivered with the aim of training perceptual skills[34-36,25].

Conclusion

The current study illustrates the impact that deceptive actions have on an individual's response initiation and also performance level as the findings indicate a slower response initiation and eye movement response time when facing deceptive passes compared to non- deceptive passes. Individuals initiated their response prior to ball release when facing non- deceptive passes but on average initiated their response after ball release when facing deceptive trials. This suggests that on average the participants responses to deceptive passeswere more reactionary whereas responses to non-deceptive passes were more anticipatory. Further, facing deceptive passes has a detrimental impact on response accuracy compared tonon-deceptive, therefore demonstrating the power that deceptive actions possess and how they can be utilized for performance benefits in sport.

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