

Understanding the tactical behaviour associated with turnovers in elite netball.

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ABSTRACT

The primary objective of this study was to identify why turnovers occur in netball. In a previous study, the Tactical Principles Guideline (TPG) was developed using a group of expert netball coaches (Coombe, Millar, Button, & Oldham, 2020). In the development of the TPG, the expert coaches defined 18 tactical behaviours (nine attacking and nine defensive behaviours), that can explain why turnovers occur in netball. Despite the tactical behaviour definitions being rated as content valid in the initial study, further research was needed to determine if a second group of coaches were able to identify the tactical behaviours in real game contexts. Ten expert netball coaches responded to an online questionnaire which required them to review 10 turnover scenarios. Each coach used the TPG to identify the tactical behaviours that contributed to causing or creating the turnover, as well as which players were involved in the turnover. All 18 tactical behaviours in the TPG were identified and used to explain why turnovers occur in netball. The results also show that turnovers are the result of multiple players using a variety of different tactical behaviours. Unlike traditional notational analyses the TPG is able to identify that turnovers are the result of multiple interacting players. Therefore, this study has taken a step further in validating the TPG as an effective tool for understanding turnovers in netball.

1. Introduction

In team sports there is a constant demand for players to collectively respond and react to uncertainty in the performance environment (Silva, Garganta, Araújo, Davids, & Aguiar, 2013). These demands create an environment where players are presented with a multitude of tactical problems to solve (Grehaighe, Bouthier, & David, 1997). Tactical problems include how to maintain possession and score during offensive (attacking) phases, and how to regain possession and prevent scoring during defensive phases (Gutierrez, Villora, Lopez, & Mitchell, 2011). The ability to solve these tactical problems has been shown to be indicative of success in team sports (Grehaighe, Godbout, & Bouthier, 1999).

In order to understand team sport success, it is important to recognise team sports as complex adaptive systems (Chow et al., 2006). This complexity can be observed in the antagonistic relationship between opposition teams as they produce examples

of self-organising behaviour. This constant battle between teams creates a game that flows between states of stability (stable patterns of behaviour), instability (unstable patterns of behaviour) and phase transitions (changes in the organisation of the team) (Vilar, Araujo, Davids, & Button, 2012). For example, in situations where the ball changes possession from one team to another, a phase transition occurs, which creates moments of disorder that can be capitalised on to gain advantage over the opposition and create scoring opportunities (Garganta, 2009).

The coordination of team behaviour is critical during these unstable, transitional periods of play that occur when there is a change in possession or a disruption in the flow of the game. Therefore, the ability to collectively exploit environmental resources becomes indicative of good team performance (Gesbert, Durny, & Hauw, 2017). When an affordance or 'opportunity to act' is perceived, the subsequent actions performed are the realisation of that affordance (Araujo, Davids, & Hristovski, 2006). Whether the affordances are acted upon

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effectively or not, the observed actions provide valuable information regarding a player or team's tactical competency. At the interpersonal level, players can be perceptually attuned to affordances *for* and *of* others. The ability to perceive affordances for others requires that an athlete is able to accurately assess what actions are possible for a teammate or opposition player. Perceiving affordances of others, is the ability to act upon the opportunities others have created (Fajen, Riley, & Turvey, 2008).

Many invasion sports are well suited to understanding complex tactical behaviours that occur during turnovers. This paper will focus on netball, a seven-a-side court sport, similar to basketball. In netball, the seven team members are allocated a position, each with different roles and positional court restrictions. For example, the primary role of the 'goal shoot' (GS) is to shoot goals, while being restricted to playing in one third of the court. The main role of the centre (C) is to restart the game after every goal is scored (from a centre pass in the middle of the court) and act as a link between the attacking and defensive positions to move the ball through the court. The C is allowed in all three thirds of the court, but not inside the shooting circles. Netball also has a set of rules that differentiate it from basketball. Firstly, when a player is in possession of the ball they cannot move (more than one step), and they must dispose of the ball (pass to a team mate or shoot a goal) within three seconds of receiving the ball. Defensive players must not 'defend' or have their arms up defending a player if they are within 0.9m of a player in possession of the ball. In addition, unlike basketball, a defender may not 'contact' another player (INF, 2016).

Current methods for exploring the processes that lead to turnovers in netball are grounded in the use of notational techniques that denote observable sequences of behaviour to describe "who-did-what-where-when" (Vilar et al., 2012, p. 2). These methods rely on coaches and/or game analysts to observe the unfolding patterns of game behaviour and then record the discrete actions that occur, such as the passing sequences between players, or the nature of different turnovers (Alexander, Spencer, Mara, & Robertson, 2019). The most common type of turnover in netball is probably 'passing and catching errors', which account for most losses in possession (according to unpublished notational analysis data). Passing and catching errors occur when the ball is lost in the transition between two players as they attempt to move the ball through the court. When using notational methods, these errors are coded by identifying the attacking player who threw the pass and the defensive player who gained the turnover.

Within the team sports literature, there has been a focus on passing and catching errors, with particular interest in the frequencies and percentages of observable behaviour for the player in possession of the ball (McGarry, 2009; Sarmiento, Campanico, & Leitão, 2010). O'Donoghue, Mayes, Edwards, and Garland (2008) provided data highlighting the performance indicators that differentiate between 'top of the table', and 'bottom of the table' netball teams, showing that 'top of the table' teams, create, and score from a greater percentage of turnovers, compared to teams at the bottom of the table. However, little detail was provided as to why or how these turnovers occurred. In a recent netball study, Bruce, Farrow, Raynor, and May

(2009), looked specifically at the cause of passing errors by classifying the error as being 'within reach' or 'out of reach' of the intended receiver. The inter-rater agreement for the categorisations of 'within reach' and 'out of reach' passes was very high ($k = 0.90$), and significantly more passing errors were classified as 'within reach', compared to passes that were 'out of reach'. Such results suggest that even when a pass is thrown within reach of the intended receiver, errors still occur. At present the role of the intended receiver in causing passing errors (or other attacking players), has not been well explained.

The classification of passing errors using observational methods has been regarded as a gold standard for assessing tactical behaviour (Rein & Memmert, 2016). However, as such methods (e.g., notational analyses) are descriptive rather than explanatory, they cannot identify the causative mechanisms and processes underpinning the error, or why it occurred (McGarry, 2009). Recently, alternative methods for analysing game complexities and tactical performance have been proposed. Computer aided technologies such as GPS (Sampaio & Macas, 2012), self-organising maps (Croft, Willcox, & Lamb, 2018), and video based time-motion analyses (Carvalho & Gonçalves, 2017) have been used to track the movements and positional organisations of players. While these technological innovations are valuable, they still require human input to specify which performance variables to track to produce meaningful data.

A more common approach in the literature to understand why turnovers occur is the manipulation of task constraints in small-sided games to identify patterns of successful behaviour (Moreira Praça et al., 2018). For example, the number of players involved in a game can shape the emergence of different individual and collective tactical behaviours (Ometto et al., 2018). In football, when team numbers are manipulated to create numerical inferiority for the defensive team, defenders have to account for the extra attacking player, which has been shown to promote high coupling between defending players (Travassos, Vilar, Araujo, & McGarry, 2014). As a result, defensive players have been shown to restrict the space between themselves and re-organise to protect the goal (Travassos et al., 2014; Vilar et al., 2012). Praça, Costa, Costa, Andrade, and Greco (2016) also found that in contexts of defensive inferiority, higher frequencies of 'defensive unity' were identified, suggesting that to combat the additional player, defensive players adapt and react as a unit to overcome their disadvantage.

In a recent study the tactical principles guideline (TPG) for netball was created (Coombe et al., 2020). The TPG was developed using the Delphi method to gather knowledge from 10 expert coaches to create a list of key tactical behaviours that contribute to turnovers in netball. Following three rounds of interview and questionnaire, a list of 18 tactical behaviour definitions were developed and refined, until the required level of agreement was reached (Coombe et al., 2020). As shown in Figure 1 below, a total of 18 tactical behaviours are included in the TPG, with nine attacking tactical behaviours, and nine defensive tactical behaviours. These tactical behaviours are categorised into four tactical principles; space and movement, timing, support and reading play.

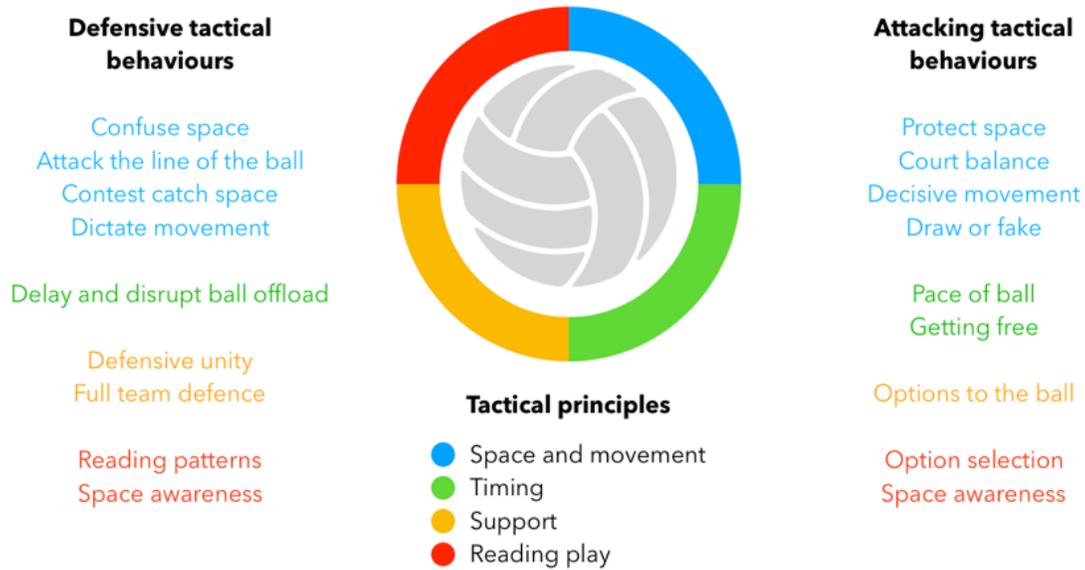


Figure 1: Tactical Principles Guideline

In developing the TPG, netball experts identified a variety of actions used by individuals and teams to create or prevent turnovers in netball. The TPG includes behaviours that occur both ‘on’ and ‘off’ the ball. On-the-ball behaviours refer to the actions of players in possession of, or guarding the player in possession of the ball, whereas off-the-ball behaviours occur away from the ball carrier (Oslin, Mitchell, & Griffin, 1998). For example, for the player in possession of the ball (on-the-ball), option selection and space awareness are tactical behaviours used to determine whom to pass the ball to, and where to pass the ball. In addition, protect space, decisive movement, and getting free are tactical behaviours that off-the-ball attacking players use to create good quality informational cues for the passer to read and decide where, when and whom to pass the ball to. Therefore, rather than turnovers being identified as the passer’s error, the TPG can potentially be used to help identify the contributing role that other attacking players have in the turnover. At present, the TPG has not been used in real game contexts, and further investigation is needed to determine if a second group of coaches are able to identify these tactical behaviours in game footage, and use them to describe why turnovers occur in netball.

Therefore, there are two aims of this current study. The primary aim is to determine whether a group of coaches can identify the tactical behaviours in the TPG in real game contexts. If these coaches are able to identify the tactical behaviours in the TPG, then the second aim can be addressed; which is to determine if the TPG can be used to effectively explain why turnovers occur in netball. Following these aims, two research questions will be addressed; Are the tactical behaviours in the TPG identifiable? Why do turnovers occur in netball? As a result,

it is hoped to gain a greater understanding of the complexity of turnovers in netball to expand upon what we know from traditional notational analysis.

2. Methods

2.1. Participants

A purposeful sample of expert netball coaches were invited to participate in this research. The invited coaches held various high performance coaching roles within Netball New Zealand. A total of 21 coaches were invited, and 10 coaches agreed to participate in this study. Five of the invited participants could not participate due to unavailability at the time of data collection and six coaches did not respond.

2.2. Procedure

Prior to commencing the study, the coaches were sent a copy of the TPG to become familiar with. The coaches were then sent an email from the lead author that contained a link to complete the study via the online platform Qualtrics (Qualtrics, 2015, Provo, UT). For the study, the coaches were presented with sequences of game footage showing the unfolding events of 10 different turnovers in netball. The game footage used was international test footage shot from an end-on perspective (above and behind the goal-post), sourced through Netball New Zealand. This footage had been previously collected and coded for performance analysis purposes. A selection of the most recent international games (as of 2018) were chosen at random, which included test matches between the New Zealand and Australia,

Jamaica, England or Wales. Each scenario was between 6-17 seconds long (M = 10.7 seconds, SD = 4.06) and the coaches were able to watch the scenarios as many times as they needed to understand the scenario. After observing each scenario, the coaches were instructed to respond to four questions. The questions required the coaches to; a) identify the players involved in the turnover, b) identify the tactical behaviours they observed in the turnover (using the TPG), c) identify which players were using the identified tactical behaviours, and d) rank each player's importance for creating or causing the turnover (1 = most important, 7 = least important). The 1-7 scale represents the seven players in a netball team, therefore, the player ranked 1st was the most important for creating or causing the turnover, and the player ranked 7th was the least important player. If there were four players selected (as shown in Figure 2 below (image A), then the ranking would be from 1-4). Figure 2 below provides an example of the visual display accompanying the four questions that the coaches responded to for one team.



Figure 2: Overview of questions the coaches responded to A: Select players involved, B: Select the tactical behaviours you observed C: Select which players used which behaviour, D: Rank the players' involvement

As shown in Figure 2 when answering questions A, C and D, the coaches were provided with a still image from the video, showing the moment (frame) immediately prior to the final pass being made. For question A, the coaches were able to click directly onto the image and select the players who were involved in the turnover, and for questions C and D, the image was used as a prompt to aid recall of the scenario. The coaches were instructed to identify tactical behaviours observed in the whole scenario, not just the moment within the still image. For question B, the coaches were asked to select the tactical behaviours they observed. If the coaches observed a behaviour that did not represent any of the tactical behaviours in the TPG, the coaches

were able to select 'other' and provide a description of what they observed.

2.3. Data analysis

The first research question; are the tactical behaviours in the TPG identifiable? was addressed by reporting the raw frequencies that each tactical behaviour was identified across all 10 scenarios, from all 10 coaches. In addition, the second research question; why do turnovers occur in netball? was addressed with three stages of analysis outlined below.

Stage one: Number of players and tactical behaviours identified

Stage one determined the number of defensive and attacking players involved in creating or causing the turnover, as well as the number of different tactical behaviours involved. Means and standard deviations were calculated for the number of players and number of behaviours involved in each turnover (for attack and defence). Cohens D effect sizes (*d*) (Fritz, Morris, & Richler, 2012) were reported to determine if there were any differences between the attacking and defensive teams for the number of players and the number of tactical behaviours involved in the turnover. Cohens D was calculated using the mean difference between the attacking and defensive measures divided by the mean standard deviation.

Stage two: Rank analysis

Stage two identified which players (from most important to least important) had a role in creating or causing the turnovers. In order to mimic traditional notational analysis, this analysis focused on the three players who are typically associated with turnovers; the passer, the intended receiver and the interceptor. For each turnover, the passer, intended receiver, and interceptor, were identified and the number of times they were ranked as the most important player for causing or creating the turnover was recorded and reported.

Stage three: Scenario analysis

As a final stage of the analysis, the researchers selected one turnover from the study to further explore the coach responses in depth to outline the processes underpinning the turnover.

3. Results

3.1. Research question one: Are the tactical behaviours identifiable?

As shown in Table 1 and Table 2 below all 18 tactical behaviours (9 attacking and 9 defensive behaviours) were observed by the expert coaches. The total observations show that each tactical behaviour was observed between 73-421 times in total across the 10 scenarios.

Table 1: Total frequency of observations for the defensive tactical behaviours

	Confuse space	Attack line of the ball	Contest catch space	Dictate movement	Delay and disrupt ball off-load	Defensive unity	Full team defence	Reading patterns	Space awareness
Coach 1	50	8	8	52	9	53	0	41	43
Coach 2	2	6	4	9	1	11	14	5	7
Coach 3	38	41	42	50	46	51	48	50	43
Coach 4	40	8	5	48	26	58	37	21	40
Coach 5	13	8	7	29	7	44	22	6	12
Coach 6	18	3	3	40	8	36	12	8	13
Coach 7	1	5	3	25	22	35	14	2	6
Coach 8	17	5	3	17	14	36	6	17	2
Coach 9	20	4	7	50	11	54	45	52	44
Coach 10	35	6	20	14	21	43	6	0	10
Total	234	94	102	334	165	421	204	202	220
SD	16.6	11.2	12.3	16.6	12.9	13.7	17.1	20.2	17.9

Table 2: Total frequency of observations for the attacking tactical principles

	Protect space	Court balance	Decisive movement	Draw or fake	Pace of ball	Getting free	Options to the ball	Option selection	Space awareness
Coach 1	24	20	23	28	10	24	26	9	22
Coach 2	1	4	4	4	2	5	8	10	4
Coach 3	39	32	40	42	28	35	40	44	43
Coach 4	38	16	40	37	14	37	44	14	19
Coach 5	12	5	11	1	6	10	17	8	9
Coach 6	11	6	16	5	2	7	29	10	9
Coach 7	3	7	7	2	2	6	12	8	8
Coach 8	8	5	9	2	6	14	17	3	6
Coach 9	6	35	33	4	0	28	35	10	27
Coach 10	7	9	16	7	3	24	30	16	2
Total	149	139	199	132	73	190	258	132	149
SD	13.9	11.6	13.5	15.9	8.4	12.1	12.1	11.4	12.8

The large range in the frequency of observations, as shown in Table 1 and Table 2 above (73-421), is representative of the number of players likely to use each tactical behaviour in a given scenario. For example, the defensive tactical behaviour ‘defensive unity’ was observed 421 times across the 10 scenarios. This large number of observations can be explained logically, as defensive unity requires the presence of multiple players working together. In contrast, the tactical behaviour ‘attack the line of the ball’ (ALOB) was observed only 94 times. Unlike defensive unity, when ALOB is observed, it is logical to assume that only one or two players per scenario would use this behaviour in the attempt to gain an intercept.

It is also important to note that there were three different tactical behaviours that were not identified by one coach (a different coach for each behaviour). As shown in Table 1 above, coach one did not identify full team defence in any of the scenarios, and coach ten did not identify reading patterns in any of the scenarios. In addition, as shown in Table 2 above, coach nine did not identify pace of the ball in any of the ten scenarios.

Research question two: Why do turnovers occur in netball?

Stage one

On average, the coaches identified 4.86 (*SD* = 1.18) defensive players involved in creating each turnover, and 3.96 (*SD* = 1.40) attacking players involved with causing the turnover. The difference between the defensive and attacking team was 0.9 players, with a medium effect size of *d* = 0.70 (Fritz et al., 2012). When creating or causing the turnovers, the coaches identified the defensive team using an average of 5.68 (*SD* = 1.97) defensive tactical behaviours per scenario, and an average of 5.58 (*SD* = 2.37) attacking tactical behaviours per scenario. The difference between the defensive and attacking teams was 0.1 tactical behaviours, with a low effect size of *d* = 0.04. See Table 3. Therefore, there was no meaningful difference between the number of tactical behaviours used to create the turnover.

Stage two: Rank analysis results

Defensive players: Seven of the ten scenarios included an intercept. In these intercept scenarios, the player who intercepted the ball was ranked as the most important player for creating the turnover 52.2% of the time (36 out of 69). This result suggests that while the interceptor was seen to be important, the other defensive players were also seen to contribute equally to creating turnovers. This is a more sensitive approach than traditional notational analysis in which 100% of intercept turnovers are coded as a ‘gain’ for the interceptor without acknowledging the impact of the other six players on the court.

Attacking players: In the ten scenarios where a passing error occurred, the passer was ranked as the most important player for causing the turnover 72% of the time (67 out of 93 ratings). The

intended receiver was ranked as the most important player 20% of the time (17 out of 85 ratings), and finally the other attacking players were ranked as the most important players 11% of the time. While the passer was ranked as the cause of the turnover most often, the coaches did recognise the contribution of the “other” attacking players, not just the passer and intended receiver. These results will be explored further in stage three below.

Table 3: Mean number (SD) of players and tactical behaviours involved in the turnovers

	Defensive team (D)	Attacking team (A)	Mean difference: (D-A)	Effect size (d)
Players involved	4.86 (1.18)	3.96 (1.40)	0.9	0.70
Tactical behaviours involved	5.68 (1.97)	5.58 (2.37)	0.1	0.04

Stage three: Scenario analysis

The next stage of the analysis adopted a flexible method to report the different tactical behaviours that were identified by the coaches when explaining why turnovers occur. In this study the ‘flexible method’ refers to taking an investigative, qualitative approach where one scenario was used as a case study. This approach was necessary as every turnover is different and while patterns may emerge in different scenarios, the specific combinations of tactical behaviours used differ for each turnover, in terms of who was involved and what they did to contribute to the turnover. The scenario being used for this stage of the analysis is shown in Figure 3 below. This scenario was a representative performance scenario that commonly occur in netball games. In this scenario, the wing attack in red (WA) is about to pass the ball to the goal shoot in red (GS). As the pass is released, the opposition goal keep (GK) (in black) runs out and intercepts the pass. Using traditional notational analysis, the passing error made by the WA would be recorded as a ‘loss’ for the WA, and the resulting intercept would be recorded as a ‘gain’ for the GK. However, when using the TPG, the coaches in this study were able to further explore why the turnover occurred through identifying multiple players using a variety of tactical behaviours. The specific tactical behaviours identified in this scenario, for the attacking and defensive team are discussed below.



Figure 3: Scenario example resulting in an intercept

Attacking team

In the scenario shown in Figure 3 above, the coaches identified four attacking players (in red) as causing the turnover; wing attack (WA), goal shoot (GS), goal attack (GA) and centre (C). As shown in Table 4 below, all 10 coaches identified the attacking tactical behaviour option selection for the WA, suggesting that she made a bad decision about whom to pass to. Seven of the ten coaches also selected the tactical behaviour draw and fake, suggesting that if the WA had attempted to ‘fake’ the pass in one direction, then pass in a different direction, the turnover may not have happened. The coaches also recognised the role that the GS, GA and C had on contributing to the passing error. For these players (GS, GA & C), the tactical behaviours, decisive movement and options to the ball were identified most often, highlighting that the GA and GS did not drive strongly and clearly to the ball (decisive movement) and the GA and C did not present themselves as viable passing options (options to the ball).

While the WA threw the pass that was intercepted, her options were limited by the ineffective positioning and movements of her teammates. The GA, GS and C were unable to

communicate clearly where they wanted to receive the pass, forcing the WA to make a poor decision, resulting in the turnover. The results from this example scenario reflect the most common results from all other nine scenarios, as option selection was the most frequently identified tactical behaviour for the passer and decisive movement and options to the ball were the most frequently identified tactical behaviours for the other attacking players.

Defensive team

For the scenario in Figure 3 above four defensive players (in black) were identified as creating the turnover; the goal keep (GK), goal defence (GD), wing defence (WD), and centre (C). As shown in Table 5 below, the GK (interceptor) was identified by all 10 coaches as being involved in the turnover. The coaches identified the tactical behaviours, attack the line of the ball, confuse space, defensive unity and space awareness as the tactical behaviours the GK used to intercept the ball.

The defensive tactical behaviour, dictate movement is shown in the scenario (Figure 3), as the attacking players (WA and C), are pushed very wide, which is not considered the best position to pass into the goal circle. Therefore, the defensive players (WD and C) were able to dictate their opposition into ineffective spaces on the court, and shut them down as potential passing options. The GD and GK were identified as confusing space, as their movements made it difficult for the passer (WA) to know which players were free to pass to. The C and GD also used delay and disrupt ball off-load, which can be seen being performed by the player defending the ball carrier, with their arms up, making it difficult for the passer (WA) to clearly see where to pass the ball. These actions forced the WA to make a pass that was easy for the GK to read, using space awareness to make the decision to attack the line of the ball and contest catch space to gain the intercept.

Table 4: Attacking players involved in the turnover and attacking tactical behaviours identified

Number of experts who identified the player		Tactical behaviours identified (number of coaches)
WA (passer)	10/ 10	Option selection (10/10), Draw & fake (7/10)
GS (receiver)	8/ 10	Decisive movement (6/8)
GA	8/ 10	Decisive movement (6/8), Options to the ball (6/8)
C	7/ 10	Options to the ball (6/7)

Table 5: Defensive players involved in the turnover and the defensive tactical behaviours identified

Number of experts who identified the player		Tactical behaviours identified (number of coaches)
GK (interceptor)	10/ 10	Attack the line of the ball (9/10). Confuse space (7/10), Defensive unity (8/10), Space awareness (6/10).
GD	10/ 10	Confuse space (8/10), Defensive unity (8/10), Delay and disrupt (7/10)
WD	9/ 10	Dictate movement (6/9), Defensive unity (7/9)
C	10/ 10	Delay and disrupt (7/10), Defensive unity (7/10), Dictate movement (6/10)

4. Discussion

This study aimed to answer two primary research questions to determine the effectiveness of the TPG for understanding turnovers in netball. The first question aimed to identify whether the tactical behaviours in the TPG are identifiable in turnover scenarios. The results highlight that all 18 tactical behaviours were detected in the turnovers, and thus were considered ‘identifiable’. In total, the tactical behaviours from the TPG were observed 3,397 times by the expert coaches to explain ‘why turnovers occur’ and thus we can answer the first research question, and conclude that all the tactical behaviours are identifiable. To further strengthen this finding, it was notable that the expert coaches only selected the ‘other’ option three times. This finding provides support for the overall content validity of the TPG as the tactical behaviours in the TPG are able to describe the tactical events observed in each turnover without any additions or modifications (Heale & Twycross, 2015).

The second research question was used to gain deeper insight into why turnovers occur in netball? One of the key results was that the coaches in this study were able to identify multiple players, using different combinations of tactical behaviours to

explain why turnovers occur. On average, across the 10 scenarios, the coaches identified more defensive players (4.86 players) involved in the turnovers compared to attacking players (3.95 players), suggesting that when defenders create numerical superiority (more defensive players than attacking players), they may be more likely to gain a turnover.

As shown in previous studies, in small sided-games, researchers deliberately alter the number of players in a team to manipulate the tactical behaviours used. In football, Praça et al. (2016) found that in contexts of defensive inferiority, higher frequencies of ‘defensive unity’ were identified, suggesting that to combat the additional attacking player, defensive players adapt and react as a unit to overcome their disadvantage. In addition, Travassos et al. (2014) showed that numerical inferiority for the defensive teams is associated with decreased distance between defensive players, as they converge and retreat to protect the space in front of the goal.

Although this present study did not specifically manipulate the number of players involved in the turnovers, there are moments within the scenarios where numerical superiority or inferiority can be observed. For example, Figure 4 below shows one of the scenarios used in this present study. In this scenario



Figure 4: Scenario example, which resulted in the black team (GA) intercepting the ball.

the player in possession of the ball (C) is unmarked (i.e., there is no defender in immediate proximity). This leaves the five defensive players (GD, WD, C, WA, GA, shown in the red squares), marking four attacking players (WA, GA, GD, WD, in the yellow dresses, who are legally able to receive the ball); that is, the defensive team has numerical superiority, placing the C under more pressure to make the decision of whom to pass to. In this scenario, the C is forced to pass to the WD, and the ball is intercepted by the GA.

While creating moments of numerical superiority is important, the results from this study also highlighted that we need to understand the tactical behaviours that players use to create or prevent turnovers. The tactical behaviour option selection was most frequently recognised as the cause for turnovers for the passer. However, from an ecological dynamics perspective, decision making (or option selection) is not derived solely from an individual's (passers) thoughts and perceptions; rather, it involves a complex interplay between the performer's perceptions, cognitions, and actions, within the nuances of their performance environment (Araujo et al., 2015). The detection of affordances (opportunities to act) requires that the passer is attuned to the relevant environmental information to guide their decision-making; however, successful attunement depends on the quality of information available (Correia, Araujo, Craig, & Passos, 2011). Grehaigne et al. (1997) referred to this as 'problems related to information' and noted that it is the duty of the prospective passing options to reduce uncertainty and create good quality information for the passer to attend to and use (Grehaigne et al., 1997).

This notion of the quality of information was identified in the results of this current study, as the coaches were able to identify that attacking players (other than the passer) were partly responsible for the turnovers occurring. The attacking players (other than the passer) were ranked as the most important players for causing the turnover 28% of the time. Although this is relatively low, it is an important first step in recognising that passing errors are not solely caused by the passer. The results highlighted the different tactical behaviours that attacking players use to increase the quality of information to the passer. Particularly, the tactical behaviours of decisive movement, options to the ball, protect space and get free. These results are corroborated by the earlier study in chapter four as these four tactical behaviours were rated as the most important for preventing turnovers on attack by a different group of experts.

The coaches in this present study also identified a variety of defensive tactical behaviours that can create uncertainty for the attacking team. For example, when defensive players dictate movement and confuse space they are able to control or condense the space that attacking players have to use, limiting the options the attacking player has to pass to. When the defenders work effectively as a unit and limit the passer's passing options, they increase the predictability of where the ball will be passed; therefore, other defensive players are able to more accurately anticipate where the ball will go. To gain the

intercept, the potential 'interceptor' must be able to read the affordances (intercept opportunities) that are being created for them (Fajen et al., 2008). The coaches in this study also identified the defensive tactical behaviours, attack the line of the ball, and contest catch space for the player who eventually intercepts the ball, suggesting that once the affordance has been created, the player still needs to work hard to be in the right position to ensure they can intercept the ball cleanly (without a penalty).

A limitation of this study was that while all 18 tactical behaviours were considered identifiable, the notion of 'identifiability', must be assessed cautiously. From a critical realist perspective, captured in a pragmatic approach, reality exists independently of a human's capacity to comprehend it (Levers, 2013). In this way, the "observation of an entity is not required to determine whether it exists" (Levers, 2013, p. 2). In other words, if nine coaches identified a tactical behaviour and one coach did not, this is not proof that that behaviour did not exist. The results from this study highlighted three instances where only nine of the ten coaches identified the tactical behaviours; full team defence, pace of ball and reading patterns. However, as suggested above, just because one coach did not identify these behaviours it is not proof that they do not exist. Rather, what should be focused on within the pragmatic approach is how the identification of a tactical behaviour can have practical implications for the coach who identified it. If identifying the behaviour helps the coach decipher why a turnover occurred, then its pragmatic consequences have been realised. Likewise, if the coach can explain why a turnover occurred without certain tactical behaviours, then that is their non-contestable version of reality. It is also important to consider 'identifiability' outside of pure observation, because in some cases the object (or tactical behaviour) may not be directly observable (Levers, 2013). For example, the tactical behaviour space awareness may not be directly observed; rather, the result of good space awareness, such as an accurate pass or movement into a free space, is what is observed

5. Conclusion

Despite the criticism that notational methods have received in the literature, they remain the most frequently used tools for assessing team performance in team sports such as netball. This current research has built upon notational methods, to highlight the wider contextual factors that influence turnovers in netball. Specifically, this research has shown that turnovers are the result of multiple interacting athletes, using a variety of tactical behaviours to create or cause turnovers. The TPG appears to be an effective tool that coaches can use to identify tactical behaviours which contribute to turnovers in netball. As the TPG is still in the development phase, more research is needed to determine its effectiveness outside of video based protocols. For example, the TPG could be used to design training tasks that manipulate certain tactical principles, to help players create

turnovers on defence, and prevent turnovers on attack. This knowledge can enhance the impact that coach-led interventions can have on the development of tactical skill and overall team success (Clemente, Couceiro, Fernando, Mendes, & Figueiredo, 2013).

5.1. Practical applications

Based on the results from this study, we recommend that coaches focus on the 'supportive' behaviours that a team can do to prevent or create turnovers. For example, on attack, the tactical behaviour options to the ball was the most frequently recognised attacking tactical behaviour (a total of 258 times), suggesting that turnovers were frequently caused by the passer not having options of whom to pass to. Coaches can develop this tactical behaviour by emphasising the need to have at least three passing options at all times (to support the ball carrier) – a straight option, a square option and a backwards option. In addition, the defensive tactical behaviour defensive unity was the most frequently recognised defensive behaviour for creating turnovers (a total of 421 times). This suggests that when players work together and adjust to each-other's movements, when they are reacting to the opposition, they are more likely to gain an intercept. Coaches can develop this skill in their players through teaching a zone style defence, where players are instructed to mark 'space' rather than their direct opponent.

Conflict of Interest

The authors declare no conflict of interests.

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