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A comparison of attacking strategies that leads to goal scoring opportunities in elite level men's hockey and football.

PERFORMANCE ANALYSIS

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ST20003898

A comparison of attacking strategies that leads to goal scoring opportunities in elite level men's hockey and football.

Cardiff Metropolitan University Prifysgol Fetropolitan Caerdydd

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Abstract

This study compares the attacking strategies that lead to goal scoring opportunities across elite level Men's field hockey and association football. This study used the top eight Male Olympic hockey teams and UEFA Championship football teams (n=16) competing in seven classification matches from the London 2012 Olympics and UEFA European Championships (n=14). These matches were observed and analysed resulting in two hundred and thirty two (n=232) hockey and one hundred and fifteen (n=115) football possessions. Of these three hundred and forty seven possessions (n=347) forty (n=40) goals were scored. Details of successful possessions were recorded from the origin of possession right until an upgrade was achieved or possession was lost. For analysis and data collection purposes, the defensive half of the pitch was split into six (n=6) sections (labeled A-F), the attacking half was split into ten (n=10) sections (labeled 1-10) and the area/D was split into six (n=6) sections (labeled 1a-6a). These were done to meet the requirements of the title as they give good indications of zones of play, and they allowed data to be collected in regards of repossession points and position of entry into the attacking half and area/D. Using an apple iPad application called 'Dartfish EasyTag' the data was collected for each game and then exported into a format suitable for a Microsoft Excel spreadsheet which allowed every phase of the possession to be noted on the iPad before being visually put into order on Microsoft Excel. The study revealed that successful plays were initiated by an interception (42.7%) more than any other method of repossession and found that there was a significant difference between the two sports (p=0.000). The most used method of entering the area/D was through a dribble (41.7%) however the push/pass (39.1%) was also a well used tool within both sports and, it was found that there was a significant difference in regards to the method of area/D entry was also found (p=0.000). The results showed that across the two sports the left hand side (46.4%) of the area/D was predominantly favored to gain entry into, however the right hand side was also used a considerable amount (44.1%) showing very little difference and preference between the two sports and also showing no significant difference (p=0.171). Passing patterns showed that football

teams ($n=5.9$) used significantly more phases ($p=0.000$) than hockey teams ($n=3.6$) per possession in order to advance into an area of the pitch a scoring opportunity could be taken. The results suggest that for the game of hockey, the play requires a more direct approach and once possession is won the balls needs to get to the D as quickly as possible, where as football teams tend to look to be more patient and wait for the right opportunity to arise before committing to their attack. The results show that the dribble is the most effective way at gaining entry into the areas that are needed in order to score goals. These results give scope to further improve attacking down the right hand side of the pitch and utilizing the simple push/pass in order to make the most of the movement of the ball in gaining metres up the pitch into better goal scoring opportunities.

CHAPTER ONE

Introduction

1.1 Performance Analysis

Hughes and Franks (2008) concluded that performance analysis aims to analyse and improve performance and has 5 predominant areas in which it can be applied; tactical evaluation, technical evaluation, analysis of movement, database development and modeling and finally in educating coaches and players. In addition to this, modern technology and software have revolutionized the way in which performance analysis is conducted and the means by which data entry and procession have become increasingly efficient (Bloomfield *et al*, 2004; O'Donoghue, 2008).

The main purpose of performance analysis in sport is to provide information from a performance. The information gained through performance analysis will be relayed from the analyst to the athlete via the coaching staff (O'Donoghue, 2006) and performance analysis can be dated back as far as Fullerton's (1912) early effort to analyse the various facets of baseball.

Since then, there have been many significant advances in technology, money and media attention within sport. Croucher (1997) suggested that it wasn't actually until the computer was created in the 1960's that performance analysis really took off and Blaze *et al.* (2004) found that 80% of the modern day, Premiership football clubs used a computerized based system, and all twenty football clubs declaring that they used some form of obtaining information regarding performance. It is now accepted that performance analysis is an essential part of the post-game feedback to players and coaching staff (Reilly and Gilbourne, 2003) but, due to the need to gain an advantage over their opposition, the full extent and results of analysis that football clubs conduct remains secret to all but authorized personnel within the club (James, 2006). It is key to recognize that performance analysis is not just growing vertically in terms of better and more advanced technology, but is also growing horizontally with the increased media interaction across a wider range of sports for both sexes. The main reason of this is because more clubs are realizing that performance analysis assists

them in gaining small scientific advantages in preparation for future performances (Bartlett, 2001), and creating an advantage over the opposition.

1.2 Rationale

The decision to research the similarities and differences in attacking strategies between hockey and football was solely due to the lack of literature that focused on the comparison of attacking strategies in invasion sports. The choice to focus upon successful attacking plays was to limit the scope of the research and the decision to examine the UEFA European Championships and the London 2012 Olympic Hockey Tournament was because these two tournaments were the most up to date and high profile tournaments at the current time of the study.

The necessity for notational analysis to discover any differences or similarities between sports is highlighted with studied from Franks and Miller (1986) and Laird and Waters (2008) who found that coaches can only recollect 30-60% of the key factors that determine successful performance. Without the use of notation analysis the differences that distinguish between successful and unsuccessful attacks and the comparison across the two sports, in regards to the amount tactics are transferrable, is based solely upon subjective opinions.

1.3 Hypotheses

The following hypotheses will be tested:

1. Possessions will enter the area/D within the top two sections significantly more than the other four segments.
2. Teams will use push/ground pass significantly more times than any other method to advance into the attacking area.
3. Possessions will begin through an Interception/tackle significantly more times than any other method of repossession

4. Teams will win the ball back in the attacking half of the field significantly more times than the defensive half.
5. Possessions phases in terms of number of passes will be significantly different across the two sports.

1.4 Limitations

For the purpose of this study, the videos from all of the matches that were analysed were obtained from terrestrial television broadcasting companies that were filmed whilst being played live on television. The aim of these broadcasts were to make the matches more enjoyable for the viewers, not to facilitate notation, and therefore added extras used by the broadcasters such as replays and camera angles occasionally hindered match play analysis.

The choice to disregard the attacking team and their opponents in order to generalize the sports of hockey and football and not focus on specific nations and their tactics meant that a generalized 'defensive strategy' was assumed for all of the teams that took part in the competitions. However if there is such a wide spread variety of attacking strategies that teams can use, then there must be a range of defensive strategies that could also be used to combat these attacking plays.

Finally, the samples consisted of seven games from both the hockey and football competitions; however the amount of results pulled out of these games were not balanced in terms of number of possessions. The amount of possessions coming from the football games accounted for almost half that of the hockey games, meaning that none of the raw data was able to be represented in diagrams for the results section but percentages of the overall possessions had to be used.

CHAPTER TWO
Literature Review

Chapter 2 Literature Review and Rationale

2.1 Overview

This study is looking into attacking strategies that lead to goal scoring opportunities and goal scoring patterns across two invasion games, field hockey and football, in order to see if applied tactics in either sport are transferrable across one another.

To apply boundaries to the width of this study, only the successful attacking strategies of the team were analyzed, along with the outcome of their strategies.

2.2 Invasion Games

Read and Edwards (1992) identified that sport was divided into three types; these have been identified as net games, wall games and invasion games. Following this, Hughes and Bartlett (2002) suggested that invasion games are divided into sub-categories, these are; try scoring games, goal throwing games and goal striking games. Field Hockey (hockey) is categorized as a goal striking invasion game, and is similar to Association Football (football) in its structure. Wade (1996) suggests that football has three phases of principles; defensive phase, attacking phase and preparation phase. When reviewing his phases it was clear to see his emphasis was based on possession being the key to success. However, he also suggest that this could be compromised if there was an opportunity for a clear chance or shot on goal, due to the main aim in invasion games being to outscore ones opponents.

Hockey and Football are both team based invasion games consisting of ten outfield players and a goalkeeper. The game of hockey has been known for becoming particularly fast, powerful and dynamic, beginning to push all boundaries of the field through vertical, horizontal and diagonal play (Dorion 2004). The overall success of both sports is attributed to a team's ability to score more goals than their opponent (Mara *et al.* 2012) and although the skill bases of the two sports may differ, ultimately, the strategies used in order to score the most goals are often very similar.

All invasion sports adhere to similar if not the same principles of play and have the same aims as one another. Hughes and Bartlett (2002) stated that these can be achieved by following structures that were also identified. One study by Palmer *et al.* (1994) looked into invasion games and in particular the patterns of play, focusing on the centre's positioning and passing choices in Netball. Netball requires similar principles as hockey and football to become successful. Eliminating defenders to create overloads and move forward up the pitch in order to find a goal scoring opportunity which can be achieved through a variety of passes.

Following this, it was found that the key for successful attacks made by the centre was to try and make a penetrating forward pass as early as possible. This therefore means that the skills of the team members and the centre player plays a vital role in deciding the tactics which the team will use to get the ball moving forward as early as possible and thus, determines the type of pass used to achieve success. The study gives us an insight into the principles of invasion games and how these principles can relate to both hockey and football. This is because it discusses the relevance of the central player's decision making to create the highest level of success (Smeeton *et al.* 2004). However, due to the fact that a netball team only has one centre player, the options in moving the ball forward as early as possible are limited and therefore this literature may not be the best to use when thinking about hockey and football due to the nature of the two sports. It also allows people to see that certain generalizations across all invasion sports cannot be made in this case due to the size of the a netball pitch compared to that of hockey and football which have larger playing areas.

Palmer *et al.* (1994) suggested the biggest impact on finding patterns from the outcomes was mainly reliant on the skill level of the players. Individual differences are central to applicability. The higher the level in any sport, the better the basic skills and the more consistent these basics skills are. This is relevant for this study due to the fact that elite level hockey and football players will have better skills, however within both elite level football and hockey there is still a variety of abilities that are believed to form the backbone for any sporting activity.

Skills form an integral part of sport and in this instance hockey. However, tactical moves can break down because the skills fail either on or off the ball in hockey (Cadman 1985). This also links in with a study by Williams *et al.* (2006) who found that skilled players were able to perceive patterns of play in dynamic sports tasks better than amateur sportsmen. They achieved these findings by getting two groups of participants to identify sequences in a football scenario and found that the skilled players were much quicker in recognizing sequences. This is helpful because it allowed them to identify the correct time to pass and dribble with the ball. This will prove useful when applying to hockey as in all invasion games it is essential to identify when the attack manages to eliminate a defender and gain a numerical advantage over the opposition and deciding when it is best to pass or dribble with the ball. Smeeton *et al.* (2004) further looked into the pace at which such patterns were identified. Here they found that the invasion sport players were quicker to recognize the correct patterns of play allowing them to make adjustments accordingly. This could be related back to both hockey and football. However, due to the fact that the study was performed across such a wide range of sports, it is hard to make comment about specific units and or players, how they adjust and how quickly they can do so. This could allow for more research to be undertaken in the future to determine whether different positioned players in football and hockey identify patterns differently and more quickly than others and whether this could further help to identify reasons why players chose the wrong option and dribble into trouble when they should pass, and vice-versa.

The nature of team-sport activity requires several aspects of fitness, including aerobic and anaerobic capabilities, muscular strength, flexibility and agility (Ekblom, 1986; Reilly and Doran, 2003; Macutkiewicz and Sunderland; 2011). These studies analysed the physiology of hockey and the requirements for elite performance, mainly using GPS to track players' movements across the pitch. However, they give very little information on technical and tactical aspects of play. This is one subject in which hockey and football do differ. Due to the allowance of 'roll-on, roll-off' substitutions, meaning that players are allowed to be substituted off and back on again as many times as the coach wishes too, and the game of hockey being 10 minutes shorter than that of a football game, a

comparison of movements between hockey players and football players throughout games should differ in the sense that on an individual basis, football players should effectively cover more ground around the pitch than that of hockey players. In general terms, as a whole squad (16 players) due to the difference in substitution rules the distance covered should be fairly equal. Minimal research has been undertaken focusing on the analysis of attacking outletting and tactical analysis in hockey, however, a study of football games by James (2006) identified that the key to success was fast play and getting the ball into the areas of the pitch that could be scored from, as often as possible in order to create more goal scoring opportunities. He found that it took on average ten attempts at goal in order to score one. This has key implication on tactical decisions that could be transferred across to hockey and used to create successful goal scoring opportunities.

If you look at strategies of attacking in invasion sports, many coaches have different opinions about methods of attack. This argument arose from the research of Reep *et al.* (1968) study. They analyzed 3213 matches between 1953 and 1968 and found that 80% of goals were scored after fewer than four passes whereas similarly further work of Bate (1988) showed that 94% of goals arose from when a team has fewer than five possessions in the lead up to the goal.

Alternatively, Hughes and Franks (2005) created a similar study to that of Reep *et al.* (1968) and, despite finding similar results, they also found then once the data had been normalized, more shots were created per possession after a larger amount of passes than there were for the shorter passing possessions. This is further supported by the analysis of Tenga *et al.* (2010a) who found that when five passes or more were achieved the rate of scoring was higher than when attacks that consisted of two passes or less were made. This can be very important when thinking about the comparison of tactics and outletting options should be used in other invasion games and particular in hockey.

2.3 Performance Analysis in Hockey

Boddington *et al.* (2001) stated that hockey is ranked as the third highest participating sport in the world, and is ahead of rugby and cricket in these statistics. The game of hockey has been known for becoming particularly fast, powerful and dynamic, beginning to push all boundaries of the field through vertical, horizontal and diagonal play (Dorion 2004). All of these characteristics contribute to making hockey an exciting game to both play and watch. This is down to, particularly at elite level, the vast improving physical fitness in hockey players as well as the ever improving skill levels.

Skill and identification of patterns is essential as identified by Smeeton *et al.* (2004). These are the building blocks of successful hockey performance. When attempting to attack in hockey, the best teams are those which are most effective at getting from the outside of the oppositions quarter and gaining entry into the D. This gives them the best chance at scoring a goal (Sunderland *et al.*, 2006). The attacking team requires players to join together to create an attacking unit and choose the best attacking option available to them. This is to allow them to enter the opposition's 23 metre section and keep possession, thus creating a positive outcome.

Andrews (1985); Hughes and Billingham (1986); Wilson (1987a) and Wilson (1987b), found that the most attacks and entries are made down the right hand side of the pitch. This could be due to the fact that the attacker has the ball on their strong side when running with the ball and the defender has to defend on their weak side, making it harder to defend. However, when it came to looking at the amount of goals scored and where these goals came from, the majority of the goals were scored from the left hand side of the D.

Due to the development of pitch technology and significant rule changes in recent years, means that previous research might not be relevant to today's modern game. Rule changes such as the abolishment of the offside rule, originally implemented at the Atlanta Olympic games in 1996 as a test, and which was

finally removed from the rules in 1998, as well as the introduction of the allowing of aerial passes into the D, the self-pass rule and the 5 yard rule, when taking a free hit inside the attacking 23 (FIH, 2011). These findings are still useful as they give a starting point for this study, however they still do not offer details on the type of passes made, where the attacking team entered the 23 and then the D, nor give information on how successful the outcomes were.

The major step that hockey has taken in the last five to ten years has been the introduction of the self-pass rule (2009) in which players can automatically restart play after a foul has been committed. This was investigated by Tromp and Holmes (2011) who analysed twenty-eight international women's field hockey matches. They looked to analyse the methods and areas of repossessions and D entries and found that since the rule change in 2009, the game had become much faster and the intensity was thus increased due to the fact that there were less stoppages in the game. They also found a significant increase in the use of dribbling as a method of D entries, with 33% in 2008 rising to 57% in 2009. This is useful to this study as it helps to show how the new rule changes have helped teams to adapt their attacking strategies to become more successful.

The pace of the modern day hockey match is much higher. Spencer *et al.* (2004) reported that forwards and the inside players sprint the most during a game of hockey, meaning that they would be rolled on and off with greater frequency to stop fatigue from affecting the team's performance. Hockey's physical requirements have had to increase even further due to the offside rule being abolished, thus allowing for teams to create their own automatic height on the pitch rather than having to adhere to the offside rule that is still in place in football. Due to the fact that there is still only three substitutions allowed per game in football, hockey players are required to be able to work at a higher intensity and can come off when they are tired as Robinson (2010) suggested.

A further reason for the change in pace is due to the pitch surface and advances in technology. Modern day elite hockey is now played on water-based astro-turf pitches which aid not only the pace of the game but also the accuracy and skill

level as it allows more of a consistent roll, something grass and sand based astro-turfs don't do, as well as allowing the ball to bounce making it more important for modern day players to have three dimensional skills, to be able to lift the ball slightly into the air and over sticks. With the game now played in the third dimension, it has also meant that defenders have to adapt and change the way that they defend. Previously attackers could merely hit the ball straight into the D but were not allowed lift the ball even an inch or so off the floor as this was called a 'lifted ball' by the umpire, this was simpler to defend. As long as you had the ability to keep your stick flat on the floor as a defender, if the ball came straight at you, you could stop it. However now, due to the 'lifted ball' rule being changed to 'dangerous play', meaning that if the ball is lifted above the knee for example where the defender has no protection it is deemed dangerous, attackers are awarded a lot more leniency on the height the ball travels past the defender, ultimately making it harder to defend and meaning that the defender has to be a lot more upright when protecting the D.

These pieces of research are key in highlighting areas of field hockey requirements, especially with the evolving rules that affect play within the 23. Although elite international hockey players should all have similar levels of fitness, some teams are more successful than others. This could be down to skill levels of the varying teams, and due to the increase and resulting cost implications of pitch technology, the teams accessibility in being able to train on water-based astro-turfs. The coaching that these teams employ and the experience of those coaching in knowing what to do can both help or hinder success when educating teams in making the right offensive and defensive decisions.

2.4 Performance Analysis in Football

It is estimated that, globally, several hundred million people of all ages and genders participate in football (Aslan, 2013). Football is a sport characterized by high-intensity activities, such as sprints, high-intensity running, turns, and jumps. Mohr *et al.* (2003) these factors contribute to make football one of the most played and watched sports across the whole world.

Unlike hockey, football is an invasion game whereby a team can score from any position on the pitch, something which may be a contributing factor when teams think about how they are going to execute their attacking strategies. Which areas of the pitch they are looking to exploit and gain entry into may constantly change depending on the opposition, formation and even weather conditions. Mara, Wheeler and Lyons (2012) identified that 50% of goals and just under 40% of shots on goal came about from the centre of the pitch, whereas in total under 10% of shots on goal and goals came from the wide areas of the pitch. This contradicts what was said earlier that most attacks and entries in hockey are made down the right hand side and the most goals down the left.

The offside rule is one of the main laws of football that plays a lead role when coaches and players look at their attacking strategies. A player should be called offside if he is nearer to his opponents' goal line than both the ball and the second last opponent. However, there is no offside if the player is level with the last or last two opponents, or in his own half (FIFA, 2004). In recent years there have been multiple changes of interpretation of the offside rule in regard to whether the player is interfering with play, or which part of their body is offside. Once again FIFA (2004) stated that consideration should be given to any part of the head, body or feet of the attacker in relation to the second last defender, the ball or the halfway line and for the purposes of this decision, the arms are not considered to be part of the body. Effectively meaning that if any part of the body, of which it is legal to play the ball with, is in front of the ball and the second to last defender, then the offence should be penalised. The offside rule, unlike other invasion games such as hockey and netball, makes it generally harder to set up attacking strategies. This is due to the fact that because the offside 'line' is the line of the last defender, the length of the pitch is constantly being changed (up to the half way line).

One thing that a forever changing pitch length can alter is passing styles in order to achieve the key principles of invasion games. These principles include things such as height, width, and moving the ball forward which, with the offside rule (other than width) are hard to achieve because the attackers have limitations as

to where they can stand. This means that passing styles may completely differ from that of those for netball and hockey, where the majority of passes are made from player to player and can be made directly up the field with no fear of players becoming offside causing a turnover of possession. This is backed up by Mara et al's (2012) study of high level women's football in four different countries. After coding all ball distributions that were received in the attacking half of the field (n = 12,321) during all 34 regular season games it was found that 65% of passes were made into space and 50% of free kicks were split into space and direct to a player. This suggests that footballers combat their inability to stand wherever they want on the pitch by passing the ball into space and trying to regain/keep possession high up the pitch when they can.

2.5 Rationale

Both football and hockey are field-based invasion team sports where the primary success is attained through scoring more goals than your opponent. Within the current body of literature through hockey and football, there are clear areas where the two sports differ mainly surrounding that of the offside rule abolished by the FIH in 1998, and more importantly where the sports cross paths and are very similar, for example in structure and patterns of play suggest by Wade (1996). However, there is no said literature that combines the two sports for their attacking strategies in the hope of gaining a greater understanding as to how to successfully attack in both hockey and football and to explore whether there are any specific areas in which they offer a similar amount of success for both sports. This study will be done using a hand notation system to collect the data, which will help benefit sport exercise scientists and coaches to give them an insight into creating new tactical choices available to players. This investigation will be using the highest level and most recent competitive match play to gain the best results possible in order to allow research to take a further step towards maintaining a regular flow of up to date and relevant literature to coaches, players and supporters of the game.

CHAPTER THREE

Method

3.1 Pilot Study

O'Donogue (2010) identified the pilot study as a way of testing the accuracy and method of the data collection process to enable and errors to be identified and thus give the ability to adjust the data collection prior to the commencement of the real study to ensure that the results are as reliable as possible.

To operationalize the pilot study a coding operator watched one game of football and one hockey one after the other to ensure that the notation system would work for both sports. The system used was a downloaded application for an Apple iPad called Dartfish EasyTag, a notational analysis application aimed to time-stamp the key performance indicators (KPI) of the sport and display instant statistics of their frequencies. The video was watched until a successful possession (entry into the 'D' or area) was gain and then simply re-winded to the beginning of that possession and coded from start to finish of the possession including the outcome and the number of passes completed during the phase.

The games that were analyzed included a hockey game from the group of the London 2012 Men's Olympic Hockey competition and a football game from the Barclays Premier League .The results of which were not stages included in the final study and the full game (70 and 90 minutes respectively) were recorded to properly identify any errors that may have been present in the design of the hand notation system, as certain issues are more likely to arise over a longer period of time than a short burst of 10-15 minutes.

3.2 Participants

All of the participants used in this study are professional athletes competing at International level in their respective sports either the Men's Hockey at the London 2012 Olympic Games or in the Men's FIFA European Football Championships 2012. The underlying rationale for choosing these two competitions are so that the performances are at least at the same level as one another, and are competing at the top of their sports. These participants are therefore the best of what is to offer within their sports respectively creating no reason to argue that the study is unreliable in terms of performance levels.

The participants will be male and of varying ethnicities from around the world. No consent was need due to the videos being available to the public domain through the BBC (British Broadcast Company) and ITV (Independent Television) television broadcasters.

3.3 Sample

Hughes et al. (2001) suggest that the number of matches required to constitute a sufficient sample is dependent upon the level of analysis. The footage being used for the purpose of the study was recorded from the London 2012 Olympic Games Men's hockey competition, and the Mens UEFA European Football Championships in Austria and Poland 2012. The games analyzed are taken from the classification stages (8th vs. 7th and 6th vs. 5th), the Semi Finals, Bronze medal match and Final of the competition (hockey), plus the Quarter finals, Semi finals and overall Final of the competition (football). Both teams were analyzed through the full duration of the game (70 and 90 minutes respectively) however if the game went into extra time and then penalties, the data was not collected. Data collected from the seven hockey and eight football matches was deemed appropriate.

3.4 Equipment

A computerized notation system was designed and implemented through the iPad application 'Dartfish EasyTag', to analyze the game and the data was then exported to a Microsoft Excel spread sheet. This Microsoft software can also be helpful in analyzing patterns of results allowing the results to be represented in a more visual way.

The raw data collected was then put into Microsoft Excel and IBM SSPS statistical system to allow more inferential tests to be carried out to see if there was any difference or similarities occurred between successful and non-successful teams. The data within SPSS will then be put through a non-parametric Mann-Whitney U Tests in order to identify if there are any significant differences within the data samples (see Appendix). Data samples are deemed significant if they come out with a significance score that is less than 0.05 and insignificant if on or about the 0.05 mark.

The Microsoft Excel software was also used to look into the difference between more simple data in graphical form in order to propel answers for the specific aims of the study.

3.5 Observation and Analysis

The computerized notation system was derived to record the data observed from the matches and data collection commenced as soon as pushback/kick off commenced. Only the data from the possessions that were deemed successful were recorded. A successful attack had been achieved if the team in possession of the ball managed to get into a position of potential upgrade. For hockey, a successful attack was deemed as a possession of play whereby the attacking team had gained entry into the shooting D. Likewise for football, a successful attack was achieved if the attacking side completed a possession into the 18 yard penalty box. Despite this, in order to completely be successful a player of the attacking team must have been in full control of the ball in order for the attack to have reached that specific area of this pitch. Any attacks where the ball was not controlled by an attacking player in these areas said to be unsuccessful. Free hits and indirect free kicks won during the possession phase and not won resulting in a change of possession were recognized as part of the possession phase and not the start of the new one except those won inside the opposition half. In addition to this, long corners/corners and side lines/throw-ins (taken in the attacking half of the pitch), were not classified in the same repossession phase. This is due to the fact that sidelines/throw ins and long corners/corners and free hits/free kicks are not deemed to be an upgrade but more of a set piece that can be practiced prior to performance. When the possession started from a long corner, sideline or free hit, inside the attacking half and in particular the final quarter, for the purposes of hockey, if the ball was then played out of the final quarter, providing that the team kept possessions and the ball was entered back into the attacking area, the possession was not deemed unsuccessful. When looking at attacking strategies starting from the repossession phase of the attack, all teams had key phases that they went through in order to achieve the best result possible. Once these attacks had been coded and the data from the attacks collected, the results were then looked at into further depth to see which routes brought about the most successful outcomes and which only allowed for

lesser upgrades such as shots off target and long corners etc. As well as this, similar to Reep et al. (1971) who found that 80% of goals resulted from a sequence of three passes or less and that a goal is scored every 10 shots. The same data will be look at regarding to the amount of players that touch the ball in the successful attacks and whether or not the numbers differ if the attack results in goal or not.

Table 1: Phases of Attack

| | |
|---|--|
| Phase 1: <i>Repossession</i> | Where the team has regained full control of the ball on the pitch. |
| Phase 2: <i>Entering the final quarter</i> | The method in which the ball enters the final third of the pitch. |
| Phase 3: <i>Final quarter</i> | The outcome in the final quarter of the pitch including outcome. |

The hand notation system that has been used for this study is the system devised by Sunderland et al. (2006) used for visual guidance when looking at which area of the pitch certain instances occurred. The pitch map was slightly altered and applied to that of a football pitch (figure 2.) and areas were kept as similar as possible to maintain reliability between the two sports. The information was entered straight into an excel spread sheet. The hand notation system is useful in being able to record match data easily through creating a pitch broken up into segments. These segments have been created in order to pick up certain phases of the attack and look at where attacks were most successful across the pitch. Both pitches were split up in similar ways and labeled accordingly. As seen in figure 1 and 2 respectively, the half of the pitch that the team in possession is defending was labeled A – F in six sections across the pitch. Due to the fact that the majority of passes into the final third of the pitch will less than likely come from over sixty or seventy meters it was deemed unnecessary to split up the pitch to make these areas more specific. Going into the attacking half of the pitch was made different however. The penalty area and D were cordoned off and split up individually into six sections. Two of which (1a and 2a) were the closes to the goal, either side of the centre of the goal, and the remaining four were located between the two and the edges of the areas in order to see where the ball

entered the area and then how a shot was manifested and where it was taken from. Outside the areas in the attacking half, the pitch was split into ten sections labeled 1-10 across the pitch similar to the defensive half, but with smaller segments including two straight down the middle of the pitch.

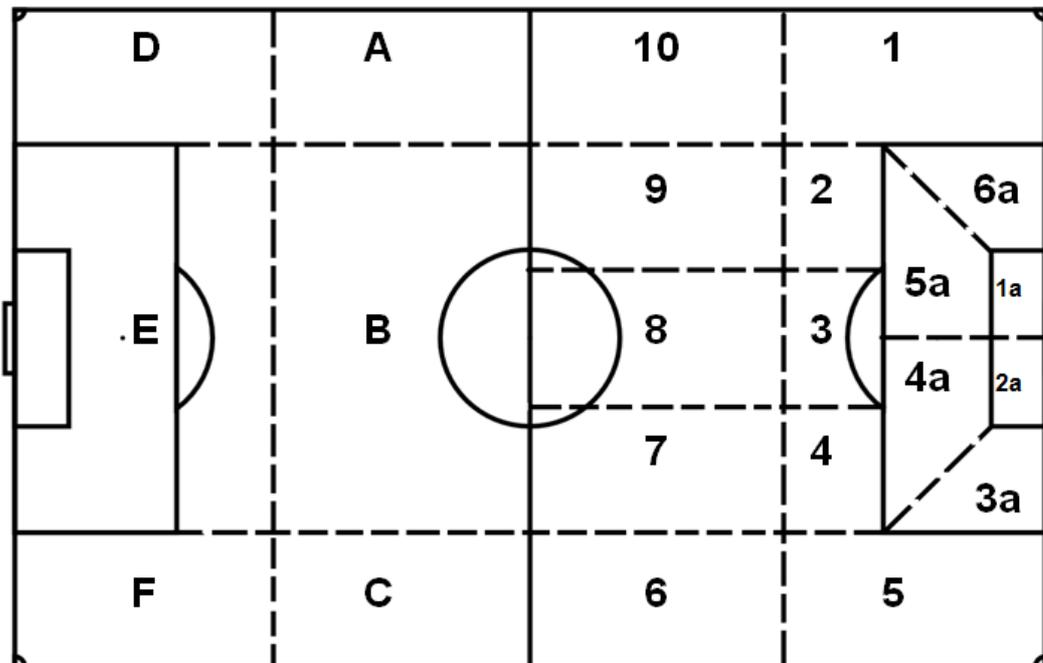


Figure 1. Pitch Map taken from SunderInd et al., (2006) study.

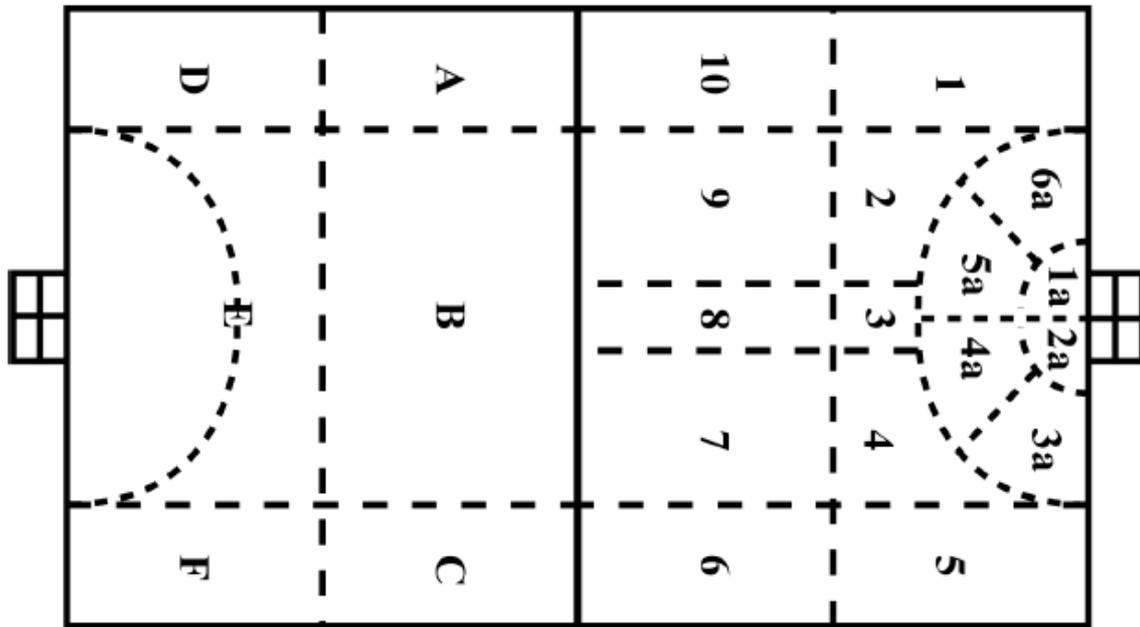


Figure 2. Sunderland et al's (2006) pitch map adapted for the purpose of this study for a football pitch.

When looking into attacking strategies across both hockey and football, in order to determine the strategies that are the most and least successful, not only is it important to look at which areas of the pitch teams use in order to better their success, but in the case of this study, it will also be important to look into the way that teams get into certain areas of the pitch, for example the types of passes they use. This will help to see the strategies that are most effective across different areas of the pitch and whether or not there is a trend in the way that the successful and unsuccessful teams approach their attacks in different areas of the pitch.

3.6 Operational Definitions

Operational definitions are used to give clarity and understanding to increase the reliability of data recording (O'Donoghue, 2007). When using short hand codes as part of a hand notation system, it is important that there are not any

misunderstood interpretations of events that occur during the match play. Due to the fact that two sports are being used in this study, operational definitions for the KPI's across the two sports have been identified and defined (see Appendix) along with short hand codes. This will ultimately help the transfer of theory and knowledge between the two sports and aid the overall comparison of attacking strategies. These definitions have been split into three separate tables in order to distinguish between the three possession phases, including the manner in which the ball was turned over to start the repossession, the pass that was played into the final third or the pitch and how it was taken into the D, and the final outcome of the possession phase.

3.7 Reliability Evaluation

Reliability refers to the extent to which the event codes, notated by an analyst, reflect what happened in the match (James et al., 2007), and also refers to the repeatability of the data collected to ensure that it is not biased by one observer's opinions and that the same data can be collected if the process was conducted again. This study is using a computerized notation system and therefore making sure the data it produces is reliable is the key factor (Cooper et al., 2007) and until this any data produced is unusable. The reliability test was conducted in order to determine whether or not the prospective system used to collect data would be as effective if used by any operator, and not just that the one observer of the study was able to use the system because they were the creator and knew the system well.

In order to determine the reliability to its greatest effect two operators watched the two same videos twice, one hockey and one football, one week apart to ensure that there was little recollection of the game and no social cues were assigned with certain phases in the play in order to establish an Inter and Intra reliability test. This allowed seeing how many times the two operators' results agreed with one another (Intra) and how the frequency at which they agreed with that of the same operator (Inter) in terms of the number of game actions that were seen. An evaluation as to when these times agree and disagree would lead to the calculation of a Kappa value first determined under the research of Altman

(1991) whereby a score between zero and one was given to judge the reliability of the analysis in relation to how similar the sets of results were to each other. Zero was seen as completely different, whereby not a single piece of data was similar to the second set and a score of one show that the results were identical. It was deemed by Altman (1991) that a score of 0.8 was good reliability. Figure 3 shows the kappa reliability values from the two intra and inter reliability tests carried out for the purpose of this study. It also shows that all of the values were above Altman’s (1991) value for good reliability (0.8) confirming that the system used was reliable and has the potential to be used by future studies without a great deal of problems for the operator.

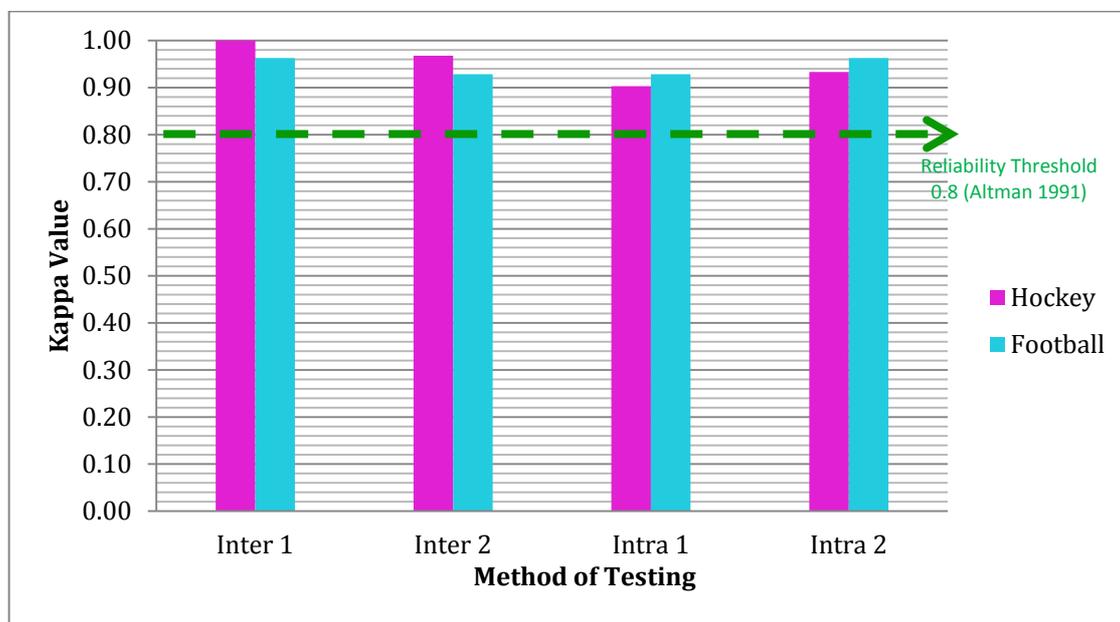


Figure 3. shows the difference in Kappa values for the two Inter and two Intra methods and the differences of Kappa value between hockey and football for the total number of possessions.

Intra-operator reliability tests are limited in their ability to completely evaluate reliability as they show merely the ability of the analyst to use the notation system (O’Donoghue, 2007). It is possible that, as an analyst, one could be consistently inaccurate but still achieve high levels of reliability through the use of inter-operator tests, however O’Donoghue (2010) stated that Inter-operator tests reveal whether the system is objective regardless of the perceptions of different

analysts whilst the operation definitions are rigorous enough in this case to enable the operator to distinguish between the different variables collected

CHAPTER FOUR

Result

4.1 Overview

The following tables and graphs present a comparison between the successful possessions of both hockey and football respectively. Firstly, analyses of variables pertaining to the final outcome of the attack (upgrade) were examined, followed by Area/D entry and the method of such entry, the origin of possessions and the method in which they started and then finally moving onto the amount of passes made within possessions. Due to an unbalanced sample size in terms of number of possessions, percentages and means were used to present the data.

4.2 Upgrade Variables

Figure 1 shows the types of upgrades achieved in the games of hockey and football by all the teams involved. Each bar shows the figures as a percentage of the total upgrades within that sport. In total, there were two hundred and thirty two (n=232) total upgrades for hockey and one hundred and fifteen (n=115) for football across the seven games (n=7). As shown, around 40% (n=92 and n=47 for hockey and football respectively) of possession ended up in a turnover before any further upgrade could be achieved. It can also be taken from this that, 44.8% of possession in hockey ended up as a positive outcome (meaning that either a goal was scored, short corner was won, or shot on target was achieved) and of this 12.1% ended up in an outright goal (n=28) while in terms of football, 30.4% of possession outcomes were positive and only 10.4% (n=12) resulted in an outright goal.

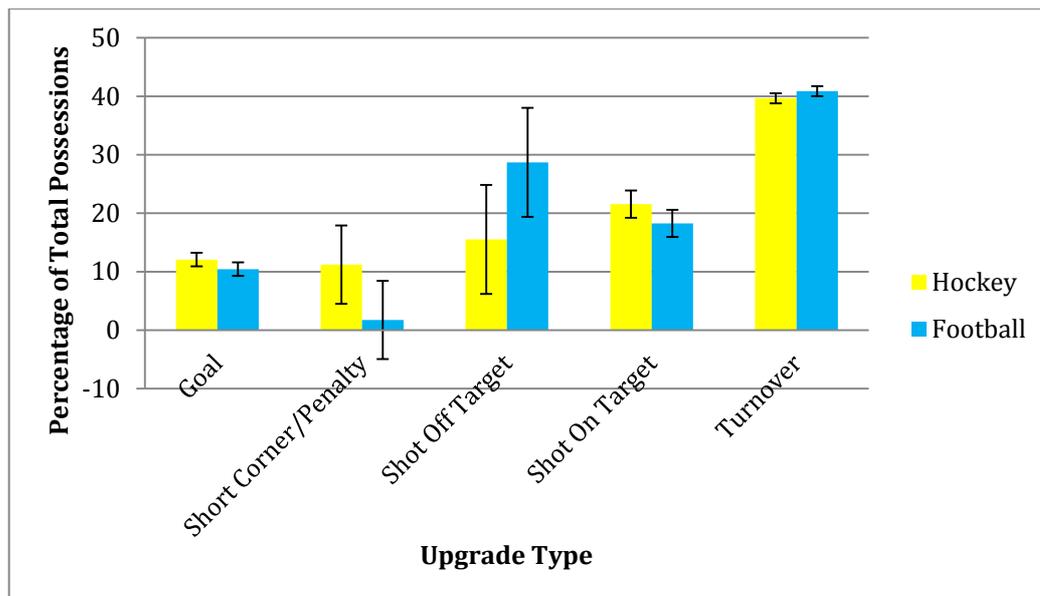


Figure 4: Upgrade type as a percentage of total possessions for hockey and football.

One major difference between the two sports was around the short corner and penalty differences between the two sports. 11.2% of the possessions in the hockey games resulted in a short corner being won (n=26) where as only 1.7% (n=2) of possession in football resulted in the equivalent as expected.

The non-parametric Mann-Whitney U tests that was carried out on IMB SPSS statistic program (see Appendix) reinforced that no there was no significant difference regarding upgrades across the two sports (p=0.101).

4.3 Area/D Entry

As expected, the minority of possessions were first controlled in the area/D in the areas 1a (n=6) and 2a (n=9) due to the fact that these were the two areas directly next to and in front of the goal, so the ball would have to skip the areas further towards the edges of the penalty and shooting D in order to gain entry into these

parts of the D/area. Figure 2. Therefore shows that only 3% and 8% of possessions for the two sports respectively were first picked up in these areas.

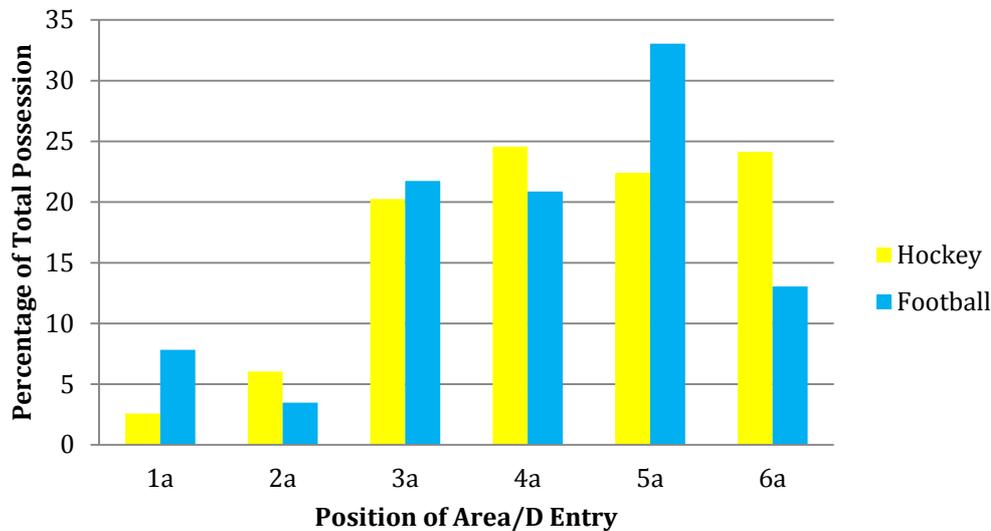


Figure 5: Position of Area/D Entry as a percentage of total possessions for hockey and football.

The figure also shows that the external areas were more popular however but did not differ much. 47% (n= 109) of possessions in the hockey games entered the area via the two areas at the top of the D (4a and 5a) and 44% (n=103) entered from the two parts of the D next to the dead ball line at the end of the pitch. This did however differ for football, where 54% (n=62) of possessions entered the top two areas of the penalty box and only 35% (n=40) entered in the areas next to the dead ball line, specifically only 13% (n=15) of possessions entered from the left hand side of the area (6a). It was found that no significant difference (p=0.171) between the two sports in regards the position of which the area/D was entered.

There was however a significant difference (p=0.000) found between the methods of area/D entry across the two sports. Shown in figure 3 and 4, as expected, the number of possessions that entered the area/D through the use of an aerial/lobbed ball (n=2 and n=9 respectively) was a large proportion less than that of other methods of entry. In the hockey games 43% (n=100) of possessions made entry into the D by use of dribble and 31% (n=71) by use of a push pass,

which is reversed in the football statistics where 44% (n=51) of possessions were made by the use of a ground pass and 26% (n=30) were used by a dribble. 22% (n=25) of possessions in football were from the use of a cross into the area whereas only 10% (n=24) of possessions in hockey utilized the hit as a method of gaining entry into the D.

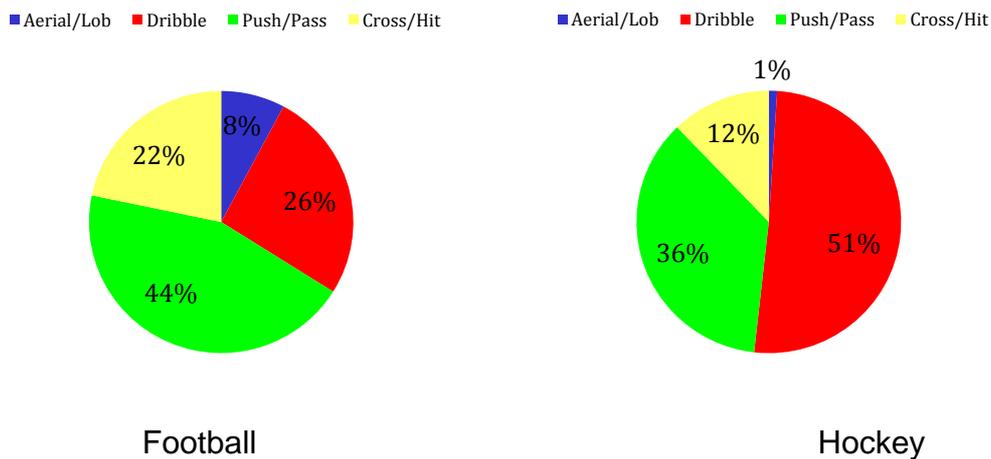


Figure 6 and 7: Method of area/D entry as a percentage of total possessions for football (left) and hockey (right)

4.4 Origin of Possession

The origin of the three hundred and forty seven possessions (n=347) was deemed not significant (p=0.290). In the overall breakdown of the pitch, 16.8% (n=39) of possessions in hockey originated from section B of the defensive half and 14.8% (n=17) in football originated from the same area of the pitch. In terms of the breakdown of general areas of the pitch there was a trend in the origination of possession with 46.6% (n=108) and 47.8% (n=55) of possession starting in the defensive half of the field for hockey and football respectively.

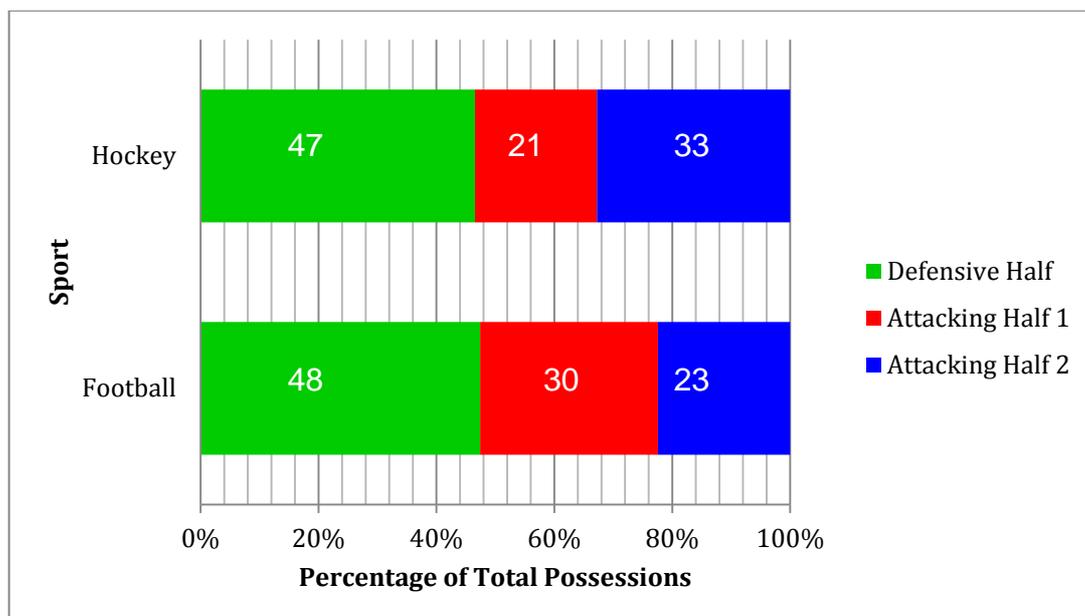


Figure 8: Location of repossession as a percentage for both hockey and football.

However, as shown in figure 5, in the attacking half of the field (split into two sections 1-5 (2) and 6-10(1)) there were contrasting results. In the hockey games, the last section of the attacking half (2) had 32.8% (n=76) of possessions originate from within it, whereas the first section (1) had 20.7% (n=48) originate from it. On the other hand though, from the football games, 22.6% (n=26) of possessions originated from section 1 of the attacking half and 30.4% (n=35) of possessions originated from section 2.

The method as to how each of the possessions started was significant (p=0.000). Figure 6 shows that overall only 18% of possessions in football (Goal Kick, n=7, Free Kick, n=6, Corner, n=4, Kick Off, n=1) originated from a dead ball situation where as 63% (n=72) possessions started from an interception or tackle and 19% (n=22) from a throw-in. In addition to this, for hockey, there was a combined 36% (n=79) of possessions that started with a 16 yard hit (n=20), long corner (n=31), push back (n=5) or sideline (n=23), and much like football a greater 33% (n=76) of possessions began through the means of an interception or tackle but unlike that of football, 33% (n=77) of possessions started with a free hit.

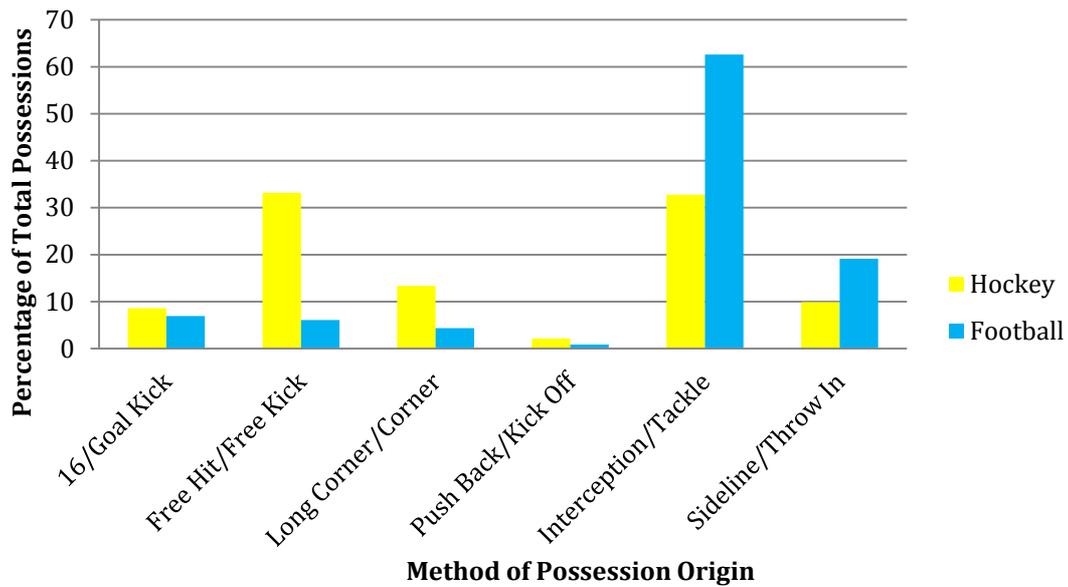


Figure 9: Method of repossession as a percentage of total possessions.

Furthermore, when looking at the outcomes of possessions in terms of how they started, one hundred and four (n=104) were deemed successful in terms of outcome (resulted in a goal, short corner or shot on target) and one hundred and twenty eight (n=128) were deemed unsuccessful (resulted in a turnover or shot off target). Of these 37% (n=36) came from free hits and 32% (n=31) from interceptions or tackles, whereas 35% (n=44) unsuccessful possessions came from a 16 yard hit (n=16), long corner (n=15), push back (n=3) and sideline (n=10). From football, thirty five (n=35) of the one hundred and fifteen (n=115) possessions were deemed to of had a positive outcome. Of which 60% (n=21) originated from an interception or tackle.

4.5 Passes

The number of passes within each possession was deemed significant (p=0.000). The average number of passes per possession in regards to outcome was 3.6 (n=825) passes for hockey, and 5.93 for football. There was little difference between the values in terms of hockey (Goal, 3.6, Short Corner, 3.5, Shot off Target, 3.6, Turnover, 3.6, Shot On Target, 3.6) however for football, the average amount of passes for penalties to be won was 4.5 and for shots on target 6.1 with the overall average number of passes for all possessions 5.9 (n=682).

| | Hockey | Football |
|-----------------------------|---------------|-----------------|
| Goal | 3.6 | 5.8 |
| Short Corner/Penalty | 3.5 | 4.5 |
| Shot On Target | 3.6 | 6 |
| Shot Off Target | 3.6 | 6.1 |
| Turnover | 3.6 | 6 |

Table 1: Shows the average number of passes per possession dependant on upgrade type.

CHAPTER FIVE

Discussion

5.1 Overview

The aim of the current study was to use the highest level and most recent footage to produce up-to-date statistics and analysis regarding patterns of attacking play across both hockey and football, in an attempt to see if such possessions, in particular those that ended in a successful outcome, were transferable across the two invasion games. This chapter aims to interpret the results gained and then presented within the previous chapter against theories and results gained by researchers in previous literature as well as any perceived problems and alterations that could have been made within the method of the study, in order to enhance the effectiveness of programs and software that was used.

5.2 Upgrades

The build-up play is often talked about as a key phase in all invasion games, however it almost useless if the right decision and skill are not carried out in the final playing section pitch. This is even more paramount in games with restricted shooting areas such as hockey and netball whereby the attacking team need to gain entry into a specific section of the pitch before they can think about shooting at goal. It was found that there was no significant difference ($p=0.101$) between upgrades across the two sports in this study. 44.8% of possession in hockey ended up as one of three positive outcomes (goal was scored, short corner was won, or shot on target was achieved) meaning that the remaining 55.2% was taken up by only two negative variable (shot off target, turnover of possession). However, conversion rates of attack are also heavily dependent upon the quality of the opposition defence and goalkeeper (Papahirstodoulou, 2008), as although teams may have the best attacks playing at the highest level, opposition teams also have the best defences in the world, and if the defensive unit is stopping the attackers from even entering the D then.

One the other hand however, the results from the games of football showed that only 30.4% of possessions ended up in a positive outcome and of which only 10.4% actually ended up in a goal. The reason for such the difference in positive outcomes between hockey and football could be due to fact that hockey players are restricted to a specific shooting area, where as football players can shoot and

score from any area of the pitch. This also reflects in the percentage of shots off target in football compared to hockey, with nearly 30% (n=33) of the remaining 69.6% being attained to shots off target in football, where as for hockey, only 15.5% of possessions equate to shots off target, further suggesting that not having a restricted shooting areas plays more of a role tactically by inviting the attacking team to kick the ball in the direction of the goal, from many different areas of the pitch and from many difference distances from the goal.

Future studies could look to investigate the differences in D entry methods in open play inside the 23 in comparison to a free hit inside the 23, and see what effect the new own goal rule has on methods used (FIH, 2013). One thing that hockey has over football is the amount of rule changes over the last decade of the game that have had the opportunity to majorly influence the game play. Where football, compared to hockey, may have stood still for the last 10 years, hockey has been able to enhance its likability through the introduction of new rules of several rule changes like the 5 yard and the own goal rule (FIH, 2013).

5.3 Area/ D Entry

Due to the increases in tactical awareness and skill development of elite level field hockey, D entries are becoming more widely dispersed (Dorion, 2004). Previously Hughes and Billingham (1986) found that most of the attacks derived from the right hand side of the pitch predominantly due to the fact that attacking down the right hand side of the pitch aims to exploit the offensive team's strong open side against the defensive units weaker reverse stick side. The current study's findings more closely align with that of Dorion (2004) indicating a more even spread around the D in terms of entries despite the fact than no significant difference was found ($p=0.171$). All four sections of the D (3a-6a) adjacent to the outside of the circle came out with twenty to twenty five percent of the total possessions (3a =20%, 4a=25%, 5a=22%, 6a=24% - with the remaining 9% of entries being accounted for deeper within the D from the two sections nearest the goal, 1a= 3%, 2a=6%). This contrasts the finding of Hughes and Billingham (1986) who found that the majority of attacks entered the D from the right had

side of the pitch. The current study shows that, although a very slight difference, the area on the far left hand side of the D (6a = 24%) was entered more often than the area on the far right of the D (3a = 20%). The reason for this could be due to the enhancement of player skills. When Hughes and Billingham carried out their study in 1986, the game of hockey at international level was being played on astro-turf pitches however the modern technology that have enhanced the sticks that players now use and players attempting to seek a way of gaining an advantage over their opposition, all players now at international level can hit and pass the ball using their weak side (reverse stick side) meaning that space can be exploited on both sides of the field with greater ease.

Alternatively, football portrays a similar but in some ways contrasting set of results. Taking into consideration that at the top level it is very hard to make the statement that a player has a strong side and weak side for example like hockey, due to the fact that, as Dorion (2004) argued that skill development of elite level performers is increasing, across all sports worldwide, having the ability to use both feet, and training both of those feet every day, footballers are another example of where the term strong side and weak side is used loosely. However the fact that they have the ability to play on the side of the pitch that suits them best, it would be thought that perhaps, like the hockey, there will be similar results in regards to how dispersed the entries into the attacking area are. Research by Griffiths (1999) found that the French national teams - at a time when they were the world's best team – created significantly more crosses than their opponents. This implies that their main strategy, at the time in which they were the best team in the world, was to get the ball into the wide areas of the pitch and then cross the ball into the area, possibly because they had a player on their team who was strong in the air which their team wanted to exploit. The results of this study showed that down the right hand side of the area, levels were similar in terms of the amount of entries (3a=25%, 4a=24%), but it was the left hand side that brought about a contrast. It showed that entries very wide right only added to 13% (n=15) of the total possession whereas the zone at the top of the area to the left counted for 33% (n=38) and the highest zone of entry on the pitch. This could be due to the offside rule in football, where by a player not in control of the ball must be either behind the player with the ball, or level with the

last man of the defensive team. This rule only applies in the attacking half of the pitch and therefore in order to get the ball into the wide areas the attacking teams needs to beat the offside trap or pass the ball into space for a player to run on to. Both of which carry higher risk that being able to pass to ball into a players feet at the top of the area. This statistic is certainly backed up by Mara, Wheeler and Lyons (2012) who identified that 50% of goals and just under 40% of shots on target came about from the centre of the pitch, whereas in total under 10% of shots on goal and goals came from the wide areas of the pitch. These results contradict what was concluded by Jinshen et al (2003) who stated that a considerable number of goals scored in high-level football were attributed to an attacking phase of play through the wide zones of the attacking half of the field. It was then suggested that a cross into the central area of the attacking quarter immediately following this wide attacking strategy would promote goal scoring opportunities. The results of the study show that the area was entered via a cross in 22% (n=24) of the total number of possession and within that percentage, 33% (n=4) of the goals that were scored in the football games also came from crosses. This reinforces findings by Wright et al (2011) that indicated that most (31%) of goals are scored when the assist is from an airborne delivery which completely contradicts the finding by Mara, Wheeler and Lyons (2012) who found that there was a strong association between a cross ball distribution and a loss of possession.

On the other hand however, this study found a significant difference ($p=0.000$) in the method at which the ball entered the respective area/D, 36% (n=10) of the goals scored in the hockey games came about from a dribble into the D and 51% of the overall possessions (n=100) were from a dribble also. Tromp and Holmes (2011) found that balls were dribbled into the D in 2009 24% more of the times than in 2008, the year that the 5 yard rule came into play. This rule meant that teams were no longer allowed to hit the ball straight in the 'D' from a free hit, sideline or long corner taken inside the attacking 23. As well as this Sunderland et al. (2006) showed that 21% of balls were hit into the 'D' where as in the present study, nearly half of this figure (n=12%) accounted for D entries being classified as a hit due to the fact that in 2006, players had the ability to hit the ball straight into the D from a free hit, sideline or long corner, however due to the new

5 yard rule, a player cannot hit the ball into the D before the ball has travelled 5 yards from when the dead ball situation was taken from.

5.4 Repossession

This study looked into the complete sequence of attacking phases, not just focusing on what happened in those phases but also how those phases began and within which areas of the pitch. In terms of the comparison of hockey and football, the two sports showed similarities and difference on this matter and found that the position as to where the possessions began showed no significant difference ($p=0.290$). The results of the study showed that the majority (48% ($n=55$) and 47% ($n=108$) for football and hockey respectively) of possession originated from the defensive half of the field. In the attacking half however, the two sports showed a difference in terms of location of repossession. 30% of total possession in football started within the first part of the attacking half (closest to the half way line) where as only 21% of the possession originated from the same part of the hockey pitch. This was reversed in the second part of the attacking half (closest to the goal) where 22% of total possessions in football were deemed to have originated from this section where as in hockey 33% of possessions started in this area. This is interesting to see as it can infer that football teams look to press the ball high up the pitch even in the final third looking for a turnover whenever they possibly can, a statement that is backed up Olsen (1988) who said pressurizing opponents into making mistakes, and thus winning possession in the attacking 3rd, is a tactical recommendation. In contrast hockey teams appear to press less in the final attacking third, but as teams begin to advance on the half way line, then the defense will interact and begin to try and make the turnover. This could be something highlighted by Mitchell-Taverner (2005) who stated that a key principle in defence is to defend the middle of the pitch in the press, because it is the quickest and most direct route to goal. This principle is of greater importance in hockey due to the fact that there is no offside rule and a player can stand wherever he wants between the ball and the goal.

Compared to the literature surrounding it, the method at which repossession occurred also showed similarities. Due to only a handful of literature investigating

patterns of play in field hockey it is hard to compare strategies between hockey to football but however there is abundance within football. The results in this study showed that the method in which the repossession occurred was significantly difference across the two sports ($p=0.000$). The most common method of repossession was that of an interception whereby 63% ($n=72$) of possessions started in this manner. This is backed up by Hughes et al (1998) who identified that the greatest method of repossession within football was by interception (68%). Hockey results showed that this was also the case for the majority of possessions where 33% ($n=76$) of possessions were started by an interception, however they also showed that 33% of possessions ($n=77$) were started by means of a free hit.

5.5 Passes

As previously discussed there is very little literature that has investigated patterns of play in field hockey and in particular relating to the amount of passes per possession especially for successful possessions including goal scored. There is however much more research within football on this matter. Hughes and Franks (2005) stated that in the 1990 FIFA World Cup 84% of goals came from team possession of four passes or less. In the 1994 FIFA World Cup this figure went down to 80%. The results of this study found that there was a significant difference ($p=0.000$) in passing phases across the two spots and it was found that out of the twelve ($n=12$) goals that were scored during the seven games, only 67% ($n=8$) came from possessions of four goals or less for football, and for hockey, out of the twenty eight ($n=28$) goals that were scored, 71% ($n=20$) came from possessions with four or less passes within them. This could be that due to the fact that the study by Hughes and Franks' is nearing ten years old then this figure especially for football is just a factor of general regression and possessions are in fact becoming longer with teams looking to keep the ball a lot more during possession phases, backed up by Hughes and Franks (2005) who suggested that possession was key in achieving successful attacks. It was found by Redwood-Brown (2008) that scoring a goal significantly influenced the passes that were successful five minutes after a goal was scored for the team that scored the goal but not for the team that conceded it. Bloomfield et al. (2004a)

found that successful teams in the English FA Premiership generally tried to increase possession when ahead or behind, suggesting they try and “control” the game by dictating play and Hughes and Frank (2005) found that teams who made longer passing sequences had a better chance of scoring, suggesting a slower build up style may be more appropriate.

CHAPTER SIX

Conclusion

6.1 Main Findings

This study had the main aims to identify whether attacking strategies between two invasion sports, hockey and football, are transferrable between the two sports.

The following hypotheses were accepted:

1. Possessions will begin through an Interception/tackle significantly more times than any other method of repossession
2. Teams will win the ball back in the attacking half of the field significantly more times than the defensive half.
3. Possessions phases in terms of number of passes will be significantly different across the two sports.

The finding that Interception/Tackle's will be the method of repossession significantly more times than any other method supports the existing body of work (Hughes et al. 1998).

Similarly, the number of passes per possession was deemed to be significantly different. It was suggested that possessions was key in achieving successful attacks (Hughes and Franks, 2005) and that 80% of goals came from 4 passes or less (Reep and Benjamin, 1968).

The following hypotheses were rejected:

1. Possessions will enter the area/D within the top two sections significantly more than the other four segments.
2. Teams will use push/ground pass significantly more times than any other method to advance into the attacking area.

The push pass was one of the most used methods of entry into the area/D however was not used significantly more times than that of any other method and was not the most commonly used either. The push pass is said to be a controlled pass and it doesn't require a large static base like the hit and slap, in elite men's hockey it can be executed at a high pace to create fluidity to the attack (Hardcore Hockey, 2013), and would therefore indicate to be the best way for teams to retain possession, keep the ball and advance up the pitch limiting the amount of risk involved. Despite this the dribble was the main method of entry accounting for 51% of possessions.

As well as this it was shown that across both sports there are widely dispersed set of results in regards to the position of area/D entry. This agrees with the work of Stomp and Holmes (2010), who suggested that due the introduction of the 5 yard rule change (FIH, 2013) team will work the ball around more in the 23 than before.

6.2 Applied Implications

From the findings and limitations of this study, there are numerous areas that future research could look into to investigate further. These could include:

- The difference in passing averages across invasions game sports.
- Difference in attacking strategies between successful and unsuccessful teams. Taking the top three or four teams from both competitions and comparing that to the strategies of the bottom three or four teams in order to see how the strategies compare.
- The difference in defensive strategies, in relation to area/D entries conceded and achieved.

This study will enable coaches in football and hockey to reflect upon their own practices and performances, to make them aware of some of the strategies in alternative sports that they can potentially use to enhance their team's chances of greater success.

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APPENDICES

APPENDIX A

OPERATIONAL DEFINITION TABLES WITH SHORT HAND CODES

Table 2a: Possible actions, shorthand codes and definitions of hockey match-play events involved in repossession (phase 1) taken from Sunderland *et al* (2006).

| Possible Action | Code | Definition |
|-----------------|------|--|
| Free Hit | FH | Possession awarded to the opposition following an illegal infringement. Play is restarted by a player from the non-offending team by the player hitting or pushing the ball back into play from a 'dead ball' placed where the offence occurred. |
| 16 Yard Hit | 16 | Possession is awarded if the whole of the ball crosses the back line having last touched the stick of an attacker, or if a 'Free hit' is awarded against the attack nearer than 16 yards to the back line. Play is restarted by a player from the defending team hitting or pushing the ball back into play from a 'dead ball' placed in line with the 16-yard marking on the side line (level with the top of the D). |
| Interception | In | Possession is gained without play being stopped and restarted. The opposing team wins the ball from the team in possession during open play through actions such as tackling. |
| Side Line | SL | Possession is awarded if the whole of the ball crosses the side line. Play is restarted by a player from the opposite team to the last player to contact the ball. The player hits or pushes the ball into play from a 'dead' ball placed on the side line level to where the ball left the pitch. |
| Push Back | PB | Possession is gained through the restarting of a game after a half time break or preceding a goal. In the instant that a goal is scored, the team that conceded the goal gets the pushback. |

Table 2b: Possible actions, shorthand codes and definitions of football match-play events involved in repossession (phase 1).

| Possible Action | Code | Definition |
|-----------------|------|--|
| Free Kick | FK | Possession awarded to the opposition following an illegal infringement. Play is restarted by a player from the non-offending team by the player hitting or pushing the ball back into play from a 'dead ball' placed where the offence occurred. |
| Goal Kick | GK | Possession is awarded if the whole of the ball crosses the back line having last touched an attacker. Play is restarted by the goal keeper from the defending team kicking the ball back into play from a dead ball position from their 6-yard area. |
| Interception | In | Possession is gained without play being stopped and restarted. The opposing team wins the ball from the team in possession during open play through actions such as tackling. |
| Thrown In | TIn | Possession is awarded if the whole of the ball crosses the side line. Play is restarted by a player from the opposite team to the last player to contact the ball. The player throws the ball from the side line level to where the ball left the pitch. |

Table 3a. Possible actions, shorthand codes and definitions of match-play events in hockey involved with passing the ball into the final quarter (phase 2) and the final quarter phase (phase 3). Taken from Sunderland *et al* (2006)

| Possible Action | Code | Definition |
|-----------------|------|---|
| Hit | H | A powerful stroke with a swinging movement of the stick in order to increase the ball's speed, hands are placed closed together at the top of the stick to maximise acceleration (Law 1990). |
| Push | Pu | A 'push' moves the ball along the ground by a pushing movement of the stick after the stick has been placed close to the stationary or rolling ball. When a push is made, both the ball and the head of the stick are in contact with the ground (Law, 1990). |
| Dribble | Dr | The action of 'carrying' or manoeuvring the ball while keeping it in close contact with the stick (Ward, 1994). |
| Slap | Sl | A stroke where the stick remains in contact with the pitch making an arc around the base of the feet. |
| Deflection | De | Changing the direction of the ball using the momentum of the ball created from the previous pass by placing the hockey stick in the path of the balls motion. |
| Aerial | Ae | The ball leaves the floor and is flicked over the heads of defenders in order to eliminate them and gain territory up the pitch much quicker. |

Table 3b. Possible actions, shorthand codes and definitions of match-play events in football involved with passing the ball into the final quarter (phase 2) and the final quarter phase (phase 3).

| Possible Action | Code | Definition |
|-----------------|------|--|
| Pass | Pa | A distribution made during open play with the distributor's foot, with the intention of transferring possession to another teammate. Any distribution which was used primarily as a defensive mechanism (e.g., a long clearance under pressure) as opposed to an intention to maintain possession is excluded.. (Mara <i>et al</i> , 2012) |
| Cross | Cr | The distributor played the ball from a wide zone outside the 18-yard box (left wing or right wing) to a central zone inside the 18-yard box. |
| Lob | Lo | A distribution made during open play with the distributors foot, with the intention of transferring possession to another team mate through the air. |
| Dribble | Dr | The action of 'carrying' or manoeuvring the ball while keeping it in close contact with the foot. |

Table 4a. Possible actions, shorthand codes and definitions of match-play events in hockey involved with possession outcomes both positive and negative in the final quarter phase (phase 3).

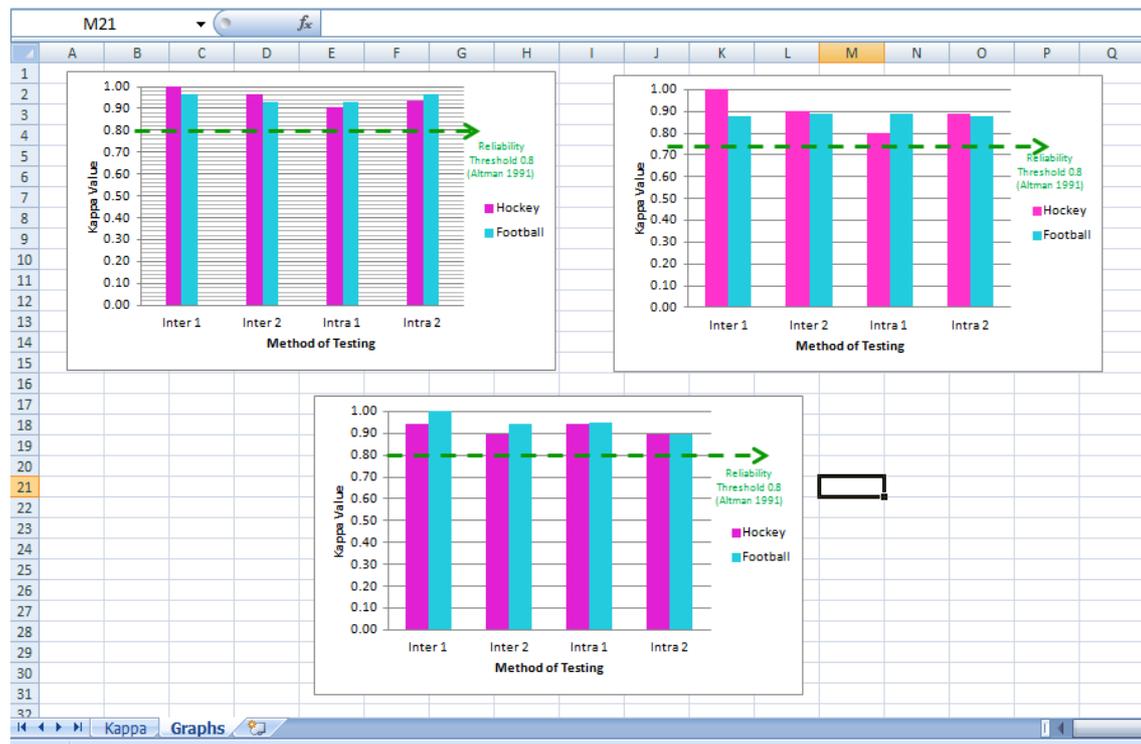
| Possible Action | Code | Definition |
|-----------------|------|--|
| Goal | Go | The action that sees the ball struck over into the goal by an attacking player from inside the D. As of 2009 a goal was awarded if a defending player touched the ball into their own goal. (FIH) |
| Shot on Target | SoN | The ball is struck by an attacker inside the D, towards goal but is saved by the goalkeeper. A further outcome such as a Long Corner, Short Corner, Sideline or a turnover of possession will occur from this if no goal scored. |
| Shot off Target | SoFF | The ball is struck by an attacker inside the D, but it misses the intended target without the goalkeeper having to make a save. Action will result in a turnover of possession in the form of a 16 yard hit, if the shot is not contacted by a defender. |
| Short Corner | SC | A short corner is awarded following an offence from the defending team inside the D. |
| Penalty Flick | PF | Awarded following an offence within the D that stops a clear goal scoring opportunity. |

Table 4a. Possible actions, shorthand codes and definitions of match-play events in football involved with possession outcomes both positive and negative in the final quarter phase (phase 3).

| Possible Action | Code | Definition |
|-----------------|------|---|
| Goal | Go | The action that sees the ball struck over into the goal by an attacking or defending player. |
| Shot on Target | SoN | The ball is struck by an attacker, towards goal but is saved by the goalkeeper. A further outcome such as a Corner or Throw In. A turnover of possession will occur from this if no goal scored. |
| Shot off Target | SoFF | The ball is struck by an attacker, but it misses the intended target without the goalkeeper having to make a save. Action will result in a turnover of possession in the form of a goal kick, if the shot is not contacted by a defender. |
| Penalty | Pe | A penalty is awarded following an offence within the penalty area. This could be any sort of offence from the defending side. |

APPENDIX B

EXAMPLE OF EXCEL KAPPA RELIABILITY GRAPHS



APPENDIX C

EXCEL RELIABILITY SCORES

| | A | B | C | D | E | F | G | H | I | J | K | L |
|----|---------------------|--------|----------|---|-------------|--------|----------|---|-----------|--------|----------|---|
| 1 | | | | | | | | | | | | |
| 2 | Overall Possessions | | | | No of Shots | | | | Turnovers | | | |
| 3 | Game 1 | | | | Game 1 | | | | Game 1 | | | |
| 4 | | Hockey | Football | | | Hockey | Football | | | Hockey | Football | |
| 5 | Observer 1 | 28 | 26 | | Observer 1 | 8 | 8 | | Observer | 16 | 19 | |
| 6 | Observer 2 | 30 | 26 | | Observer 2 | 9 | 8 | | Observer | 19 | 17 | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10 | Game 2 | | | | Game 2 | | | | Game 2 | | | |
| 11 | | Hockey | Football | | | Hockey | Football | | | Hockey | Football | |
| 12 | Observer 1 | 28 | 27 | | Observer 1 | 8 | 7 | | Observer | 17 | 19 | |
| 13 | Observer 2 | 31 | 28 | | Observer 2 | 10 | 9 | | Observer | 17 | 18 | |
| 14 | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | |
| 19 | | Hockey | Football | | | Hockey | Football | | | Hockey | Football | |
| 20 | Inter 1 | 1.00 | 0.96 | | Inter 1 | 1.00 | 0.88 | | Inter 1 | 0.94 | 1.00 | |
| 21 | Inter 2 | 0.97 | 0.93 | | Inter 2 | 0.90 | 0.89 | | Inter 2 | 0.89 | 0.94 | |
| 22 | Intra 1 | 0.90 | 0.93 | | Intra 1 | 0.80 | 0.89 | | Intra 1 | 0.94 | 0.95 | |
| 23 | Intra 2 | 0.93 | 0.96 | | Intra 2 | 0.89 | 0.88 | | Intra 2 | 0.89 | 0.89 | |
| 24 | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |

APPENDIX D

iPad DARTFISH EASY TAG APPLICATION

| Hockey | | | | | Football | | | | |
|----------|----------------|---------------------|--------------|---------------|-----------|----------------|-------------------|---------|-----------|
| D | A | End of Possession | 1a | 2a | D | A | End of Possession | 1a | 2a |
| E | B | Aerial | 3a | 4a | E | B | - | 3a | 4a |
| F | C | Interception/Tackle | 5a | 6a | F | C | Interception | 5a | 6a |
| Sideline | Long Corner | 16 Yard | Push Back | Free Hit | Free Kick | Goal Kick | Throw In | Corner | Kick Off |
| 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 6 | 7 | 8 | 9 | 10 |
| Push | Slap | Hit | Dribble | Deflection | Pass | Lob | Cross | Dribble | - |
| Goal | Shot On Target | Shot Off Target | Short Corner | Penalty Flick | Goal | Shot On Target | Shot Off Target | Penalty | Free Kick |

APPENDIX E

DESCRIPTIVE STATISTICS INFORMATION FROM IBM STATISTICS PROGRAMME

Descriptive Statistics

| | N | Mean | Std. Deviation | Minimum | Maximum | Percentiles | | |
|-------------|-----|--------|----------------|---------|---------|-------------|---------------|--------|
| | | | | | | 25th | 50th (Median) | 75th |
| StartOfPoss | 347 | 9.08 | 4.824 | 1 | 16 | 5.00 | 10.00 | 13.00 |
| Method1 | 347 | 2.5706 | 1.55350 | 1.00 | 6.00 | 1.0000 | 2.0000 | 4.0000 |
| AreaEntry | 347 | 4.22 | 1.354 | 1 | 6 | 3.00 | 4.00 | 5.00 |
| Method4 | 347 | 2.8559 | 1.57362 | .00 | 6.00 | 1.0000 | 3.0000 | 4.0000 |
| Upgrade | 347 | 3.6916 | 1.36852 | 1.00 | 5.00 | 3.0000 | 4.0000 | 5.0000 |
| NoOfPasses | 347 | 4.3429 | 3.42980 | .00 | 22.00 | 2.0000 | 3.0000 | 6.0000 |
| Sport | 347 | 1.6686 | .47140 | 1.00 | 2.00 | 1.0000 | 2.0000 | 2.0000 |

APPENDIX F

MANN-WHITNEY U TEST FROM IBM STATISTICS PROGRAMME

Ranks

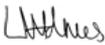
| | Sport | N | Mean Rank | Sum of Ranks |
|-------------|----------|-----|-----------|--------------|
| StartOfPoss | Football | 115 | 182.07 | 20938.00 |
| | Hockey | 232 | 170.00 | 39440.00 |
| | Total | 347 | | |
| Method1 | Football | 115 | 128.77 | 14808.50 |
| | Hockey | 232 | 196.42 | 45569.50 |
| | Total | 347 | | |
| AreaEntry | Football | 115 | 163.77 | 18834.00 |
| | Hockey | 232 | 179.07 | 41544.00 |
| | Total | 347 | | |
| Method4 | Football | 115 | 133.82 | 15389.00 |
| | Hockey | 232 | 193.92 | 44989.00 |
| | Total | 347 | | |
| Upgrade | Football | 115 | 186.00 | 21390.00 |
| | Hockey | 232 | 168.05 | 38988.00 |
| | Total | 347 | | |
| NoOfPasses | Football | 115 | 214.45 | 24661.50 |
| | Hockey | 232 | 153.95 | 35716.50 |
| | Total | 347 | | |

Test Statistics^a

| | StartOfPoss | Method1 | AreaEntry | Method4 | Upgrade | NoOfPasses |
|------------------------|-------------|-----------|-----------|-----------|-----------|------------|
| Mann-Whitney U | 12412.000 | 8138.500 | 12164.000 | 8719.000 | 11960.000 | 8688.500 |
| Wilcoxon W | 39440.000 | 14808.500 | 18834.000 | 15389.000 | 38988.000 | 35716.500 |
| Z | -1.059 | -6.213 | -1.370 | -5.507 | -1.638 | -5.332 |
| Asymp. Sig. (2-tailed) | .290 | .000 | .171 | .000 | .101 | .000 |

a. Grouping Variable: Sport

APPENDIX G
ETHICAL APPROVAL FORM

| | |
|---|--|
| |  Cardiff Metropolitan University Prifysgol Metropolitan Caerdydd |
| Date: 11 March 2014 | |
| To: <u>Callum French</u> (st200003898) | |
| Project reference number: 13/05/119U | |
| Your project was recommended for approval by myself as supervisor and formally approved at the Cardiff School of Sport Research Ethics Committee meeting of 29th May 2013 | |
| Yours sincerely | |
|  | |
| Supervisor | |
| Cardiff School of Sport Cyncoed Campus, Cyncoed Road, Cardiff, CF23 6XD UK Ygol Chwaraeon Caerdydd Campws Cyncoed, Heol Cyncoed, Caerdydd, CF23 6XD DU | |
| Telephone/F0n +44 (0)29 2043 6991 Fax/Facs +44 (0)29 2043 6768 Email/Ebost cs@cardiffmet.ac.uk www.cardiffmet.ac.uk | |

