Beyond the Royal Road: A grid-based Approach to Identify Effective OZ Passes

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Abstract. This study investigates the impact of crossing passes on scoring opportunities in hockey by expanding the traditional concept of the "royal road," an imaginary line that splits the rink into two halves. In this paper, the offensive zone is divided into the seven areas and analyzed sequences that contain passes that traverses these zones to understand. We tracked sequences and their outcomes across 156 games. The results highlight the effectiveness of certain zone transitions, particularly involving the slot, in increasing expected goals (xG) and contributing to team success. This paper offers insights into puck-zone transitions puck movement and its potential to improve scoring chances in hockey.

1 Introduction

Scoring goals in hockey can be done in multiple different ways. One particularly efficient method is to pass across an imaginary line, commonly referred to as the "royal road", which can be considered an imaginary line across the vertical centre of the rink. According to Valiquette, a pass crossing this line greatly increases the probability of scoring a goal, as the goaltender must adjust their position [1]. Instead of dividing the rink in two sides, this paper investigates if similar patterns can be found when the rink have been divided into seven different areas. Furthermore this paper also investigates how these passes relate to teams performance.

2 Background

Figure 1 shows how the offensive rink is divided. There are seven different zones, we are particularly interested in passes that traverses from zone to the other. The zones are referred to as (1) upper left, (2) upper middle, (3) upper right, (4) lower left, (5) slot, (6) lower right and (7) behind goal crease. This division is similar to Hellberg *et al,.* zone split of the rink in [2], but with the modification of accounting for which sides the passes or shots are coming from (left or right side).

3 Algorithm

The algorithm used in this paper can be described as a event sequence extraction algorithm. The algorithm is designed to identify two types of sequences

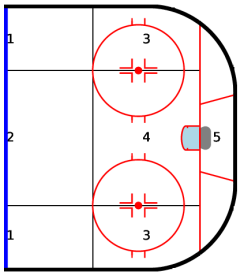

Fig. 1. The rink divided in predefined zones.

- **Sequence 1:**
  1. A *pass* from one of the predefined zones.
  2. A *reception* in a different predefined zone.
  3. A *shot*.
  4. The next event, checking if possession is maintained.
- **Sequence 2:**
  1. A *pass* from one of the predefined zones.
  2. An *assist* within a predefined zone.
  3. A *reception* in a different predefined zone.
  4. A *shot* on goal.
  5. Goal

These sequences are simple yet capable of capturing exactly what we seek to achieve; an analysis and quantification of what type of passes occur and which variants most successful. Furthermore this also used to identify correlation between the different passes and a teams success. The algorithm iterates through all rows in the datasets, and when a pass occurs in one of the zones of interest (referenced in Figure 1). If this pass is followed by an assist, a goal is guaranteed in this sequence since we require the next event should be a reception and a shot immediately afterwards. Alternatively if a the next event is a reception in another zone of interest it indicates a pass has changed zone, if the next event is a shot, we save the next event if the attacking team is still in possession. The result of this algorithm is two different type of sequences that capture the passes and puck movement we seek to analyze. This algorithm was chosen for its simplicity yet effective capability of capturing the interesting sequences.

4 Results

This section contains statistics about the different type of passes, xG values based on pass what zone the pass originated from and patterns that can be discovered from the sequences. Finally an analysis is done to investigate if any type of zone transition is particularly correlated to a teams success in terms of winning games.

4.1 Basic statistics the different type of passes and sequences

The data features 156 different games and the number of goals is 821. Out of the total 821 goals, 446 of these were found in sequence 2 sequences, in total around 9000 of sequences were identified meaning that around 5% of the sequences lead to a goal. Considering the the total size of the data set (156 games, and well over 500 000 rows), we manage to capture a significant amount of goals in relatively few events.

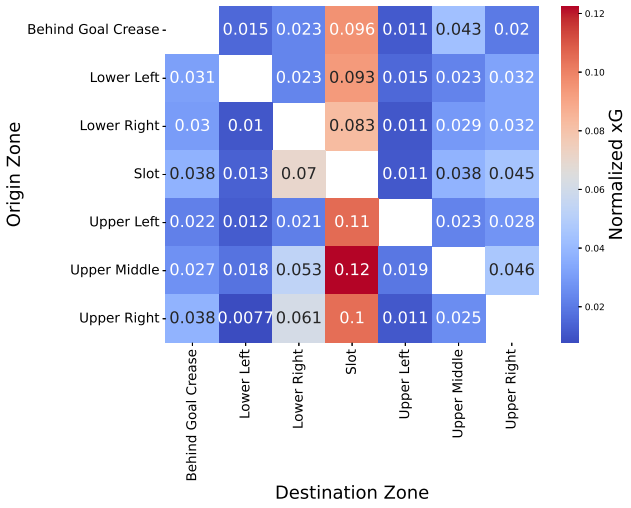

Fig. 2. Heat map off origin zone and destination zone.

Figure 2 shows the distribution and frequency of passes between the seven. Each cell in the heat map corresponds to the frequency of passes from an origin zone (rows) to a destination zone (columns). The color intensity in each cell reflects the normalized xG value where more red shades indicate higher normalized values and bluer shades indicate a lower normalized xG value. Recall that the normalized xG value is derived from dividing the accumulated xG-value for each pass-zone combination by the frequency of said pass-zone combination Not surprisingly, the slot is an important zone, receiving passes from all zones, leading to the highest xG-values, particularly the Upper Middle (0.122), Upper Right (0.105), and Upper Left (0.106). Significant activity has been observed behind the goal crease, highlighting its importance in starting plays. Notably, there is a strong link to the Lower Right area, with a xG value of 0.096. This suggests that teams might be using this area strategically to create scoring opportunities. Moreover, the analysis reveals a pattern of frequent lateral and diagonal passes, such as from the Lower Left to the Slot, which has a xG value of 0.093, and from the Upper Middle to the Upper Right, with a strength of 0.046. These insights not could be used to discover under-used combinations of the sequences.

Figure 3 displays a scatter plot where each dot represents an individual passing sequence within the dataset. The x-axis measures the total number of passes within each sequence, and the y-axis shows the corresponding total expected goals (xG) value. The plot includes a linear regression line, demonstrating a positive correlation: as the number of passes in a sequence increases, so does the xG value. This suggests that sequences involving more passes are likely to increase the likelihood of scoring, reflecting effective offensive play.

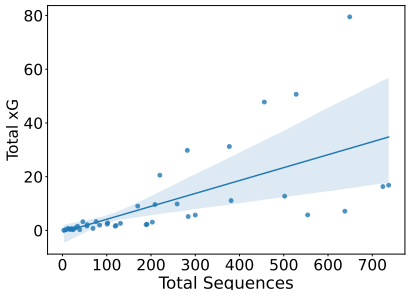

Fig. 3. Normalized xG vs Sequences.

4.2 Passing Zones correlation with team performance

In the earlier section we concluded that these types of passes are an effective way of scoring goals, the sequences are relatively infrequent but carry a majority of the goals in the total datasets. This is correlated with a teams success, from the dataset we identified team performance simply by looking at what team had won the most amount of games.

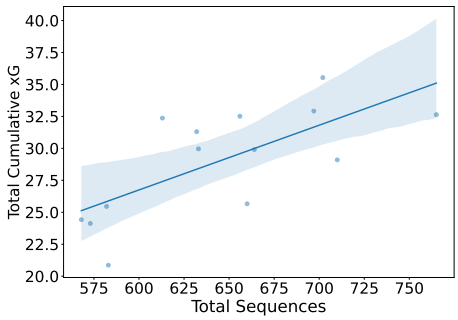

Fig. 4. Normalized xG vs Sequences per team.

Figure 4 shows a scatter plot where each dot is a team in the data set, and y-axis shows the normalized xG-value and y-axis shows the total amount of sequences. Furthermore we also have a linear regression line that suggests as the number of sequences that are transitioning from one zone to another, so does increases so the xG, which is a good measurement of overall team performance. Most of the teams follow the trend, however some points are outside of the confidence interval, teams that are out of the confidence interval suggests that it exists over-and-under performers in this aspect. This Figure provides visually that there is a relationship between having many sequences where a shot come from another zone than where it originated from is correlated to higher xG-values. This Figure share multiple characteristics with the similar plot based on total sequences, as seen in Figure 4.1.

Table 1. Performance Analysis in High xG Zones

Zone	Best Team ID	Best Team xG	Worst Team ID	Worst Team xG
Upper (M) to Slot	885	0.183	869	0.075
Behind to Slot	825	0.135	877	0.080
Upper (R) to Slot	885	0.141	792	0.060
Lower (R) to Slot	524	0.113	825	0.049
Upper (L) to Slot	634	0.166	686	0.056
Lower (L) to Slot	628	0.216	792	0.052
Lower (L) to Upper (M)	792	0.033	726	0.016
Upper (L) to Upper (M)	877	0.032	628	0.014

In Table 1 team 885 shows strong performance in generating higher xG from different field locations, conversely, Team 792 frequently appears as having the lowest xG, suggesting areas for improvement in their attacking plays. This table only shows a small subset of the available data. The data chosen was the highest xG transitions along with the top and bottom performers.

5 Overview and Discussion

The key findings in this paper is that it is established that are certain zones in the OZ that are more effective than the others, most of the findings are fairly trivial such as slot passes are effective in terms of xG, however when comparing the sequences in terms of performance wise in team we can get more novel and usable information.

6 Future work

This paper studied the effectiveness of transitioning from one zone to another in the OZ. A robust correlation was observed between these sequences and high team performance. I suggest future research to dig deeper into more team specific

information such as presenting whether there are any significant deviations from the identified sequences with lots of action to and from the slot. This could lead to insights on what the teams should do and not do in the rink in terms of these zone transitioning passes. Lastly it would be interesting to validate the passing zones correlation with team performance with the results of the 156 games.

7 Code appendix

The can be found in this public repository

References

1. Valiquette, Steve `http://www.springer.com/lncs`, last accessed 2024/05/05
2. Olivestam, A., Rosendahl, A., Svens, H., Hellberg, L. On the Attack: Using Analytics to Unlock the Secrets of Successful Zone Entries in Hockey. In Proceedings of the Linköping Hockey Analytics Conference LINHAC 2023 Research Track." Linköping Hockey Analytics Conference LINHAC 2023. Linköping University Electronic Press, 2023