The Effect of Shot Location on Rebound Quality

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1   Introduction

In the modern game of hockey, every team is trying to improve the way that play and are using analytics to help them make decisions [6]. To increase scoring opportunities, teams must pick the best places to center their offenses around in order to create the best chances for scoring. This paper will discuss the current behavior of offenses in hockey, and how they can possibly improve through the use of second chance points.

2   Background Information

This report references multiple different hockey terms, the most commonly used in the report are defined below [1, 2].

- Second chances
  - The opportunity that is created when the attacking team collects a rebound
- The slot
  - The area in and around the front of the net
- Expected goals(xg)
  - How likely a shot attempt is to score, written as a value from 0 (less likely) to 1 (more likely)

3   Algorithms and Methods

3.1   Cleaning and Sorting the Data

When first looking at the data that was given for this paper, it was clear that only a small fraction of it would be used for this report. The data provided had already been organized in some ways. It was a complete breakdown of every event that happened during the game, labeled by what type of event it was, such as a shot on net, a pass, a rebound, and more. Each event also had more data about it, including whether or not the event was successful or not, the team and player in possession at the time, and most importantly, the location of where the event occurred, as well as much more information on each event.

In order to gather and extract the data that was needed, some sorting of the data was required. A few pieces of data were retained from the dataset: shot locations and their respective expected goals(xg), as well as data on rebounds and any second chances.

To achieve this, every line of the dataset was checked if it met the certain criteria. Different criteria that was used to determine when to save different parts of data include:

- Possession changes to determine if a shot was taken during a second chance on offense
- The location on xg of first shot attempts of a possession
- If there was a rebound, and where it was picked up

- Any second chance shots, along with their location, xg, and the data from the first shot in the possession

3.2 Algorithms

To analyze the data, different methods were used. First, the data had to be filtered into different categories based on the sequence that proceeded the event. To do this, the data was searched over line by line to read the sequence. A offensive possession was defined as all of the consecutive events that occurred while a team was in possession of the puck [4]. Using this definition, we were able to gather information about all offensive possessions that included a rebound opportunity. Different information gathered on each sequence includes every shot location, xg of each shot, whether or not the shot was off of a rebound, and the location of the rebound.

Using the data from the event sequencing, more computation was used to generate meaningful plots to visualize the data. To get predictive rebounded shots xg, the second chance shots were matched up with the first shot in the possession in order to determine where second chance opportunities are likely to come from. Another algorithm that was used was a linear interpolation in order to generate a map of xg over the entirety of the offensive zone [3].

3.3 Generating Plots

To assist with generating plots, the python library matplotlib was used, along with numpy and pandas to help store information in easily accessible methods [5]. The locations used in the data and all plots shown are based on a grid centered at center ice. The bounds of the offensive zone is shown below in Figure 1
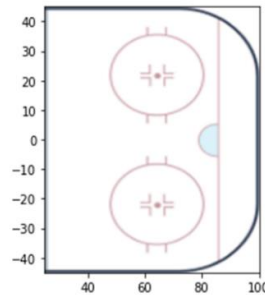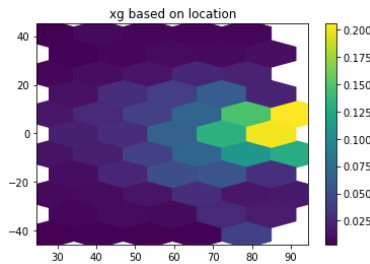

Fig. 1. The scale used for locations in the offensive zone.

4 Results

4.1 The Efficiency of Rebounds

In order to analyze the best locations to generate advantageous rebounds, a comparison between second chance shots and non-rebound shots must be analyzed.

Shown below in Figure 2 is a heat map of xg based on location of the shot.

Fig. 2. The xg for all non-rebound shot locations in the offensive zone.

As expected, the closer shots are to the net, the more likely they are to score, with xg reaching as high as 0.2. However, when compared to Figure 3 below, that does not seem so impressive.
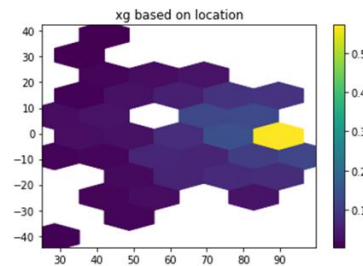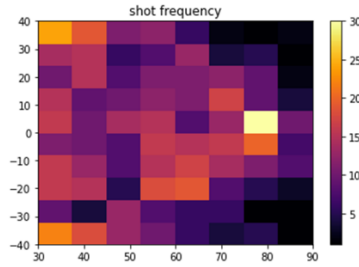

Fig. 3. The xg for all second chance shots in the offensive zone.

Much like Figure 2, Figure 3 follows the same pattern: higher xg closer to the net. However, the second shot xg is higher than the xg of a non-rebound shot and gets above 0.5 in front of the net.

The efficiency of rebound shots is also better than non-rebound shots when looking at the average xg. For non-rebound shots, there is an average xg of 0.043, while rebound shots have an average xg of 0.074, showing that rebound shots are 1.7 times more likely to score than non-rebound shots.

4.2 Current Offense Playstyles

When looking at how teams play today, their most frequent shot locations line up with Figure 1, they shoot most shots from the slot in order to maximize their xg. This shot frequency can be seen in Figure 4 below.

Fig. 4. The non-rebound shot frequency in the offensive zone

While this strategy may result in scoring chances from high quality shots, a better strategy can be formed. Shown in Figure 5 is the xg for second chance shots based on the location of the shot that generated that rebound.
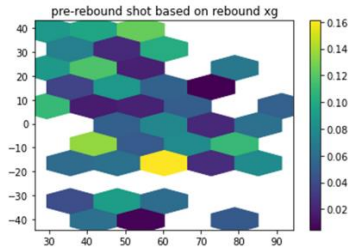
Fig. 5. The xg for all second chance shots based on original shot location.

This plot shows that the best place to generate an advantageous rebound is not directly in the slot, but a bit further back, and from an angle, as seen by the bright yellow hexagon, and the cluster of green in the top left corner of the offensive zone, and it should not matter if the shot is taken from the left or the right side of the ice. Because the number of data points used is small, there are some holes in Figure 5. When analyzing just the distance from the net, we get Figure 6, shown below.
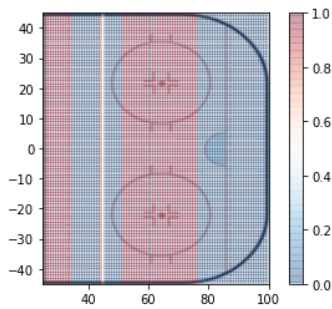
Fig. 6. The xg for all second chance shots, based on distance from the net.

When looking at Figure 6, some oddities can be seen. The 2 low rebound xg areas are where hockey teams are typically shooting from. Teams should move their shots from the top of circles either to the point or to the slot in order to have higher xg off of rebounds. The blue area in front of the net should still be shot in, as the highest xg area is right in front of the net, teams just won't generate many rebounds from that location.

5   Summary of Key Points and Next Steps

5.1   Summary of Key Points

In summary, this report has found a few things. It has proven that rebound shots are much better scoring opportunities than non-rebound shots. It has also shown that teams should adjust their offenses to shoot less from the top of the circle and more from other areas of the ice in order to generate higher quality second chance opportunities.

5.2   Next Steps

Many different things were considered for this study, but there is still plenty of improvements to be made. As this report studied the quality of second chances from shot location, the logical next step would be to study the frequency of second chances from shot locations in order to find the best place to shoot to get a rebound, regardless of quality.

6   References

[1]   "Glossary of Ice Hockey Terms," Wikipedia, 6 May 2022. https://en.wikipedia.org/wiki/Glossary_of_ice_hockey_terms.

[2]   A. Ryder, "Shot Quality," 2004.

[3]   "Interpolation," Scipy, 2 Feburary 2021. https://docs.scipy.org/doc/scipy/tutorial/interpolate.html#.

[4]   @garick16, "Introduction to Hockey Analytics Part 4.1: Possession Metrics (Corsi/Fenwick)," Lighthouse Hockey, 7 August 2011. https://www.lighthousehockey.com/2011/8/7/2302188/an-introduction-to-hockey-analytics-part-4-1-an-introduction-to.

[5]   "MatPlotLib," Available: https://matplotlib.org/3.5.0/index.html.

[6]   T. B. Swartz, "Hockey Analytics".

7   Link to Code

https://github.com/eparly/Linhac_2022