

# **Decision Making in the Neutral Zone and its Impact on Possession Value**

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## **1 Introduction**

In the fast paced game of hockey, the neutral zone stands as a decisive area where the outcome of the game can hinge on split-second decisions. The swift and precise choices required in this zone can often determine the value of your possession, and ultimately, the game. To increase scoring opportunities, players must make the right choices when gaining possession in the neutral zone. This paper seeks to examine the impact that different actions taken in the neutral zone have on the value of a possession. By understanding the values added or removed by taking different actions, this study aims to equip players with the knowledge to make informed decisions when they gain possession.

## **2 Background Information**

Creating strong possessions from the neutral zone is a crucial part of the game, as it often leads to extended possessions in the offensive zone, and more scoring opportunities. To assess the value of a possession, several metrics can be used. Cumulative expected goals (xG) serves as a strong indicator of possession strength. Possessions with multiple scoring chances and shots will have a higher cumulative xG than possessions with no shots. Another metric to value a possession is the duration of the possession. Longer possessions indicate control over the game, and can both create offensive chances and prevent the opposing team from scoring.

This paper aims to investigate the impact of the first decision made by the player with the puck when starting a possession in the neutral zone. The most common events were:

1. Passing the puck
2. Carrying the puck
3. Protecting the puck
4. Controlled Entry

A greater focus will be put on the differences between passing the puck, and carrying the puck, as those are by far the most common events.

## 3 Algorithms and Methods

### 3.1 The Dataset

The data provided for this competition by Sportlogiq included data from 156 games of the 2023-24 SHL season, with a total of 541,802 single events that were tracked. Each row represents a single event that occurred during the game, and includes data such as the team and player, event name, possession number, and the time and location of the event. The dataset also includes the xG for all shot attempts. These events were crucial for the continuation of this research. The coordinate system used in the dataset played a large role in this analysis. The circle at center ice is located at (0,0), with the defensive blueline located at  $x=-25$  and the offensive blueline located at  $x=25$ . The boards along the neutral zone are located at  $y=42.5$  and  $y=-42.5$ . This coordinate system will be used when showing plots of results.

### 3.2 Method

Before getting into the analysis, some pre-processing of the dataset had to be done to make the data easier to work with. The dataset was broken up into an array of individual possessions so that the value of each possession could be determined. Then, a filter was applied to only consider possessions that started in the neutral zone, which was determined using the location of the first recorded event.

Once the possessions were separated and filtered, a baseline of the metrics was created to compare to the different events. The average xG and average time of possessions was found for all event types for possessions starting in the neutral zone. Using this, it is possible to find the value gained or lost by making different decisions to start your possession.

To evaluate the cumulative xG of a possession, each single event in the possession was checked for its xG value, and summed up for the whole possession. This was then stored in a dictionary, with each possession starting event type (pass, carry...) as the keys, and an array containing the xG, and starting location of each possession as the values. This allowed comparison between different event types, as well as a comparison of the impact that location plays in these situations.

A similar process was followed to find the duration of each possession. The length of each possession was found by finding the difference in elapsed time from the start of the possession to the end of possession. Like with cumulative xG, this was stored in a dictionary along with the starting location of each possession, allowing for comparison of time of possession based on event type, and location on the ice.

## 4 Results

### 4.1 Comparing Baseline Metrics

Comparing the average xG and time of possession for different event types shows that the decision made by the player has a very clear impact on the value of the possession. Table 1 compares the impact that different event types have on the cumulative xG of a possession. It shows that by keeping the puck you can greatly increase the odds of scoring a goal. Passing the puck and protecting the puck will give a slight decrease in xG on average.

	All events	Pass	Carry	Puck Protect	Controlled Entry
Average xG	0.00558	0.00474	0.01395	0.00355	0.02038
% Change from all events	0	-15.05%	+150%	-36.38%	+265.23%

*Table 1: Average xG by event type*

Increasing time of possession shows a different strategy than trying to increase xG. Table 2 shows that by passing the puck you can increase the length of the possession. Carrying the puck or attempting an entry on the offensive zone will slightly decrease the length of the possession, and protecting the puck will greatly lower the length of the possession.

	All events	Pass	Carry	Puck Protect	Controlled Entry
Average Time of Possession (s)	5.0	6.45	4.57	3.57	4.20
Increase/Decrease (s)	0	+1.45	-0.43	-1.43	-0.8

*Table 2: Average time of possession by event type*

The relationship between time of possession and xG can be seen in Figure 1. There is an inverse relationship between time of possession and xG. Possessions that are longer typically have lower xG. This is a tradeoff that teams are faced with, their strategy and game plan can dictate whether they want to control the game with time of possession, or go for higher xG, but shorter possessions.

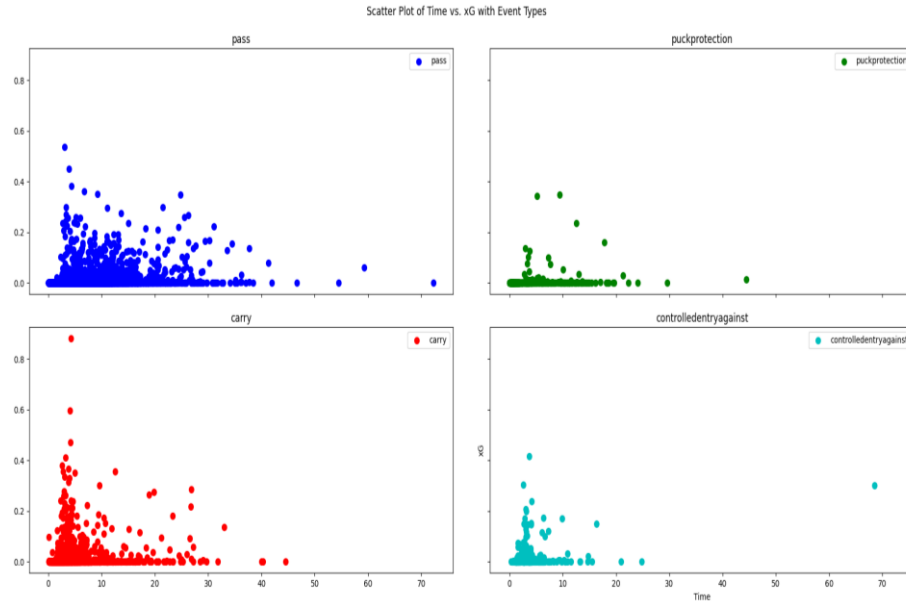


Figure 1: Comparison of time of possession vs xG for different event types

## 4.2 Location Based Metrics

When making these plays in a game, the player's location can play a role in deciding which read they should make. Figures 2,3,4,5 show average time of possession and average xg based on event type and location. The defensive blueline is at  $x=-25$  and the offensive blueline is at  $x=25$ . Seen below in Figure 2 and Figure 3, the effect that location plays on time of possession is shown. In both cases, the starting location does not seem to play a significant role in changing the length of the possession.

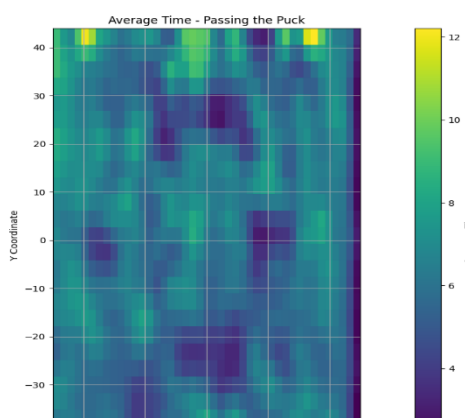


Figure 3: The average time of possession by location for passing the puck

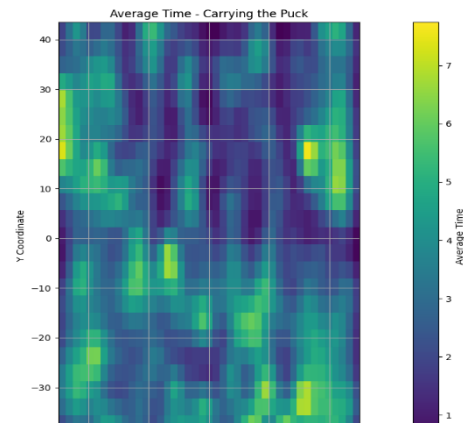


Figure 2: The average time of possession by location for carrying the puck

Unlike time of possession, the starting location of a possession does have an impact on the xG of a possession. Shown in Figure 4 and Figure 5, the effect of location does make a difference on whether the player should pass the puck or carry it. In the case of passing the puck, a greater advantage can be gained by passing the puck if the possession starts closer to the defensive blueline. The opposite can be said for carrying the puck, where it is more advantageous to carry the puck the closer you get to the opponents blueline. Knowing this, players can make better decisions by choosing to carry the puck if they are close to the opponents blueline, and to pass the puck if they are closer to the defensive blueline.

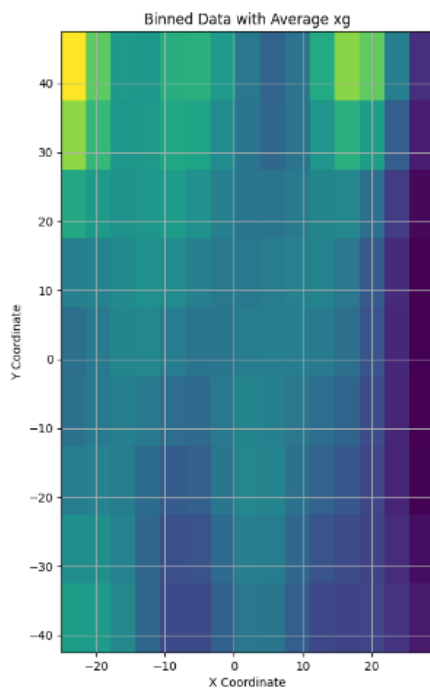


Figure 5: The effect of location on the average xG for passing the puck

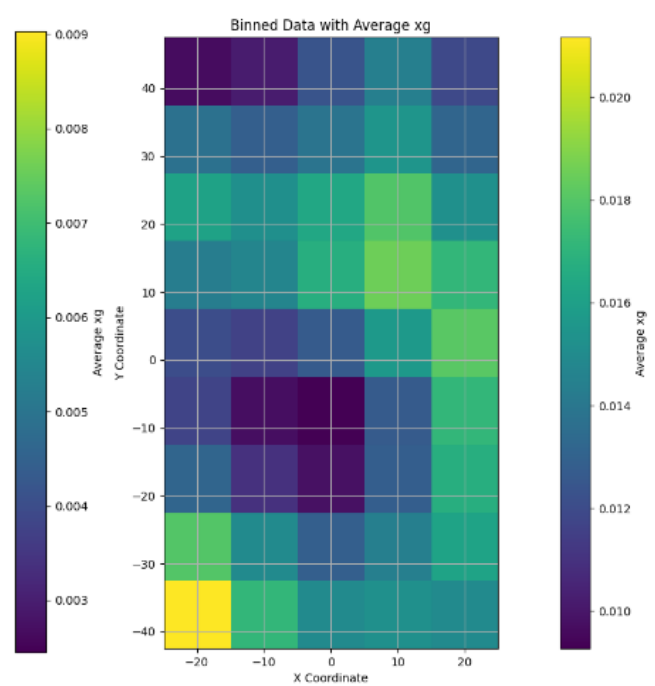


Figure 4: The effect of location on the average xG for carrying the puck

## **5 Summary of Results and Next Steps**

The decision a player makes when starting a possession in the neutral zone significantly impacts the value of that possession. Given the fast-paced nature of hockey, players must quickly assess the situation based on various factors, such as the position of other players on the ice, and the game situation.

This analysis provides valuable insights to help players make informed decisions. For instance, when the puck is near the opponent's blue line, carrying it into the offensive zone is often the most advantageous option. If carrying isn't feasible, players should look to pass.

Moving forward, several avenues for further analysis present themselves. Exploring the direction of the next event, such as where to pass or skate, could enhance players' decision-making abilities, and guide them in the most effective direction. Additionally, investigating how a player's position or handedness influences decision-making could offer valuable insights. For example, forwards may excel at carrying the puck, while defensemen may be better suited to passing it.

By delving deeper into these areas, we can continue to refine our understanding of decision-making dynamics in the neutral zone and provide practical guidance for players and coaches alike.

## **6 Link to Code**

<https://github.com/eparly/Linhac2024>