Pass or Shoot: The Great Dilemma in Ice Hockey 2v1 Situations*

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Abstract. This paper explores the factors and actions that lead to a high Expected Goals (XG) metric in two-versus-one scenarios in ice hockey, specifically examining the choice between passing and shooting. Through an analysis of average outcomes, we develop a preliminary model designed to inform players' decisions in these situations. While the model provides initial insights, its primary value lies in suggesting potential trends rather than prescribing definitive actions. Our findings offer a foundational understanding that may assist coaches and analysts in refining their strategies.

Keywords: 2on1 · 2v1 · xG.

1 Introduction

In this paper, we present an analysis of what actions that produce a high Expected Goals (xG) value in a two-versus-one situation in ice hockey. We specifically examine the impact of passing or shooting on the xG value in said situation. Two-versus-one situations in ice hockey are rare on a game basis, meaning that they happen only a couple of times per game. They are however high scoring opportunities, and scoring in such a situation could be the difference between winning and losing a game in the regular season, playoffs or finals. Determining the best plan of action for these situations is therefore crucial.

Previous work on the topic is limited and we cannot find any paper or report discussing this specific topic. The common belief is that in a two-versus-one situation, the defender should cover the pass, and let the goaltender take care of the awaiting shot from the puck carrier.

2 Background

A two-versus-one situation is defined as a situation where two attacking players are attacking against a single defender and the goaltender. In the provided dataset, this situation is registered by the defending team as an entry with event name "controlledentryagainst" and the type "2on1". In this situation, decisions has to be made quickly as the situation generally is over within five seconds.

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The player in control of the puck when the opportunity is registered has mainly three options. The player can carry the puck and shoot, try and dribble either the defender or goaltender or pass the puck to the teammate. Multiple passes between the attacking players are rare due to the short time window.

3 Algorithms

The work consists of a combination of scripts written in R. We will refer to the two primary scripts as "Script 1" and "Script 2".

3.1 Script 1

Script 1 sorts out all 2on1 events in the dataset and the 6 following events for each 2on1 sequence. These sequences are then divided into 2 categories. Sequences with a pass and sequences without a pass. These are refereed to as the "pass" category and the "shot" category. The sequences in the pass category are all the sequences which contain a pass in the 6 events following the registration of the 2on1 event and no shot prior to the pass. This means that if a pass was attempted, but has a failed outcome, meaning that the pass was not received by the teammate, it will be counted to the pass category. A situation like this will have 0 xG since no shot was taken. A situation with a successful pass and shot will be also be counted to the pass category with an xG determined by the shot. All shots have a listed xG in the dataset.

The pass category also has a subcategory which can be refereed to as the "completed pass" category. This category only consists of sequences which contain a completed pass with a following shot. The point of this category is to display the differences in xG for successful pass sequence compared to the average pass sequence.

Sequences counted to the shot category are sequences that contains a shot and no pass prior to the shot in the sequence. This sequence will also have an xG determined by the shot. If a pass was made after the shot, it will still be counted to the shot category. The important thing is that the shot was not made from a pass.

The choice to base the sequences on 6 events was made since the compiled game time for 6 events averages out to a time we determine appropriate for a 2on1 situation. This appropriate time window is about 5 seconds. We do not want to dismiss events within the 2on1 situation, but we also do not want to take into account events that happen after the 2on1 situation has passed.

The simple mathematical formula

$$\text{Average xG for sequence category} = \frac{\sum(\text{xG for all sequences})}{\text{Total number of sequences}}$$

is used to compare the xG for the different categories.

3.2 Script 2

The idea behind Script 2 was to calculate a weighted xG per pass and shot for each player in a 2v1 situation. This in order to determine which players that would benefit from either passing or shooting in a 2v1 situation. We only considered players that had appeared in a 2v1 situation in the dataset since they are of most relevance. For passing we first calculated each players passing accuracy, defined as all successful passes by the player divided by the players total number of attempted passes. Mathematically described as

$$\text{Passing accuracy} = \frac{\sum(\text{Successful passes})}{\text{Total number of passes}}.$$

This value was then used to define a new xG per pass for each player in 2v1 situations. The new xG was calculated by taking the total number of xG gained for all passes in a 2v1 situation in the entire dataset, divided by the total number of attempted passes in a 2v1 situation, weighted by a players passing accuracy. This weighted total number of attempted passes was calculated by taking the total number of successful passes in a 2v1 situation divided by a players passing success rate, therefore obtaining a weighted total number of attempted passes needed for each player to gain the total number of xG. The weighted attempted passes can be summarized by the formula

$$\text{Weighted attempted passes} = \frac{\sum(\text{Successful passes in 2v1})}{\text{Players passing success rate}}.$$

The new xG for a unique player can then be described by the formula

$$\text{Weighted xG per pass} = \frac{\sum(\text{xG for passing sequences})}{\text{Weighted attempted passes}}.$$

To calculate the weighted xG per shot in a 2v1 we compared each players actual goals versus the players expected goals gained on all shots taken. This generated a value to define a players shooting ability, given by the formula

$$\text{Player performance versus xG} = \frac{\text{Player goals}}{\sum(\text{xG for player shots})}.$$

This value was then multiplied by the average shooting xG given by Script 1 (Section 3.1) to calculate each players weighted shooting xG in a 2v1 situation. Worth noting is also the fact that passing sequences are twice as common as shooting sequences in the dataset.

4 Results

The results found by Script 1 can by summarized by Table 1. This data indicates that the highest average xG is achieved by shooting and not by attempting a pass. We can however also see that when passes are successful, a higher xG is achieved.

A sample of suggested unique player decisions based on the output from Script 2 can be seen in Table 2. The 3 players with the highest xG for shooting can be seen in Table 3. The 3 players with the highest xG for passing can be seen in Table 4. When counting the numbers of suggested shots and passes by Script 2, it can be concluded that 51.16% of players should shoot and 48.84% of players should pass.

Category/xG	**Pass**	**Completed pass**	**Shot**
Average xG	0.069	0.161	0.093

Table 1. xG for each sequence category as described in Section. 3.1

playerID	**xG shot**	**xG pass**	**Decision**
5038	0.155	0.092	shoot
23843	0.156	0.102	shoot
35236	0.056	0.091	pass
38465	0.119	0.102	shoot
79286	0.073	0.090	pass

Table 2. Sample of outputs from Script 2 showing suggested unique player decisions.

playerID	**xG shot**	**xG pass**	**Decision**
693747	0.226	0.097	shoot
580351	0.216	0.090	shoot
475158	0.206	0.089	shoot

Table 3. The top 3 players with the highest weighted shooting xG.

playerID	**xG shot**	**xG pass**	**Decision**
945327	0.047	0.107	pass
458311	0.045	0.102	pass
941262	0.073	0.102	pass

Table 4. The top 3 players with the highest weighted passing xG.

The average passing accuracy in general is 75% and in 2v1s 58%. If adjusting for this discrepancy to better represent the passing accuracy in 2v1s, the decision split becomes approximately 70% for shooting and 30% for passing.

4.1 Discussion

There are some things worth noting regarding how the calculations were made and the amount of data in the dataset that possibly could have effected the outcome of the results. The pass accuracy calculated to weight a players xG per pass in a 2v1 situation is slightly biased towards generating a higher xG per pass since passing accuracy in general does not represent a players ability to successfully pass in a 2v1. The weighted shooting xG calculation is however not

biased since it is calculated compared to xG, which is based on situation. If the dataset was bigger the passing accuracy could be calculated in 2v1 situations leading to a more representative result.

4.2 Summary

The initial results from Script 1 suggest that going straight for the shot results in a higher xG on average in 2v1 situations. In situations where pass attempts were successful, an even higher xG was achieved. This tells us that passing in a 2v1 is high-risk-high-reward. Since passes in 2v1 situations occur twice as often as shots in 2v1s in the dataset, this tells us that players might have an intuition about this increase in xG for successful passes. The numbers does however suggest that they would be better of going for the shot on average.

The results from Script 2 indicate the same thing. This as the script suggest 51.16% of players should shoot and 48.84% of players should pass. This script also provides nuance to the problem as skilled passers possibly could leverage the increase in xG from successfully passing the puck in 2v1s. The results show that this seems to be the case for some players. Worth noting is also the fact that the most skilled shooters seem able to obtain a significantly higher xG for shooting than the most skilled passers can obtain for passing, again indicating that going straight for the shot might be an underrated tactic in 2v1 situations based on how often it is attempted in relation to going for the pass.

The points made together with the existing bias towards passing in our calculations mentioned in Section 4.1 leads us to conclude that shooting generally would be the preferred option for the majority of players.

5 Future ideas and improvements

A larger dataset with more 2v1 situations would strengthen the results as the passing and shooting accuracy then could be based on the situation on which it is being applied. This would make the underlying statistics more representative and the results more trustworthy. Future works could try to find passing patterns that possibly have lower risk while still leveraging the increase in xG that comes from a successful pass. Future works could also try to find patterns in events leading up to a 2v1. Taking into account who the receiving player is could also be an area of interest for future works.

6 Code appendix

The code used for this project can be found in the following GitHub Repository using the link: GitHub Repository