Introduction

Coaches at essentially every level of hockey have (consciously or not) applied the same roster construction tactics for years in relation to the handedness of their wingers. The rosters provided for the 578 AHL games showed 89% of wingers played on their strong side while only 11% played on their off side. Similar trends hold true at the highest level of hockey. Per NHL.com's reporting tool, among the 262 wingers who have played one or more games in 2019-20, 206 (79%) played on their strong side. The research presented in this paper aims to provide quantitative evaluation of whether these standard practices in roster construction provide benefit to a team or whether coaches could help their teams by playing wingers on their weak side.

Evaluation of the impact of handedness was split into two components. The first area of examination was scoring production in transition. Do players entering the zone on their off side provide better scoring opportunities for their team in terms of expected goals, actual goals, shots on net generated, etc.? The second area of comparison based on handedness was defensive zone exits. If a player on their off wing performed significantly worse in breaking the puck out of the defensive zone with or without control, deploying them at that position could be disastrous to their team.

Methodology & Results

All data analysis and plotting was completed in a Jupyter Notebook using Python and pandas data frames. All the provided event and roster CSVs were assigned a game number and then combined into a singular data frame ordered by game time and game number.

The first area of focus was evaluating whether handedness impacts the quality of offensive opportunity based on the area of the ice a player entered the ice with control. For example, is it better to be a right handed shot or a left handed shot when entering the zone on the left side of the ice?

All successful controlled entry events were filtered from the data frame and segregated by areas of the ice using the 'xadjcoord' and 'yadjcoord' coordinates provided. The filtering criteria is shown below in Figure 1.

```
if CE_yadjcoord <= -23:
    CE_location = 'Far Left'
elif CE_yadjcoord > -23 and CE_yadjcoord <=-10:
    CE_location = 'Center Left'
elif CE_yadjcoord > -10 and CE_yadjcoord <10:
    CE_location = 'Center'
elif CE_yadjcoord <23 and CE_yadjcoord >=10:
    CE_location = 'Center Right'
elif CE_yadjcoord >=23:
    CE_location = 'Far Right'
else:
    CE_location = 'Error'
```

Figure 1: Zone Entry Location Criteria

After a player entered the zone with control, subsequent events in the data set were evaluated to see how the play developed. Did the player shoot or pass the puck? Did the receiving player end up with a shot on net? If the player kept the puck and shot, did they hit the net? What was the quality of the shot?

Table 1 below shows the resulting metrics for all successful even strength zone entries excluding breakaway and empty net situations. To reduce the number of possible outcomes, results were simplified based on whether the player kept the puck or attempted to pass the puck upon entering the zone.

	Far Left		Center		Far Right	
Metric	**RH**	**LH**	**RH**	**LH**	**RH**	**LH**
Total Entries	3973	7510	2038	2912	5714	6421
Total Shots	1632 (41%)	3176 (42%)	1045 (51%)	1453 (50%)	2523 (44%)	2612 (41%)
On Net	967 (24%)	1975 (26%)	614 (30%)	838 (29%)	1644 (29%)	1550 (24%)
Goals	85 (2.1%)	125 (1.7%)	38 (1.9%)	53 (1.8%)	84 (1.5%)	133 (2.1%)
Avg Expected Goals	0.0829	0.0597	0.0678	0.0671	0.0608	0.0801
Entered & Kept Puck	1543 (39%)	2946 (39%)	917 (45%)	1230 (42%)	2341 (41%)	2374 (37%)
Keep Shots	883 (22%)	1917 (26%)	586 (29%)	796 (27%)	1556 (27%)	1365 (21%)
On Net	554 (14%)	1234 (16%)	336 (16%)	446 (15%)	1077 (19%)	835 (13%)
Goals	37 (1%)	48 (0.6%)	18 (0.9%)	26 (0.9%)	36 (0.6%)	49 (0.8%)
Avg Expected Goals	0.047	0.027	0.053	0.051	0.032	0.049
Entered & Passed Puck	2430 (61%)	4564 (61%)	1121 (55%)	1682 (58%)	3373 (59%)	4047 (63%)
Pass Shots	749 (19%)	1259 (17%)	459 (23%)	657 (23%)	967 (17%)	1247 (19%)
On Net	413 (10%)	741 (10%)	278 (14%)	392 (14%)	567 (10%)	715 (11%)
Goals	48 (1.1%)	77 (1%)	20 (1.0%)	27 (0.9%)	48 (0.8%)	84 (1.3%)
Avg Expected Goals	0.13	0.11	0.086	0.086	0.12	0.12

Table 1: Zone Entry Metrics Grouped by Location and Handedness

An interesting pattern emerges in both actual goal percentage and average expected goals by handedness for different zone entry locations. While left handed players are slightly more likely (26% versus 24%) than right handed players to make a play resulting in a shot on net from entering on the far left, the resulting shot quality based on expected goals is noticeably lower (0.0597 versus 0.0829). The difference in both shot quality and actual goals is attributable to the plays where the player entering the zone kept the puck and got on a shot on net. For zone entries on the far left, shots by right handed players resulted in a goal 1% of the time versus 0.6% for left handed players. Right handed players had an average expected goals of 0.047 versus 0.027 for left handed players. The same pattern related to handedness holds true for zone entries on the far right side of the ice. The shot quality generated from zone entries by left handed players is higher with an expected goals average of 0.0801 compared to the 0.0608 average from right handed players. Once again, these differences are attributable to the plays where the player entering the zone kept the puck and took a shot on net.

As zone entry moves towards the center of the ice, handedness becomes a non-factor. The shot quality based on expected goals for both right and left handed players is

similar at 0.0678 and 0.0671 respectively. Both expected goal averages where the player entered the zone and kept the puck or entered the zone and passed the puck show similar results by handedness when a player enters the zone through the center of the ice.

Figures 2-9 show heatmaps of shot locations segregated by zone entry location, handedness, and play decision. Both the total shots on net and plays where the zone entry player kept the puck and shot are displayed.

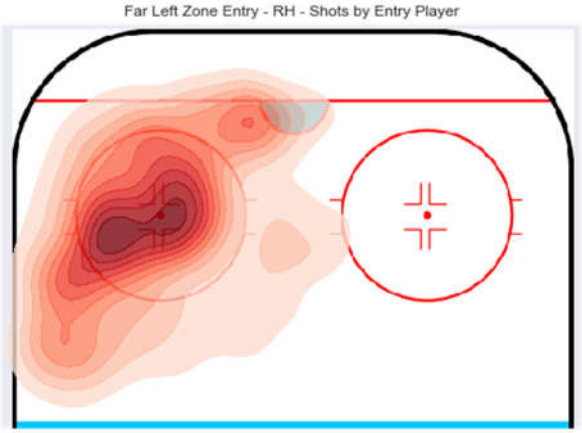

Figure 2: Far Left Entry Shots by RH

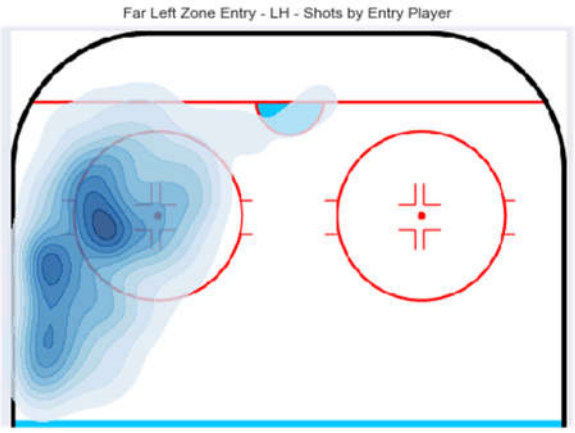

Figure 3: Far Left Entry Shots by LH

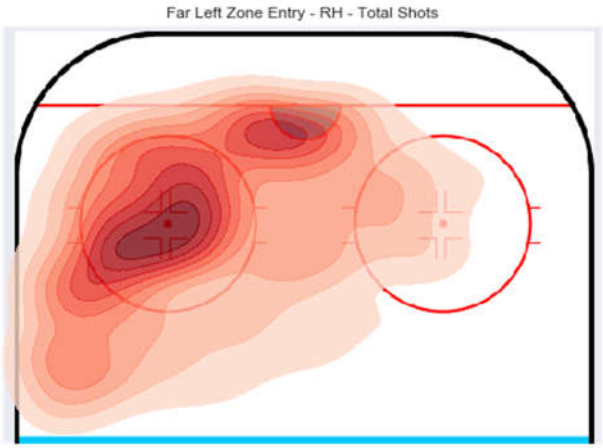

Figure 4: Far Left Entry RH – Shots

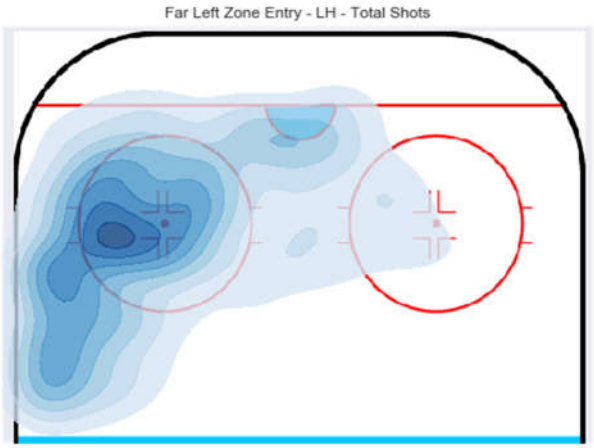

Figure 5: Far Left Entry LH – Shots

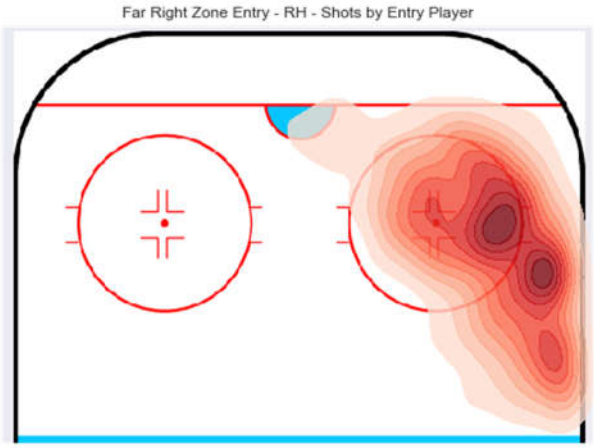

Figure 6: Far Right Entry Shots by RH

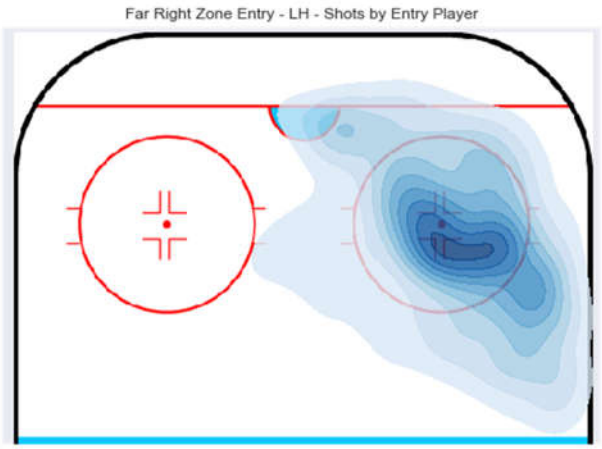

Figure 7: Far Right Entry Shots by LH

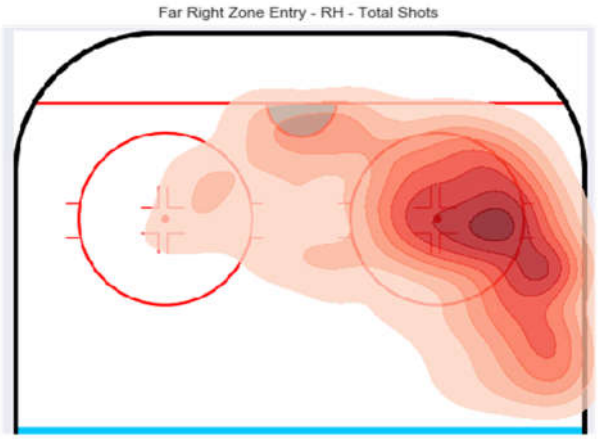

Figure 8: Far Right Entry RH – Shots

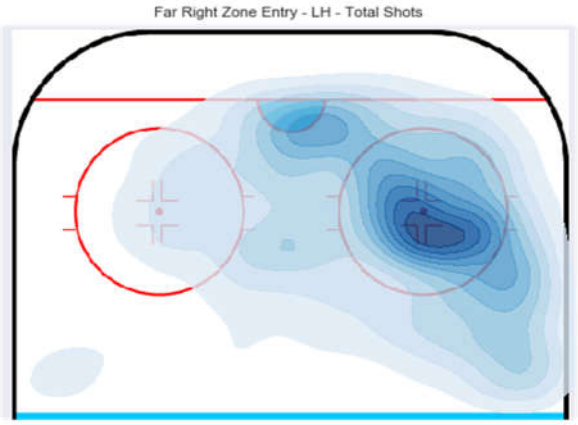

Figure 9: Far Right Entry LH - Shots

The shot plots displayed in Figures 2-9 align intuitively with the expected goal and goal percentage differentials by handedness shown in Table 1. For example, Figures 6 and 7 show shots by players entering on the far right side of the ice for right handed shooters and left handed shooters, respectively. The right handed shooters shown in red tend to shoot more outside shots, while left handed shooters (Figure 7, blue) show a pattern of more centralized shots. This same pattern is seen for strong side versus weak side shooters on both sides of the ice.

Table 2 provides the metrics for the distributions of expected goals by handedness and zone entry locations for all shots on net (both keep shots and pass shots). Figure 10 shows a comparison of the distributions of expected goals by zone entry location and handedness on a logarithmic scale.

	Far Left		Center		Far Right	
Metric	RH	LH	RH	LH	RH	LH
Total Shots on Net	967	1975	614	838	1644	1550
Mean	0.0829	0.0597	0.0678	0.0671	0.0608	0.0801
Median	0.0405	0.0208	0.0394	0.0361	0.0248	0.0445
Standard Dev	0.111	0.087	0.0792	0.0832	0.0843	0.0983
Min	0.0025	0.0022	0.0043	0.0036	0.0021	0.0019
Max	0.761	0.791	0.693	0.811	0.719	0.868
25%	0.0144	0.0097	0.0169	0.0165	0.0109	0.0164
75%	0.106	0.079	0.0975	0.0913	0.0829	0.109
2 sample KS p-value	5.00E-17		0.533		1.20E-15	

Table 2: Expected Goal Distribution by Zone Entry Location, Handedness

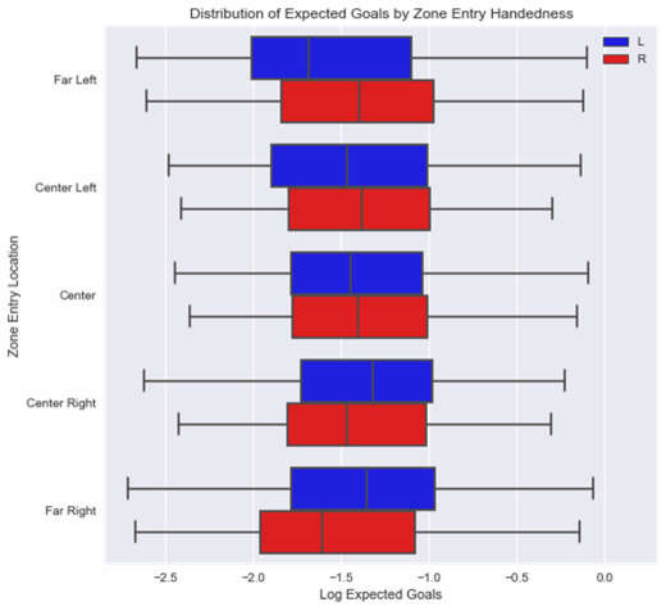

Figure 10: Distributions of Expected Goals by Zone Entry Location, Handedness

Figure 10 shows that on a relative basis, the shots generated when a player enters the zone on their off wing are of higher quality in terms of expected goals compared to entry on their strong side. Table 2 supports this conclusion showing a higher mean, median, 25th percentile, and 75th percentile of expected goals for shots resulting from zone entries by off side players compared to strong side players. Figure 10 shows visually, and Table 2 shows numerically that zone entry through the center of ice results in similar offensive opportunities regardless of handedness. A two sample Kolmogorov-Smirnov test was used to compare the distributions of expected goals by handedness for the three different zone entry locations in Table 2. The extremely small p-values for the far left and far right zone entry locations indicates that the expected goal distribution for left handed versus right handed players are different. The relatively large p-value for central zone entry indicates that the expected goal distribution is very similar for both right and left handed players.

Although off side zone entry indicates increased offensive opportunity, defensive liability must be measured as well. Zone exit, both total and controlled was used as the metric to measure defensive liability. Table 3 below shows zone exit metrics based on sides of the ice for both left and right handed wingers. The sides of the defensive zone were cut at xadj <=-23 and abs(yadj)>=10. Metrics were calculated on whether a player successfully possessed the puck within this area of the ice (lprs, receptions) and their subsequent actions with the puck. Both left handed and right handed players show similar frequencies on both sides of the ice in terms of in zone pass plays, controlled exits (pass out of the zone, carry out of the zone), dump-outs, and failed exits. This research indicates that handedness is not a factor in defensive zone transition play, and a player playing the off wing would not be considered a defensive liability on its own accord.

	Left D-Zone		Right D-Zone	
Metric	**RH**	**LH**	**RH**	**LH**
Possible Poss.	7777	21043	16875	13105
Successful Poss.	6679 (86%)	18081 (86%)	14595 (86%)	11183 (85%)
Zone Exits	2871 (37%)	7351 (35%)	6068 (36%)	4592 (35%)
In Zone Passes	1930 (25%)	4872 (23%)	3920 (23%)	3187 (24%)
Controlled Exits	2158 (28%)	5065 (24%)	4294 (25%)	3412 (26%)
Carry	1585 (20%)	3480 (17%)	2915 (17%)	2435 (19%)
Outlet Pass	573 (7.4%)	1585 (7.5%)	1379 (8.2%)	977 (7.5%)
Dumpout Exits	713 (9.2%)	2286 (11%)	1774 (11%)	1180 (9%)
Failed Exits	1878 (24%)	5858 (28%)	4607 (27%)	3404 (26%)
Passes	1049 (13%)	3294 (16%)	2626 (16%)	1993 (15%)
Dumpouts	564 (7.3%)	1457 (6.9%)	834 (4.9%)	467 (3.6%)
Carry/Other	265 (3.4%)	1107 (5.3%)	1147 (6.8%)	944 (7.2%)

Table 3: Zone Exit Metrics by Defensive Zone Side, Handedness

Conclusion

In brief conclusion, coaches and team management should experiment with playing winger on their weak side of the ice more often. This research indicates that off side play results in more favorable offensive outcomes in terms of expected goals and actual goal percentage while not hindering defensive transition play on the basis of zone exits, both controlled and uncontrolled. Additional heuristics for studying handedness in terms of both offensive production and defensive liability could and should be looked at in the future. These include but are not limited to: power play situations, in zone offensive play, and defensive turnover outcomes by zone side and handedness.