Using Shot Location Data for Team and Player Strategy

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Introduction

• NHL has been collecting shot location data since 2007-2008
  • Since 2010-2011, the NHL has also been including on-ice data in these files
• Most of the analysis done to date has focused on likelihood of scoring from a particular location (for example, Hextally)
• Going to look at 2 questions today:
  1. How do shooter position and handedness factor into shooting percentage?
  2. What other information can we infer from shot location data, and how can we apply it?
• Focus on 5v5 play and data from 2010-2014 (with on-ice data)
Players Shoot Better on their Off-Hand

- In aggregate both forwards and defensemen shoot better from their off-hand
  - F: 9.9% Off-Hand vs. 8.6% On
  - D: 4.8% Off-Hand vs. 4.1% On
- Outside of the Scoring Chance area forwards tend to score on a higher percentage of shots from their off hand
- In general, forwards tend to be better shooters than defensemen, regardless of shot location
So does this mean everyone should play on their off-hand?

• Not necessarily: calculating shooting percentage isn’t enough to tell the whole story
• Increase in shooting percentage may be offset by:
  • A decrease in total shots for, or
  • An increase in total shots against
• Need to know how on-hand and off-hand players are doing possession-wise
• To do that we need a way to find out when plays are on their on-hand vs. off-hand
Calculating Player Side Bias

- Wingers and defensemen tend to shoot primarily from the side they’re positioned on

- **Side Bias:**
  \[
  \frac{\text{# of Shots From Left Side}}{\text{Total # of Shots}} - 50% 
  \]

- Positive numbers = Left Side
- Negative numbers = Right Side

- Guess which season Alexander Ovechkin switched from LW to RW

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**Alexander Ovechkin - Left Side Bias**

<table>
<thead>
<tr>
<th>Season</th>
<th>Shot Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-2011</td>
<td>15%</td>
</tr>
<tr>
<td>2011-2012</td>
<td>10%</td>
</tr>
<tr>
<td>2012-2013</td>
<td>-5%</td>
</tr>
<tr>
<td>2013-2014</td>
<td>0%</td>
</tr>
</tbody>
</table>

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Figuring out who’s playing on what side

• If a defensive pairing has played together significantly (more than 10 shots each together) use their shot data together to define sides
  • If Player A takes more shots from the left side of the ice, Player A is likely the left defenseman

• If a defensive pairing has not played together significantly use each players Side Bias
  • The player with the higher Side Bias is likely the left defenseman
Shots Against for Defensive Pairings

- Same handed pairs tend to post lower Shots For % than Opposite Handed Pairs
  - However, shots aren’t more likely to come from the left vs. right
  - Some of the difference could be explained by a difference in Shot Generation by same-handed pairs

<table>
<thead>
<tr>
<th>Metric</th>
<th>L/R</th>
<th>L/L or R/R</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Shots Against</td>
<td>125,229</td>
<td>71,000</td>
</tr>
<tr>
<td>Shots Against – Left Side %</td>
<td>48.2%</td>
<td>48.1%</td>
</tr>
<tr>
<td>Shots Against – Right Side %</td>
<td>49.6%</td>
<td>49.7%</td>
</tr>
<tr>
<td>Shots For %</td>
<td>50.1%</td>
<td>49.0%</td>
</tr>
</tbody>
</table>
Side Bias & Evaluating Defensive Ability

• We can also use our Side Bias numbers to evaluate an individual’s defensive ability
• First we can calculate the % of shots from a defenseman’s side

\[
\text{% Shots Against From Side} = \frac{\text{# of Shots from Right Side of Ice}}{\text{(# of Shots from Left + Right Side of Ice)}}
\]

• Second, we can calculate an alternate Shots For % using only shots from his defensive side

\[
\text{Alt. Shots For } \% = \frac{\text{Shots For}}{2.04 \times \text{Shots Against from Def. Side} + \text{Shots For}}
\]
Pittsburgh Penguins 2013/14 Stats

• % Shots Against From Side will tell you whether a defenseman was better or worse than their partner defensively

• Alt. Shots For % provides a fuller picture as it includes offensive ability

• Alt. Shots For % can highlight players whose individual defensive ability is potentially undervalued (Martin) or overvalued (Orpik)

<table>
<thead>
<tr>
<th>Player</th>
<th>% Shots Against From Side</th>
<th>Alt. Shots For %</th>
<th>Shots For %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paul Martin</td>
<td>46.8%</td>
<td>54.9%</td>
<td>52.6%</td>
</tr>
<tr>
<td>Matt Niskanen</td>
<td>49.9%</td>
<td>54.3%</td>
<td>54.6%</td>
</tr>
<tr>
<td>Simon Despres</td>
<td>47.5%</td>
<td>51.7%</td>
<td>50.4%</td>
</tr>
<tr>
<td>Kris Letang</td>
<td>49.8%</td>
<td>51.3%</td>
<td>51.4%</td>
</tr>
<tr>
<td>Olli Maatta</td>
<td>51.3%</td>
<td>51.1%</td>
<td>51.9%</td>
</tr>
<tr>
<td>Robert Bortuzzo</td>
<td><strong>43.3%</strong></td>
<td><strong>49.9%</strong></td>
<td><strong>46.8%</strong></td>
</tr>
<tr>
<td>Rob Scuderi</td>
<td>46.8%</td>
<td>47.2%</td>
<td>45.7%</td>
</tr>
<tr>
<td>Deryk Engelland</td>
<td>51.0%</td>
<td>45.0%</td>
<td>45.4%</td>
</tr>
<tr>
<td>Brooks Orpik</td>
<td><strong>56.8%</strong></td>
<td><strong>44.0%</strong></td>
<td><strong>46.9%</strong></td>
</tr>
</tbody>
</table>
Conclusion

• Players tend to shoot better on their off-hand

• We can determine which players are playing on which side of the ice using shot location data

• Same-handed defensive pairs post a lower Shots For % than opposite-handed pairs
  • Some of this loss may be offset by their higher shooting percentages

• Shot location data can be used to look at individual play in the defensive zone as well
  • One extension is to further divide the defensive zone up and add defensive responsibility for forwards

• More shot location data (for misses, blocks) will of course make our analyses more accurate and allow us to better refine our defensive metrics