Ice Position (Again)

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The Idea

Can players affect their team results by gaining or losing territory?
The Idea

Can players affect their team results by gaining or losing territory?

► Not really.
The Idea

Can players affect their team results by gaining or losing territory?
How much do players affect their team results by gaining or losing territory?
How much do players affect their team results by gaining or losing territory?

▶ A fair bit!
How much do players affect their team results by gaining or losing territory?

▶ A fair bit!

▶ (I think it might be more)
The Approach

- Focus on transitions across blue lines.
The Approach

- Focus on **transitions** across blue lines.
  - Exits and exit defence
The Approach

- Focus on transitions across blue lines.
  - Exits and exit defence
    - INTO the neutral zone
The Approach

- Focus on transitions across blue lines.
  - Exits and exit defence
    - INTO the neutral zone
  - Entries and entry defence
The Approach

- Focus on transitions across blue lines.
  - Exits and exit defence
    - INTO the neutral zone
  - Entries and entry defence
    - OUT OF the neutral zone
Model Meat

Logistic Regression with terms:
- Five skaters trying to make the transition happen.
- Five skaters trying to prevent it
Model Meat

Logistic Regression with terms:

▶ Five skaters trying to make the transition happen.
▶ Five skaters trying to prevent it
▶ The score
Logistic Regression with terms:
- Five skaters trying to make the transition happen.
- Five skaters trying to prevent it
- The score
- The time in the game
Logistic Regression with terms:

- Five skaters trying to make the transition happen.
- Five skaters trying to prevent it
- The score
- The time in the game
- Some interactions between score and time
Model Meat

Logistic Regression with terms:

- Five skaters trying to make the transition happen.
- Five skaters trying to prevent it
- The score
- The time in the game
- Some interactions between score and time
- Team, as a cheap proxy for coaching systems
Exit Model: an observation every second the puck could enter the neutral zone.
- Target variable 1 if it does, 0 if it does not.
- In 19-21:
  - 92k transitions
  - 3.7m attempts
  - \( \approx 2.5\% \) success.

Entry model: an observation every second the puck could leave the neutral zone.
- Target variable 1 if it does, 0 if it does not.
- In 19-21:
  - 101k transitions
  - 1.7m attempts
  - \( \approx 6.1\% \) success.
Exit Model: an observation every second the puck could enter the neutral zone.
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    - 101k transitions
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(Not as many exits as entries because of goals and period ends)
Average Time To Transition

Fit a logistic regression model with ridge penalties for all non-constant terms, some extra penalties to pool the score effects properly, technical chicanery of various other kinds which need not detain us here.
Average Time To Transition

- Exits: 27s
- Entries: 11s
Structure (Exits)
Structure (Entries)
### Players: Best at Exits (19-21)

<table>
<thead>
<tr>
<th>Player</th>
<th>Position</th>
<th>Impact on Time Until Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathew Barzal</td>
<td>F</td>
<td>-13.6%</td>
</tr>
<tr>
<td>Matthew Tkachuk</td>
<td>F</td>
<td>-12.9%</td>
</tr>
<tr>
<td>Nikolaj Ehlers</td>
<td>F</td>
<td>-11.9%</td>
</tr>
<tr>
<td>Adam Fox</td>
<td>D</td>
<td>-11.8%</td>
</tr>
<tr>
<td>Jaden Schwartz</td>
<td>F</td>
<td>-11.6%</td>
</tr>
</tbody>
</table>
Players: Best at Entries (19-21)

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<th>Impact on Time Until Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathew Barzal</td>
<td>F</td>
<td>-19.7%</td>
</tr>
<tr>
<td>Dmytro Timashov</td>
<td>F</td>
<td>-18.7%</td>
</tr>
<tr>
<td>Carl Grundström</td>
<td>F</td>
<td>-18.5%</td>
</tr>
<tr>
<td>Travis Konecny</td>
<td>F</td>
<td>-18.0%</td>
</tr>
<tr>
<td>Brandon Davidson</td>
<td>D</td>
<td>-17.2%</td>
</tr>
</tbody>
</table>
## Players: Best at Preventing Exits (19-21)

<table>
<thead>
<tr>
<th>Player</th>
<th>Position</th>
<th>Impact on Time Until Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martin Frk</td>
<td>F</td>
<td>+14.3%</td>
</tr>
<tr>
<td>Nathan Bastian</td>
<td>F</td>
<td>+13.8%</td>
</tr>
<tr>
<td>Christian Wolanin</td>
<td>D</td>
<td>+12.9%</td>
</tr>
<tr>
<td>Phillip Danault</td>
<td>F</td>
<td>+11.6%</td>
</tr>
<tr>
<td>Mikko Rantanen</td>
<td>F</td>
<td>+11.1%</td>
</tr>
</tbody>
</table>
Players: Best at Preventing Entries (19-21)

<table>
<thead>
<tr>
<th>Player</th>
<th>Position</th>
<th>Impact on Time Until Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alex Steen</td>
<td>F</td>
<td>+24.0%</td>
</tr>
<tr>
<td>Casey Cizikas</td>
<td>F</td>
<td>+21.7%</td>
</tr>
<tr>
<td>Kailer Yamamoto</td>
<td>F</td>
<td>+21.6%</td>
</tr>
<tr>
<td>Jesse Puljujärvi</td>
<td>F</td>
<td>+20.7%</td>
</tr>
<tr>
<td>Kiefer Sherwood</td>
<td>F</td>
<td>+18.7%</td>
</tr>
<tr>
<td>Jared Spurgeon</td>
<td>D</td>
<td>+18.0%</td>
</tr>
</tbody>
</table>
Correlations for Players

Exit Offence → Entry Offence: $r = 0.40$

Exit Defence → Entry Defence: $r = 0.37$

Exit Offence → Entry Defence: $r = 0.54$
Convert to Off-ice Impact

Want to measure impact on shifts after a given player's shift.

$$T = \begin{bmatrix} D \to D & D \to N & D \to O \\ N \to D & N \to N & N \to O \\ O \to D & O \to N & O \to O \end{bmatrix}$$
Convert to Off-ice Impact

Want to measure impact on shifts after a given player’s shift.

\[
T = \begin{bmatrix}
D \text{ to } D & D \text{ to } N & 0 \\
N \text{ to } D & N \text{ to } N & N \text{ to } O \\
0 & O \text{ to } N & O \text{ to } O
\end{bmatrix}
\]
Convert to Off-ice Impact

Want to measure impact on shifts after a given player’s shift.

\[
T = \begin{bmatrix}
D \text{ to } D & D \text{ to } N & 0 \\
N \text{ to } D & N \text{ to } N & N \text{ to } O \\
0 & O \text{ to } N & O \text{ to } O
\end{bmatrix}
\]
Convert to Off-ice Impact

Want to measure impact on shifts after a given player’s shift.

$$T = \begin{bmatrix}
D \text{ to } D & 2.5\% & 0 \\
6.1\% & N \text{ to } N & 6.1\% \\
0 & 2.5\% & O \text{ to } O
\end{bmatrix}$$
Convert to Off-ice Impact

Want to measure impact on shifts after a given player’s shift.

\[ T_{\text{McDavid}} = \begin{bmatrix} D \text{ to D} & 2.7\% & 0 \\ 6.9\% & N \text{ to N} & 6.9\% \\ 0 & 2.4\% & O \text{ to O} \end{bmatrix} \]
Convert to Off-ice Impact

Want to measure impact on shifts after a given player’s shift.

\[ T_{\text{McDavid}} = \begin{bmatrix} 97.7\% & 2.7\% & 0 \\ 6.9\% & 86.2\% & 6.9\% \\ 0 & 2.4\% & 97.6\% \end{bmatrix} \]
Off-ice impact

- Apply this transition matrix many times to a league-average zone-start distribution
- Subtract off league average
- Multiply by known on-ice impact of starting shifts in those zones (from my other model)
- Off-ice impact in xG/60!
Off-ice Distribution

Off-ice Impact Distribution 2019-2021

Off-ice Impact (% of league average xG/60) vs Frequency
Off-ice Distribution

Off-ice Impact Distribution 2019-2021

Off-ice Impact (% of league average xG/60)

Frequency

Provorov

McDavid
Off-ice Impact

Skater impact on the following shift is about 10% of the impact on the current shift.
Future Work

- Synchronize diffuse impact (here) with direct-impact microstats (Sznajder).
Thanks!
Team Entries

Zone Entries, $r = 0.709$
Team Exits

Zone Exits, $r = 0.397$