What Does It Mean To Draft Perfectly?

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Looking Backward

We define what it means for an NHL team to be successful in drafting, and use this framework to determine if any teams exhibited a sustained edge in drafting from 2000 to 2009. At a high level, we compare actual draft outcomes to teams' **perfect draft** outcomes. The perfect draft can be thought of as what would happen if a GM could redo a draft with complete knowledge of prospects' career values as well as other teams' choices, while all other teams act just as they did previously.

Draft Case Study: Johnny Gaudreau

*"Calgary beat us to the punch. There were people banging their hands on the table, like, 'Oh, we should have taken him a round earlier.' It's a **calculated risk**. The Flames got Gaudreau in a **really good spot**."*

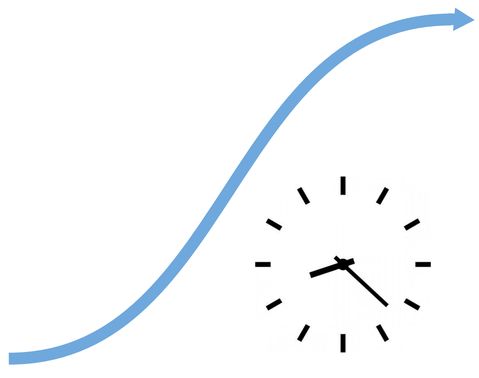
~ John Weisbrod, former Bruins scout

Gaudreau was drafted with the 2011 104th overall pick. Calgary was very excited about his potential, but they never approached him before draft day and only used their 4th round pick on him. Why?

Let's Talk About Game Theory

In a competitive environment like drafting, teams care about other teams' choices. **If you think he'll be around at your next pick, just wait.** Calgary waited as long as they could before drafting Johnny Gaudreau, which maximized their 4th round pick's return on investment and helped them extract value from all rounds. We can model drafting in a way that reflects this consideration: teams aren't always trying to select the best player available.

Now, to evaluate drafting, we can travel back in time...



Optimizing the Philadelphia Flyers' '07 Draft Selections

PS: Career Point Shares from hockey-reference.com (through 2015-16)

Best Player Available

Pick	Player	PS
2	Jamie Benn	55.8
41	P.K. Subban	52.8
66	Alec Martinez	27.7
122	Jake Muzzin	24.6
152	Carl Gunnarsson	23.9
161	Carl Hagelin	21.1
182	Justin Braun	21.1

***Backwards* Best Player Available**

Pick	Player	PS
182	Justin Braun	21.1
161	Carl Gunnarsson	23.9
152	Carl Hagelin	21.1
122	Jamie Benn	55.8
66	Alec Martinez	27.7
41	P.K. Subban	52.8
2	Max Pacioretty	46.2

It turns out that the notion of best player available is still relevant: we just have to **work backwards**. If we travel back in time with full knowledge of prospects' career values, we can apply the classic game theoretic algorithm of backwards induction to figure out our best case scenario for that year. Selecting the best player available from our last pick to our first pick ensures that we draft the best players while always picking them right before any other team does. For the Flyers in 2007, this means drafting Jamie Benn at 122nd overall rather than 2nd, because it's right before Dallas got him at 129th. This allows them to draft Max Pacioretty with the 2nd overall pick, as he would not have been available later on in the draft. Of course, we aren't accounting for the butterfly effects of this scenario, but it gives us an idea of the maximum value available at *every* pick.

Did Your Team Draft Badly in the 2000s?

For the Flyers in 2007:

Perfect Draft Value = Total Career Value of Optimal Picks = 248.6 Point Shares

Actual Value Drafted = Total Career Value of Actual Picks = 41.1 Point Shares

$$\text{Draft Efficiency} = \frac{\text{Actual Value Drafted}}{\text{Perfect Draft Value}} = 16.5\%$$

This means that the Flyers extracted roughly 16.5% of the value that was available to them in the 2007 draft. We can evaluate any team's actual performance versus their best case scenario in a given year using draft efficiency. It's an easy way to compare team draft outcomes more fairly than by simply summing up drafted player values. With draft efficiency percentages, teams with better picks have higher benchmarks for success in terms of their perfect draft values.

Draft efficiency penalizes the Blackhawks and helps the Red Wings the most.

From 2000 to 2009, no team is significantly better or worse than average when it comes to drafting.

NHL Team Draft Efficiency Rank by Year

Team	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Avg.
Buffalo Sabres	21	2	6	3	7	22	12	24	10	10	11.7
Nashville Predators	11	12	20	5	6	9	26	22	5	6	12.2
Los Angeles Kings	3	9	23	19	27	4	13	3	6	16	12.3
Atlanta Thrashers	7	8	5	10	30	12	10	21	15	12	13
Washington Capitals	22	18	13	24	2	26	2	18	2	5	13.2
Chicago Blackhawks	26	10	3	1	14	23	6	5	27	18	13.3
Toronto Maple Leafs	12	16	4	26	28	3	3	12	12	17	13.3
Pittsburgh Penguins	16	24	14	6	4	1	5	13	29	22	13.4
Ottawa Senators	6	1	29	16	18	24	7	27	3	4	13.5
Columbus Blue Jackets	17	21	7	18	26	13	4	6	13	11	13.6
New York Rangers	1	7	22	28	8	15	19	16	4	19	13.9
Detroit Red Wings	10	26	1	8	11	14	21	17	17	15	14
Philadelphia Flyers	4	6	11	7	29	19	11	9	23	27	14.6
Colorado Avalanche	14	17	8	23	21	11	17	7	28	1	14.7
Anaheim Ducks	5	15	15	2	25	10	24	25	20	8	14.9
San Jose Sharks	28	3	27	4	20	5	20	2	11	30	15
Dallas Stars	13	4	18	20	23	7	25	4	25	13	15.2
Minnesota Wild	2	13	12	13	22	21	22	26	19	2	15.2
St. Louis Blues	24	22	26	14	12	8	8	8	9	25	15.6
Montreal Canadiens	18	11	21	11	5	2	28	1	30	29	15.6
New York Islanders	9	30	9	27	16	28	9	29	8	3	16.8
Carolina Hurricanes	20	28	2	15	9	17	16	11	26	24	16.8
Edmonton Oilers	19	14	16	25	15	20	18	10	7	26	17
Phoenix Coyotes	25	25	25	30	10	6	23	14	16	9	18.3
Boston Bruins	23	19	24	12	3	25	1	28	22	28	18.5
Vancouver Canucks	29	5	28	21	1	16	15	30	24	21	19
New Jersey Devils	8	29	30	9	13	18	29	20	21	20	19.7
Florida Panthers	30	20	10	22	17	30	14	23	18	14	19.8
Calgary Flames	15	23	19	17	24	27	27	15	14	23	20.4
Tampa Bay Lightning	27	27	17	29	19	29	30	19	1	7	20.5

Set yourself up to succeed! Perfect draft value increases as you accumulate more and better picks, and it's correlated positively and linearly with actual value drafted (r = 0.45). No teams can consistently outperform the league in terms of drafting efficiently, so the best way to draft well is to draft early and often: **trust the process**.

Why Should You Care Now?

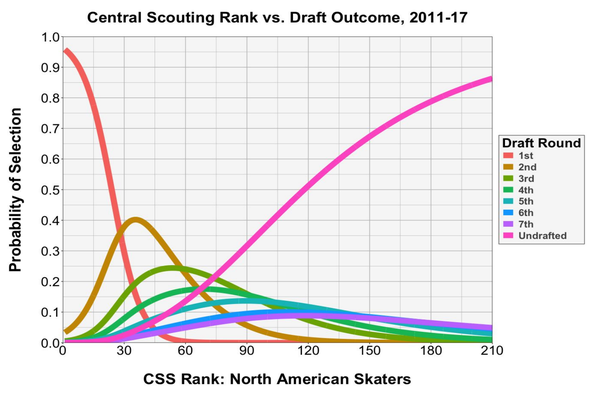
Looking Forward

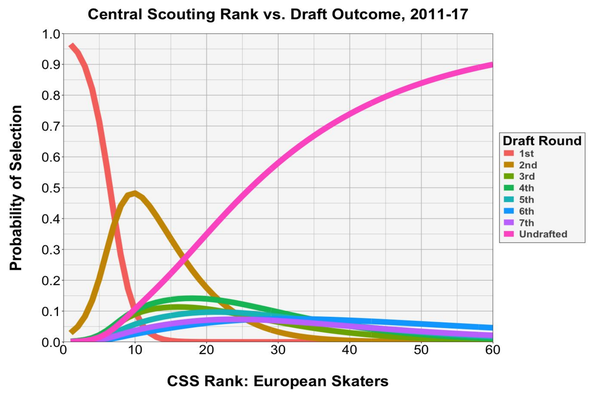
What do these ideas mean for an NHL scouting department trying to figure out next year's picks? The optimal solution for maximizing the total value of a team's draft picks relies not only on expected future NHL value, but also on when prospects are projected to be drafted by any other team. With enough predictive precision, we can simulate draft outcomes and prescribe a set of picks that results in more value added than simply always selecting the best player left on the draft board.

It turns out that precisely predicting the future is quite difficult.

For one thing, the question of assigning draft position probabilities to all relevant prospects is tricky, as we don't know ahead of time who will be drafted. Fortunately, we can rely on the NHL Central Scouting Service's pre-draft rankings to define our prospect pool; roughly 83% of players selected in recent NHL entry drafts were ranked by the CSS beforehand. These rankings are divided by position (skater or goalie) as well as by junior team location (North America or Europe). Using 2011-17 CSS data, we can get a sense of how the probability of being selected in each round varies by pre-draft rank. See below for the results of logistic regressions predicting draft round from skater ranks.

Moving forward, we can add in more prospect ranking systems as well as other relevant variables (size, age, junior point production, etc.) in order to define probability estimates at the pick level rather than the round level. Then, we feed those probabilities into our draft optimizer along with our NHL value projections.





We need to define a few extra inputs:

Here, we have **sample** input values*** for a 5-pick draft (presumably occurring in 2015). The NHL value function is truly up to you: it can be statistically modeled or even calculated based on scouts' projections. In this sample scenario, your estimations of some prospects differ from market estimations. Suppose you have the 3rd and 5th picks in this draft: how can you leverage your superior knowledge?

Every Available Prospect → **Draft Position Probability Distribution** → **E[NHL Value]** → **Preference Order**

Player	Pick 1	Pick 2	Pick 3	Pick 4	Pick 5	Value	Preference
Connor McDavid	0.9	0.05	0.03	0.01	0.01	5	1
Jack Eichel	0.05	0.6	0.3	0.03	0.02	4	2
Pavel Zacha	0.03	0.2	0.4	0.3	0.07	1	5
Kyle Connor	0.01	0.1	0.2	0.6	0.09	2	4 (?)
Travis Konecny	0.01	0.05	0.07	0.06	0.81	3	3 (?)

We initially order our preferences by best player available. Other teams' picks are simulated based on the above probabilities, while we always select our most preferred player. We see that we often select Konecny because our team likes him more than the market does.

```
Number of trials: 10000

Proportion of times each player
was selected by my team:

Player
Connor McDavid  0.0943
Jack Eichel     0.3372
Kyle Connor     0.2263
Pavel Zacha     0.4500
Travis Konecny  0.8922

Average value obtained by my team:
5.3995
95% confidence interval:
[ 5.3715  5.4275]
```

We can try moving him down to 4th on the preference list, despite our **(hypothetical)** belief that he will be a better NHL player than Kyle Connor. This results in a higher expected value of all draft picks because we can *usually* wait to select Konecny without missing out.

```
Number of trials: 10000

Proportion of times each player
was selected by my team:

Player
Connor McDavid  0.0903
Jack Eichel     0.3473
Kyle Connor     0.6136
Pavel Zacha     0.1533
Travis Konecny  0.7955

Average value obtained by my team:
5.6077
95% confidence interval:
[ 5.5812  5.6342]
```

***These are fictional values. Please don't tweet angrily at me if you love Pavel Zacha or something.