

## IMPROVING A HOCKEY TEAM

*Josh Weinstein wrote this case under the supervision of Professor Hubert Pun solely to provide material for class discussion. The authors do not intend to illustrate either effective or ineffective handling of a managerial situation. The authors may have disguised certain names and other identifying information to protect confidentiality.*

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On November 4, 2017, Steve Scala watched as his favourite hockey team lost 6–4 to an opponent. After a great start to the season with a record of 6 wins and 1 loss, his team had now lost 6 of the last 8 games, dropping their record to 8 wins and 7 losses. Scala knew that the time was approaching for the inevitable discussions with his friends regarding the team's success. Which players should they have signed? Which player should the team trade for? What line combinations would serve the team best? Knowing that conversations among his friends typically took a random and unstructured format, Scala planned to provide a more analytical approach to the discussion this year. His research would raise the level of the conversation and help back up his suggestions.

### HOCKEY LEAGUE CONTRACTS AND SALARY CAP

The team's annual salary cap was the maximum total salary amount that the team could pay out each year. As a result, teams needed to be strategic when offering contracts. They had to try to maximize total player value for the team, while staying within their imposed salary cap.

There were three contract types specified for the players. The first type was an entry-level contract for players younger than age 25, who were signing their first contract. These types of contracts specified a maximum salary of US\$925,000<sup>1</sup> per year. The second type was a 35+ contract for older players. This type of contract was designed to prevent a team from artificially lowering the team's salary cap burden by taking advantage of the likelihood that an older player would retire soon, thereby creating a smaller "cap hit." A cap hit was the player's salary amount, which was charged against the team's salary cap.<sup>2</sup> The third type of contract was a standard contract.

<sup>1</sup> All currency amounts are in US\$ unless otherwise specified.

<sup>2</sup> The annual "cap hit" to a team was a player's average salary over the life of a contract. For example, a three-year contract paying \$2 million in year 1, and \$3.5 million in years 2 and 3 would result in an average cap hit of \$3 million per year. Prior to the enactment of 35+ contracts, teams could offer older players a long-term contract with a substantially higher salary in first few years, and a much lower salary in later years (by which point the player would likely be retired). The overall cap hit would thus be kept low because of the effect of the later years of the contract. However, the advent of 35+ contracts caused the cap hit to apply over the entire life of the contract, regardless of whether the player had retired or not, thus removing the incentive to "front load" veteran contracts.

### COMBINING PLAYER RANKINGS

A hockey team typically had several groups of three forward players (called lines), that played together and substituted other lines during a game. When players played together on the same line, it was unclear how their respective skills would affect the overall performance of the line. The players' skills were not always calculated as a linear average of the individual players' rankings for that skill. In some cases, a line's ranking for a skill depended only on one key player.

For example, to restart the game after a stop in play, only one player was needed for the faceoff. Therefore, the entire line's ranking for that particular skill could be represented by the maximum of the line member's faceoff abilities. Also, the proficiency of some skills could depend on the quality of other skills. For example, because shots typically occurred after passes, the passing skill of a line could affect the line's shooting skill, so that the line's shooting skill could only be as high as its passing skill.

An individual player's skill level could affect interactions for the entire line, especially if one player was significantly better or worse than the other line members. For example, a player with very slow skating speed could have a significantly negative effect on the line's overall success if the player constantly struggled to keep up with, and assist, his linemates. Conversely, a player with a strong physical playing style could amplify the entire line's physical skill by creating opportunities for the team to be aggressive in key positions, such as screening the goaltender in front of the net.

The above discussion of one player's skill's effect on the complete line could be represented numerically. For lines of three players, amplifying the effect of one player's skill that was lower than the rest of the line could be modelled using the following formula:

$$\text{Line Value} = 100 - \sqrt{\sum_{i=1}^3 \frac{(100 - \text{value}_i)^2}{3}}$$

Amplifying the effect of one player's skill level that was higher than the rest of the line could be modelled by the following formula:

$$\text{Line Value} = \sqrt{\sum_{i=1}^3 \frac{(100 - \text{value}_i)^2}{3}}$$

### MAKING A DECISION

Scala gathered a collection of player statistics from the 2016–17 season (see Exhibit 1). He wondered whether this data could help determine the factors that drove players' salaries. If so, he would be able to identify undervalued players who would potentially be good targets for his team.

In addition, Scala was curious about which line combinations made the most sense for his team to use going forward. He wanted to determine what team members should comprise the top three forward lines. He compiled player rankings using information for twelve of the forwards (see Exhibit 2). Scala was aware that the rankings provided by the video game were not perfect, but he was curious about what insights could be drawn, and how certain rankings could interact with each other.

When different players were put together on the same line, would their rankings add up as a linear average? Was a more in-depth analysis required to determine how each player's specific skills interacted with those of other players? Which type of interaction should apply to each skill?

## EXHIBIT 1: PLAYER STATISTICS FOR 2016–17

Player	Position	Contract Type	Contract Expiry	Cap Hit	GP	G	A	P	TOI
Player 1	C	Standard	UFA	\$10,500,000	72	21	37	58	20.15
Player 2	RW, C	Standard	UFA	\$10,500,000	82	34	55	89	21.38
Player 3	C	Standard	UFA	\$10,000,000	76	12	40	52	20.75
Player 4	LW, RW	Standard	UFA	\$9,538,462	82	33	36	69	18.35
Player 5	C, RW	Standard	UFA	\$9,500,000	62	33	39	72	18.62
Player 6	D	Standard	UFA	\$9,000,000	66	10	30	40	24.40
Player 7	C	Standard	UFA	\$8,700,000	75	44	45	89	19.87
...									
Player 715	D	Standard	UFA	\$575,000	73	1	7	8	11.92
Player 716	D	Standard	UFA	\$575,000	74	3	11	14	16.27
Player 717	LW	Standard	RFA	\$575,000	77	5	12	17	12.42

Note: GP = games played; G = goals; A = assists; P = points (goals + assists); TOI = average time on the ice per game (in minutes); RW = right wing; C = centre; LW = left wing; D = defence; UFA = unrestricted free agent

Source: "Cost per Point 2016–17," CapFriendly, accessed January 15, 2018, [www.capfriendly.com/cost\\_per\\_point/2017](http://www.capfriendly.com/cost_per_point/2017).



## EXHIBIT 2: PLAYER RANKINGS

	Player	Player 430	Player 466	Player 444	Player 249		Player 599
Puck Skills	Deking	90	90	83	82	...	83
	Hand-Eye	89	89	81	81		82
	Passing	88	90	82	82		82
	Puck Control	89	90	82	82		82
Shooting	Slap Shot Accuracy	88	88	81	81		82
	Slap Shot Power	89	87	85	85		84
	Wrist Shot Accuracy	89	88	82	82		83
	Wrist Shot Power	89	86	84	83		83
Skating	Acceleration	88	90	84	84		85
	Agility	88	92	84	83		85
	Balance	85	82	84	85		80
	Endurance	85	84	82	82		80
	Speed	88	90	84	84		85
Senses	Discipline	89	87	82	83		93
	Offensive Awareness	88	89	81	82		80
	Poise	87	83	79	78		78
Physical	Aggressiveness	79	80	84	88		78
	Body Checking	84	74	84	88		75
	Durability	85	85	84	84		83
	Fighting Skill	64	63	64	73		61
	Strength	87	82	84	85		80
Defence	Defensive Awareness	86	84	84	83		81
	Face Offs	74	75	74	68		68
	Shot Blocking	82	75	84	81		78
	Stick Checking	86	85	85	86		82

Source: "Team Builder," HUTDB, Hockey Ultimate Team Database, accessed January 15, 2018, <https://hutdb.net/18/builder>.

## EXHIBIT 3: POSSIBLE INTERACTIONS AMONG PLAYER STATS

**Sample Scenario A:** Player 1, Deking = 80; Player 2, Deking = 80; Player 3, Deking = 90

**Sample Scenario B:** Player 1, Poise = 80; Player 2, Poise = 80; Player 3, Poise = 70

1. Linear (Average) Rating: For the three players on a line, averaging their values for each skill.
  - Scenario A:  $\text{Line Deking} = \frac{80+80+90}{3} = 83.33$
  - Scenario B:  $\text{Line Poise} = \frac{80+80+70}{3} = 76.67$
2. Maximum Rating: For the three players on a line, take the maximum of their values for each skill.
  - Scenario A:  $\text{Line Deking} = \max(80,80,90) = 90$
  - Scenario B:  $\text{Line Poise} = \max(80,80,70) = 80$
3. Amplifying the effect of one player being worse than others by using the following formula:

$$\text{Line Value} = 100 - \sqrt{\sum_{i=1}^n \frac{(100 - \text{value}_i)^2}{n}}$$

- Scenario A:  $\text{Line Deking} = 100 - \sqrt{\frac{(100-80)^2 + (100-80)^2 + (100-90)^2}{3}} = 82.68$
- Scenario B:  $\text{Line Poise} = 100 - \sqrt{\frac{(100-80)^2 + (100-80)^2 + (100-70)^2}{3}} = 76.20$

4. Amplifying the effect of one player being better than others by using the following formula:

$$\text{Line Value} = \sqrt{\sum_{i=1}^n \frac{(\text{value}_i)^2}{n}}$$

- Scenario A:  $\text{Line Deking} = \sqrt{\frac{(80)^2 + (80)^2 + (90)^2}{3}} = 83.47$
- Scenario B:  $\text{Line Poise} = \sqrt{\frac{(80)^2 + (80)^2 + (70)^2}{3}} = 76.81$

Source: Prepared by the author.