

NHL SlapShot:

A Visualization Tool to Analyze the
Value of NHL Players

CSC485D Final Paper

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1 Introduction

In this paper we present *NHL SlapShot*: a visualization tool to analyze hockey salary caps. The goal of *NHL SlapShot* is to identify the value of a given player by plotting their NHL stats, and compare it to how much they are making annually. For the purpose of the visualization, a player's value will be defined as the NHL SAT formula $((\text{Goals} + \text{Shots} + \text{Missed Shots} + \text{Team Blocked Shots}) - (\text{Goals Against} + \text{Shots Against} + \text{Missed Shots Against} + \text{Opponent Shots Blocked}))$ when player is on the ice) graphed over the player's salary. Discovering the value of a given player can be used to help NHL analysis shows such as TSN and Sportsnet. Furthermore, an accurate value of a player could help fantasy hockey enthusiasts, NHL General Managers (GMs), and scouts make more informed decisions when picking players. NHL.com is one of the most prominent destinations for hockey enthusiasts to find statistics and interesting information about the game. Currently on NHL.com, stats are visualized as a simple table, which makes discovery actions and finding correlations and outliers hard to accomplish.

Note that *NHL SlapShot* is designed for people with domain knowledge and who already have an idea of what they are looking for in the data. *NHL SlapShot* supports the following actions: discovery and presentation. The discovery actions for this visualization are when a user is following a hunch about a given player and wants to discover the validity of that hunch. In addition, presentation actions are accomplished when the user wants to show a third party about a given player's value. This makes *NHL SlapShot* relevant to many people, from business professionals to sports fans. These user groups also share the target goal of finding correlations and outliers (players to trade and players to offer extended contracts), which *NHL SlapShot* offers as a solution. There has been similar work trying to analyze NHL players, however, none have tried to correlate player statistics and salary. The hockey impact analysis done by Dark Horse Analytics et al. [1] has a similar goal, however, they treat each team as a single entity. In our research we would like to dig deeper into the team's success and figure out the value of all players involved in a championship team.

2 Related Work

Another project with a similar domain is *SnapShot* by Pileggi et al.[4] *SnapShot* uses a radial heat map in order to show information about shots taken in NHL games. Although *SnapShot* and *NHL SlapShot* are both concerned with displaying hockey statistics in a novel, and meaningful way, beyond this, there are not many similarities (aside from the names). *SnapShot* is mostly concerned with showing where shots are taken in games, rather than the overall player statistics from previous seasons like *NHL SlapShot* is concerned with.

Most of the current hockey analysis tools do not involve the use of visualizations as much as they could or probably should. Most of this data is presented in table format, as is the case on *NHL.com*. There is however, on *NHL.com*, an interactive portion called *Ice Tracker*, which is used to keep track of events as they happen on the ice. It represents each event as a glyph on the ice, some of which have video related to the event. The audience for *Ice Tracker*, however, is more casual than the intended audience of *NHL SlapShot*, which is aimed more at GMs, fantasy hockey enthusiasts, and hockey analysts. For these reasons, *NHL SlapShot* does not really have any direct competition, and it was decided that it was a novel way to view statistics about hockey.

3 Approach

The goal of *NHL SlapShot* is to make it easy determine a player's value. The tool consists consist of three sections; a hierarchical bi-level partition graph, a selectable drop down menu, and a scatterplot. The hierarchical bi-level partition graph will be used as a selector to navigate from the NHL divisions (top level) all the way down to the individual team. We chose this style of navigation based on the following concepts presented et al. [3].

- Grouping: divisions naturally group Teams.
- Colour is used to distinguish divisions; this was chosen because colour is one of the highest identity channels.
- A 3-Dimensional view is not used for reasons outlined in chapter 6 of [3].
- Hierarchical bi-level partition graph allows for Shneiderman's mantra of overview, zoom, and details.
- A navigation title at the top of the visualization shows users where they are; this is an example of reducing cognitive load.

Furthermore, users can select the comparison metrics that will be needed in the analysis; this will update the scatter plot visualization with the required data. The scatter plot shows the calculated value of each player on the team and compare that value to any user selected metrics. This style of filtering was chosen based on the following concepts presented in [3].

- Drop down menus have a low learning curve.

- Simplicity.
- Title and legend bars help users understand context without need of memory.

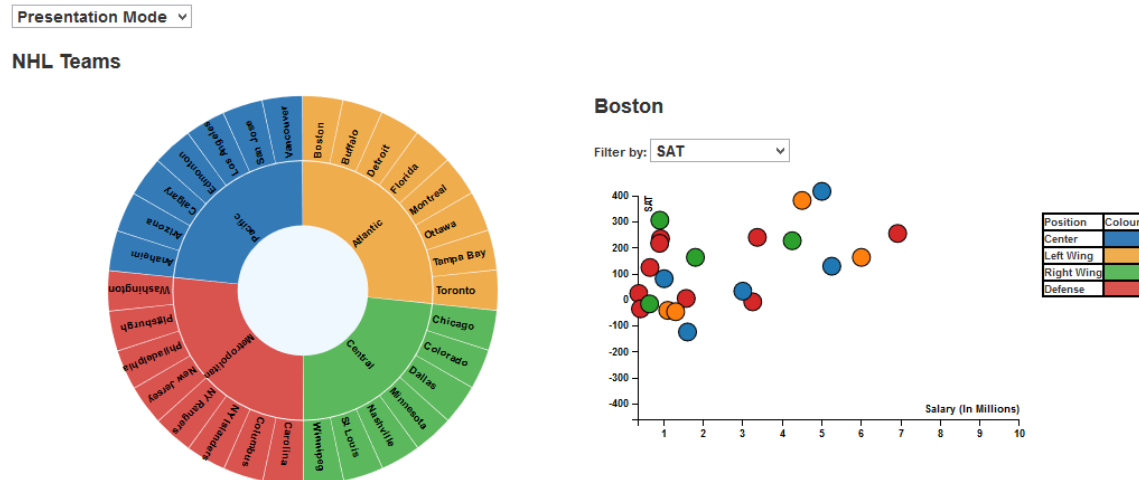


Figure 1 - Boston and bi-level graph

Figure 1 shows an overview of the visualization with all three parts displaying some data. The goal of the bi-level partition graph and its title is to increase the level of context and understanding of their current depth in the NHL hierarchy. Furthermore, the filter list supplements this by allowing users to remember the state and chosen metrics for the scatter plot graph. Finally, the scatter plot graph will render the data allowing for easy visualization and analysis.

4 Implementation

NHL SlapShot was implemented using a web-based application based on the D3.js library. Python is a great tool to parse very large datasets and therefore was used to parse through the .xls files to gather the required data for our analysis. These design choices were made based on recommendations from other Visualization experts (CSC 485D students) and prior knowledge of the uses for Python.

5 Results

5.1 User Interactions

Users can interact with the visualization by selecting any one of the two sections; the bi-level partition graph or the drop down menus. For example, a user can simply change division, teams, or players by clicking on the desired section from the bi-level partition graph. In the following example, Atlantic Division has been selected causing the resulting display in figure 2.

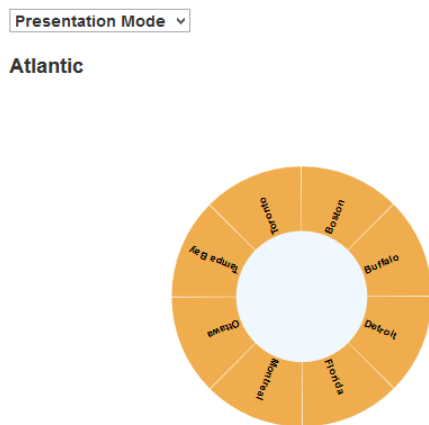


Figure 2 - Atlantic Division

Users can then use the same selection interaction to go deeper into the bi-level graph. This consistent navigation allows users to easily learn and find the data that they are looking to analyze. After the desired data has been selected, which in this case is Boston, comparison metrics can be selected from the filter drop down menus, which in this case is SAT. This allows users to easily selected the data that they are interested in displaying. The steps described above causes the scatterplot graph to appear with all the relevant data being displayed resulting in the visualization shown in Figure 3.

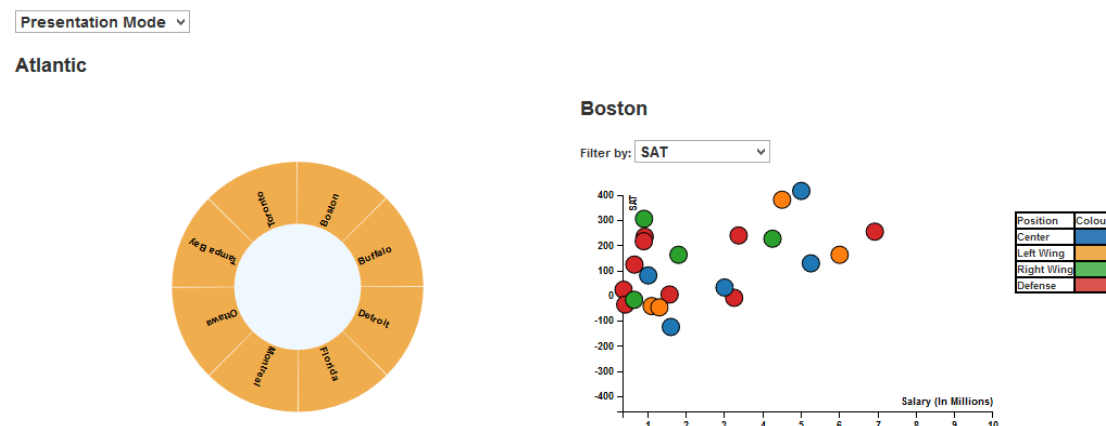


Figure 3 - Boston Scatterplot

5.2 Visualization Use Case and Walkthrough

User interaction with *NHL SlapShot* is trying to gather insights about the value of a given player. This means the interactions with *NHL SlapShot* will be either discovery actions (following a hunch about a given player) or presentation actions (showing a third party a given player's value). In the following example a user would like to know if Alexandre Burrows is a player worth keeping at the upcoming trade deadline.

1) Select a Team

a) Select the Pacific Division from the top level of the bi-level partition graph.

NHL Teams



Figure 4 - Selecting Pacific Division

b) Select Vancouver from the next level of the bi-level partition graph.

Pacific

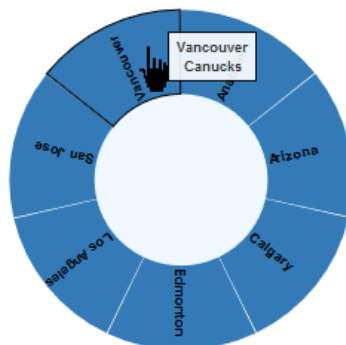


Figure 5 - Selecting Vancouver Canucks

2) Select the desired comparison metrics from the filters list; by default, SAT would be displayed

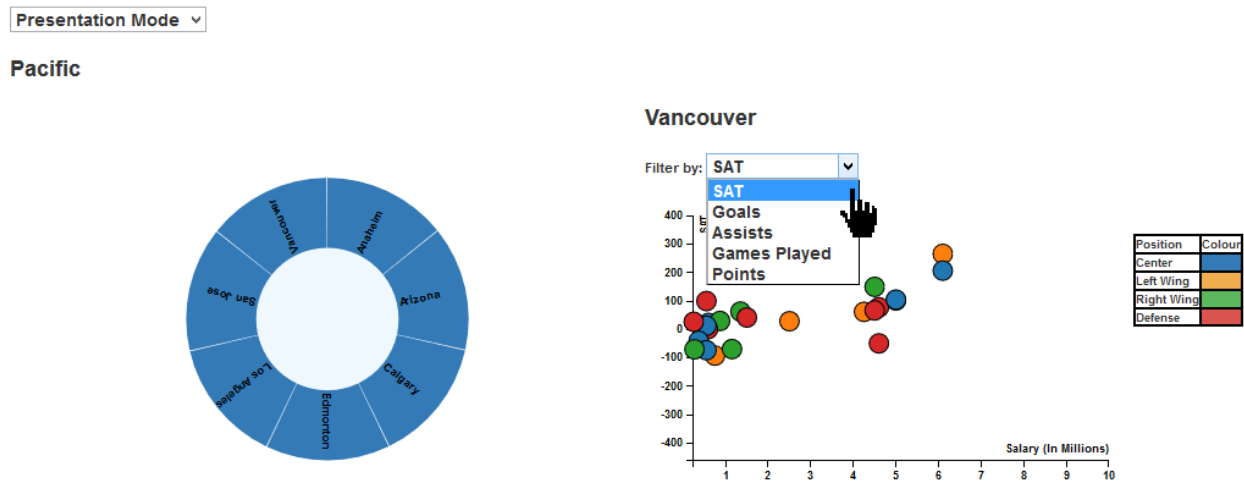


Figure 6 - Selecting SAT

3) The Scatter Plot graph will render with team data. This allows users to look at the graph to analyze the data. Hovering over the circle will show more information, such as player name, and exact salary.

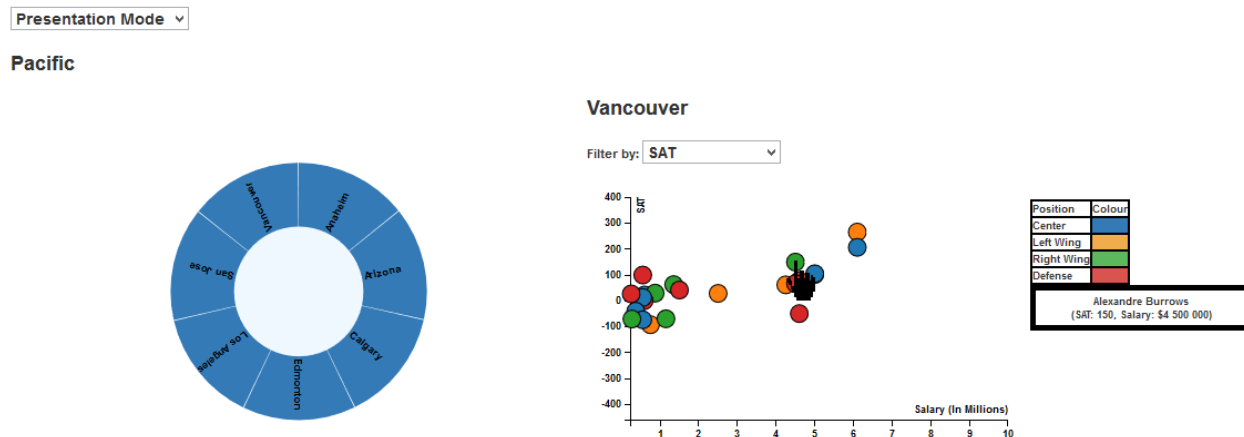


Figure 7 - Example of the hover over for Alexandre Burrows

5.3 Performance of the System

Delay was found to be minimal when interacting with the system. Interactions produced output in less than 1 second, which is consistent with immediate response according to the responsiveness principle. In addition to being fast to produce output, clicks are accurate, and there are no obvious bugs in the system.

6 User Study

In the user study, users were provided with several use cases and monitored how they accomplished these specific tasks(See Appendix A). After the tests, users were asked to rate how easy or difficult they found the tasks using a scale from 1-10, where 1 means they had a trivially easy time accomplishing the task, and 10 means they could not accomplish the task. The overall average of all participant responses was 3.4 indicating that the users had a relatively easy time accomplishing the given tasks with our visualization.(See Appendix B)

Some comments and criticism that were discovered during the user study include: initial difficulty of navigation, users requested a league average or similar comparison metric, users enjoyed interacting with the navigation wheel that was implemented, compare mode also received positive feedback (See Appendix C).

7 Discussion

NHL SlapShot was determined to be successful in many ways, and in some ways it came up short. Navigation through the tool was decided to be very fluid, natural, and straightforward. The navigation design was based on Shneiderman's mantra of overview, zoom, and filter. Users enjoyed the ability to mouse-over points on the scatterplot in order to reveal more information and context about the player. This use of mouse-over would be considered superimposition because the revealed text appears on top of the existing visualization. The use of the scatterplot for each team's player stats is valuable because it helps users easily see both trends and outliers in the data. The use of two graphs, as seen in the compare section, is useful because users are able to offload their memory, following the "eyes beat memory" principle. Furthermore, it was decided that the most effective channels would be chosen to represent our most important data features. For example, the positioning channel, ranked number 1, is used for players on the scatterplot graph. Player position is separated by colour, as are the divisions and teams in the navigation wheel, and colour is ranked the number 2 most effective channel. The use of position

and colour is also convenient because these two channels are considered fully separable, thus creating more clarity in our visualization.

Some areas that were determined to be lacking were found through the user study, and by our own review of the tool. Users requested that on the scatterplot, there was some way to compare to a league, or division average, rather than having to compare one team to another one-at-a-time. Users wanted more of a visual cue, as to how to go back a level in the navigation wheel. This could be accomplished easily by placing a back arrow, or similar graphic in the centre of the wheel. Users also requested more contexts about teams, such as win/loss/tie records. Further, some features that the tool creators desired included the addition of jersey numbers or some other identifier on the scatterplot points which would allow users to see which player is represented by the dot at a glance rather than having to hover over. In addition to jersey numbers, there are many more statistics that could be used with the visualization, which leaves plenty of room for future work.

8 References

- [1] "How Do Different NHL's Statistics Impact Team Performance?" *Hockey Impact Visualization Tool* by Darkhorse Analytics. Web. 9 Apr. 2015. <<http://hockeyimpact.darkhorseanalytics.com>>.
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- [3] Munzner, Tamara. *Visualization Analysis and Design*. CRC Press, 2014.
- [4] Pileggi, H., C.D. Stolper, J.M. Boyle, and J.T. Stasko. "SnapShot: Visualization to Propel Ice Hockey Analytics." *Visualization and Computer Graphics, IEEE Transactions on* 18.12 (2012): 2819-828. IEEE. Web. <<http://ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=6327288&url=http://ieeexplore.ieee.org/iel5/2945/6327196/06327288.pdf?arnumber=6327288>>.

9 Appendix

Appendix A : Questionnaire

Rate the following questions from 1 (easy) to 10 (gave up):

- 1) Can you determine if the Vancouver Canucks should make the playoffs?
- 2) Can you determine if the Chicago Blackhawks have a good defense?
- 3) Can you compare the players of the L.A. Kings to the Anaheim Ducks?
- 4) Can you determine who scored the most goals for Detroit?
- 5) Can you determine if Washington has a cheap or expensive Defense?
- 6) Can you find the player that has the worst value (low SAT with high salary) on the Toronto Maple Leafs?
- 7) Can you determine if Edmonton is overpaying a one or more positions?
- 8) Can you find determine who is the better team: the Edmonton Oilers or Boston Bruins.
- 9) Was the navigation system intuitive? Explain your answer.
- 10) Was understanding the graphs intuitive, did you know what you were looking at? Explain your answer.
- 11) Anything you liked or disliked about the interface design?
- 12) Any other comments?

Appendix B : Questionnaire Results

Participant	knowledge	q1	q2	q3	q4	q5	q6	q7	q8	avg
1(H)		2	5	5	5	6	6	7	5	5.5
2(J)		5	4	1	1	1	1	2	4	1.875
3(C)		5	10	2	2	2	2	2	10	4
4(JT)		7	8	2	2	1	3	1	4	2.875
5(S)		2	9	1	1	1	2	5	9	3.75
6(K)		9	5	2	1	1	3	1	3	2.125
7(M)		6	9	2	2	1	4	2	6	3.625

Appendix C : Feedback

Suggested features / dislikes

- Baseline or league average
- "Wasn't clear how to get back to the league level"
- "Took me a little while to get familiar with how to navigate but once I figured it out it was very easy"

- Definition of SAT
- More context about teams (win/loss/tie record by team name)

Positive feedback

- “Compare mode is great”
- “I liked how it was laid out by division”
- "I like the wheel design"
- "I liked the movement of the graphic when you click division"
- "I liked the round design"